MIDDLE APPLEGATE ASSESSMENT
PROJECT
ROGUE

Middle Applegate Assessment Project

2007

Completed by the Applegate River Watershed Council with support from the Oregon Watershed Enhancement Board

OWEB Grant #204-278

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1.0 Introduction

The Applegate River Watershed Council (ARWC) completed the Middle Applegate Assessment Project with support from the Oregon Watershed Enhancement Board (OWEB) and other partners. Through this project we engaged local residents, assessed watershed conditions and developed a prioritized ecological restoration strategy for the middle Applegate watershed.

Ecological restoration is the process of assisting the recovery of a system that has degraded, damaged or destroyed (Society for Ecological Restoration 2004). The Middle Applegate watershed has been degraded by mining, land conversion and irrigation, timber harvest, fire exclusion, residential development, road construction, and other impacts. Impacts to the landscape caused problems including: threatened fish species, impaired water quality, forests that suffer from high fire risk and limited productivity and others. Ecological Restoration can improve conditions within a watershed. To this end, the middle Applegate assessment will help guide the restoration of structure, function and processes that benefit both aquatic and terrestrial ecosystems.

The Oregon Watershed Assessment Manual was used to guide the middle Applegate assessment. The assessment involves historical analysis, a review of current conditions and recommendations for future restoration activities. Results and recommendations are presented at a 6th field Hydrologic Unit Code (HUC) scale.

1.1 Project Study Area

The Applegate watershed is located in SW Oregon and N. California (Figure 1.1). The Applegate River is a tributary to the Rogue River, which flows into the Pacific Ocean.

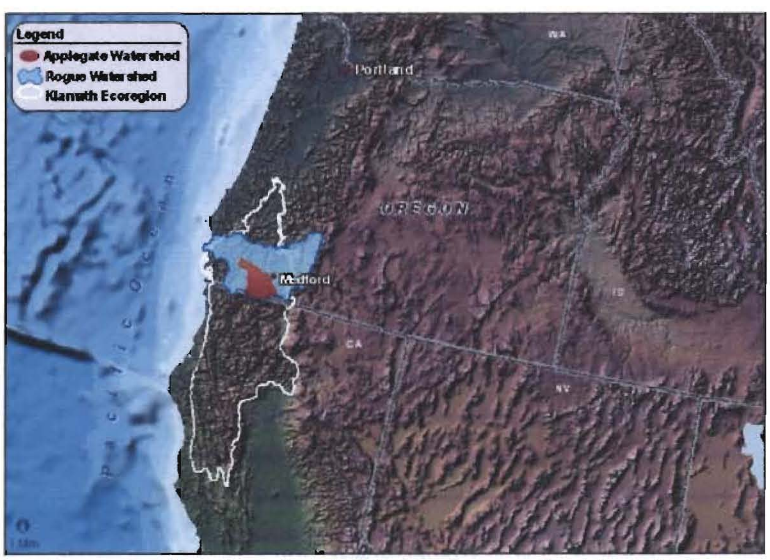


Figure 1.1 – Location map showing the Applegate watershed in relation to the Rogue River watershed and broader Klamath Ecoregion.

The middle Applegate watershed is the focus of this study. The middle Applegate extends roughly from the town of Applegate to the town of Ruch and includes the following sub-watersheds: Forest Creek, Spencer Gulch, Humbug Creek, Thompson Creek and Slagle Creek. (Figure 1.2)

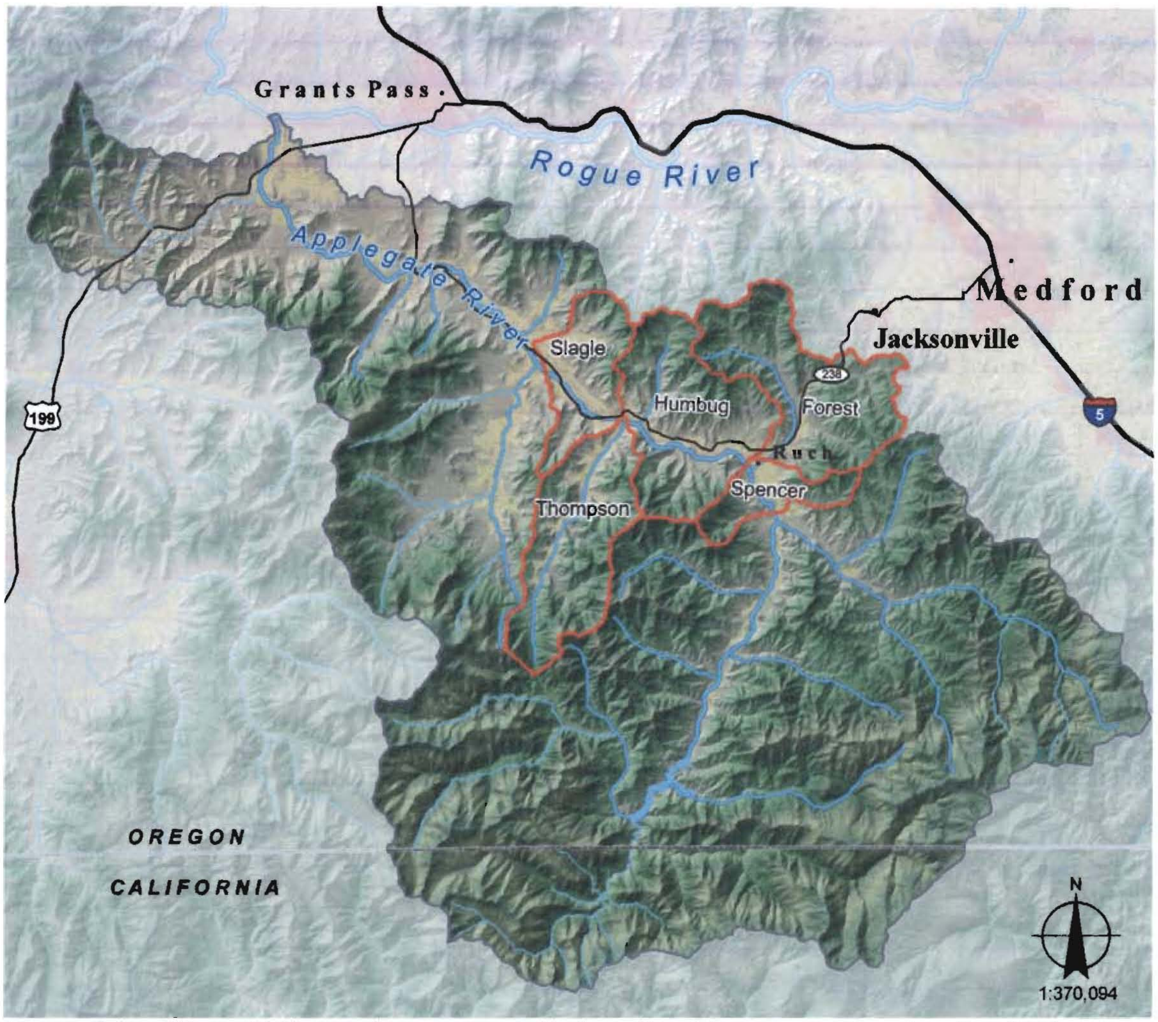


Figure 1.2 – The middle Applegate watershed outlined in orange showing focal sub-watersheds: Forest Creek, Spencer Gulch, Humbug Creek, Thompson Creek and Slagle Creek.

2.0 Historical Conditions

Section 2.0 provides historical narrative, information about historical trends, a historical timeline, and conclusions about historical impacts on natural resources. Historical events shaped current conditions. Current conditions influence management opportunities and constraints that determine future conditions to some degree. Managers use historical information along with current conditions to derive strategies and set trajectories towards desired future conditions.

2.1 Watershed Resources at the time of exploration/settlement

Exploration of the Oregon Coast began in the 18th century as Spanish explorers sailed north from Mexico. The British soon followed, warring with the Spanish for claims to the Coast. Robert Gray, an American born in Rhode Island, reached the Oregon Coast by sea in 1792 and returned to the east coast with furs and other goods. Trappers first visited the Applegate Valley in 1827 and then trapping subsided during the late 1840's (LaLande 1995).

Vegetation at the time exploration was very diverse across the middle Applegate landscape. Land cover varied from grassland, oak woodland and chaparral to heavily forested coniferous stands however historical landscapes had fewer acres of dense conifer forest (LeLande 1995). Large diameter (>30") sugar pine were present in the Applegate along with valleys dominated by large ponderosa pine and oak. Stream corridors varied in width. Some stream corridors were broad and composed of mesic species such as willow and alder while other stream corridors were relatively narrow and supported pine and other conifers along the stream bank. In general, historic riparian zones in the Applegate are characterized by ponderosa pine as the dominant conifer species with an association of hardwoods including Oregon ash, black cottonwood, big-leaf maple, white alder, and white oak (Franklin and Dyrness 1973). At the landscape scale, vegetative diversity was influenced by factors including geology, soils, aspect, elevation, slope shape, wildfire, and Native American use of fire.

Floral and faunal populations thrived on diversity and utilized niche habitats created by natural disturbances. The middle Applegate watershed was, and still is home to a variety of fish species. Salmon and other anadromous fish such as lamprey rely on the middle Applegate watershed for fresh water habitat during various life history stages. Historically, Indian Tribes harvested fish for consumptive use and developed annual rituals around their harvest, but had relatively little impact upon total fish production (Winthrop 1993). Within the Applegate as a whole there has been a 30% reduction in coho habitat (Prevost et al 1997); approximately 9% of this habitat loss resulted from the construction of the Applegate Dam. The Applegate Dam reduced coho and steelhead habitat however it allowed for increased summer flows, which have benefited Chinook salmon. Historically, the mainstem Applegate would go dry in certain years prior to the construction of the dam. Within the middle Applegate watershed there has been a decline in fish populations and a decline in freshwater habitat. The behavior of settlers and prospectors impacted fisheries and other ecological assets and ecosystem services.

2.1.2 Historical settlement, land use, and resource management

Settlers changed the landscape. Change increased quality of life but also resulted in negative impacts to watershed structure and function. Negative impacts resulted from mining, road building, logging, land conversion, residential development, disruption of natural processes, and other synergistic impacts.

The discovery of gold brought thousands of people to the Applegate area in 1852. People mined for gold and in the process impacted stream corridors and upland areas. Gold mining started with picks, shovels and sluice boxes on the banks of creeks and rivers. By the late 1870's hydraulic mining operations, which can impact entire hillslopes had moved north from California and were active in the Applegate. Mining impacts can be found throughout the middle Applegate watershed, from the stream channel and stream bank to the upland hillslopes.

Roads were constructed within the floodplain and bridges were built to allow for stream crossings. Roads spread into the uplands as mining and logging increased.

Logging occurred throughout the late 1800's as settlers' harvested trees to build houses and structures. High grade logging was the norm as settlers harvested the largest trees. Sugar pines were targeted for shingles and other wood products; sugar pines were preferred by mills because they grow large and straight with fewer knots than other pines. Several mills were established throughout the middle Applegate watershed – remnant log ponds can still be found in the town of Ruch.

Land conversion occurred as agriculture increased. People cleared the land, changing it from one landcover type (i.e. oak woodland) to another cover type (i.e. pasture). Land use also changed as people developed the landscape for agricultural and residential purposes. Agriculture most often requires water so water was diverted from streams into irrigation ditches; water was also diverted for mining and other purposes. Changes in landcover and landuse affected the middle Applegate watershed.

Settlers modified natural disturbance patterns associated with wildfire and floods. Natural disturbances vary by frequency, intensity, duration and overall effect. Settlers altered these disturbance characteristics through activities such as fire suppression. Altering natural disturbances altered the landscape. Native American people inhabited the Siskiyou region for 10,000 years prior to European exploration. Native people used fire to achieve objectives associated with hunting, food cultivation and collection, safety, and travel. The use of fire by native people influenced the composition of the landscape.

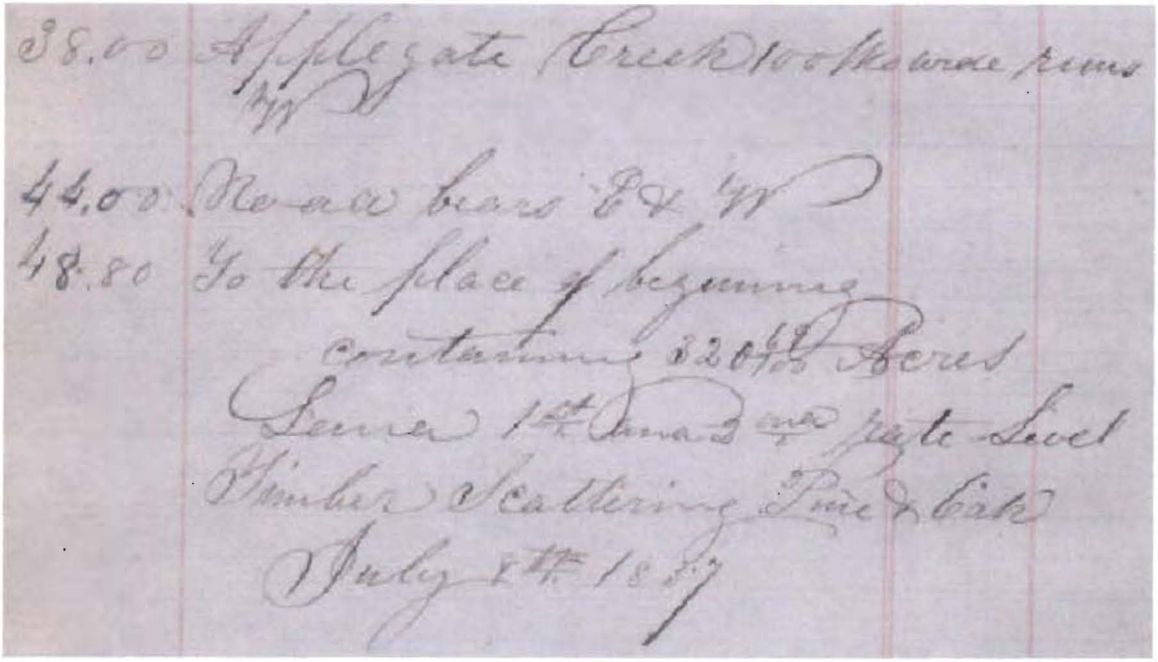
Human ignited fires began to subside during the mid 1850's as Indians were killed and removed to reservations. During the 1850's Indians experienced "dislocation and rapid destruction" (Spier 1927). Settlers and Indians clashed throughout the Applegate and the Rouge Basin, with the Rogue River Indian Wars erupting in 1853. A temporary reservation was established between Table Rock and Evans Creek, just outside of Medford, and then in November 1855 the Coast Reservation was established by President Franklin Pierce. In 1856, Native people throughout Northern California and Southwest Oregon were removed from their ancestral lands and were relocated to the Coast Reservation.

Wildfires, which burn under different conditions than human ignited fires, exhibit ubiquitous presence in SW Oregon. Historically, wildfires burned more frequently with less severity than today. Mean fire return intervals range from 10-80 years depending on elevation, with low elevation forests burning more frequently with less severity. Wildfires influence landscape structure and diversity and play an important role in watershed health. Fire suppression changed the extent of wildfire. An article in the Jacksonville newspaper from August 31, 1904 identifies that the government has a system of rangers to prevent and extinguish fires – the article goes on to identify "one of the greatest pieces of folly…in preventing fires and allowing brush and undergrowth become so high and thick that when the inevitable fire comes the whole forest is destroyed".

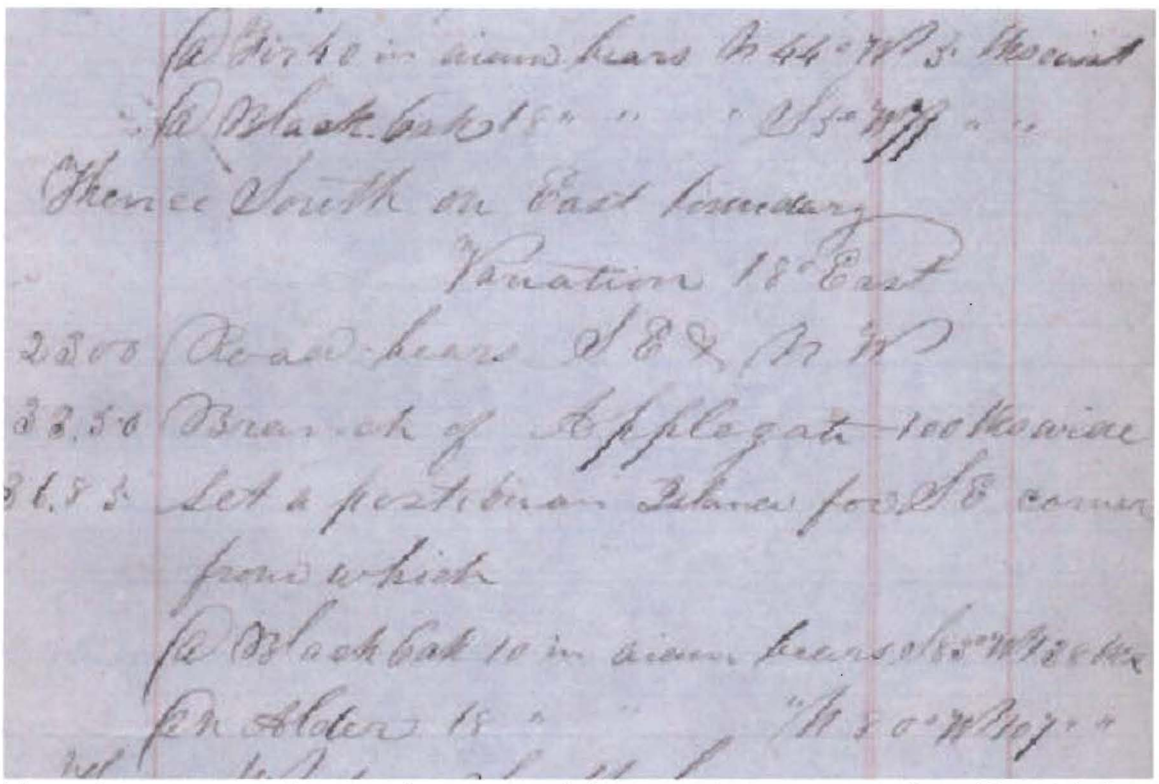
Settlement, resource extraction and land use lead to the need for restoration. Overall, historical documents provide valuable information for restoration planning. Historical notes and maps provide information about the types of impacts and locations of impacts to the watershed.General Land Office (GLO) surveyors for example mapped the landscape and took notes according to the Land Ordinance of 1785:

> *"The surveyors, as they are respectively qualified, shall proceed to divide said territory into townships of 6 miles square, by lines running due north and south, and others crossing these at right angles, as near as may be, unless where the boundaries of the late Indian purchases may render the same impracticable, and then they shall depart from this rule no further than such particular circumstances may require...As soon as 7 ranges of townships and fractional parts of townships, in the direction from south to north, shall have been surveyed, the geographer shall transmit plats thereof to the board of treasury, who shall record the same, with the report in well bound books to be kept for that purpose."*

In the Applegate, GLO surveyors worked from ~1857 through the early 1900's. Surveyors recorded bearing tree records from reference points at the corners of mile-square sections and half way between corners ("quarter corner" points), where surveyors measured the distance and the compass direction to several nearby trees (Figure 2.1). Surveyors were instructed to identify four witness trees at section corners and two at quarter-corner boundaries, or on Indian reservations, at 1/16 corners (White 1991). In their field notes, surveyors recorded the diameter and common name of each witness tree and the distance and bearing to it. Surveyor records provide an overview of dominant tree species on the landscape (Collins et al. 2003). Pine and oak dominated the low elevation landscape of the middle Applegate watershed; large pine and oak trees were recorded, such as the 36 inch oak and 34 inch pine illustrated in Figure 2.1; which was a survey of the area around "Applegate Creek". General Land Office (GLO) survey notes are most applicable to low elevation landscapes as many mountain sides were deemed unsurveyable.



38.00 Applegate Creek 100 lks wide runs SW
44.00 Road bears E & W
48.80 To the place of beginning
containing 320.00 Acres
Land 1st [illegible] rate Level
Timber Scattering Pine & Oak
July 8th 1857



Fir 40 in diam bears N 44° W [illegible]
Black Oak 18 " " S [illegible] W [illegible]
Thence South on East boundary
Variation 18° East
23.00 Road bears S E & N W
33.50 Branch of Applegate 100 lks wide
31.83 Set a post in [illegible] place for S E corner
from which
Black Oak 10 in diam bears [illegible]
An Alder 18 " [illegible]

Figure 2.1 – Excerpts from GLO Surveyor field notes: the page on top identifies "Timber Scattering Pine & Oak" near 'Applegate Creek' while the page on the bottom, recorded along a branch of the Applegate, identifies a 40 inch Fir along with black oak and alder.

GLO maps provide a historical reference for mine sites, landscape features, roads, water courses, soil types, landcover, and other features. During the middle Applegate assessment, GLO maps were georeferenced and overlaid on current Digital Elevation Models (DEMs) and aerial photographs to evaluate the relationships between historic features (e.g. roads, stream courses, mines) and modern day features (Figure 2.2). USGS topographic maps also show the location of mining operation, mine tailings and other features (Figure 2.3).

Figure 2.2 Historical GLO map georeferenced and draped over digital elevation model then overlaid with current roads layer, seen in red. This section is near Ruch around the junction of Hwy 238 and Upper Applegate Road (Hwy 238 coming from Jacksonville enters at the top of the image and Hamilton Road is seen in the bottom left). Notice the similarity between major roads in 1857 and major roads today, plus the number of new roads today. Also, hats off to the surveyor – the mapped terrain matches today's digital elevation model very well. Map also shows Ashland Forest Reserve which was established in 1893.

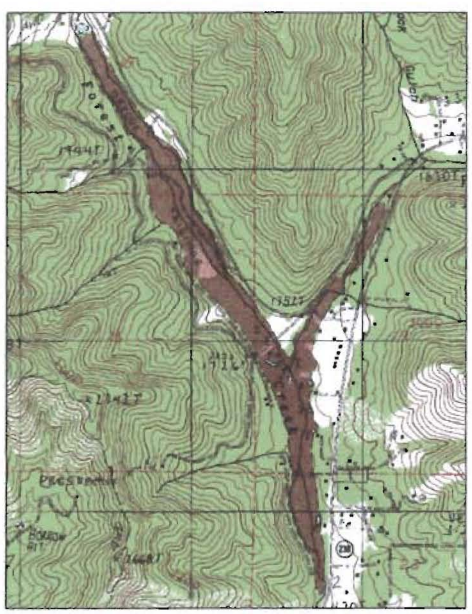


Figure 2.3 – Dredge mine tailings identified along Forest Creek and lower Poorman's Creek. The identification of tailings at this scale (1:24k) reflects a significant amount of tailings. The stream channel within this area is heavily impacted.

2.2 Historical Timeline

The following chronology highlights some of the more significant natural and cultural events of southwest Oregon history. The chronology was derived in large part from the 1980 edition of "Rogue River Time Line" which appeared as Appendix II in Prehistory and History of the Rogue River National Forest (LaLande 1980). The first section, a geological history, is obviously an approximation based on currently available information.

Circa 500 million to 350 million years ago:
What is now southwestern Oregon-northwestern California was part of the floor of an ocean basin, most likely near the edge of an oceanic "plate" which was being drawn beneath a volcanic chain of islands. Some metamorphosed sediments (e.g., Condrey Mountain Schists) in the "Siskiyou" portions of the Klamath Mountains may date from this era - if so, they are among the oldest exposed rocks in Oregon.

Circa 230 million to 180 million years ago:
Deposition of vast amounts of marine and volcanic sediments in a major ocean "trough"; tens of millions of years later these rocks were folded into the Applegate Group metamorphics of the Klamath Mountains.

Circa 180 million to 130 million years ago:
The Klamath Mountain rocks were evidently first raised above sea level during this period. (Fossil plants dating from this period -- such as fern, cycad, conifer, ginkgo -- are now exposed in vicinity of Riddle, Douglas County. Jurassic sea shells [clams, oysters, scallops, ammonites] presently occur in the formations west of Grants Pass and south of Roseburg.)

Circa 130 million to 75 million years ago:
Further uplift of what is now the Klamath Mountain Province; deposition of sediments (e.g., Hornbrook Formation conglomerates and sandstones, with fossil clam-like shells such as Exogyra and Trigonia) in the adjacent shallow sea; these are presently exposed near Ashland, Jacksonville and other portions of the Bear Creek Valley. (Cretaceous plant fossils [fern, cycad, gingko] now exposed on southern Oregon coast near Port Orford indicate a moist, semi-tropical climate during Cretaceous times.)

Circa 50 million to 10 million years ago:
The climate of the Cascades during the early Tertiary period was sub-tropical. Elkhorn Peak and Pilot Rock fossil beds (late Eocene and early Oligocene leaf-prints, including fig, magnolia, palm), petrified wood (30-35 million years old south of Ashland; 20-15 million years old north of Prospect), some low-grade coal deposits (e.g., Fern Valley, Siskiyou Summit) date from this time. During later Oligocene and early Miocene times the Western Cascades experienced continued deposition of huge quantities of volcanic ash, breccias, agglomerates and flows from many separate vents. Much of this material is presently exposed in the Little Butte Series volcanic sequence.

Circa 10 million to 2 million years ago:

During the late Mliocene (ca. 7 million years B.P.), extensive basalt flows resulted in a thick layer of lava in the Rogue River Valley, later eroded into the mesa-like Table Rocks. Late Miocene fossil pollen profiles from elsewhere in Oregon reflect the growing dominance of conifers, due to major cooling trend. This period also witnessed the "final" major uplift of the Klamath Mountains. The "rain shadow" effect of the young High Cascades had a pronounced impact by the mid-Pliocene Epoch; by then the basic topography of the Pacific Northwest was similar to that of the present day.

Circa 2 million to 250,000 years ago:
The Pleistocene Epoch witnessed the continued build-up of the crest of the High Cascades as large composite volcanoes (e.g., Rainier, Adams, Hood, Mazama) erupted and grew along a major fault series of north-south lineation. Mt. McLoughlin began its initial build-up ca. 700,000 years B.P.; Mt. Shasta started to form less than 300,000 years B.P. The Pleistocene Epoch was characterized by intervals of glaciation in the higher elevations of the Cascades and the highest peaks of the Klamath Mountains (i.e., the "Ice Age" sequence).

Circa 250,000 to 12,000 years ago:
Volcanic events during this period included continued eruptions and flows from major peaks of the High Cascades. The climate was generally colder than present, but Pacific Northwest glaciers retreated to near present size by 12,000 years B.P. due to warming trend (leaving deep glacial canyons like those of the Middle Fork-Rogue River). During the very late Pleistocene, Oregon experienced a milder climate and increasing dominance of Douglas-fir forest in the western part of the State.

Circa 4,000 to 200 years ago:
A short climatic interval around 4,000 B.P. brings more effective precipitation, causing a period of canyon down-cutting which is evidenced in the Columbia Plateau as well as the Rogue River Basin.

A.D. 1542: Spanish explorers Cabrillo and Ferrello explore portions of the California coast; Ferrelo may have sailed as far north as the mouth of the Rogue River.

1577-1578: Englishman Francis Drake sails north along the Pacific Coast (after raiding a number of Spanish settlements), perhaps as far north as the southern Oregon coast.

1602-1603: Spanish explorers Vizcaino and Aguilar sail along the northern California (and possibly the southern Oregon) coast in search of harbors and a "City of Gold."

1774-1775: Spanish explorers Perez, Heceta and Bodega sail along the Oregon-Washington coast, making landfalls and naming various points, such as Cape Sebastian and Cape Blanco.

1776-1780: Englishman Capt. James Cook's "Third Voyage" takes him to the North Pacific coast in search of the "Northwest Passage"; he first sights Oregon coast near Yaquina Bay; his crew trades metal objects with Vancouver Island natives in exchange for furs, which prove to bring astonishingly high prices in the Chinese port of Canton---resulting in the birth of the Northwest Coast fur trade.

1785-1804: Development of maritime fur trade along the Oregon coast; Englishman Capt. George Vancouver explores Puget Sound and other coastal areas.

1792: "discovery" of Columbia River by American Capt. Robert Gray in same year. Maritime traders include English, Russian, Spanish, French, American, Dutch and Austrian ships; Canadian Alexander MacKenzie reaches the Pacific Cost by overland route in 1793. Rivalries between Spain, England and others lead to the Nootka Sound Convention of 1793 and rapid Spanish withdrawal from the area. Americans (called "Bostons" by the native inhabitants) increase their trading activity in lower Columbia River and other coastal areas.

1805: Lewis and Clark expedition reaches mouth of Columbia River on November 14, having traveled overland from St. Louis, Louisiana Territory; spends winter near present-day Astoria, making short forays south along the coast as far as Tillamook Head, before returning eastward.

1808-1810: Trappers of the Montreal-based Northwest Company are active in the upper Columbia River drainage.

1811: Employees of John Jacob Astor establish Astoria, a trading post of the Pacific Fur Company, at the mouth of the Columbia.

1812: some exploration/trading parties ascend the Willamette River drainage during this period.

1818: Northwest Company trappers, under Alexander Ross, travel as far south as the upper Umpqua River drainage; hostilities with the (Umpqua or Takelma) Indians result.

1820: Thomas McKay establishes small Northwest Company outpost/rendezvous point on Umpqua River.

1821: Northwest Company is absorbed into the rival Hudson's Bay Company; Fort Vancouver is established on the north side of the Columbia (near the mouth of the Willamette) in 1824; long reign of H.B.C. Chief Factor, Dr. John McLoughlin, begins.

1825-1826: Thomas McKay and Finan McDonald, H.B.C. trappers, enter the upper Klamath River Basin from the north; several H.B.C. parties enter the Umpqua River drainage during the mid-1820s.

1826-1827: Peter Skene Ogden's H.B.C. brigade travels west along the Klamath River and crosses north into the Applegate/Rogue River drainage in February 1827; party under Francois Payette follows Klamath River downstream to vicinity of Happy Camp or Orleans before rejoining Ogden. (Ogden's party is first recorded group of whites in the upper Rogue River Basin; Payette's group may have passed north through the headwaters of the Applegate River, in the vicinity of Red Buttes.)

1828: American trappers under Jedediah Smith travel northwest through mountains of California to reach the Pacific Ocean at the mouth of Smith River, just north of present Crescent City area; they continue north along the Oregon coast to present-day Reedsport area, where most are massacred by Umpqua Indians.

1829: Alexander McLeod's H.B.C. brigade travels south through the Rogue River Valley and then returns north over the Siskiyou Summit during winter; H.B.C. fur brigades (many led by Michel LaFramboise) continue to use this route through the 1830s and early 1840s; intermittent conflict with local Indians.

1836: H.B.C. establishes Fort Umpqua, a trading post on the lower Umpqua River, replacing a small up-river post which Thomas McKay had built in about 1828-29.

1837: Ewing Young and other American trappers/settlers drive a herd of 700 cattle north to Willamette Valley from California missions, passing through the Rogue River Valley; Young had brought horses and mules along the same route in 1834.

1841: Lt. George Emmons' party, part of the Wilkes Pacific Exploration Expedition, passes south through the Rogue River Valley on the H.B.C. trail.

1846: Applegate brothers (Jesse and Lindsay), Levi Scott and other upper Willamette Valley settlers lay out the Southern Emigrant Road of the Oregon Trail ("Applegate Cutoff"); portions of it parallel Emigrant Creek and Bear Creek. Great Britain gives up territorial claims to the Oregon Country south of the 49th Parallel; Capt. John Fremont, Kit Carson and others at Upper Klamath Lake; outbreak of Mexican War leads to American annexation of California as a state.

1848: Discovery of gold in the American River near Sutter's Fort (Sacramento Valley, California)--beginning of the "gold rush." Many Willamette Valley settlers head south through Rogue River Valley to the California gold fields.

1849: Oregon Territory organized by Congress; Joseph Lane becomes first territorial governor.

1850: U.S. Congress passes the Oregon Donation Land Act, further stimulating settlement of the Pacific Northwest.

1851-1852: First discoveries of gold in southwestern Oregon, beginning of mining boom in Siskiyou Mountains and first permanent agricultural settlement in Rogue River Valley; communities of Jacksonville and Ashland Mills are established; continuing conflict between American settlers and Indians.

1853: "Treaty of Table Rock" establishes Table Rock Reservation for the

Takelma and other local Indians.

1855-1856: Final phase of the Rogue River Indian Wars; Indian survivors moved to Siletz and Grande Ronde Reservations on the north Oregon coast; initial influx of Chinese, Hawaiians and other ethnic groups. Trans-Cascade railroad surveys occurring in southwestern Oregon.

1857: Construction of stage/wagon road from Crescent City to Jacksonville; Oregon constitution denies the vote to "Chinese, Negroes, mulattoes."

1858-1859: Development of stage/wagon road over the Siskiyou Summit, linking central California and western Oregon; Oregon gains statehood in 1859.

1864-1865: "John Day Trail" along upper Rogue River to north central Oregon gold mines built during this time.

1866: Construction of the railroad south from Portland begins; Oregon and California Railroad land grant approved.

1869-1870: Transcontinental railroad completed in northwestern Utah; construction of Dead Indian Road by Klamath Indians under Oliver C. Applegate; large-scale hydraulic mining getting underway in the Applegate Valley.

1870s: Discovery of Dead Indian Soda Springs by local hunter; sawmill built near future site of Prospect; Chinese companies mining in the Siskiyous, especially on old placer claims abandoned by whites. The Modoc War in California lava beds, southeast of Rogue River Valley, creates economic boom for Jacksonville, Ashland and Linkville (Klamath Falls).

1882: Chinese Exclusion Act prohibits additional Asian laborers from entering the United States.

1883: Oregon-and-California Railroad reaches Rogue River Valley from the north; new town of Medford is established as a shipping point.

1887: Completion of railroad between Oregon and California; "golden spike" ceremony, held at Ashland in December, marks completion of circum-continental railroad loop; Rogue River Valley's economic development accelerates after this date.

1891: Congress gives President power to establish Forest Reserves; railroad logging commences in southwestern Klamath County around Pokegama.

1893: Cascade and Ashland Forest Reserves established by Grover Cleveland's presidential proclamation; controversy in local communities over the Forest Reserve concept. (See Figure 2.2 which identifies Ashland Forest Reserve around present day Ruch and Forest Creek)

1897: Gifford Pinchot, John Muir and others in southern Cascades on Forest Reserve inspection tour; Congress authorizes management of the Reserves and makes appropriations for hiring personnel.

1899: First "rangers" hired for duty on the Cascade Forest Reserve (South Division); John Leiberg's timber survey of Cascade and Ashland Reserves sponsored by U.S. Geological Survey. Nathaniel Langell appointed first supervisor of Cascade (South) and Ashland Forest Reserves.

1905-1907: "Bureau of Forestry" of U.S. Department of Agriculture is reorganized as the Forest Service. Forest Service takes over administration of Reserves (renamed "National Forests") from General Land Office (USDI). First Supervisor's Office is located on second floor of Jackson County Bank Building, Medford.

1908-1910: Large-scale development of Rogue River Valley fruit orchard industry is underway; Klamath Basin pine mills and logging railroads expand into Upper Klamath Lake area.

1910: Numerous large forest fires in southwestern Oregon and throughout the Pacific Northwest during the tinder-dry summer; timber homesteading boom reaching its peak in the southern Cascades.

1911: Star Ranger Station is built in the Applegate. First reforestation project at Cat Hill Burn.

1912: Reorganization of O&C Railroad Grant Lands; much of this acreage reverts to Federal ownership in 1916.

1917-1918: United States enters the First World War.

1920-1923: Medford airfield serves as base for U.S. Army planes on Air Fire Patrol flights over southwestern Oregon-northwestern California forests; Hershberger Mtn. lookout built in 1922

1924: Owen-Oregon Lumber Company (became Medford Corporation) takes over the Fourbit Creek Timber Sale from defunct Brownlee-Olds Lumber Company and extends logging railroad east from Butte Falls (first commercial timber sale within present boundary of Rogue River National Forest.)

1927: Fish Lake fire; lookout built at Dutchman Peak; municipal watershed management agreements with cities of Medford and Ashland go into effect during the late 1920s.

1929: "Crash" of stock market and onset of the Great Depression; many local people turn to mining and trapping to supplement their incomes.

1932: Name of Crater NF changed to Rogue River National Forest (to lessen confusion with Crater Lake National Park).

1933: Beginning of Franklin D. Roosevelt's "New Deal"; Civilian Conservation Corps establishes first camp in Region Six ("Camp Applegate F-41" at Seattle Bar); CCC begins numerous forestry and recreation projects.

1938: Blister Rust Control ("Ribes Eradication") initiated on the Prospect Ranger District; Passage of O&C Grant Lands-Sustained Yield Act.

1939-1943: Beginning of large-scale timber sales on all Districts, especially Prospect; United States enters Second World War in December 1941 and CCC is disbanded soon thereafter. Army Corps of Engineers builds numerous bridges in Applegate RD (used for training purposes and for timber harvest in war effort). War Production Board prohibits mining for gold and other "non-strategic" minerals for the duration of the conflict.

1947: New "White City Industrial Park" (on site of former World War II Army training base) inaugurates expanded timber industry in the Rogue River Valley; Forest Pest Control Act enables increased emphasis on combatting insect and disease infestations.

1951-1955: 1955 flood damages many sites in the Rogue River Basin including McKee Bridge Campground on the Applegate River. Multiple-Use Mining Act of 1955 passed (stimulated by the Alsarena Mine controversy on the Prospect RD), 1955 Mill Creek Fire.

1956: National Forest lands in Green Springs and Ruch areas transferred to jurisdiction of Bureau of Land Management (created in 1947).

1957-1961: 1959 Ashland Ridge Fire threatens the city and its watershed; Multiple-Use Sustained Yield Act of 1960 formalizes FS land management philosophy; construction of timber access roads accelerates.

1962: Columbus Day windstorm blows down large amount of timber (approx. 113 MMBF) on the Rogue River NF; initial development of FS Air Tanker Base at Medford Airport.

1964: Very destructive flood in Rogue River Basin damages roads and facilities on Applegate and Ashland RD's; Mt. Ashland Ski Area opens; Congress passes Wilderness Preservation Act.

1969: National Environmental Policy Act passed, leading to significant changes in environmental planning processes. "Counter-culture" groups and individuals settling in and near the Rogue River NF.

1970-1975: Roadless Area Review and Evaluation (RARE I); new timber harvest methods (e.g., helicopter and multi-span skyline) come into use on or near Rogue River NF. Shelterwood system becomes major timber harvest method in use on Rogue River NF.

1976-1979: National Forest Management Act of 1976 leads to modifications in planning and management practices on National Forests (including limitations on size of clearcuts); RARE II recommends wilderness designation for Sky Lakes Area and further study for Red Buttes area. Soapstone mine on Elliott Creek Ridge produces large quantities of this material for sale to native carvers in Alaska, Hong Kong, Japan and elsewhere.

1980-1982: Applegate Dam (Army Corps of Engineers) completed (2.5 million dollars in gold recovered by contractors during construction phase), FS enters period of budgetary austerity; severe downturn in lumber market affects NF timber sale program; a major land management planning program, with heavy reliance on computerized data base is underway.

1995: Two Oregon Coho ESUs proposed for ESA listing as threatened – Oregon Coastal Coho ESU and Southern Oregon-Northern California Coastal Coho ESU

1997: Legislation adopts *The Oregon Plan for Salmon and Watersheds*

1997: Southern Oregon-Northern California Coastal Coho ESU listed as threatened

1998: Oregon Coastal Coho listed as threatened

2001: Klamath Mountain Province Steelhead not warranted for listing

2002: Applegate Partnership marks 10 year anniversary

2.3 Historical Conditions Conclusion

The middle Applegate watershed is located in the Siskiyou Mountains of the Klamath Ecoregion - an area with globally significant biodiversity. The middle Applegate watershed experienced mining, trapping, logging, land conversion, residential development and other anthropogenic impacts. People inhabited the Siskiyou region for over 10,000 years prior to European exploration. Exploration of the Oregon Coast began in the late 1700's and trappers first visited the Applegate Valley in 1827 (LaLande 1995). Miners followed, with large scale mining occurring during the mid to late 1800's. Logging increased during the early to mid 1900's and began to subside during the late 1900's especially on Federal lands. Residential development continues to this day.

Human actions impact nearly every stream in the middle Applegate watershed. Impacts from mining are extremely pervasive; as evidenced by sources such as the USGS map shown in Figure 2.3, which identifies mine tailings at a scale of 1:24k. Logging, fire suppression and other anthropogenic activities (some associated with mining) altered the structure and composition of the forests and woodlands in the middle Applegate and beyond. High tree densities and fire hazard resulted while roads also threaten the health of the watershed. Road densities are highest on private lands adjacent to streams – some current roads have been active since the late 1800's, such as Thompson Creek Road.

3.0 Results

In this section we provide results from the Middle Applegate Assessment project. Results are presented separately for each sub-watershed in the Middle Applegate Watershed, including: Forest Creek; Spencer Gulch; Humbug Creek; Thompson Creek; and Slagle Creek.

The results section is organized as follows: Section 3.1 provides an overview of each sub-watershed; Section 3.2 addresses fish distribution; Section 3.3 covers the stream corridor, consisting of instream and floodplain/riparian components along with barriers; Section 3.4 addresses water quality and Section 3.5 addresses Uplands. Discussion of results follows in Section 4.0 including priorities for restoration.

3.1 Sub-watershed Overviews

Sub-watershed overviews consist of physical information (i.e. acreage, landcover, zoning) as well as information about road density. The entire Applegate Watershed is 496,690 acres and the middle Applegate portion of the watershed is 82,643 acres (17% of total watershed). Table 3.1 provides acreage information for sub-watersheds located within the Middle Applegate.

Table 3.1 – List of sub-watersheds located within the Middle Applegate Watershed, including acreage and percent of middle Applegate watershed. The table also contains elevation information as well as information about landuse.

			ELEVATION (meters)							
SUBWATERSHED NAME	ACREAGE	% TOTAL	MIN	MAX	RANGE	MEAN	FORESTRY	AGRICULTURE	URBAN	AGGREGATE
FOREST CREEK	22,570	27%	422	1,372	950	798	91%	4%	5%	0%
SPENCER GULCH	6,549	8%	419	1,518	1,099	742	76%	15%	10%	0%
HUMBUG CREEK	22,423	27%	382	1,530	1,148	720	80%	14%	6%	0%
THOMPSON CREEK	20,053	24%	382	1,530	1,148	720	86%	13%	2%	0%
SLAGLE CREEK	11,050	13%	347	1,253	906	578	66%	33%	1%	0.15%

The Forest Creek sub-watershed contains Forest Creek along with tributaries including Poorman's Creek and Bishop Creek. The Spencer Gulch sub-watershed contains Spencer Gulch and Rock Creek. The Humbug Creek sub-watershed contains Humbug Creek along with Chapman Creek and Keeler Creek; the Humbug sub-watershed is the least homogenous because it spans the valley and thus contains North and South facing aspects. The Thompson Creek sub-watershed contains Thompson Creek along with Ninemile and several other smaller tributaries. The Slagle creek sub-watershed includes Slagle Creek and also spans the valley to include Ferris Gulch.

Road Density

Road densities were calculated and risk ratings were assigned - Table 3.2 provides a summary of road density information per subwatershed. Risk was assigned according to the following criteria: $<4.2 mi/mi^2$ is low risk; $4.2\text{-}5.5 mi/mi^2$ is moderate risk; $>5.5 mi/mi^2$ is high risk/

Table 3.2 – Road density information by sub-watershed. Sub-watersheds with greater than 5.5 miles of road per square mile are assigned a 'high' risk rating while sub-watersheds with less than 4.2 miles of road per square mile were assigned a low risk; others were classified as moderate (4.2-5.5mi/mi^2).

SUBWATERSHED NAME	ACREAGE	Square Miles	Road Length (ft)	Road Length (mi)	Density (mi/mi2)	Risk
FOREST CREEK	22,569.52	35.26	1,029,641.98	195.01	5.53	High
SPENCER GULCH	6,548.50	10.23	278,108.65	52.67	5.15	Moderate
HUMBUG CREEK	22,422.78	35.04	612,887.16	116.08	3.31	Low
THOMPSON CREEK	20,052.61	31.33	565,744.84	107.15	3.42	Low
SLAGLE CREEK	11,049.88	17.27	374,351.16	70.90	4.11	Low

Road densities were also calculated at finer resolution (7th field HUC) to investigate distribution of roads within a given sub-watershed. Figure 3.1 shows the location of high road densities in darker red color.

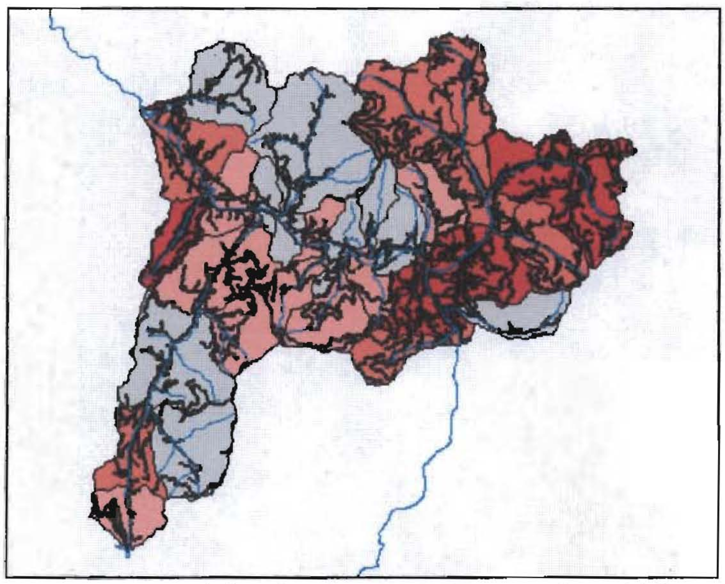


Figure 3.1 – Image showing road density 'hot spots' across the middle Applegate watershed; the darker the color the higher the density. Three areas with high density are located in Ferris Gulch, lower Forest Creek around Ruch, and upper Poorman's creek near the crest of Jacksonville Hill.

Road density varies by ownership. For example, Table 3.3 provides information about the difference of density between public lands and private lands.

Table 3.3 – Road density according to public versus private ownership. As you will see, risk also changes accordingly. The table shows that road density on private lands is greater than density on public lands throughout the middle Applegate

SUBWATERSHED NAME	Public Road Density	Risk - Public	Private Road Density	Risk - Private
FOREST CREEK	4.49	Moderate	6.53	High
SPENCER GULCH	3.74	Low	7.50	High
HUMBUG CREEK	1.81	Low	5.89	High
THOMPSON CREEK	2.66	Low	5.75	High
SLAGLE CREEK	2.27	Low	5.56	High

Density distribution also changes when evaluated according to ownership, as illustrated in Figure 3.2.

Figure 3.2 – Road density ranked on public land (left) and private land (right); again the darker the color the higher the density. These images illustrate how density 'hot spots' change according to ownership. High densities on public lands occur in upper Forest Creek, Ferris Gulch and around the Chapman Keeler area including Rock Gulch while Private densities are highest around Ruch and Poorman's Creek.

We discuss roads, including Off Highway Vehicle (OHV) roads and trails in the context of restoration strategies in the following section 4.0 – Discussion.

3.2 Fish Distribution

Fish distribution results are derived from Oregon Department of Fish and Wildlife database and ARWC surveys.

Forest Creek

In Forest Creek, Fall Chinook are present up to river mile (RM) 0.75 and they use the system for spawning and migration; spring Chinook do not use Forest Creek. Coho spawn, migrate and rear to RM 1.0 (near HWY 238 bridge) in Forest Creek. Summer Steelhead are present above Ruch, up to RM 4.4 and they spawn, migrate and rear in the system. Trout are present up to RM 7.3, which is above the confluence with Poorman's Creek. Poorman's Creek provides trout habitat, with trout present in the lower mile of the creek. Bishop Creek, which flows into Forest Creek below Poorman's Creek is utilized by summer Steelhead up to RM 0.6 for spawning, migration and rearing.

Spencer Gulch

Spencer Gulch, a tributary to the Applegate River, provides habitat for coho and summer steelhead up to RM 0.3 - the section of stream extending from the mainstem to Upper Applegate Road. Fish use Spencer Gulch for spawning, migration and rearing.

Humbug Creek

Humbug Creek contains summer steelhead and trout. Summer steelhead distribution extends to RM 1.3 and trout distribution extends to RM 4.2. Both steelhead and trout use the stream for spawning, migration and rearing. The left fork of Humbug Creek is utilized by trout to RM 0.3. The Humbug sub-watershed is southerly facing so summer rearing is limited in places.

Thompson Creek

Thompson Creek contains the greatest number of fish distribution in the middle Applegate. The system contains fall Chinook, coho, both summer and winter steelhead and trout. Chinook are present to RM 1 and use the creek to spawn and migrate, not for rearing. Coho are present to RM 9 and they use the system for spawning, migration and rearing. Steelhead, both summer and winter extend to RM 10.8 and use the system for spawning, migration and rearing. Trout are present to RM 12.8. Other fish bearing tributaries in the Thompson Creek sub-watershed include Tallowbox Creek, Jamison Creek, Ninemile Creek, and Darnelle Gulch. Of these tributaries, Ninemile Creek provides the only coho habitat, to RM 0.5. Ninemile Creek also contains the greatest distance of steelhead distribution, 1.5 miles. Darnelle Gulch only contains trout.

Slagle Creek

Slagle Creek contains summer steelhead and trout. Summer steelhead extend to RM 1.4, N. Applegate Road, while trout extend to RM 1.2. Residents have reported seeing fish in Wooldridge Gulch.

3.3 Stream Corridor

The stream corridor consists of the instream channel, floodplain and transitional upland fringe (FISRWG 1998). Results from this assessment include the stream channel and floodplain; riparian areas are addressed as part of the floodplain.

3.3.1 Stream Channel

Stream channel results include information about Channel Habitat Type (CHT), sinuosity, and detailed instream data where available. CHT is assigned according to channel gradient and confinement (WPN 1999) - the channel gradient classes used to define CHT's are: <1%, 1-2%, 2-4%, 4-8%, 8-16%, and >18% (WPN 1999). Stream channel information is presented for each 6th field subbasins located within the Middle Applegate. The streamline used for analysis was derived from a digital terrain model with 5' grid cells (Jackson County, OR)

Forest Creek

Forest Creek is a low to moderate gradient stream. The total length of Forest Creek is 9.62 miles. Over half of stream (53%) is less than 3% gradient. Excluding headwater steams, 67% (6.4 miles) of Forest Creek is less than or equal to 4% gradient. Figure 3.3 shows a distribution of CHT's in Forest Creek. The lower section of Forest Creek, from the mouth to the Highway 238 Bridge is characterized as Low Gradient Medium Floodplain. This average gradient for this lower reach is 1.2%.

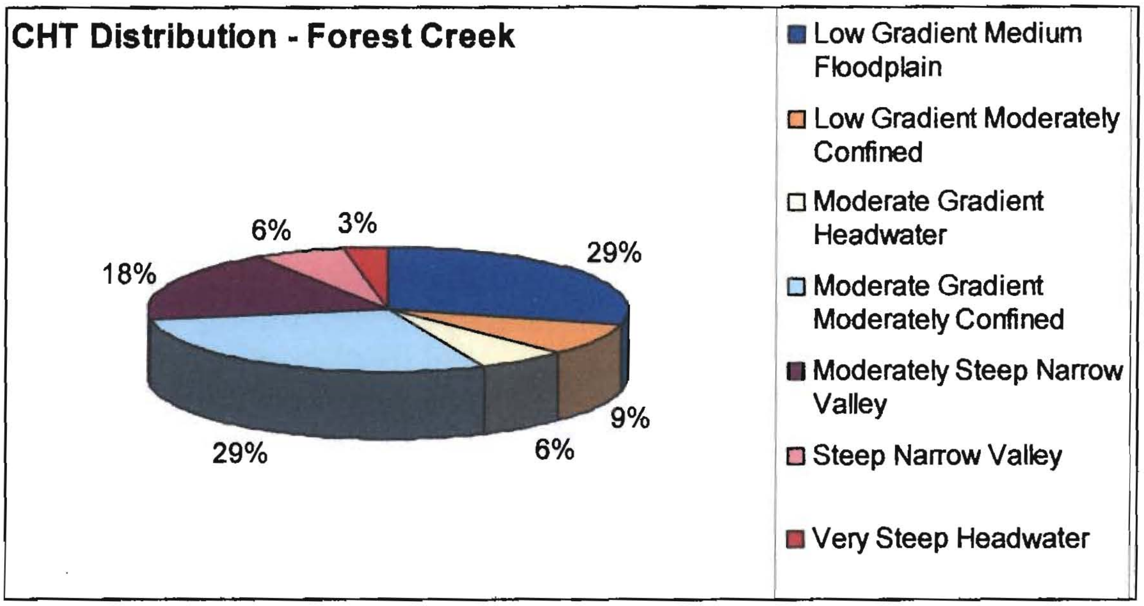


Figure 3.3 - Distribution of Channel Habitat Type (CHT) in Forest Creek only, not the entire sub-basin. CHT is designated based on gradient and confinement of the stream channel.

Sinuosity in Forest Creek averages 1.02. Table 3.4 summarizes sinuosity by gradient class. As you will see in the table, sinuosity decreases as gradient increases, as would be expected; sinuosity averages 1.06 in gradient class 2 (1-2%). Sinuosity in the lower section of Forest Creek averages 1.10 with a maximum of 1.18 (this is the Low Gradient (1.2%) medium floodplain reach that is utilized by coho, Chinook and steelhead).

Table 3.4 Summary of sinuosity by gradient class for Forest Creek. Sinuosity decreases as gradient increases. A sinuosity value of 1 indicates that stream segment length equals valley length (i.e. the stream segment is straight).

Gradient Class	2	3	4	5	6
Sinuosity	1.06	1.04	1.01	1.00	1.00

We conducted a field survey of Forest Creek using ODF&W Intermediate Level Stream Survey. The survey extends from the mouth of Forest Creek to the following end point coordinate (Easting 0497566/Northing 4678288 NAD 83 UTM); the ending coordinate is located just downstream of the confluence of Poorman's Creek (~RM 3).

Reach 1, extending from the mouth to the Hwy 238 Bridge, is classified as being a single channel flowing through constraining terraces within the broad valley floor. One section of reach 1 has unconstrained connectivity with the floodplain, which we address shortly. The active width of reach 1 is 5.8 meters (m) with a height of 0.9m, yielding a Width:Depth (W:D) ratio of 6.4. The primary channel encompasses 7,452m^2 while secondary channels encompass 1,866m^2. Instream wood in this reach is lacking.

Reach 2 extends from the Hwy 238 Bridge to the confluence with Bishop Creek. Reach 2 is also a single channel with constraining terraces. The active width of reach 2 is 6.5m with a height of 1.4m, yielding a W:D ratio of 4.6. The primary channel encompasses an area of 9,374 m^2 and the secondary channels encompass $73m^2$.

The survey was ended at a section of the creek that flows subsurface through remnant mine tailings. A previous survey conducted in 1970 describes this section of stream as "split up with old mine tailings". Just upstream of the end point is a beaver dam complex, which was also noted in the 1970 survey. The beaver dam complex is located just upstream of Poorman's Creek.

In Forest Creek we also conducted a hydrologic analysis to investigate floodplain connectivity. Modeling was conducted using a combination of HEC-GeoRas and HEC-Ras software along with ArcGIS software. Output provides an indication of stream and floodplain interaction (Figure 3.4).

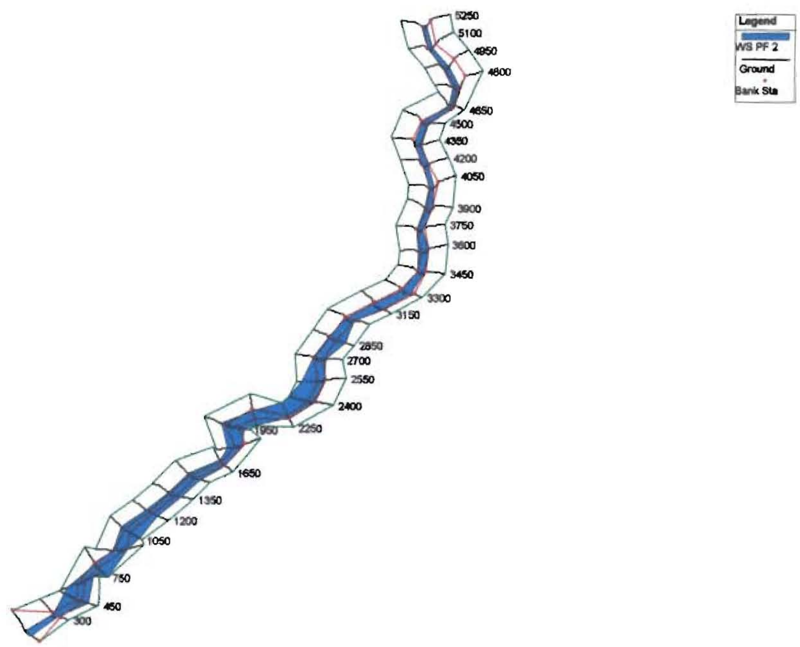


Figure 3.4 - Hydrologic analysis of lower Forest Creek showing locations with greatest floodplain connectivity. The Red line is the stream bank and the blue polygon is the water surface profile. The upper portion of the image shows a confined channel with limited overbank flow potential while the lower portion shows hydrologic connection between the channel and floodplain. The image also shows distance, in feet, along the stream, which helps identify specific locations for project planning purposes.

Spencer Gulch

Spencer Gulch is dominated by moderate gradient reaches with 58% of the stream characterized as Moderately Steep Narrow Valley (Figure 3.5). Spencer Gulch from the mouth to Upper Applegate Road is moderately confined, above Upper Applegate Road the stream flows through a well defined valley that extends upwards to the Woodrat Mountain area.

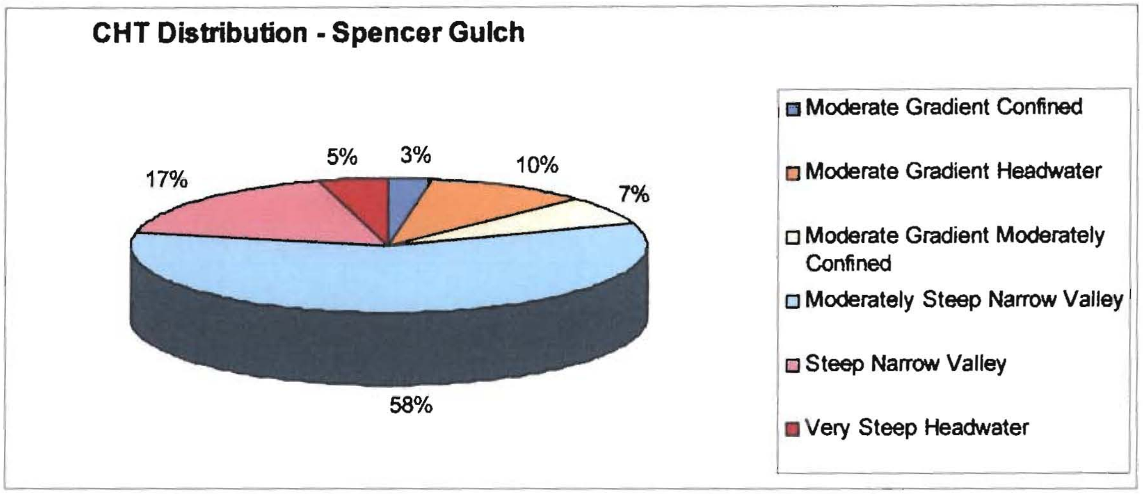


Figure 3.5 - Channel Habitat Type (CHT) distribution in Spencer Gulch. The dominance of 'Moderately Steep Narrow Valley' CHT reflects the relationship between the stream and surrounding topography.

Sinuosity in Spencer Gulch averages 1.0 with a maximum of 1.15. The average sinuosity of 1.0 is consistent with a confined stream where stream length equals valley length.

Humbug Creek

Humbug Creek rises quickly from the mainstem Applegate river into a moderately confined valley. Balls Branch and Left Fork Humbug, which are primary tributaries of Humbug Creek, rise quickly into moderately steep narrow valleys. The primary CHT in Humbug Creek is moderately steep narrow valley (48%). Chapman Creek and Keeler Creek are also located in the Humbug Creek sub-watershed; these systems are dominated by steep and moderately steep valley topography (Figure 3.6).

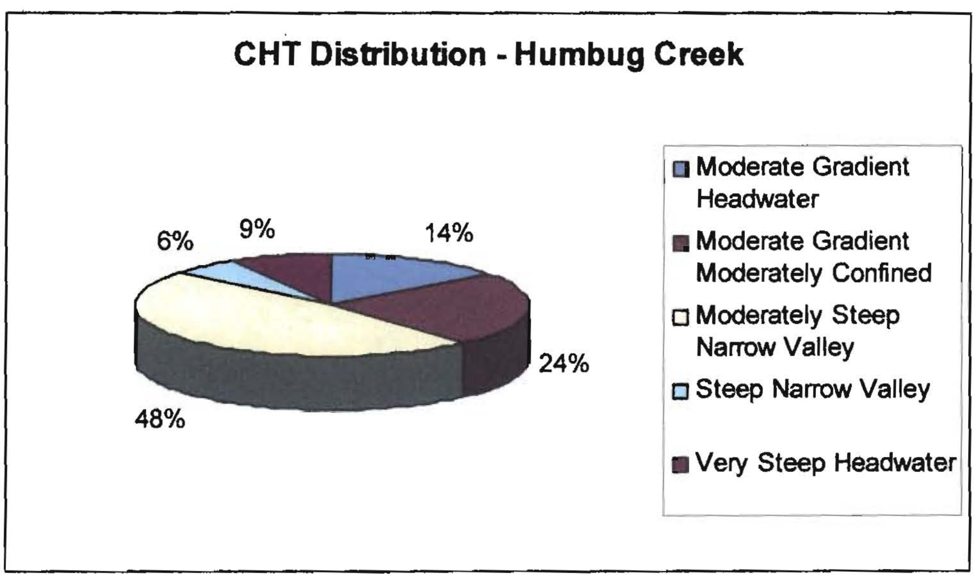


Figure 3.6 - Channel Habitat Type (CHT) distribution in Humbug Creek. The dominance of 'Moderately Steep Narrow Valley' CHT illustrates that Humbug quickly rises from the mainstem Applegate into moderately steep valley topography.

Sinuosity in Humbug Creek averages 1.0 with a maximum of 1.16. The maximum reach is located in a moderate gradient section of stream within a mile of the mouth.

Thompson Creek

Thompson Creek is dominated by low gradient medium floodplain CHT (56%) (Figure 3.7); Thompson Creek has the greatest number of fish distribution miles of middle Applegate tributaries. The next largest CHT in Thompson Creek is moderate gradient moderately confined (19%). Thompson Creek is approximately 12.7 miles long, of this length nearly 80% (10.1 miles) is under 4% gradient.

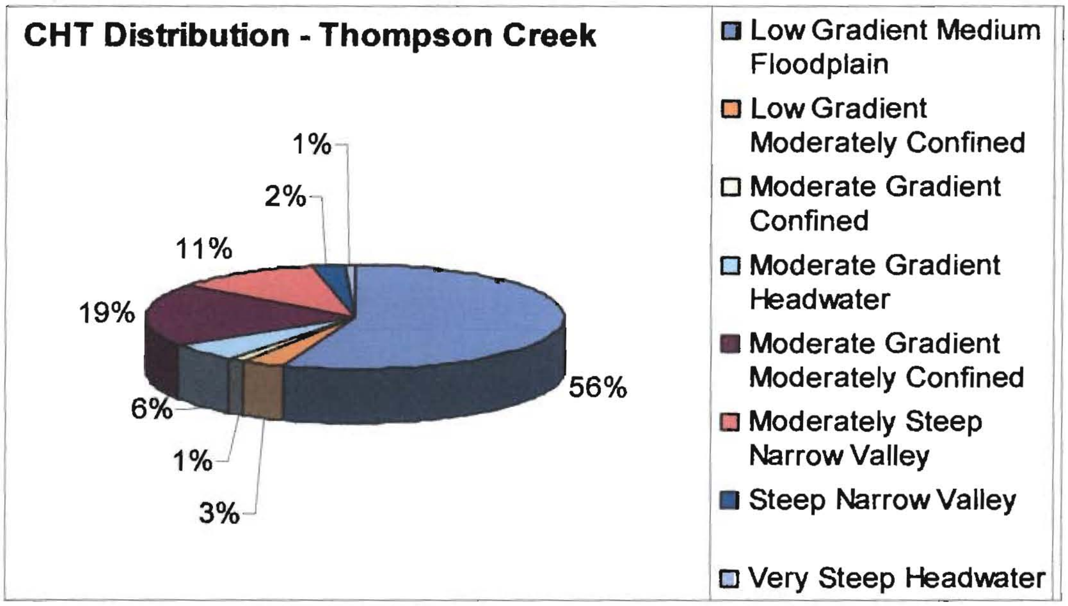


Figure 3.7 - Channel Habitat Type (CHT) distribution in Thompson Creek. The dominance of low gradient habitat type corresponds with valley topography, as well as fish distribution.

Sinuosity in Thompson Creek is low, 1.04. The maximum sinuosity is 1.3 – reaches with the highest sinuosity are located near the mouth of Thompson Creek.

Survey data indicate that many reaches in Thompson Creek lack complex pools and large instream wood; 54% of the reaches surveyed are classified as undesirable according to Oregon Department of Fish and Wildlife (ODFW) benchmarks of <1pool/Km. With regards to large wood, undesirable is classified as <1piece/100 meters; a condition found in 31% of the reaches sampled. Large wood creates pools and valuable fish habitat. Many pools in Thompson Creek are lateral scour pools formed under alder and ash trees, not scour pools typically formed by large wood. Instream wood over 25 inch diameter is effectively absent from Thompson Creek below Ninemile; none of the reaches surveyed below Ninemile had an average of 1 or more large pieces per 100m.

Survey results also indicate accelerated bank erosion in Thompson Creek. Many sites exhibited bank failure, which is thought to be from stream incisement, channel straightening, past mining, removal of streamside vegetation, high water events and other synergistic impacts. Several bank failures threaten sewer lines and have impacted building, roads and other infrastructure including irrigation ditches. Channelization impacts floodplain connectivity, which is limited in Thompson Creek by development and roads, with some main roads along the creek in existence since the late 1800's.

Slagle Creek
Slagle Creek is a relatively short creek, ~4 miles, dominated by moderately steep narrow valley (55%) (Figure 3.8). The lower and mid sections of the creek contain low to moderate gradient channel habitats that transition to moderately steep to steep channel types in the Slagle Creek headwater basin.

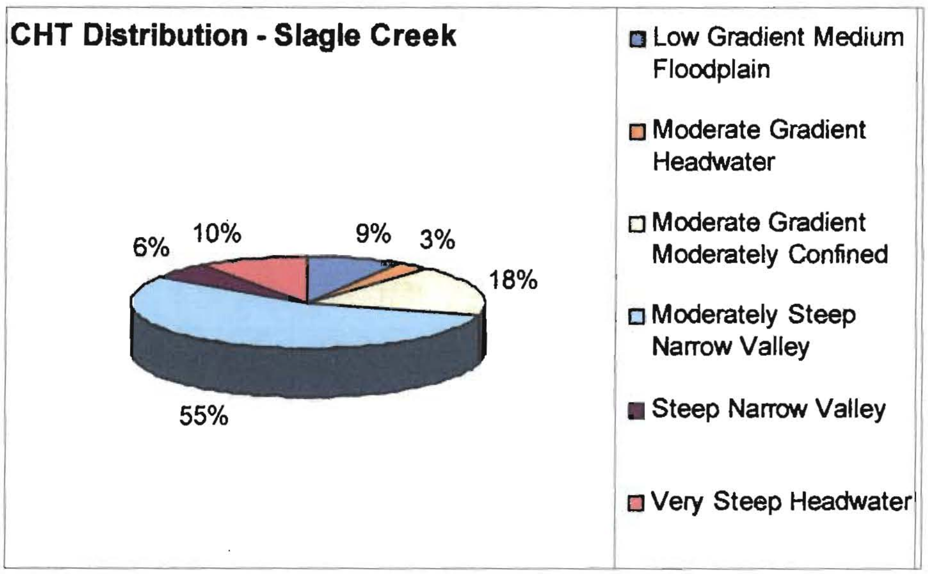


Figure 3.8 - Channel Habitat Type (CHT) distribution in Slagle Creek. The approximate length of Slagle Creek is 4 miles.

Sinuosity in Slagle Creek averages 1.0 with a maximum sinuosity of 1.22, which is relatively high within middle Applegate sub-watersheds.

Mainstem Applegate River
The portion of Applegate River that flows through the middle Applegate watershed is 14.7 miles long 30.8% of the total 47.7 miles of mainstem Applegate River (ending at the Applegate Dam). Focusing on the middle Applegate section, 100% is low gradient large floodplain habitat with an average gradient of less than 1%. Sinuosity averages 1.15, which is at or above maximum for some tributaries, while the maximum sinuosity of the middle Applegate River equals 1.47.

Much of the instream large woody debris (LWD) has been cut from the channel, as evidenced by sawn log butts with embedded ends. LWD jams are relatively absent from the Middle Applegate watershed however woody debris does begin to accumulate towards the lower portion of the watershed near the town of Applegate.

Figure 3.7 – Log on mainstem Applegate that has been sawn off. Removal of wood from the channel, which occurs at multiple locations in the middle Applegate is a problem because it prevents wood from functioning and decreases the potential formation of large woody debris jams.

3.3.1.1 Barriers

Barriers pose a threat to instream migration and hydrologic processes within the stream corridor. Several barriers are present in the Middle Applegate Watershed.

Forest Creek
An old bridge pier is located on Forest Creek above Hwy. 238. This structure (Figure 3.8) acts as a partial barrier to fish migration. Additional structures in Forest Creek, as identified by the Rogue Basin Fish Access Team (RBFAT) database, are located at RM 3.9 and 7.6, with the latter outside of the area of fish distribution.

Figure 3.8 – Structure in Forest Creek near the Ruch Country Store

Humbug Creek

An old diversion is located in Humbug Creek, RM 0.5 (Figure 3.9). This diversion has been breached along the edge however is channel spanning. Additional structures in Humbug Creek include:

Figure 3.9 – Structure in Humbug Creek at RM 0.5.

Thompson Creek

Several push up dams are located in Thompson Creek, along with other structures. Push up dams are seasonal in nature and impact juvenile fish migration. Figure 3.10 shows a push up dam in Thompson Creek. Records from the RBFAT database also identify the following structures in Thompson Creek:

Figure 3.10 – Channel spanning push up dam in Thompson Creek

3.3.2 Floodplain/Riparian

Forest Creek

Riparian corridors average 45% cover along Forest Creek and primary tributaries including Poorman's Creek and Bishop Creek, which is low for a riparian corridor. Conifer trees dominate (26%) while hardwood accounts for 22% of the riparian species composition, of which 12% is oak. Mixed conifer/hardwood accounts for another 10% while madrone comprises 24% - found mostly in the headwater locations. Pasture and exposed soil comprise 7% of the composition; most of the pastureland is located in the lower reaches of Forest Creek. Overall recruitment potential is classified as inadequate.

The floodplain of lower Forest Creek is dominated by Agricultural landuse followed by rural residential landuse. The lower reach of Forest Creek contains sapling/pole forest which is classified as regeneration (<4in. dbh)/Small (4-12in. dbh) – these riparian areas (RC1 and 2) are dense (<1/3 ground exposed). In addition, there are sections of lower Forest Creek that are barren and shade is absent. Blackberries are prolific throughout lower Forest Creek.

The middle section of Forest Creek above the town of Ruch is primarily rural residential landuse with current and historic mining present. Deciduous trees dominate the middle sections; blackberries are also present throughout the middle portion of Forest Creek. Upper Forest Creek transitions from rural residential into forestry. Conifer and mixed-conifer forest types dominate the upper portions of Forest Creek. Recruitment potential increases within the upper reaches of Forest Creek.

Spencer Gulch

The Spencer Gulch sub-watershed includes Rock Gulch and portions of the mainstem Applegate River. Overall, conifers dominate the riparian areas of Spencer Gulch with

46% conifer, primarily Douglas-fir. Oak and madrone combined encompass 31% of the riparian. Hardwood vegetation accounts for only about 6% of riparia in Spencer Gulch. Blackberries are prolific along the mainstem Applegate River and tributaries in the Spencer Gulch sub-watershed.

Floodplains are relatively absent along Spencer Gulch and Rock Creek however, 15% of the sub-watershed is agriculture which is primarily located along the mainstem Applegate. Mainstem floodplain is composed of native and non-native vegetation within riparian zones 1 and 2 – approximate 100 foot buffer – and pasture/agricultural land beyond. Overall recruitment potential is classified as inadequate.

<u>Humbug Creek</u>

The Humbug Creek sub-watershed spans the valley to include north and south facing slopes. As such, riparian composition varies with aspect. Overall, conifers comprise nearly 40% of the species, with Douglas-fir dominating. Hardwoods comprise 40% with madrone comprising over half of this composition. Oaks, which are found primarily on the southern facing portion of the valley around Humbug Creek, comprise 14% of the hardwood category. Many of the tributaries of Humbug Creek are comprised of manzanita/shrub cover. Overall recruitment potential is classified as inadequate.

Riparian cover is dense overall for the sub-basin however cover is higher within conifer dominated riparian areas around Chapman and Keeler Creeks (~70-90%) while cover decreases on the lower portions of Humbug Creek to around 35%. Cover along Humbug Creek is relatively continuous however there are a few large openings that decrease average cover.

The mainstem Applegate portion within the Humbug sub-watershed contains some pockets of large incense cedar and pine however also contains significant stretches that are dominated by blackberry and devoid of revegetation. Many sections along the mainstem are open or have buffers less than 100ft in this sub-watershed.

<u>Thompson Creek</u>

Conifers dominate the upper reaches of Thompson Creek while hardwoods, primarily alder dominate the middle to lower sections of the creek. The predominant conifer species is Douglas-fir. Hardwoods comprise 18% of the composition while mixed conifer/hardwood comprises 9%. Madrones comprise 13% of the species while shrubs comprise 4% and open prairie landcover comprises 8% cover. Pasture dominates floodplain landcover within the lower floodplain portions of Thompson Creek. Buffer widths fluctuate and many buffers are below 100 feet wide (Figure 3.11 shows a section of riparian corridor along lower Thompson Creek). Overall recruitment potential is classified as inadequate with the exception of upper Thompson Creek, above Ninemile Creek, which is classified as adequate.

Figure 3.11 – Riparian area along lower Thompson Creek showing encroachment and variable buffer widths and, on the right, infrared radar showing heat – blues and greens are cooler than reds and one can see red along periphery of open vegetation pockets, which underscores importance for riparian connectivity.

The lower reaches of Thompson Creek are dominated by 6-12 in trees, primarily hardwood with some conifer. Very few large trees are present, indicating a lack of potential large wood for the stream. Several large conifer trees are present on Thompson Creek below the confluence with Tallowbox Creek. Canopy cover in the lower portion of Thompson Creek averages over 50% however there are several large gaps and reaches with cover values equal 25% or less. Blackberries are prolific throughout the lower reaches of Thompson Creek, as are road crossings (Figure 3.12). The upper reaches of Thompson Creek above Ninemile Creek are relatively forested; canopy cover in the upper reaches, above Ninemile, is greater than 75%.

Figure 3.12 – Lower reach of Thompson Creek: photo on the left illustrates blackberries, bridge crossing and a sample of riparian structure while the photo on the right shows a more open riparian area; notice the wood cut from the bank on the lower left portion of this photo.

Slagle Creek
The Slagle Creek sub-watershed encompasses nearly 6 miles of mainstem river. Riparian areas along this section of mainstem river range from entirely open pasture lined banks to sections of cottonwood and pine. The mainstem section of river begins to morph into a braided system with side channel habitats. Islands support riverine communities of cottonwood and alder. Pine, along with some incense cedar dominate the conifer component of stream bank communities. Buffers under 100' are common along this section of mainstem river and the stand density as a whole is classified is sparse; due in large part to the lack of connectivity between vegetated patches. Blackberries are present along the mainstem river.

The riparian area along Slagle Creek is comprised of a relatively high amount of 'prairie' landcover (16.5%). Conifers account for approximately 13% of the species composition while mixed conifer and hardwood cover accounts for 16%. Below North Applegate Road the buffer width averages over 100' while upstream of N. Applegate Road the buffer decreases substantially with open areas present. The headwaters of Slagle Creek are densely covered with a mixed conifer and hardwood cover.

3.4 Water Quality

Forest Creek
Forest Creek is listed on the 303(d) list of impaired waterbodies for the Dissolved Oxygen parameter; Summer. Temperature is 'attaining' status as no 7 day averages were in exceedence for temperature. Forest Creek has the highest level of nitrates of streams tested in the Applegate Valley (ARWC 2004); though at 0.53mg/l this level is well below the EPA 10mg/l standard (levels have fluctuated in Forest Creek to a high of 3.0mg/l). Flow Modification and Habitat Modification are listed as 'water quality limited not needing a TMDL'.

Humbug Creek
Temperature in Humbug Creek is classified as 'Water quality limited, TMDL approved'. Humbug was delisted upon TMDL approval in February 2004.

Thompson Creek
Thompson Creek has the second highest level of nitrates of the streams tested in the Applegate Valley (ARWC 2004), though again well below EPA standards. Nitrate levels decrease in the upper reaches of Thompson Creek; nitrates are commonly caused by agricultural runoff or leaking septic systems. Nutrient levels of nitrates and phosphates in Thompson Creek contribute to excessive algae growth and increased instream vegetation. Excessive algae growth has been associated with low dissolved oxygen values. Algae transpire during sunlight hours, thus producing oxygen however at night algae consumes oxygen, greatly decreasing the dissolved oxygen. Thompson Creek is listed on the 303(d) list for Dissolved Oxygen.

The status of stream temperature in Thompson Creek, during the summer, is 'Potential Concern'. Flow Modification and Habitat Modification are listed as 'water quality limited not needing a TMDL'. Thompson Creek is unique because water in transported into the sub-watershed from outside via Sturgis Ditch and O'Brien Ditch, thus providing an opportunity to increase flows within a sub-watershed; Sturgis Creek and O'Brien Creek drain into the Applegate Reservoir.

3.5 Uplands

Terrestrial ecosystems possess great diversity within the within the Middle Applegate. Priority factors that limit watershed health in the uplands are Fire Risk and Seral Stage (Priority 1), Road Density (Priority 2) and Wood Source (Priority 3) (RBCC 2006). Hydrologic impacts from timber harvest are determined to be 'unlikely' across the middle Applegate watershed.

Fire risk and altered seral stage result from logging, fire suppression and other anthropogenic impacts. High fire risk areas include major ridges, lands adjacent to roads, powerlines, and private lands (BLM 1995). Off-highway vehicles and other vehicles are one source for ignition along roads. Low elevation areas in the middle Applegate are at risk of uncharacteristic high intensity fire. Priority locations for fuel reduction work in the middle Applegate watershed include:

Forest Creek and Spencer Gulch Sub-watersheds
- West side of Sterling Creek from Cady road to Poorman's Creek road
- Forest Creek road
- Area between Forest Creek and Humbug Creek
- West side of the river in the Lomas and Dunlap Area

Thompson Creek Sub-watershed
- Ridge between Thompson and Chapman/Keeler
- Work between Star Gulch and Thompson Creek
- Evacuation loop along Carberry Creek from Thompson Creek
- Southeast corner of the sub-watershed at BLM/FS interface

Humbug Creek Sub-watershed
- Work towards Forest Creek
- Build on recent work by Fire District #9 and the BLM

Slagle Creek
- Pprivate lands adjacent to BLM Ferris/Bugman project
- Fuel break between Slagle and Savage Creek
- Slagle Creek headwaters between Slagle and Humbug

Low elevation landscapes within the middle Applegate include valuable yet imperiled forest types including: (*NatureServe URL*)

-Globally Ranked Critically Imperiled (G1) Associations

Sugar Pine - Ponderosa Pine - Douglas-fir / California Fescue
Ponderosa Pine - Oregon White Oak / Whiteleaf Manzanita / California Fescue
Ponderosa Pine - White Oak - Black Oak

Vegetation density levels are currently much higher than in the past, especially in conifer forests (BLM 1995). High densities threaten plant vigor and health and in some cases can lead to insect invasion and tree mortality. Species composition is also shifting as Douglas-fir encroaches upon oak woodlands and other pine associated conifer stands. Pre-logging data from the Rogue Basin indicate that pine forest type historically covered roughly 23% of the landscape while Douglas-fir forest type covered 56% (Ripple 1994); BLM lands in the Middle Applegate contain 5% pine and 67% Douglas-fir (BLM 1995).

Impaired conditions in the uplands can impact wildlife species. According to BLM assessment, twenty-three special status species are known or suspected to be present in the middle Applegate (BLM 1995) (Table 3.4)

Table 3.4 – Special Status Wildlife Species found in the Middle Applegate Watershed (from BLM 1995)

Species	Status
Western Pond Turtle	C2
Tailed Frog	C2
Siskiyou Mountain Salamander	C2
Foothill Yellow-legged Frog	C2
California Mountain Kingsnake	BA
Common Kingsnake	BA
Northern Spotted Owl	T
Bald Eagle	T
Northern Goshawk	C2
Great Gray Owl	BS
Pileated Woodpecker	BA
Flammulated Owl	BA
Northern Saw-whet Owl	BA
Western Meadowlark	BA
Western Bluebird	BA
Fisher	C2
Townsend's Big-eared Bat	C2
Fringed Myotis	C2
Long-eared Myotis	C2
Yuma Myotis	C2
Long-legged Myotis	C2
American Marten	BA
Red Tree Vole	SM

Key: (T)Threatened under ESA; (C2) Candidate for listing as threatened or endangered; (BS) Bureau Sensitive; (BA) Bureau Assessment; (SM) Survey and Manage species

Noxious weeds known to occur in the middle Applegate include: tansy ragwort; yellow star thistle; medusahead rye; Klamath weed; bull thistle; and blackberry. Noxious weeds should be addressed within restoration strategies and project designs to minimize spread and aid in control.

4.0 Discussion

Ecological restoration treatments are designed to assist in the recovery of systems that have been degraded, damaged or destroyed. Many systems and components in the middle Applegate have been impacted across a range of scales. So what do we hope to restore? Restoration priorities (table 4.1) are separated into aquatic priorities and terrestrial priorities. Each primary category (aquatic and terrestrial) are separated into three priority classes (RBCC 2006).

	Priority One	Priority Two	Priority Three
Aquatic Priorities	Barriers	Channel Modification	Gravel
	Large Wood	Stream Complexity	Chemistry
	Temperature		Pool/Riffle Ratio
	Sediment		
Terrestrial Priorities	Fire Risk	Riparian Shade	Wood Source
	Seral Stage	Roads	

Through applied restoration we aspire to improve the condition of key factors that influence watershed health. Restoration strategies will integrate multiple project types and priorities where possible to maximize limited resources and achieve meaningful results. Spatially explicit strategies provide a step towards on the ground project planning and implementation. This middle Applegate assessment identified priority locations for project work.

Beginning with fish as a target – focusing upon coho salmon and steelhead - two priority sub-watersheds emerge from the middle Applegate: Thompson Creek and Forest Creek, with Thompson Creek as the number one priority sub-watershed. Thompson Creek has the greatest number and sub-watershed percentage of low gradient stream miles in the middle Applegate and, as somewhat of a corollary it contains the greatest number of coho and steelhead distribution miles in the middle Applegate.

Thompson Creek is in poor condition and requires significant restoration, as evidenced by the "limiting" designation assigned to: temperature, chemistry, water quantity, large wood, stream complexity and channel modification. Barriers in Thompson Creek are rated as "moderate", which implies moderate to significant amount of restoration required. Barriers below Ninemile Creek are primarily push-up dams with the exception of Hogan Diversion, which is a concrete structure. Push-up dams should be modified where possible because push-up dams impede juvenile migration, impact rearing habitat availability and can lead to bottlenecks within the life cycle of fish.

Instream habitat structures such as porous rock weirs should be considered as possible replacements for push-up dams. In-depth site assessment and engineering are needed to evaluate potential options for push-up dam modification and removal. As such, a priority step towards restoration in Thompson Creek involves comprehensive survey and engineering of push-up dam locations along with social development of the project. Through outreach we have begun to develop project opportunities for instream work in Thompson Creek, including push-up dam modification and irrigation efficiency. We are currently working to increase water quantity in Thompson Creek through improved function of the Sturgis and O'Brien ditch network. This ditch network provides unique opportunity to import water into a sub-watershed. Thompson Creek should be the focus of irrigation efficiency improvements that address ditch efficiency and instream diversions and habitat.

Channel Habitat Type (CHT) information derived from the middle Applegate assessment is used to gain a better understanding of geomorphic context and to identify areas that are likely to respond to restoration efforts – these sections of stream are referred to as 'response reaches'. For example, Low gradient floodplains are more responsive to restoration treatments and management activities while bedrock canyons and steep headwater valleys are less responsive. Thompson Creek sub-watershed contains low gradient response reaches, primarily below Ninemile Creek. In Thompson Creek, restoration work should be focused upon push-up dam barriers while integrating habitat structures such as porous rock weirs or woody structures. Large woody debris placement should take place in multiple locations below Ninemile; LWD placement should be distributed with sites below Ninemile (~RM7) in the middle of Thompson Creek (RM5) and towards the mouth; additional consideration should occur for LWD placement around RM 2.6. Porous weirs should also be installed in coordination with LWD and irrigation management. Instream and riparian restoration work should be coordinated and should take place with consideration of seasonal barriers.

Private road densities are high in the Thompson Creek sub-watershed so stormwater management projects should be considered a priority and completed in conjunction with other projects. Roads and road crossings should be maintained / improved and stormwater retention structures should be developed to reduce sediment input.

Forest Creek is another priority sub-watershed in the middle Applegate watershed. Forest Creek contains coho, steelhead and Chinook salmon. Restoration should be focused within the lower reaches of Forest Creek near the mouth because the riparian corridor has been degraded, blackberries are dense, there is good floodplain connectivity, the lower reaches are utilized by Chinook and coho as well as steelhead, and there are willing landowners. Large woody debris should be installed within the lower reaches of Forest Creek. There is only one bridge crossing within the lower portion downstream from Hwy 238. Therefore, potential impacts from LWD transport are reduced. Large wood and other structures, such as porous rock weirs can increase habitat complexity and provide usable habitat area for threatened and endangered fish amongst other wildlife species. Additional work should be done to remove an existing barrier located near Ruch at RM 2.0 (Figure 3.7). This barrier may benefit from removal using a phased approach so that sediment transport can be monitored. Bridge construction upstream from this barrier, at the Hunter Feedlot will be a step towards improved water quality as cows are provided a crossing.

Road densities are high in the Forest Creek sub-watershed and OHV use is expanding. Sediment is a concern and should be monitored, especially in the upper reaches of Forest Creek. Roads and road crossings should be maintained / improved and stormwater retention structures should be developed to reduce sediment input. Two large ponds located near the confluence of Poorman's Creek provide some sediment storage – again monitoring of sediment in Forest Creek should occur. OHV use and associated impacts should be monitored more comprehensively around Forest Creek, China Gulch, Humbug Creek and Ferris Gulch.

In the long term, channel reconstruction should occur in Forest Creek near RM 3.0 – the section of Forest Creek located between Bishop and Poorman's has some very nice pool structure and riparian cover however at the upper extent of this reach (towards the confluence of Poorman's) has been heavily impacted by mining and lacks channel structure or hydrologic function as flows go subsurface. Tailing piles litter the floodplain and historic channels and mining pits are prolific in the upper sections of this reach. As one continues upstream there are two large pond complexes that span the floodplain of Forest Creek.

Additional stream corridor restoration opportunities are found in Humbug Creek and other places throughout the middle Applegate however initial stream corridor restoration work should focus upon Thompson Creek and Forest Creek. A concrete structure located at RM 0.5 in Humbug Creek should be modified or removed however other projects take precedence.

With regards to the uplands, results indicate high fire risk throughout the Middle Applegate. Fuels reduction activities on private land should be coordinated with other work (i.e. BLM, USFS, Fire Districts, County efforts, other fire and fuels related work and aquatic restoration work) in an effort to achieve results that are meaningful at a landscape scale. Coordinated efforts are more likely to be effective at broad scales. Also, fuels reduction efforts should be integrated with forest restoration projects in an effort to reduce fire risk and improve seral stage distributions; 'fire risk' and 'seral stage' are primary terrestrial restoration priorities for the middle Applegate watershed. ARWC should cultivate and participate in collaborative planning efforts and prioritization projects such as the ongoing Fire Learning Network (FLN), which is organized by The Nature Conservancy as part of their Global Fire Initiative. Such project provide an avenue for integrating assessment data into broader regional planning efforts.

Fuels work around homes is understandably geared towards reduction of fire threat however work at the public/private land interface, away from a homes defensible space, should attempt to reduce fire risk and improve forest health and seral balance across the landscape. Landscape planning results should be shared with community members so that community members know the importance of their property in terms of the broader landscape scale. Landowners should tailor work on their property across a range of objectives, moving from defensible space near the home towards healthy forest ecosystems. Many private non-industrial lands in the middle Applegate have been logged in the past and suffer from high tree densities. Landowner outreach is a priority because it provides an opportunity for landowners to learn about natural resource management on their property and to advance applied restoration efforts.

Forest restoration opportunities are found throughout the middle Applegate however priority locations include upper Slagle Creek with possible extensions into Humbug, upper Forest Creek, Thompson Creek with possible extensions into Chapman-Keeler, and some post fire restoration work in upper Spencer Gulch. Forest restoration should improve stand structure and composition of forest stands, with focus on density reduction, while increasing vigor and growth. Restoration of sugar pine and low elevation pine forests is a high priority. Forest restoration should encourage development of old-growth stand characteristics. Forest restoration efforts should be undertaken at the stand level and incorporated into watershed planning efforts to encourage diversity of seral stages across the landscape. Oak woodland restoration is also a high priority; oak woodland restoration should be linked with wildlife management including migratory bird species. Chaparral management is a moderate priority and should be integrated with fuels planning and treatment. Noxious weeds should be explicitly addressed on all restoration projects.

Uplands work should be conducted in combination with stream corridor work where possible so that aquatic and terrestrial priorities can be addressed. Forest restoration should be linked with riparian silviculture in an effort to integrate terrestrial and aquatic restoration efforts and improve 'riparian shade', 'wood source' and water quality conditions. Opportunities for integrated efforts can be found between Forest Creek and Humbug and between Thompson Creek and Humbug on the Chapman/Keeler side of the valley. Fuels reduction should occur at a landscape scale, which is easier said than done given limited resources. To achieve results at scale, coordination between agencies and organization should occur. For example, counties have developed strategies and Fire District #9 has completed fuels reduction work in many areas of the middle Applegate, as have other federal agencies such as BLM and USFS. ARWC is working cooperatively with the BLM and Fire District #9 on a project near Lomas Road, a project that marries 123 acre BLM treatment with a 77 ARWC effort on private lands. Lomas Road is a priority location identified by the Applegate Fire Plan (Shafer and Shipley 2002) and work in this location should continue to expand to other properties. Additional fuels reduction work should focus on sites identified in section 3.4 of this document and sites where past work has occurred in proximity.

Road work should be coordinated between federal and private lands. Road work should be focused in the Thompson Creek sub-watershed with primary focus on private roads. One particular issue surrounding Forest Creek and Humbug Creek concerns OHV traffic; attention should be given to OHV traffic when planning treatments because when stands are opened then OHV access is increased and road/trail networks are expanded – as evident in and around the Forest Creek sub-watershed.

5.0 Conclusion

The middle Applegate assessment provides guidance for project development and planning. This middle Applegate assessment provides another valuable piece to the Applegate watershed puzzle and marks an important step towards applied, on the ground restoration. ARWC will integrate data and information from the middle Applegate assessment into watershed wide planning as well as focused site planning so that resources are maximized and focal objectives are met - be they objectives associated with the restoration of coho salmon populations, restoration of oak woodlands and low elevation pine forest types, improved agricultural operations, or other integrated economic and ecologic projects that integrate complex biologic and social objectives.

Thompson Creek and Forest Creek sub-watersheds emerged as priority locations for aquatic restoration. Outreach efforts in each of these areas has lead to project development and some applied projects, such as an irrigation efficiency project in Thompson Creek and a riparian restoration project in lower Forest Creek, with more projects to come. The Lomas road area emerged as one priority location for terrestrial restoration. ARWC has been working with project partners and private landowners in the Lomas area to complete a comprehensive restoration project involving thinning, fuels reduction and prescribed fire, forest and oak woodland restoration, and riparian restoration along the mainstem Applegate.

This assessment has lead to improved relationships within the community and improved data available for management planning and project development. ARWC thanks the Oregon Watershed Enhancement Board for their support of this project and appreciates the contributions of the community and involvement of public agencies.

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