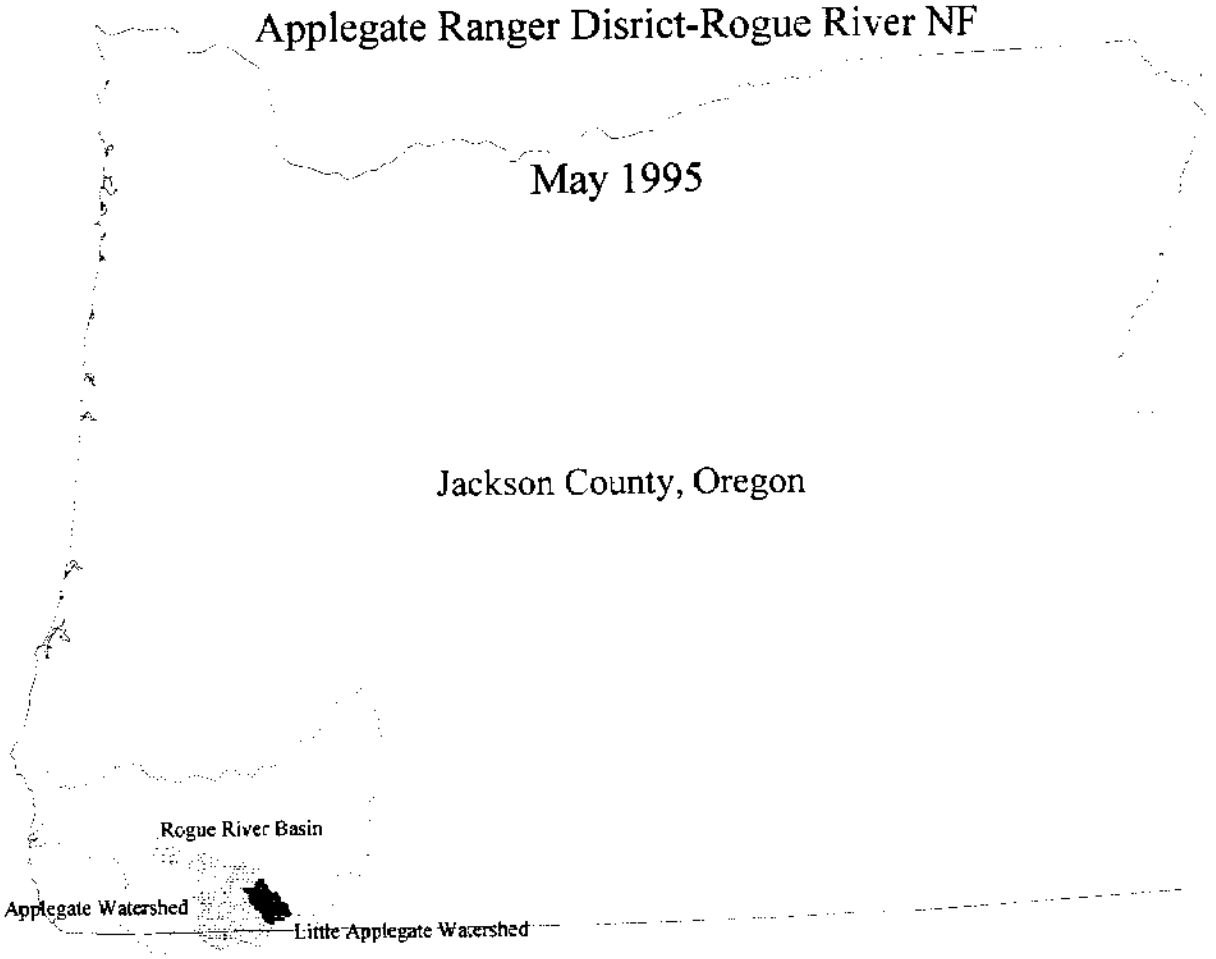
Little Applegate River Watershed Analysis

Applegate Adaptive Management Area

Ashland Resource Area-Medford BLM
Ashland Ranger District-Rogue River NF
Applegate Ranger Disrict-Rogue River NF

May 1995

Jackson County, Oregon



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1. INTRODUCTION

1.1 Document Organization

This report documents the primary findings of the watershed analysis for the Little Applegate Watershed. All lands (public and private) were considered during the analysis.

This report focuses on the "high points" of the analysis concerning issues, areas of concern, findings, and recommendations. Greater detail can be found in the Specialist's Reports, from which this integrated report was based. Specialist's Reports are listed at the end of this document, and are available at the Applegate and Ashland Ranger Districts, and Medford BLM offices.

The maps shown in this document are small scale. They are intended to show general information. They are not intended to be suitable for project planning. Most of the maps shown are in the specialist's reports at a larger scale. All of the maps were generated through the geographic information system (GIS).

The real value of this analysis is in the data gathered and stored in Specialist's Reports, data bases, and the GIS used for the analysis. This information is available for site specific project planning; however, much of this data will need to be supplemented for specific projects.

1.2 Location of Watershed

The 72,262 acre Little Applegate Watershed (darkened on map)is located in Southwestern Oregon. It comprises 14.7% of the 491,000 acre Applegate Watershed (shaded on map), and 2.1% of the 3,301,000 acre Rogue River Watershed (outlined on map).

1.3 Purpose of the Analysis

Following the President's Forest Conference convened in Portland, Oregon in April of 1993, the Forest Ecosystem Management Team (FEMAT) was formed to complete an assessment leading to an ecosystem approach to forest management. The Assessment Team completed a report entitled Forest Ecosystem Management: An Ecological, Economic, and Social Assessment (FEMAT Report).

One component of the FEMAT report, the Aquatic Conservation Strategy (ACS), focuses on restoring and maintaining the ecological health of watersheds and aquatic ecosystems on all public lands. A system of Key Watersheds are identified in this strategy to serve as a refuge

for maintaining and recovering habitat for at-risk stocks of anadromous fish species. Portions of the Little Applegate River Watershed are designated under the ACS as a Key Watershed; identified for its potential, through restoration, to become high quality habitat in the future for anadromous and other fish species.

The ACS serves as the basis for the **Record of Decision** (ROD) for Amendments to Forest Service and Bureau of Land Management Planning Documents Within the Range of the Northern Spotted Owl and the **Standard and Guidelines** (S&Gs) for Management of Habitat for Late-Successional and Old-Growth Forest Related Species Within the Range of the Northern Spotted Owl.

Watershed Analysis is an important part of implementing the ACS. The ROD describes specific tasks for watershed analysis. This analysis is intended to describe how the watershed and associated upland ecosystems "work". The analysis identifies things that people care about in the watershed and how ecosystem conditions influence those things.

The Little Applegate Watershed Analysis is an assessment of ecosystem health at the watershed scale. Key ecological processes and functions that are critical to maintaining ecosystem functions in the watershed are identified. Human impacts and interactions with these functions and processes are assessed and compared to human-ecosystem interactions in a "pre-Euro-American settlement" era (generally, prior to major human residential, industrial and agricultural impacts, before the middle 1800's) in order to identify trends and implications for future management considerations. This analysis identifies information needs and data gaps that will be important to address and which will help provide a basis for sound management decisions in this watershed. It also identifies opportunities for restoration of aquatic habitat and ecosystem health.

1.4 Analysis Process

In order to develop consistent procedures for conducting watershed analyses, selected watersheds in the Pacific Northwest were identified as "pilots" that would carry out guidance provided in A Federal Agency Guide for Pilot Watershed Analysis, version 1.2. The pilot watershed analyses were charged with trying out the analytical steps recommended in the Guide and reporting their successes and difficulties to the Analysis Coordination Team of the Regional Ecosystem Office (REO) for use in revising the Guide. The team met with representatives of REO at the halfway point of this effort to provide feedback for their use in revising the Guide.

In the time since the Little Applegate Pilot Watershed Analysis was initiated, several "pilot" and "interim" analyses have been completed. Their successes and difficulties have been noted in review by environmental advocacy groups, REO, Region Six of the Forest Service, Oregon/Washington BLM, and others. The review of the work of these groups who have preceded the Little Applegate Pilot Watershed Analysis has been used to determine the format and language of this report. Of special note is the Beaver-Palmer Watershed Analysis, which was conducted by the Applegate Ranger District for a sub-watershed of the Applegate River immediately adjacent to the Little Applegate Watershed. The portions of the Beaver-Palmer analysis which dealt with fire and forest fuels issues have been heavily drawn upon to make inferences for the Little Applegate Watershed.

An interagency team was assembled to conduct an "Ecosystem Health Assessment" for the Applegate Adaptive Management Area (AMA) which includes the Little Applegate Watershed. Their report, issued in September 1994, also draws conclusions applicable to the Little Applegate Watershed and is taken to represent broad-scale conditions present in the Little Applegate Watershed.

1.5 Peer and Public Collaboration and Review

Specialists worked with their counterparts in other agencies and organizations to complete their analysis

The watershed analysis team spent several days studying and integrating into our work a report entitled Words Into Action: A Community Assessment of the Applegate Valley (May 1994), prepared by Kevin Preister of the Rogue Institute for Ecology and Economy. This was commissioned by a consortium of public and private agencies and not-for-profit foundations. Kevin met with the watershed analysis team early in the project to help design our public involvement process.

The issues and questions developed by the watershed analysis team were the basis for information sent to more than 350 neighbors and interested groups and individuals in the region. This mailing invited public participation in refining or adding to the analysis issues. The team hosted an information open house at the Applegate Ranger District which was attended by more than 40 people. Specialists discussed their analytic approaches and heard from the public about their concerns.

It is important to note that watershed analysis is widely described as an "iterative" process. The analysis document remains dynamic and open to revision as experience is gained and data gaps are addressed. Stewardship and maintenance of the analysis document will be very

important in establishing its effectiveness as a working tool. Shifting social values and the availability of new information about the watershed means that this analysis is never "completed". This team, however, is willing to let go of this first iteration.

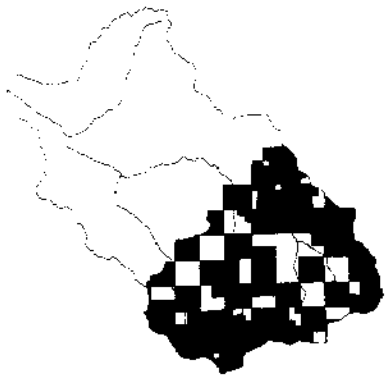
1.6 Why This Watershed is Important

In a letter nominating this watershed for "pilot" or "slower track" analysis (February 25, 1994), the Medford District BLM District Manager and the Rogue River National Forest Supervisor listed some significant attributes of the Little Applegate Watershed. The watershed has a high potential to quickly contribute projects for implementation of the President's plan, including erosion reduction, fish passage enhancement, precommercial thinning, prescribed fire treatments to reduce hazard, and commercial timber sales.

The Little Applegate Watershed is within the Applegate AMA. The social keystone of the AMA is the Applegate Partnership, a community-based project involving industry, conservation groups, and residents. The Partnership supports the management of all land within the watershed in a manner that sustains natural resources and contributes to economic and community well being within the Applegate Watershed.

The ownership pattern of lands within the Little Applegate Watershed dictates that no one landowner acting independently of the others can effectively work to restore or enhance critical ecological functions.

Key Watershed Map



The Little Applegate River is the last major tributary of the Applegate River before fish passage is stopped by Applegate Dam. The upper half of the watershed is a Tier One Key Watershed in the President's Northwest Forest Plan.

Data availability for the watershed was described as "limited" when nominating the Little Applegate Watershed for the "pilot" watershed analysis program.

The upper elevations of the watershed are part of a "land bridge" between the Siskiyou and Coast ranges. It is ecologically diverse and important for genetic connectivity.

1.7 Management Direction

Federal Lands - The entire Little Applegate Watershed is managed as an AMA. AMA's are described on pages D1-12 in the S&Gs. The Applegate AMA is described on page D12. The emphasis for the Applegate AMA is "Development and testing of forest management practices, including partial cutting, prescribed burning, and low impact approaches to forest harvest (e.g., aerial systems) that provide for a broad range of forest values, including late-successional forest and high quality riparian habitat. Late Successional Reserves (LSR) are included in the AMA boundaries."

Mapped Late-Successional Reserves are not located in the Little Applegate Watershed. However, one hundred acre spotted owl activity centers that meet the criteria on pages C10-11 in the S&Gs are managed as LSR.

Further management direction is identified in the Rogue River National Forest Land and Resource Management Plan (1990), and the Medford District Bureau of Land Management Resource Management Plan (1995).

Private Lands - Private lands within the watershed are governed by Jackson County zoning ordinances, the Oregon Forest Practices Act, and other state and local laws.

2. Description of the Watershed

2.1 Geomorphic Landscape Units

The following are the landscape descriptions of the Little Applegate Watershed. Nine broad scale landscape units were defined, based on geology, climate and landforms. The purpose of dividing the watershed into these units is to view the watershed at a broader scale and in a way that helps focus on the processes that formed the land and are the basis for how the watershed "works". These landscapes could be considered as large management response units and the basis for integrating resource strategies.

2.1.1 Valley Floor

The landscape of the Valley Floor is characterized by gentle slope gradients and its close proximity to the major streams of the Little Applegate Watershed. Formed by alluvial processes, this landscape appears as terraces, flats and floodplains. The youngest soils of the watershed are forming in recently deposited alluvial material, while older and more developed soils are found on the terraces upslope from the streams. Unique to this landscape is the early placer mining that took place in the gold bearing terraces of Sterling Creek and lower stem of the Little Applegate River.

Deep soils and gentle slopes have made this landscape desirable for agricultural uses. This landscape also encompasses most of the residential development in the watershed. Stream diversions and wells supply water for both agricultural and residential uses. Floodplains are prone to flooding during periods of extreme rainfall events.

2.1.2 Resistant Metavolcanics

Much of the main stem of the Little Applegate is flanked by the Resistant Metavolcanic Landscape. The slopes of this landscape have long, concave profiles with steep ridgelines and moderate toeslopes. Soils grade from shallow, skeletal soils near the ridges to deeper, finer textured soils on the lower slopes. This landscape is highly dissected but is notable for the lack of perennial streams.

The mid to upper reaches of the south slopes tend to be non forested due to the shallow soils, low rainfall and high evaporation rates. By contrast, the northern slopes are cooler and favorable for conifer growth.

2.1.3 Subdued Metavolcanics

At one time, this landscape probably appeared similar to the landscape of the Resistant Metavolcanics. But through erosion, the steep upper slopes have been reduced. Gentler slopes, more rounded landforms and lower relief remain. The metavolcanic bedrock is highly fractured and weathered. Soils are deeper, finer textured and more productive. They generally support conifers.

2.1.4 Bench and Earthflow

Uneven, irregular slopes dominate this landscape. Much of this landscape was formed by large, slow moving earthflows. Some of the most obvious large landslides are associated with deeply weathered ultramafic rock surrounding the confluence of Glade Creek and the Little Applegate River. Though most of these slides are relatively dormant, areas where they are oversteepened can be reactivated during periods of high rainfall. Timber harvesting and road building activities may also reactivate these earthflows.

Some of the gentle relief found on this landscape is believed to be the remnants of high ancient valleys. These features tend to be relatively stable. Soils over much of the landscape tend to be deep and productive.

2.1.5 Glaciated Granitics

This landscape is almost entirely underlain by granitic rock. It lacks any observable faults, but the presence of springs at similar elevations indicates the possibility of some structural control.

This landscape differs from the Shallow Granitics in that the slopes are gentler and more rounded and the elevations are generally above 5,000 feet. In the recent geologic record, this landscape (see discussion of glaciation under Glaciated Headwaters Landscape description) has been strongly influenced by glaciation and periglaciation.

2.1.6 Shallow Granitics

Steep slopes with long smooth profiles characterize this landscape. It encompasses the granitics at the mid to upper elevations of the watershed. Debris slides are common and a major contributor to the development of the landscape. The soils are shallow, sandy and very susceptible to erosion. Where the soil cover is low or absent, rills and gullies have formed, supplying large quantities of sediments to the aquatic system. Sediment is of sand size and is the primary material that is embedding the gravels in the middle and upper section of the Little Applegate River.

The upper slopes are a mosaic of openings and trees due to the harsh climate while the mid to lower slopes are forested.

2.1.7 Low Elevation Granitics

Low relief and gentle slopes are typical of this landscape. The landscape is underlain by a granitic intrusion. Soils have developed from very weathered bedrock and have a higher clay content than the granitic soils of the Glaciated or Shallow Granitics. Soils are deep and relatively productive but plant growth is limited by the hot, dry summer climate.

These soils are erodible when disturbed, but to a lesser degree than the soils of the Shallow and Glaciated Granitics. Erosion dislodges sands and clays which may be transported to the aquatic system.

2.1.8 Hard Amphibolites

This landscape rises abruptly out of the low relief of the Bench and Earthflow Landscape. It is separated by the "Wagner Fault" that bisects the watershed. The amphibolite bedrock is very hard and unweathered. The slopes are steep and undissected. Weathering is slow and resultant soils are shallow and skeletal.

Forests of this landscape are mainly Shasta red fir near the ridges and white fir at lower elevations. At higher elevations, reforestation and revegetation can be slow due to skeletal soils and short growing season.

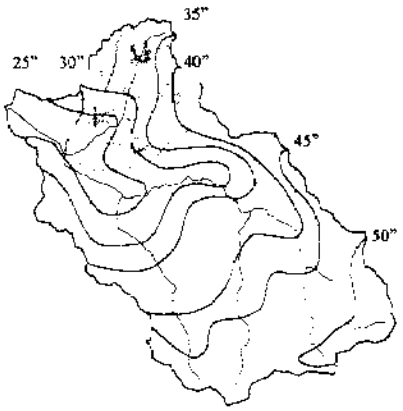
2.1.9 Glaciated Headwaters

Past glaciation and cold climate processes have helped sculpt this landscape. These processes have occurred atop a smorgasbord of rock types: amphibolites, serpentinites, and granitics. Near the ridgelines, soils are shallow but become very deep at the mid to lower slopes. Weathering is very slow at these elevations and consequently, the soils are extremely rocky.

Glaciers carved out the Monogram Lakes Basin while several glaciers around Jackson Gap and Wrangle Gap deposited glacial till as much as two miles downslope. The deep soils act as an excellent reservoir for snow melt water accumulation. This water is released throughout the summer through seeps, springs and glades. Due to the rocky soils and harsh climate, reforestation and revegetation can be very slow and difficult.

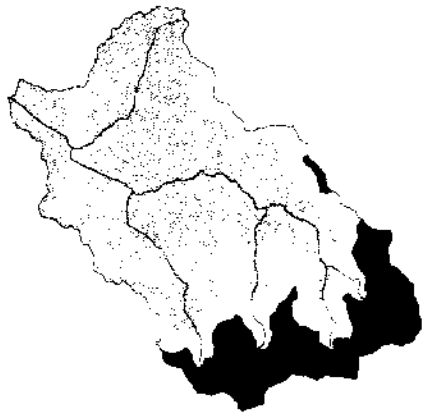
2.2 Precipitation

Isohyetal Map



Average annual precipitation in the Little Applegate Watershed is about 38 inches. It ranges from 20 inches at the lower elevations in the northeast to 55 inches at the high elevations in the southeast.

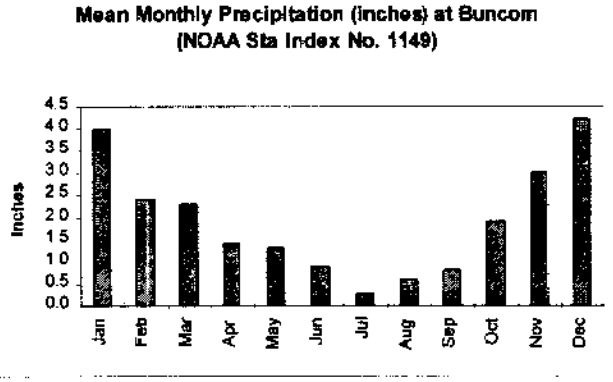
Precipitation Zone Map



Precipitation is primarily in the form of snow above 5000 feet (dark shading on map) elevation and primarily rain below 4000 feet (light shading on map). The transitional snow zone falls inbetween.

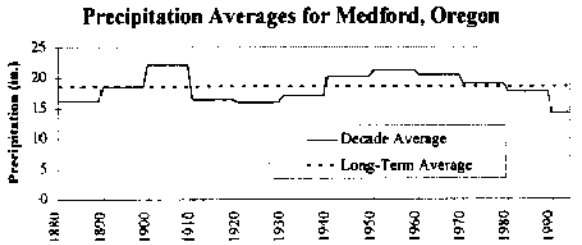
The annual distribution of precipitation is typical of the Mediterranean climate of Southern Oregon (see Figure #1).

Figure #1 - Mean Monthly Precipitation at Buncom



Wet winter and spring months are followed by a prolonged season of very little precipitation; only about seven percent of the annual precipitation normally occurs from July through September. The southwestern Oregon area is currently in a low precipitation cycle (see Figure #2). While the annual precipitation can vary widely from year to year, the decadal average better indicates wet and drought periods. The data indicates that the area has been experiencing declining precipitation over the past four decades.

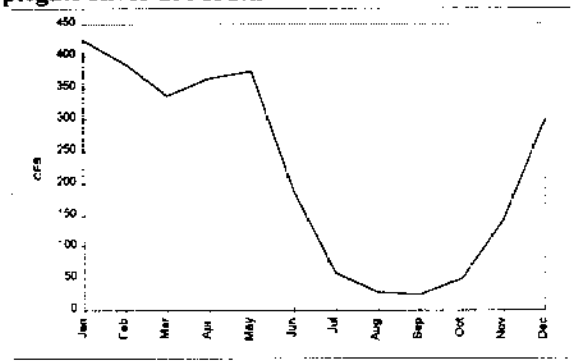
Figure #2 - Historic Precipitation at Medford, OR



2.3 Hydrology

The Little Applegate River flows in a generally northwesterly direction. The average discharge of the 72,200-acre watershed is an estimated 226 cubic feet per second (cfs) but natural, unaltered monthly flows in a normal runoff year range from about 25 cfs in September to about 424 cfs in January. Most of the annual runoff occurs during the wet winter and spring months (see Figure #3). Only about six percent of average annual runoff occurs from July through October. Water withdrawals have dramatically reduced the naturally low flows during this period, particularly after June. (See Hydrology Report p. 2-9.)

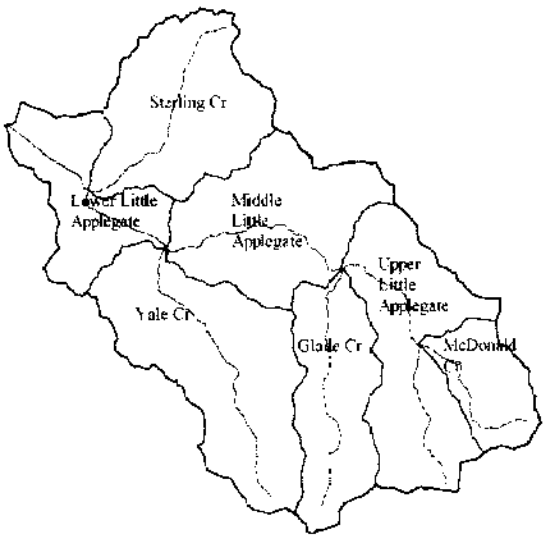
Figure #3 - Unaltered Mean Monthly Flow - Little Applegate River at Mouth



The Little Applegate River has seven subwatersheds:

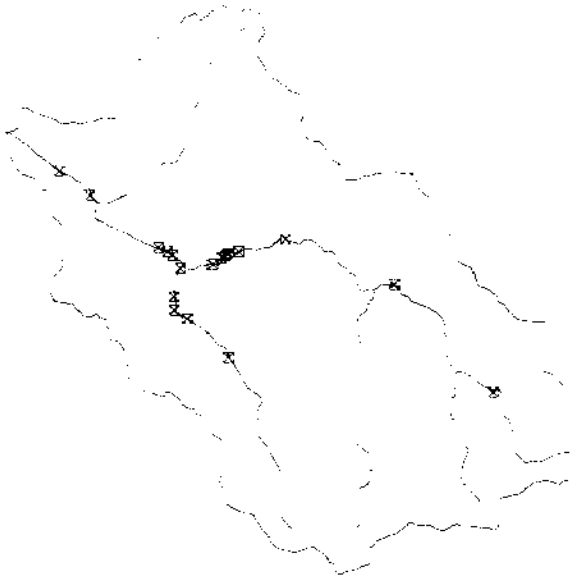
- McDonald Creek 4,650 acres
- Glade Creek 8,730 acres
- Yale Creek 15,230 acres
- Sterling Creek 11,890 acres
- Upper Little Applegate 12,200 acres
- Middle Little Applegate 11,960 acres
- Lower Little Applegate River 7,600 acres

Subwatershed Map



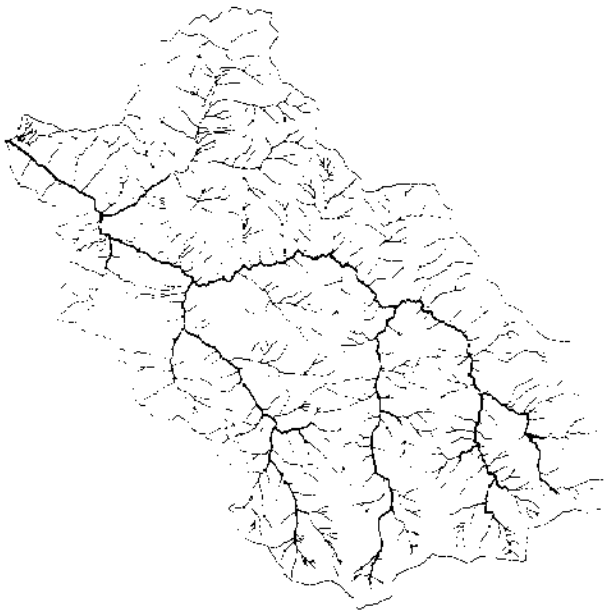
Map of Water Diversion Points

The map displays the known major points of water diversions within the watershed.



Stream System Map

Field-verified Class 1-4 streams within the watershed.
Dark Lines = fish bearing streams
Light Lines = other streams



2.4 Water Quality

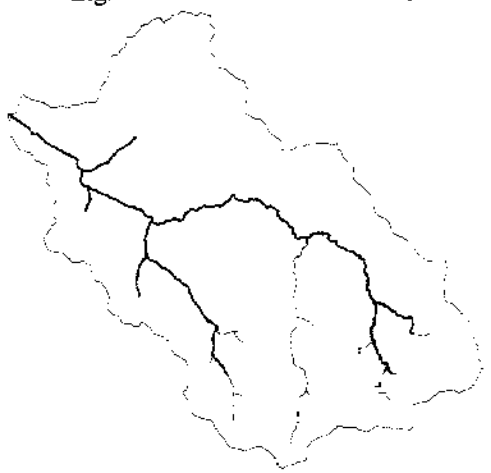
The Oregon Department of Environmental Quality (DEQ) has found that moderate to severe water quality conditions and effects on fish occur in the 16 miles of the Little Applegate River from Greely Creek to its mouth, and in the lower four miles of Yale Creek. Summer temperatures are high (deleterious to fish) in these streams, particularly the

main stem Little Applegate River below Tunnel Ridge. Sediment and embeddedness are presently high in all seven subwatersheds in the Little Applegate. Dissolved oxygen is generally high in all streams except possibly the lowest three to six miles of the main stem. Nutrient levels appear to be low in all tributaries and the main River above Tunnel Ridge (Hydrology Report p. 19-28).

2.5 Fisheries

Fall chinook, coho salmon, summer steelhead, winter steelhead, resident trout, and several other fish species inhabit approximately 50 miles of stream in the watershed.

Map of Fish Bearing Streams
Dark Lines - Anadromous & Resident Fish
Light Lines - Resident Fish Only



Ownership on Fish Habitat Streams

	Private Land	Public Land
Resident Fish	58%	42%
Anadromous Fish	65%	35%

The following fish species found in the watershed are considered "at-risk":

- summer and winter steelhead (proposed for listing as threatened by the National Marine Fisheries Service);
- coho salmon (petitioned for listing as threatened or endangered); and
- Pacific lamprey (candidate for listing as threatened or endangered).

2.6 Vegetation

An extreme range of environmental factors influence the vegetation in the Little Applegate Watershed:

- elevation ranges from 1466 to 7418 feet;
- average annual precipitation ranges from 25 up to 55 inches per year; and
- a wide variety of parent materials developing into very diverse soil characteristics.

Because of this diversity in physical characteristics, the vegetation within the Little Applegate Watershed is also very diverse. The vegetation zones present include:

- low elevation interior valley;
- mixed conifer;
- white fir;
- Shasta fir;
- mountain hemlock; and
- sub-alpine parks.

The plant community types present include;

grass-forb dry hillsides	7,950 acres
mountain shrubland	7,000 acres
deciduous hardwood	1,950 acres
evergreen hardwood	250 acres
conifer-hardwood forest	2,850 acres
mixed conifer forest	46,370 acres
high temperate conifer forest	3,520 acres
subalpine forest parks	1,460 acres
wetland coniferous	30 acres
wetland herbaceous	300 acres
wetland shrubby hardwood	550 acres

2.7 Wildlife

There are 272 species of wild terrestrial vertebrates which are either known (138 species) or suspected (134 species) to occur in the watershed. The species suspected to occur in the watershed are based on published range maps and the presence of suitable habitat; however, they are undocumented in the watershed. Fifteen suspected species have special status requiring special management (Wildlife Report, Section 1.0).

Spotted Owl Density

Under the S&Gs in the ROD, 100 acres are allocated as Managed Late Successional Reserves around each northern spotted owl site that was identified as of January 1, 1994. (S&Gs pages C10-11)

23,807 acres in the watershed are designated as Critical Habitat Units (CHU) for the northern spotted owl by the USFWS. The ROD did not address critical habitat. Consequently, federal agencies are required to undertake measures pursuant to this habitat under the Endangered Species Act. Thirteen of the 33 spotted owl sites in the watershed fall within designated CHUs.

On BLM lands all of the identified nests are on dwarf mistletoe brooms.
Timber harvest of the last five decades was concentrated in the stands that had characteristics of typical southwestern Oregon suitable spotted owl habitat (decadent stands of big trees on north and east slopes). The owl population is probably distributed differently on the landscape now than it was historically. The owls have been displaced from some of their original habitat to newer, younger habitat. The effects of this probable shift in distribution are not known.

The following species (known or expected to occur in the watershed) are candidates for listing as threatened or endangered under the Endangered Species Act:

- Siskiyou mountain salamander- known;
- foothill yellow-legged frog- suspected;
- western pond turtle- known;
- tailed frog- known;
- red-legged frog- suspected;
- northern sagebrush lizard- known;
- northern goshawk- known;
- white-footed vole- suspected;
- red tree vole- suspected;
- fisher- suspected;
- Townsend's big-eared bat- known;
- Yuma myotis (bat)- known;
- fringed myotis- suspected; and
- long-eared myotis- known.

The ROD provides for special management (on federal lands) for the following species known to exist in the Little Applegate Watershed (the species have no other federal special status):

- Pallid bat ROD - C-43
- big brown bat ROD - C-43
- black-backed woodpecker ROD - C-45
- flammulated owl ROD - C-45
- great grey owl ROD - C-21
- little brown myotis ROD - C-43
- white-headed woodpecker ROD - C-45

Little information is available regarding invertebrates in the watershed. Several special status insects (all Category 2) are suspected to occur in the watershed including:

- Siskiyou chloealtis grasshopper;
- Arctic blue butterfly;
- Siskiyou caddisfly; and
- Franklin's bumble bee

Introduced species that compete with native species include:

- starlings;
- bull frogs;
- large mouth bass;
- wild turkey;
- English sparrows;
- Virginia opossum; and
- livestock.

Special habitats in the watershed include:

- buildings\bridges;
- talus;
- large trees (super-dominants);
- boulder fields;
- wet meadows;
- ponds;
- snags;
- down logs (coarse woody debris);
- tunnels\caves;
- plowed fields;
- duff;
- dry meadows;
- cliffs;
- shrubby wetlands; and
- seeps & springs.

Domestic Livestock - Grazing has occurred in the watershed since European settlers first arrived in the area approximately 150 years ago. In the past grazing has occurred at much higher levels than currently. Effects associated with livestock grazing are addressed under the resources affected. Figure #4 displays the current grazing allotments.

Figure #4 - Grazing Allotments

Allotment	Agency	Type	Approx. Permitted Head	Season
Glade Creek	USFS	Cattle	153	May-Oct
Wagner Butte	USFS	Cattle	40	May-Oct
Beaver-Silver (Partial)	USFS	Cattle	25	May-Oct
Lower Big Applegate (Partial	BLM	Cattle	104	Apr-Jun
Tunnel Ridge	BLM	Sheep	17	May-Sep
Sterling Creek (Vacant)	BLM	Cattle	70	Apr-Jun
Spencer Gulch (Vacant)	BLM	Cattle	50	Jul-Sep
Quartz Creek (Vacant)	BLM	Cattle	10	Jul-Sep

2.8 Private Land & Residents

Figure # Land ownership

	Acres	Percentage
USFS - Applegate RD	12,623	17.5
USFS - Ashland RD	10,596	14.7
BLM - Ashland RA	28,939	40.0
Individuals and Corporations	19,784	27.4
State of Oregon	320	0.4

Ownership Map
Private Land - unshaded
Public Land - shaded

2.9 Fire Hazard and Risk

2.9.1 Fire History

The diversity of plant and animal life in the watershed is due in part to the cycle of ecological disturbance by fire. Throughout the Klamath Province fire has long been recognized as a key natural disturbance process. The combination of climate and topography results in a pattern of frequent, widespread fire across the landscape (in the absence of human intervention). Hot, dry summers with adequate winter precipitation to support vegetation are important features of the watershed's climate.

This climatic combination allows thick vegetation to grow on steep ground and dry out in the summer. Frequent lightning and a long history of human-caused fire provides an historic fire return interval on a landscape level (the number of years between fires in a given location) estimated at 8 to 10 years for the Siskiyou Mountain Interior Valley Vegetation Zone. Fire in the watershed has been in use as a cultural tool for millennia, peaking in modern times with the fires set by early European settlers.

Landscapes which evolve in the presence of frequent fires develop fire-adapted species. When fires are frequent, they are of lower intensity. This is due to accumulation of flammable material in the absence of fire. The density of living vegetation on a site increases in the absence of fire, to the point where density exceeds the carrying capacity of the site. Plant mortality resulting from excessive density contributes to the fuel load until the eventual fire is of high intensity.

Since organized fire suppression became routine in the early 1900's, shifts in species composition and stand densities have become dramatically evident in response to the absence of this important balancing mechanism. Most fire starts have been controlled at very small acreages. The pre-suppression-era fire would likely have covered a broad area for a long time at a low intensity. Few areas within the watershed would support this kind of fire in the post-suppression-era. Currently, if left uncontrolled, fires in general will quickly reach stand-replacement intensities under the kinds of stand vigor, species composition and fuel accumulations present today. Fires in fuel complexes that result from nearly a century of largely successful suppression are likely to result in stand replacement over a greater percentage of the fire's area. (See vegetation report re: at-risk stands)

Map of Fire Starts since 1965

The Beaver-Palmer Watershed Analysis was conducted by the Applegate Ranger District (1994) for adjacent watersheds and provides assessments of fire risk and hazard. The analytical methods, fire occurrence data, vegetative conditions and human values considered are reasonably applicable to conditions in the Little Applegate Watershed. The Applegate AMA Ecosystem Health Assessment (1994) considered conditions across the entire Applegate Valley, including the Little Applegate watershed, and drew broad-scale conclusions about fire hazard and risk. The material developed in these two reports are adapted for use in this report for developing inferences for fire hazard and risk in the Little Applegate Watershed. The adjacent map displays fire starts during the last 30 years.

2.9.2 Fire Hazard

Fire hazard is defined as vegetation by the kind, arrangement, volume, condition and location that forms a special threat of ignition, spread, and resistance to control. Dense, multi-storied stands of vegetation forming continuous expanses on steep, hot aspects and containing heavy accumulations of dead material is a high-hazard situation. The inevitable fire resulting on this kind of site will likely be of high, stand-replacing intensity.

Vegetative condition of the forest helps determine the fire hazard rating. The Vegetation Report describes areas at risk of stand replacing events. In the Applegate AMA Ecosystem Health Assessment, hazard categories were developed based on slope, aspect and fuels present. The

Little Applegate Watershed was rated at high to moderate hazard.

2.9.3 Fire Risk

Fire risk is defined as the chance of an ignition source resulting in a fire that threatens valuable resources such as property and life. The residents of the watershed generally express an awareness of fire risk (Preister, 1994). Exposure to fire risk is a frequent topic in public meetings throughout the AMA, and was cited several times in the public meeting held to develop and refine our analysis issues. Following the Applegate Complex fires of July 1995, about 75 residents attended a public meeting held to discuss the community and ecological impacts of the fires. Many residents voiced concern for forest health trends relative to fire hazard and urbanization relative to risk.

Generalized Fire Risk Map

Risk is a measure of the vulnerability of human values to loss from fire. Values at risk in this watershed include air quality, forest resources, private residential and agricultural property, water quality, late seral wildlife habitat, and long term site productivity. In the Applegate AMA Ecosystem Health Assessment, risk assessment of the entire Applegate River drainage showed high to moderate risk within the Little Applegate Watershed relative to human habitation and traditional values associated with the land.

Since increased human investment in the watershed is the trend, human values at risk will remain high. Natural resource values such as fire-sensitive soils or specific habitats will remain high and at risk. Fire occurrence is likely to remain high due to the continued probability of mid-to-late summer lightning events. Increased human presence is anticipated in the watershed with the number of human-caused fires likely to increase proportionately.

3. Development of Issues and Key Questions

The first step was developing a matrix comparing resources (defined as tangible elements of ecosystem) against effect mechanisms (defined as production, cycling, storage, and/or output of resources). The interactions between the resources and the effect mechanism were the activities, roles, or processes performed by resources.

The matrix included 53 resources and 28 effect mechanisms yielding a 1484 potential interactions. The team recognized that all of these interactions were not pertinent in the watershed, but felt that major interactions were addressed.

Resources were categorized into four major divisions: aquatic, terrestrial, social, and atmospheric.

Each interaction was reviewed by the team to determine its importance. Questions were developed for the most important interactions (208), yielding 166 questions which were rated for importance by the following criteria:

- major public concern;
- major ecological process;
- cumulative effects;
- change (degree, probability, significance);
- President's Northwest Forest Plan; and/or
- current management plans.

Questions were also asked for each resource concerning past conditions, current conditions, and possible future trends.

The questions were combined where possible and grouped into eight major issues. These key questions were used to determine the data needs for the watershed analysis.

The questions along with brief answers and references to discussion in this report and supporting documents are located in the Key Questions Report. This report is available at the Applegate Ranger District and the Medford District BLM.

4. Issues, Areas of Concern, Recommendations & Data Gaps

The recommendations in this report are typically general in nature and based on a watershed scale analysis. Site specific analysis, cooperation by private landowners, and available funding will determine if the recommendations are implemented.

4.1 WATER QUANTITY AND QUALITY

Issue: There is a concern about insufficient water quantity and inadequate quality in the Little Applegate River system to support all "beneficial uses".

Beneficial uses identified in the watershed by the Oregon Department of Environmental Quality are:

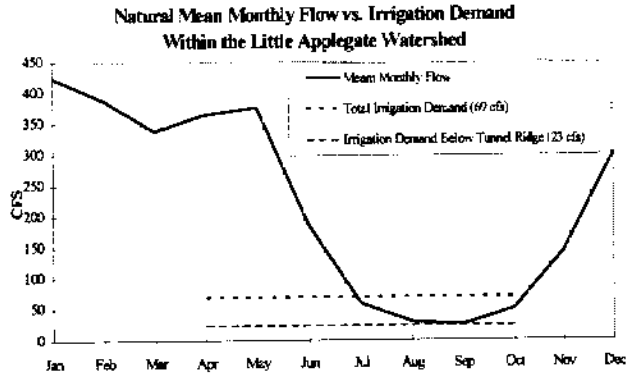
- irrigation;
- stockwater;
- coldwater fisheries;
- other aquatic;
- wildlife;

- water recreation;
- aesthetics;
- domestic; and
- mining.

Findings: The Oregon Department of Environmental Quality (DEQ) has found that moderate to severe water quality conditions and effects on fish occur in the 16 miles of the Little Applegate River from Greely Creek to its mouth, and in the lower four miles of Yale Creek. Summer temperatures are high (deleterious to fish) in these streams, particularly the main stem Little Applegate River below Tunnel Ridge. Sediment and embeddedness are presently high in all seven subwatersheds in the Little Applegate. Dissolved oxygen is generally high in all streams except possibly the lowest three to six miles of the main stem. Based on limited data, nutrient enrichment levels appear to be acceptable in all tributaries and in the Little Applegate River above Tunnel Ridge (Hydrology Report p. 19-28).

Water rights to 69 cfs for mostly irrigation uses exceeds the natural, unaltered flows which would occur at the mouth of the Little Applegate River in average and drought years from July through October (Figure #5). The portion of water (23 cfs) that can be withdrawn below Glade Creek alone results in very low flows in the reach of the river below Tunnel Ridge (M.P. 10.1), and almost total dewatering of the stream below Sterling Creek (M.P. 3.2), during July and August. Even during years of above normal runoff, flows are very low in the river below Tunnel Ridge, and particularly the six miles below Yale Creek. This also occurs in the lower mile of McDonald Creek below the TID diversion, and the lower several miles of Yale Creek which is also diverted for irrigation (Hydrology Report, p. 5-9).

Figure #5 - Mean Monthly Flow vs. Irrigation Demand



Summer stream temperatures are generally rated "good" in the tributaries to the Little Applegate River except for lower Yale Creek where they enter the "fair" range. High temperature concerns are largely confined to the Little Applegate River where they substantially increase in the 10 miles of River below Tunnel Ridge (Hydrology Report p. 20-24).

High turbidity and sediment loads are evident in six of the seven subwatersheds. Glade Creek Subwatershed does not have as severe sediment loads as the others although embeddedness is evident there. Much of the fine textured sediment originating in the lower two-thirds of the watershed is transported out of the watershed (although, high embeddedness is found there). The streams in the upper third of the watershed (above Glade Creek) are heavily aggraded with sediment of coarse-grain decomposed granite origin; this affects the entire main River (Hydrology Report p. 27-29).

All seven subwatersheds are rated in a "poor" watershed condition based on a composite of current management impacts and channel conditions (Hydrology Report p. 13-18). This is evidenced by:

- simplified aquatic habitat;
- high sediment rates and embeddedness; and
- high temperatures (main River).

Human processes contributing to this are (Hydrology Report p. 16, 17):

- past hydraulic mining (Lower Little Applegate River and Sterling Creek);
- conversion of streamside forested areas to agriculture (Mid to Lower Little Applegate River, Lower Yale Creek, and portions of Sterling Creek);
- grazing (Lower Little Applegate River, and the headwaters of McDonald Creek, Upper Little Applegate River, and Glade Creek);
- timber harvest (all subwatersheds except Lower Little Applegate);
- high road densities (all Subwatersheds); and
- slope failure associated with roads, skid trails, and the Talent Irrigation District Ditch.

Area of Concern: Low summer stream flows (resulting from water diversions) limit suitability of habitat for anadromous and resident salmonids, and other aquatic species (particularly in the lower 10 miles of the Little Applegate River). Low stream flows result in:

- reduced quantity of habitat; and
- contribute to high stream temperatures.

Recommendations: Low summer stream flow is one of the primary factors that limit fish populations in the Little Applegate River. **If an objective is to increase anadromous fish populations within the watershed then summer flows must be increased.**

The watershed analysis team recommends analyzing the following options for increasing summer flows (Hydrology Report, p. 11, 12):

- purchase of water rights for allocation to instream flows;
- use of more efficient irrigation systems with portions of the water savings devoted to instream flows;
- a combination of the purchase and increased efficiency options;
- pump water from the Applegate River for irrigation;
- divert water from Applegate Reservoir or Squaw Lakes (if feasible); and
- construct reservoirs in upper reaches of Little Applegate Watershed for augmentation of summer flows.

The watershed analysis team did not explore the feasibility of these options from either an engineering or cost effectiveness perspective. Further analysis would be required to determine feasibility and environmental effects for potential restoration projects.

Area of Concern: Sedimentation is moderate to high throughout the watershed, adversely affecting habitat quality for aquatic species including anadromous salmonids. Sediments have filled pools, and increased embeddedness which has:

- reduced cover for fish;
- reduced spawning survival; and
- affected macroinvertebrate populations.

Recommendations: The watershed analysis team recommends restoration to reduce sediment sources using the following priority (1 = highest priority) (Hydrology Report, p. 29-32):

- revegetation of grazed headwaters of McDonald Basin (1);
- upgrade or replace the Talent Irrigation Ditch and access road and stabilize adjacent slopes (1);
- revegetation of grazed headwaters of Glade Creek and upper Little Applegate River (2);
- rehabilitation and/or obliteration of roads, skid trails, and landings:
  - within Riparian Reserves on 'very highly' erosive soils (1);
  - within Riparian Reserves on 'highly' erosive soils (2);
  - outside Riparian Reserves on 'very highly' erosive soils (2);
  - within Riparian Reserves on 'moderately' erosive soils (3);
  - outside Riparian Reserves on 'highly' erosive soils (3);
  - within Riparian Reserves on 'low-moderately' erosive soils (4); and
  - outside Riparian Reserves on 'low-moderately' erosive soils (5).
- rehabilitation of harvest units or other disturbed sites whose area-wide effective ground cover (aside from roads and yarding impacts) is less than:
  - 85 % on areas with 'very highly' erosive soils (3);
  - 70 % on areas with 'highly' erosive soils (4); and
  - 60 % on areas with 'low-moderate', and 'moderately' erosive soils (5).

Potential restoration projects are identified in the watershed Restoration Report. Further analysis would be required to determine feasibility and environmental effects for potential restoration projects.

Grazing associated restoration should be analyzed during the allotment management plan updates for the Glade and Wagner Allotments (scheduled for analysis in 1995).

Recommendations to improve shading to help reduce stream temperatures are discussed under the Riparian Transition Zone Issue.

New projects should incorporate watershed restoration measures to the extent that they negate or offset impacts which degrade watershed conditions.

Data Gaps & Monitoring Needs: Additional monitoring for dissolved oxygen in the Little Applegate River below Yale Creek;

Additional monitoring for nutrients. Include nitrogen and phosphorus monitoring at additional sites and different seasons and flows;

Complete watershed improvement needs (WIN) inventory on public lands and encourage an equivalent inventory on private lands within the watershed.

Develop a water quality monitoring plan to collect baseline data to evaluate effectiveness of restoration efforts.

4.2 FISH POPULATIONS

Issue: There is a concern for the future of the Little Applegate Watershed's anadromous and resident fish populations.

Many factors, individually and collectively control the strength of the watershed's anadromous and resident fish populations:

- ocean productivity;
- predation;

- sport and commercial fishing;
- inadequate streamflow during summer;
- elevated water temperatures during summer;
- an inadequate amount of coarse woody debris in fish bearing streams;
- culverts and irrigation dams that impede or block upstream movement of fish; and
- excessive sedimentation.

Findings: Streams as well as streamside and upland vegetation in the watershed have undergone considerable alteration since the arrival of Euro-American settlers in the early 1800's. Current land use activities continue to alter the landscape.

There are very few large logs in most fish habitat. This lack of coarse woody debris:

- limits habitat complexity for fish, amphibians and other aquatic species;
- limits the ability of streams to capture and retain nutrients (e.g. leaves, salmon carcasses); and
- fails to slow water velocity.

Timber harvest, road construction, wildfire, agricultural land clearing, stream cleaning, and mining are responsible for this condition (Stream Ecosystem Report, p. 26-27).

Sedimentation is moderate to high in all streams that provide habitat for salmon, steelhead and resident trout. This condition appears to have:

- reduced pool depths;
- reduced the abundance of some types of aquatic insects (important food items for fish and amphibians),
- reduced crevice space in the streambed (escape cover from predators and high water velocity); and
- adversely affected reproductive success of fish and amphibians.

Accelerated sedimentation is primarily from roads, skid trails, vegetation removal (timber harvest, grazing, agricultural and residential development), and other ground disturbance (Stream Ecosystem Report, p. 24-26).

Irrigation diversions remove a large percentage of natural streamflow from the Little Applegate River and McDonald Creek during summer months. This condition seriously limits their ability to support healthy populations of anadromous and resident fish, amphibians and other aquatic species. The situation is similar but less serious in lower Yale Creek. Individuals of these species must compete for a finite amount of food and cover that is far less than would be available under natural (pre-settlement) steamflow conditions (Stream Ecosystem Report, p. 27-28).

Water temperatures in much of the Little Applegate River and to a lesser extent, in lower Yale Creek, are unfavorable for growth and survival of salmon, trout and other aquatic species during summer months. Irrigation water diversion, timber harvest in riparian areas, and agricultural and residential riparian vegetation clearing result in increased water temperatures and exacerbate drought-related stress on the stream ecosystem(Stream Ecosystem Report, p. 28-30).

A number of irrigation diversion dams limit upstream migration of adult salmon and steelhead and are barriers to upstream movement of small fish. Other aquatic species may also be affected. Several culverts on public land are blocking upstream movement of small fish. Both types of structures prevent or limit dispersal and genetic interchange and may be precluding some aquatic organisms from fully meeting their life history and habitat requirements (Stream Ecosystem Report, p. 17-23).

The Talent Irrigation District Ditch on McDonald Creek is the only major water diversion in the watershed without a fish screening device. McDonald Creek salmonids have altered genetic characteristics of fish in Wagner Creek (Bear Creek Subbasin) if fish populations in the two streams were genetically unique before the ditch was constructed in the early 1900's (Stream Ecosystem Report, p. 17-23).

Prospects for basin-wide recovery of anadromous fish and their habitat are only fair, even though about 70 percent of the watershed is in public ownership. Private acreage is concentrated in valley bottoms and includes about 60 percent of all fish habitat. Current resource management practices on private lands and water diversions, which are beyond the scope of the ACS, will continue to limit habitat recovery.

If an objective is to increase anadromous fish populations within the watershed then strategies similar to the ACS should be applied equally across all ownerships to achieve the potential for recovery of at-risk fish stocks. In addition, innovative ways must be found to fully restore natural flows to the river during the summer.

Area of Concern: Eleven irrigation dams and seven culverts block or restrict movement of fish and other aquatic species.

Diversion dams are on private lands on the mainstem of the Little Applegate River and McDonald Creek. All of the culverts are on BLM and Forest Service roads.

Habitats at Risk: Fish habitat in the lower ten miles of the Little Applegate River (downstream from Tunnel Ridge) is considered "at-risk" due to:

- high temperatures (summer);
- extreme sedimentation;
- low flows (summer); and
- poor riparian condition.

Recommendations: The watershed analysis team recommends that upstream passage be improved.

Options for improving fish passage include:

- replacing dams with pumps; and
- replace culverts with structures that maintain the natural streambed.

The watershed analysis team did not explore the feasibility of these options from either an engineering or cost effectiveness perspective.

The watershed analysis team recommends that all federal land in the Little Applegate Watershed be managed as a Tier One Key Watershed under the President's Northwest Forest Plan.

Other Recommendations listed under Water Quantity and Quality, and Riparian Transition Zones would benefit fish and other aquatic species.

Monitoring Needs: Continued water temperature monitoring at stations established during 1994. Inventory potential thermal refugia in the middle and lower Little Applegate River.

Aquatic insect surveys at 5 to 10 year intervals at stations established during 1994 to track changes in aquatic habitat. Relate to management activities where possible.

Aquatic insect survey in Monogram Lakes and tributaries. Glacial relict areas often have unique species associated with them

Surveys of all fish habitat in the watershed at 10-15 year intervals. Methodology should be similar to the 1994 ODFW method so that habitat changes can be detected.

Effectiveness of culverts for passing 100 year runoff events and to pass all aquatic species.

Effectiveness of artificially introduced coarse woody debris in stream channels to restore normal hydrologic function and provide fish habitat

Annual number of chinook, coho and steelhead spawners in order to assess long-term population trends. Monitor outmigration of subyearlings and smolts at a trap at Farmers dam.

Data Gaps: Instream flow study to determine optimum monthly streamflow for aquatic life in the basin's fishery streams (lower priority).

Rearing ecology of juvenile steelhead and coho salmon, cutthroat trout and sculpin in the Little Applegate River basin

Habitat requirements and population status of the Pacific lamprey in the Little Applegate River watershed.

Distribution, population status and habitat requirements of the tailed frog, foothill yellow-legged frog, Cascades frog and Pacific giant salamander in the watershed.

Importance of the Little Applegate for fluvial cutthroat and juvenile anadromous fish that rear in the Applegate River (lower priority).

Thermal requirements of salmonids in the middle Rogue Basin or, at a minimum, in interior southwest Oregon.

Determine whether there are redside shiners between the falls and Farmers dam. If they are absent, the dam could be removed to improve habitat connectivity. If present, look for alternatives to dam removal (lower priority).

Stream habitat standards for maximum water temperatures (and duration), large woody debris size and frequency, pool quality and frequency, and channel width to depth ratio for low gradient stream segments in interior southwest Oregon. Standards would be stratified by plant series.

Genetic testing of cutthroat trout in Little Applegate watershed streams and other Rogue basin streams to establish evolutionarily significant units of genetic diversity among resident salmonids in this geographic region (lower priority).

Absence/presence and distribution of resident trout in several streams in the watershed (Stream Ecosystem Report, p.70).

4.3 TERRESTRIAL BIODIVERSITY

Issue: There is a concern that terrestrial biological diversity (plant and animal species composition and populations) may be undergoing undesirable changes.

Factors affecting this issue include:

- Terrestrial biological diversity is largely dependent on a diversity of habitat types in sufficient amounts distributed across the landscape through time.
- Habitats with complex structure generally support a wider variety of species in higher numbers than structurally simple habitats.
- Manipulation of a habitat may result in simplification of that habitat (at least short term).
- Some species tolerate habitat simplification well, others do not.
- Some species which do not tolerate simplification of their habitats may be at risk of population decline.

Findings (wildlife): Grazing, agriculture, traditional logging, and fire all result in habitat simplification to some degree at least in the short term. Absence of fire leads to additional complexity in forested stands in the short term, and in Southwestern Oregon leads to habitat simplification as the larger trees die out due to competition with dense shade tolerant understories.

There have been substantial shifts in species composition, stand structure, and the spatial distribution of stands of various ages within the watershed since settlement by Euro-Americans in the 1850's. These changes are reflected in the current amounts and distribution of habitat types.

Little information on habitat conditions before 1947 is available. However, in 1947 a gross vegetation type map was produced that provided an imperfect but useful tool for comparison (Vegetation Report, p. 19). Comparison of the 1947 and 1993 data indicates that there has been a reduction of approximately 24,000 acres of late successional habitat in the watershed.

The remaining acres of late successional habitat are generally in patches that are smaller and farther apart than in 1947. This fragmentation reduces the utility of the habitat for many species. There is more early successional habitat at higher elevations than in 1947, and there is more mid successional habitat throughout the landscape. These shifts have altered the amounts and geographic distribution of habitats for terrestrial species.

Some late successional species may not fare well under the Northwest Forest Plan within the watershed since no Mapped Late Successional Reserves are located in the watershed. This will be determined by how much late successional habitat is provided for in the management of the watershed. We can expect to see the local population numbers of late successional dependent species like spotted owls, goshawks, and fisher decrease if their habitat is further reduced and fragmented (Wildlife Report, sec. 3.3.1b).

The 272 terrestrial species known or suspected to occur in the watershed were grouped into 18 guilds based on habitat needs. Habitat suitability analysis for these guilds indicates that less than 15 % of all acres in the watershed are suitable for nine of the guilds:

Three of the nine guilds for which there is less than 15% suitable habitat within the watershed. are composed of species directly dependent on late successional habitat.

An additional two of the nine guilds are composed of species which live in the edge habitat between late and early successional habitats. These species also depend, somewhat indirectly, on late successional habitat.

Late successional stands currently make up 15.1% of all of the acres across all ownerships in the watershed; whereas, in 1947 approximately 48% of watershed acres were in late successional stands. However, not all of the late successional stands currently in the watershed are suitable for all late successional habitat guilds. When the minimum home range size and minimum patch size restrictions are applied by the patch aggregation model, small and scattered stands drop out of suitability because of their distribution pattern across the landscape (Wildlife Report, sec. 3.3.1).

The remaining 4 guilds with less than 15 % suitable habitat are composed of terrestrial species which are dependent on riparian vegetation and habitats. The amount of habitat suitable for the species in these guilds is controlled mostly by the presence and absence of water. It is probable that there would never be more than 15% suitable habitat for these guilds regardless of our management because there is not enough acreage close to streams to make up 15% of the watershed. However, the fact that habitat for these guilds is so limited highlights their vulnerability to further reductions in the amount of suitable habitat Wildlife Report, sec.3.3.2).

Degradation or loss of habitat for these guilds will reduce the watershed's ability to support the existing levels of species richness and biological diversity and may result in local extirpation (within the watershed) of some of the species in these guilds in the long term. (See Wildlife Report for distribution of suitable habitat for guilds in the watershed.)

Spotted owl density in the watershed is relatively high (one pair per 1550 acres across lands capable of providing suitable habitat). Factors relating to spotted owls in Southwestern Oregon (including the Little Applegate Watershed) include (Wildlife Report, sec. 2.2.2c):

- they use different nesting substrates than spotted owls in other areas;
- they appear to eat different prey items and in different proportions than spotted owls in other areas;

- they nest and produce fledglings in younger stands than is typical for the species (if suitable nest structures are present);
- they are capable of surviving and reproducing (at least in the short term) in what appears to be a highly fragmented and modified landscape.

Under the Northwest Forest Plan, needs of species which disperse through forested stands would be provided through:

- Riparian Reserves,
- unmapped Late Successional Reserves (100 acre owl core areas),
- 15% retention of late seral stands on federal lands (capable of sustaining a forest), and
- green tree retention guidelines.

Seventy-one percent of the "capable" acres in the watershed are in a vegetative condition considered suitable for spotted owl dispersal based on the "50-11-40" rule.

Assuming the Northwest Forest Plan will be fully implemented, the results should be beneficial to most of the species in the watershed related to the following factors:

- road density should decrease; and
- amount of high quality riparian habitat should increase.

Some late successional forest associated species may be at risk of local extirpation form the watershed under the President's Forest Plan because of the amount and distribution of late successional habitat across the watershed. Also, the current distribution of late succcessional habitat within the watershed may not be optimal to meet resource management objectives.

The abundance of mid successional stands distributed throughout the landscape present an excellent opportunity to plan future distribution of late successional habitat within the watershed, and the opportunity to grow it relatively fast.

Areas of Concern (wildlife): Under the ROD, 15% of the capable acres on federal lands would be retained in a late successional condition. Currently the watershed exceeds this standard. There are currently approximately 10,900 acres of late successional stands in the watershed on all ownerships. This is approximately 15% of all acres in the watershed (26.4% of the federal land capable of sustaining a forest). The possibility of local extirpation for some species still exists under the ROD if suitable habitat continue to be fragmented and reduced on public and private lands.

Exotic Species (bass and bullfrogs) are competing with and consuming native species (western pond turtles, aquatic insects, and amphibians) in ponds. While bass and bullfrogs are aquatic associates, they are impacting terrestrial species.

There is a potential point of conflict in that long term "forest health" benefits must be balanced against the short term incremental loss or degradation of suitable owl habitat through thinnings if retention of suitable owl habitat is a goal.

Recommendations (wildlife): Develop and implement a desired condition for the watershed which would:

- evaluate the existing stands of late successional habitat in terms of relative importance to late successional species; and
- identify stands of mid successional habitat to be "pushed" toward late successional conditions to provide for future habitat needs (including quantity and connectivity).

Reduce bass and bullfrogs at sites with native species. Options include:

- fish out;
- trap;
- shoot; and
- rotenone.

Findings (plants): Twenty-three special status plant species are present in the Little Applegate Watershed:

Species	Status
Astragalus umbraticus	Special Status Tracking Species (BLM), ONHP2
Castilleja schizotricha	Sensitive (FS), ONHP2
Cypripedium fasciculatum	Sensitive (FS), Special Status/Federal Candidate (BLM), ONHP1, FC2, Survey and Manage Species
Cypripedium montanum	Sensitive (FS), ONHP4, Survey and ManageSpecies
Epilobium siskiyouense	Sensitive (FS), ONHP1, FC2
Erigeron petriphilus	Sensitive (FS). ONHP2
Eriogonum dictinum	Sensitive (FS), ONHP2
Fritillaria gentneri	Special Status/Federal Candidate (BLM), ONHP1, FC1
Haplopappus whitneyi ssp. discoideus	Sensitive (FS), ONHP2
Horkelia hendersonii	Sensitive (FS), ONHP1, FC2
Isopyrum stipitatum	Review List (FS). Special Status Tracking Species (BLM), Review List (FS). ONHP3
Lewisia cotyledon var. howellii	Watch List (FS). Special Status/Federal Candidate (BLM), ONHP4. FC2
Lewisia leana	Sensitive (FS). Special Satus/Bureau Assessment (BLM), ONHP2
Lilium pardalinum ssp. wigginsii	Watch List (FS), ONHP4
Linanthus bakeri	Review List (FS), ONHP3
Lithophragma campanulata	Review List (FS), ONHP3
Orthocarpus cuspidatus	Watch List (FS), ONHP4

Perideridia howellii	Sensitve (FS), ONHP2
Polystichum lemmonii	Watch List (FS), ONHP4
Sedum oblanceolatum	Sensitive (FS), Special Status/Federal Candidate (BLM), ONHP1, FC2
Sedum radiatum ssp. depauperatum	Sensitive (FS), Special Status/Federal Candidate (BLM), ONHP3, FC2
Smilax californica	Watch List (FS), ONHP4
Tauschia howellii	Sensitive (FS), ONHP1, FC2

ONHP = Oregon Natural Heritage Program
FC = Federal Candidate
FS = USDA Forest Service
BLM = Bureau of Land Management.

There are also several other populations of plants in the watershed that are not special status species but are rare within the watershed, are considered important because they are at the limits of their known range, and may be at risk of extirpation from the watershed, including:

- quaking aspen;
- western juniper;
- big-leaf sagebrush;
- water birch; and
- green fescue.

Many of these species are common east of the Cascade Mountains.

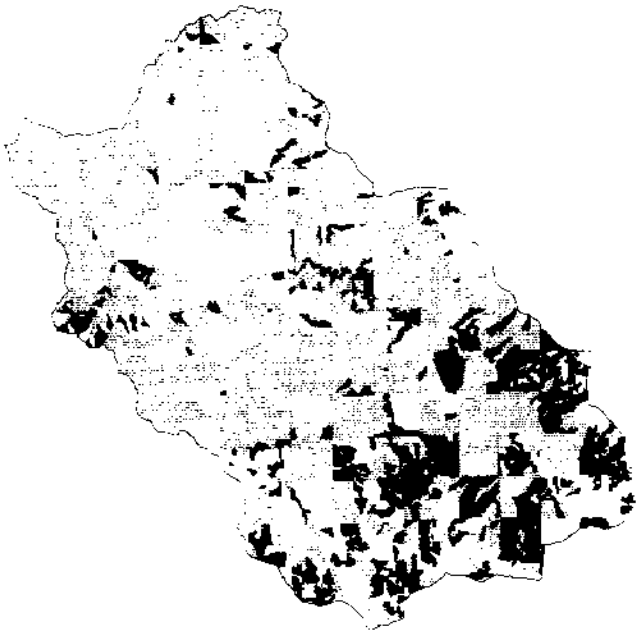
The low-mid elevation dry grasslands and moist mountain meadow native plant communities may be at risk of extirpation from the watershed from invasion of non-native plants (introduced species and noxious weeds). See Vegetation Report, page D1.

Many exotic plant species have been introduced into the Little Applegate Watershed. Seven species considered noxious weeds by the State of Oregon are known to occur in the watershed. These are :

Bull thistle	*Cirsium vulgare*
Canada thistle	*Cirsium arvense*
Medusahead rye	*Taeniantherum caput-medusae*
Scotch broom	*Cytisus scoparius*
St. Johnswort	*Hypericum perforatum*
Tansy ragwort	*Senicio jacobaea*
Yellow starthistle	*Centaurea solstitialis*

Of these species, yellow starthistle is the greatest concern because of its ability to spread into and occupy dry grassland at low to mid elevations. However, many non-native species that are not considered noxious are a considerable threat to localized biological diversity.

Map of Successional Stages
Unshaded - Early Successional
Moderate Shading - Mid Successional
Dark Shading - Late Successional



The encroachment of less fire resistant and more shade tolerant species such as Douglas-fir and white fir in the understory has been significant with the exclusion of fire. Of the 14,795 acres of large pine dominated mixed conifer forest identified in the 1947 Forest Survey, very little is still predominantly pine. Of the 5176 acres of the 1947 large pine type still considered to be unaffected by timber harvest, only 860 acres still have pine identified as component of the overstory in the current inventory.

In addition to increased fire suppression the cyclic pattern of rainfall has also contributed to increases in stand density and shifts in species composition. The drought period of 1914 to 1935 in which the average annual rainfall in Medford was 16 in. per year was followed by a period of almost 50 years (1937-1985) of higher than average rainfall in which the average annual precipitation in Medford was over 20 in. per year (Figure 2). It is assumed that the precipitation in the watershed followed the same pattern.

This five decade period of higher than average precipitation would have had three logical consequences.

- fire suppression is likely to have been more successful during this period than if precipitation had been less;
- higher precipitation would have increased the probability of successful establishment of species such as Douglas-fir and white fir; and
- increased precipitation resulted in a temporary increase in the carrying capacity of the ecosystem, allowing

some stands to increase in density beyond what the site was able to maintain during the subsequent drought period.

As a result, the density and species composition of many stands in the watershed exceed the land's capability to maintain the current stand conditions.

Figure #6 displays the number of acres that were identified as potentially "at risk" of decline in forest health. The map of Stands Potentially "at risk" of Decline in Forest Health shows the general distribution of potential "at-risk" stands (a more detailed map is located in the Vegetation Report, p. C3). Figure #7 shows the parameters of the risk ratings (Vegetation Report, p. 25-26 & C1-3).

The stands identified as "at risk" have **NOT** been field verified. Based on existing data, these stands have potential for drought/insect related mortality. Site specific analysis would be needed to determine if density management is necessary and what type of treatment should be prescribed.

Map of
Stands Potentially "at risk" of Decline in Forest Health
Dark shading = Extreme & Very High Risk
Moderate shading = High & Moderately High Risk

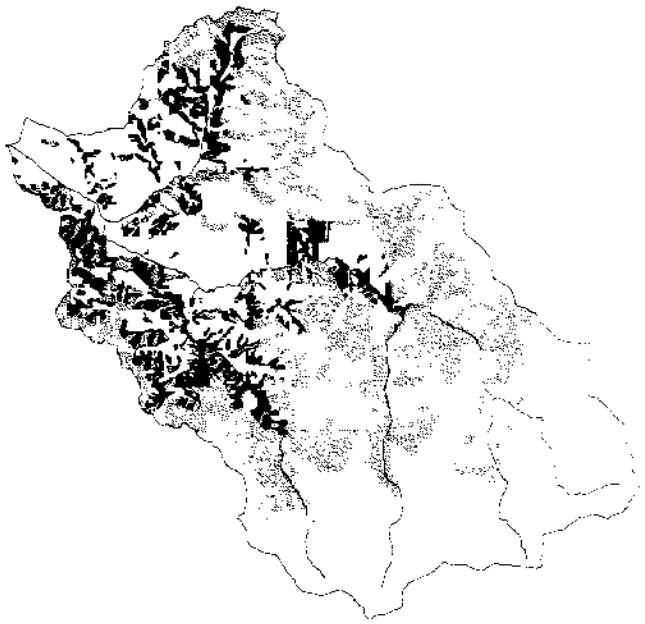


Figure #6 - Stands Potentially "At Risk" of Decline in Forest Health (Acres)

Risk Rating	Private	BLM	USFS
Extreme	566	1,007	0
Very High	1,141	3,170	65
High	749	1,877	44
Moderately High	2,885	5,337	4,338
Total	5,341	11,391	4,447

Figure #7 - Stand Risk Ratings

	Risk Rating Parameters			
	Extreme	Very High	High	Moderately High
Elevation	<3500'	<3500'	< 3500'	3500-5000'
Aspect	135-315	135-315	315-135	
Beetle Activity	< 1 mi	> 1 mi		
Canopy Closure	70-100%	70-100%	70-100%	70-100%

Past grazing (practices and numbers of animals) dramatically affected ecological functions and biological diversity in the Little Applegate Watershed. Effects include:

- accelerated erosion/sedimentation
- loss of native vegetation
- loss of riparian vegetation.

Current grazing in the watershed appears to affect ecological functions and biological diversity to a lesser degree than past grazing, but also appears to be inhibiting the recovery of the riparian and upland grassland ecosystems from past grazing impacts (Environmental History Report, pages 23-24, 55-57; Vegetation Report, pages D1-3, F1-2; Wildlife Report, Section 2.3 g; and Hydrology Report, pages 16-17).

In the issues development phase of the analysis, questions arose regarding the effects of grazing on specific ecosystem processes and parameters. The questions dealt with the relationship between current and historical grazing practice and factors of biodiversity, site productivity, sedimentation and stream channel characteristics. There is a wide breadth of professional opinion on these topics. This inability to reach conclusions results in part from a lack of site-specific data and analysis within the watershed.

There is adequate site-specific information regarding forage production and utilization. BLM lands have not been grazed significantly for several years and are thus currently relatively rich in forage. The recent completion of a Range Condition Analysis (RCA) for Forest Service lands provided information about forage production and utilization and the distribution of cattle on the allotments. The RCA did not address other ecosystem functions or biodiversity in general.

Areas of Concern (plants): Noxious weeds and other non-native plants are reducing the habitat capability for native species.

A survey for bryophytes (mosses and liverworts) and lichens conducted as part of this analysis discovered two species of mosses (*Bryum turbinatum* and *Meesia uliginosa*) which were previously unreported for Oregon. These species are associated with peat mounds in the McDonald Basin area and may be "at risk" due to grazing and trampling impact from livestock (Vegetation Report, p. F1-2).

Species shifts are occurring (primarily due to absence of fire) in multi-layered/multi-species stands. The structural and species diversity of these stands are being reduced. Understory stand density is the primary problem.

Many forest stands in the watershed are at risk of losing structure due to stresses from unsustainable high stocking levels (particularly those stands dominated by large pine). This condition is compounded by long-term absence of fire and decreasing precipitation over the last 10 years.

Recommendations (plants): There is agreement that site-specific data is required to support any conclusions regarding the relationship of grazing to the issues listed above. There is not agreement in how range management activities should proceed in the absence of this data. Although the specialist's reports make reference to effects of grazing on specific resources and processes, there were no resource recommendations widely supported by both range management and botanical experts. For purposes of drawing conclusions on a landscape level, range managers for all public and private range lands will need to establish compatibility in data gathering objectives and protocols.

Reduce or inhibit the increase in acres of noxious weed infestations. Options include:
- plant or seed only native species;
- reduce ground disturbance;
- control movement of cattle;
- manually remove noxious weeds;
- clean logging and other equipment before move-in and move-out;
- biological controls; and
- herbicides.

Determine effects of livestock grazing on:
- biodiversity in the watershed;
- general ecological condition of the watershed; and
- rare and/or special status species in the watershed.

Modify grazing practices as necessary.

Protect the peat mounds in McDonald Basin from further impacts. Options include:
- fenced exclosure of peat mounds; or
- remove cattle from area.

Improve or maintain vigor of the overstory in multi-layered stands. Potential options include:
- thinning from below;
- girdling;
- remove competing small trees from around larger trees; and/or
- prescribed fire.

Reduce the density of 'at risk' stands. Options include:
- commercial thinning;
- pre-commercial thinning;
- girdling;
- prescribed fire; and
- herbicides.

Further analysis would be required to determine feasibility and environmental effects for potential restoration projects.

Data Gaps & Monitoring Needs: General inventory (which species do we have?) of small mammals.

General inventory of special status invertebrates (terrestrial insects, aquatic and terrestrial mollusks).

Survey for "Category 2" and "Survey and Manage" species suspected or known to occur in the watershed.

Record spotted owl site history information in a common database for the watershed.

Determine the eastern boundary of the range of distribution of the Siskiyou mountain salamander.

Analyze critical habitat unit's ability to contribute to dispersal between Late Successional Reserves.

Inventory of snags and down wood in stands in various stages of development and forest type. Tie this to a predictive model such as ORGANON.

Identification of pea clam species in Monogram lakes.

Monitor the effectiveness of ROD provisions for landscape level dispersal (i.e. are spotted owls and other late successional dependent species adequately dispersing through\across the landscape, and what type of stand conditions are they utilizing?)

Research into the nature of the bat/snag relationship, and analyze the effects of large scale salvage operations on the density of snag dependent species such as woodpeckers and bats?

Research or studies to determine if cattle grazing is significantly altering riparian vegetation, and stream bank geomorphology, and species composition in habitats used by special status terrestrial invertebrates.

Monitor the effects of "forest health" type thinnings on closed canopy forest associated species.

Monitor known sites of "Category 2" and "Survey and Manage" species to provide information to determine the future status of the species.

Develop Species Management Guides for special status species.

4.4 COMMODITY PRODUCTION

Issue: There is a concern that the Little Applegate Watershed will not contribute substantially to the production of wood products and other commodities for the Rogue Valley.

Traditional commodity uses in the watershed have been:

- timber production;
- fuel wood; and
- forage for cattle.

Demand for other forest products has recently increased. These include:

- mushrooms;
- prince's pine;
- beargrass, and
- boughs.

Factors affecting the ability to produce commodities include:

- existing inventory (short-term);
- conflicting resource needs;
- site potential/productivity;
- disturbances such as fire; and
- ability to regenerate a resource after harvest.

Findings: Since the beginning of recognized regeneration harvests (clearcut, seedtree, shelterwood, and overstory removal) in 1947, 73% of all the area harvested on BLM and Forest Service lands is adequately stocked. However, reforestation success within the high elevation plant communities (high temperate coniferous forest and subalpine forest park) was considerably less successful than in the mixed confer forest plant community. Thirteen percent of the 826 acres harvested in the high elevation plant communities was adequately stocked compared to 79% of the 8031 acres harvested in the mixed conifer plant community.

Reforestation success has also improved considerably since the 1950's, 60's and 70's. Ninety percent of all acres harvested since Jan. 1, 1980 are adequately stocked, with less than 2% not meeting the specified minimum of 125 well spaced trees per acre. Only 54% of the area harvested before then was adequately stocked and over 25% did not meet the 125 tree per acre minimum (Vegetation Report, p. 22-26).

Recommendation: Since past reforestation success has been so poor in the high temperate coniferous forest plant community, additional **regeneration** harvests are not recommended in this area until an analysis of past harvest areas can identify factors or activities that have resulted in successful reforestation.

Timber harvest is not recommended for stands in the subalpine forest park plant community since all 153 acres previously harvested in this community are still not successfully reforested. This plant community is primarily located on Forest Service lands currently managed as Special Interest Areas or Botanical Areas.

The watershed analysis team recommends that short-term timber volume be produced primarily from treatments aimed at:

- reducing densities of over-stocked "at risk" stands;
- developing late successional habitats;
- developing coarse woody material for streams; and
- reducing fire hazard.

Data Gaps & Monitoring Needs: An analysis of high elevation reforestation units is needed to determine what factors contribute to the success or failure of reforestation in these areas.

4.5 FIRE RISK

Issue: A concern exists that wildfires (from either natural or human causes) will destroy natural resources and private property in the Little Applegate Watershed.

Findings: Fire has played a major role in the development of vegetation patterns in the watershed. Lightning, human carelessness, and clearing of vegetation by miners, ranchers, and Native Americans have all contributed to the rich fire history of the watershed. Wildfires have been suppressed in the watershed for over eighty years with few major burning events.

The absence of fire is believed to be a major factor in the following conditions which may have increased the risk for a major conflagration in the watershed:

- buildup of fuels in many plant communities;
- development of ladder fuels in forested stands;
- conversion of grassy south aspects to brushfields;
- overly dense forested stands; and
- removal of pine species from many sites.

Area of Concern: High fuel loadings and ladder fuels near sensitive areas including:

- houses and other structural improvements;

- northern spotted owl core sites;
- erosive soils;
- riparian zones;
- progeny sites; and
- recreation developments.

Recommendation: Reduce fuel loadings, flashy fuels, ladder fuels, and over dense stand conditions in and around sensitive areas, in high hazard zones where practical and where in compliance with other objectives of the ROD.

Options to achieve this recommendation include:
- manually manipulate vegetation;
- pile and burn;
- pile and chip;
- fuel breaks;
- low intensity prescribed fire;
- fuelwood removal.

Land managers in the watershed have the opportunity to mitigate fire hazard through projects. When land treatment projects to mitigate hazard and risk are contemplated, they should be planned as part of a watershed-level strategy to intercept hazard. General treatment recommendations identified in the Applegate AMA Ecosystem Health Assessment (and supported by this team) include
- integration of fire risk and fire hazard analyses into all aspects of ecosystem management, including analysis of habitat requirements, site productivity, and the planning of restoration activities;
- reduction of fire risk and fire hazard on a broad scale, including density management, prescribed fire, manual manipulation of live and dead vegetation and shaded fuel breaks;
- development of an interagency fire suppression plan that considers an interface structure analysis and adequate presuppression and preattack facilities such as helispots, access, and safety zones;
- development of strong prevention programs with communities that emphasize hazard reduction and the creation of defensible space around private property; and
- incorporation of prescribed fire as a restorative tool.

Data Gaps & Monitoring Needs: An inventory of the watershed for fire hazard and risk.

Monitor treatment areas to determine effectiveness of treatments aimed at reducing fire hazard.

4.6 RIPARIAN TRANSITION ZONE

Issue: There is a concern that the riparian transition zone may not be functioning at its biological and hydrologic potential.

The riparian transition zone (RTZ) as defined for this report is the predominantly terrestrial zone bordering the aquatic ecosystem (perennial and intermittent streams, lakes and ponds) and wetlands. Although the vegetation structure of the RTZ is predominantly the same as in the upland terrestrial ecosystem, its close proximity to the aquatic zone sets it apart in importance. It is an ecologically defined zone that occurs on all land regardless of ownership. Riparian Reserves are legally defined land allocations that apply only to BLM and Forest Service lands within the watershed. Riparian Reserves and the RTZ are essentially the same on the Public Lands.

Alteration of the riparian transition zone may contribute to adverse impacts to the aquatic zone, streamside habitat, and the species they support.

Factors affecting the condition of the riparian transition zone include:
- roading;
- mining;
- grazing;
- timber harvest;
- agricultural development;
- urbanization; and
- other ground disturbing activities.

Findings: From historic vegetation data and anecdotal accounts, it is believed that over 90 % of the RTZ adjacent to perennial (Class 1-3) streams had late successional vegetation characteristics prior to European settlement. Vegetation in the valley bottoms of the Little Applegate River below Tunnel Ridge, of lower Yale creek, and of virtually all of Sterling Creek were altered and have been maintained in early to mid successional condition since the 1800s.

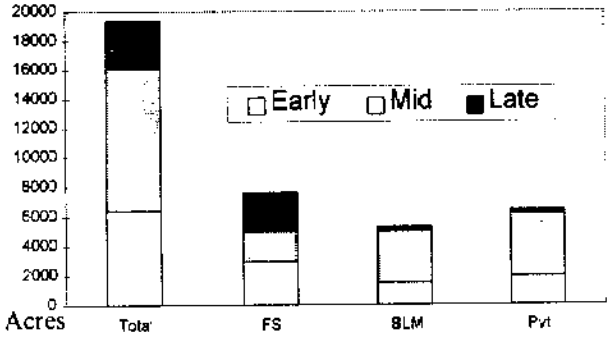
The more remote Upper Little Applegate, McDonald Creek, Glade Creek, and Upper Yale Creek Subwatersheds largely retained late successional vegetation in the RTZ until the onset of intensive logging following World War II. Since then, RTZs in McDonald Creek and the Upper Little Applegate Subwatersheds have been heavily logged so that they now retain little late successional vegetation. The acreage of RTZs with late successional characteristics in Glade and Yale Creeks has also declined since World War II, although proportionally they have not been as affected as the other subwatersheds (Hydrology Report, pages 33-36).

Riparian Transition Zone Map

Riparian Reserve Map

Interim Riparian Reserves (apply only to public lands).

Figure 7 - Successional Stage Distribution in Riparian Transition Zones (1993 Data)



Vegetation Condition in Riparian Transition Zone Map

Unshaded - Outside Riparian Transition Zone
Light Shading - Early Successional
Moderate Shading - Mid Successional
Dark Shading - Late Successional

Timber harvest, agricultural development, residential development, mining activities, and 139 miles of roads have occurred in the RTZ. These activities have reduced the late successional make-up of the RTZ. The RTZ comprises 27% of the acreage in the watershed; however, 35% of the roads occurring within the watershed (139 of 396 miles) are located in the RTZ (Hydrology Report, pages 39-40).

The consequences of reducing the late successional make-up of RTZs in the Little Applegate are reflected in the low amount of coarse woody debris (CWD) found in streams, the elimination of shading with attendant increases in water temperatures, increased sedimentation, and disruption of wildlife habitat for species dependent on these communities (Hydrology Report, p. 29, 38, & 39).

Area of Concern: Interim Riparian Reserve widths were determined in the ROD. The watershed analysis process is the vehicle to provide direction for adjusting Riparian Reserve widths.

There are probably areas where the interim riparian reserve boundaries are in excess of what is needed to meet the ACS and other functions which the reserves were designed to perform. However, we currently lack the ability to accurately identify these areas. There is insufficient information available for most species (habitat associations, range of distribution, and population numbers) which the

Riparian Reserves were designed to support to recommend changing the widths of the interim reserves at this time.

The ROD states that changes to the widths of riparian reserves must be based on "scientifically sound reasoning" (ROD B-16). The information necessary to make a biologically sound decision on riparian reserve widths is not something that an interdisciplinary team can develop during a site visit; it is the result of species specific research. Once the habitat needs of the various species are understood, then we can compare the needs of the species to the interim riparian reserve widths on a site specific basis.

Interim Riparian Reserves were verified during the summer of 1994. This involved field verification of stream class, sample field verification of the USFWS National Wetlands Inventory, and compilation of all known information pertaining to geologic stability. The Riparian Reserves associated with geologic instability has had limited field verification (Hydrology Report, pages 41-42).

Recommendation: The watershed analysis team recommends use of the Riparian Reserve widths identified in the ROD Attachment A (S&Gs pages C-30 &31) until a project level, site-specific analysis is performed.

Site specific project planning should be used to adjust the Interim Riparian Reserve widths. This should involve:

- more precise delineation of wetlands;
- more precise delineation of unstable areas;
- verifying extent of fish-bearing streams; and
- analyzing needs of the species that depend on the RTZ for survival.

This should be an interdisciplinary process involving as a minimum specialists in wildlife, fisheries, hydrology, geology, and silvilculture. Adjusted Riparian Reserve boundaries should be entered into the GIS.

Area of Concern: Many riparian transition zones are not providing desired benefits to aquatic and terrestrial species. This is primarily associated with the vegetative condition (see Vegetation Condition in Riparian Transition Zone Map). The decline of late successional vegetation in riparian transition zones is primarily a result of:

- timber harvest;
- roading;
- hazard tree removal and salvage along roads;
- residential development;
- conversion to agricultural uses; and
- past hydraulic mining.

Direction is needed to determine treatments and/or activities which achieve ACS goals in riparian transition zones.

Treatments within Riparian Reserves (Recommendation): The ACS states that the Riparian Reserves are not intended to be managed for commercial wood fiber production (S&Gs page C-31). However, situations exist where reduction of density and removal of selected trees will enhance the riparian transition zone and/or the aquatic ecosystem in the long-term.

The watershed analysis team determined that treatments (including silvicultural) within the riparian reserves were acceptable when they will promote late successional conditions, including:

- dispersal habitat for terrestrial species;
- cover for terrestrial species;
- nesting and foraging habitat for terrestrial species;
- shade for streams; and
- coarse woody debris for streams and the riparian transition zone.

Options for achieving these treatment objectives include (Hydrology Report, p. 40-41):

- planting conifers;
- reducing density in stagnant stands;
- identifying individual trees with potential for recruitment into streams and culturing them to a desirable size;
- rerouting, obliterating, and/or rehabilitating roads, skid trails, and landings in riparian reserves;
- controlling or eliminating grazing in riparian areas;
- placing coarse wood in streams (where appropriate) as a short term solution until development of stands within the RTZ can provide for coarse woody debris;
- alternatives to hazard tree removal in Riparian Reserves; and
- reducing fuel ladders.

An analysis under the National Environmental Policy Act would be required to determine feasibility and effects on the ecosystem for these potential projects.

The team recommends that treatment prescriptions for riparian reserves be developed interdisciplinarily (including hydrologists, biologists and silviculturists) and should generally be separate from prescriptions for adjacent stands since riparian-associated stands are managed for different objectives than the adjacent upland stands.

Determine effects of livestock grazing on the Riparian Reserves for compliance with the ACS (ROD pages B11 & C33-34). Adjust grazing practices as necessary.

The designation of Riparian Reserves and treatments in these areas legally apply to public lands. However, if the

objective is to increase anadromous fish populations in the Little Applegate Watershed, similar measures should be taken on private lands.

Riparian Transition Zone (Data Gaps & Monitoring Needs): Field verify Riparian Reserves relating to:

- geological instability,
- wetlands; and
- extent of fish bearing streams.

Identify and prioritize specific restoration projects.

4.7 SOCIAL/ECONOMIC

Issue: There is a concern that people's ability to use the Little Applegate Watershed for competing social and economic activities (including traditional Native American values and uses) may be reduced.

Competing uses within the watershed include:

- hunting;
- naturalist activities;
- hiking;
- camping;
- viewing/experiencing heritage resources;
- off highway vehicle use;
- mining;
- road development;
- rock source development;
- residential development;
- agricultural practices;
- timber harvest;
- irrigation ditches; and
- livestock grazing.

This is a general issue; however, most people are concerned about a specific use or set of uses that pertain directly to how they utilize the watershed. These uses are affected by the condition of the watershed.

The watershed analysis dealt with the social issue as a by product of and related to the other issues in this analysis.

Findings: The social assessment for the Little Applegate Watershed relies on the assessment conducted by the Rogue Institute for Ecology and Economy for the Applegate AMA entitled Words Into Action: A Community Assessment of the Applegate Valley (May 1994), prepared by Kevin Preister.

Copies of this report are available from the Rogue Institute for Ecology and Economy (1150 Ashland Street, Ashland, Oregon 97520 (503) 482-6031) for sixteen dollars.

4.8 SITE PRODUCTIVITY

Issue: There is a concern that there may have been a loss of site productivity in the Little Applegate watershed.

Site productivity is essential for the overall production of plant and animals in the watershed and is important to the resiliency of the ecosystem. Past human activities have negatively affected the productivity of some sites. These effects are generally long term and outside the range of natural variability, including:

- soil displacement;
- compaction;
- mass wasting;
- erosion;
- reduction of coarse woody material; and
- reduction of the duff layer.

Management activities that reduce future impacts or aid in the recovery of degraded sites will increase the overall health of the watershed.

Findings: The introduction of sheep, cattle and other domestic animals in the mid to late 1800's resulted in the reduction of soil cover and subsequent loss of topsoil. Recovery of soil cover came during the 1920's with the reduction of the number of animals from the range. There are some areas in the higher elevation meadows where bare soil is still present. Of the rangelands, aerial photo interpretation shows approximately 900 acres with less than 80% cover. Approximately 500 acres show some form of rill or gully erosion. The trend for recovery will depend on restoration projects and management of cattle. The harsh growing conditions of some of the affected sites, make for a slow recovery (Site Productivity Report, p. 18-19).

The use of ground based yarding equipment for timber harvesting has caused compaction and displacement of topsoil on many timbered sites. It is estimated that of the timber producing lands in the watershed (all ownerships), approximately 12% have had a reduction in site productivity (over 20% of area in skid trails). Broken down by ownership, 4% of BLM, 7% of Forest Service and 18% of private lands have had a reduction in site productivity as a result of tractor skidtrails and piling (Site Productivity Report, p. 5). The trend is for less ground based yarding and slash piling on federal lands; therefore, old unused skid trails and other compacted areas will likely recover over time. It is assumed that ground based systems will continue to be the primary yarding method on private lands.

Roads have displaced 2.2 percent of the soils in the watershed. Future road building is assumed to be minimal on federal and private lands since most of the land is currently accessed by road (Site Productivity Report, p. 10).

Broadcast burning and intensively yarding of coarse woody debris on some harvest units have left the areas low in "on ground" organic matter. Approximately 2000 acres on public lands are below the minimum standards (120 linear feet of logs greater than 16 feet long and 16 inches diameter) as stated in the ROD (Site Productivity Report, Table 5). The trend for coarse woody debris is positive for the watershed if the minimum standards in the ROD are met during future timber harvesting operations. Coarse woody debris on private lands will probably decline as the value of wood fiber increases.

Area of Concern: Soil disturbances from ground based logging, road building, fuels management and historic livestock grazing have reduced site productivity in some areas of the watershed. Soil disturbances include:

- compaction;
- soil erosion through loss of duff and vegetation cover;
- topsoil displacement; and
- mass wasting.

Recommendations: Future management activities should consider the following to provide the best means for mitigating sedimentation from soil disturbance (Site Productivity Report, p. 17, 18, 20, & 22):

- use full-suspension yarding systems (helicopter & skyline) on highly erosive soils;
- use full-suspension yarding systems (helicopter & skyline) within the riparian transition zone;
- use at least partial suspension yarding systems or horse logging on low to moderately erosive soils;
- use ground based logging equipment on low to moderately erosive soils if total area in skidtrails is less than 20 percent but preferably less than 10 percent, including;
  - use designated skidtrails and pull cable to logs;
  - locate skidtrails away from wet areas and draws;
  - locate skidtrails on gentle slopes (<20% slope gradients);
  - plan skidtrail layout to access total area for all future entries;
  - limit use of tractor piling for site preparation;
- maintain 85 percent of soil cover on highly erosive soils during fuels reduction treatments;
- maintain 60 to 70 percent soil cover on low to moderately erosive soils during fuels reduction treatments;
- review sites that have over 40 percent of area in compacted condition or less than 80 percent soil cover for potential restoration projects;
- minimize any activity in landslide hazard zones that increase ground water or reduces soil strength;
- install exclosure studies on range sites that have less than 80 percent cover to determine the effect of cattle on range recovery; and
- work with private land owners to develop less ground disturbance during logging operations.

Area of Concern: Some sites are low in site organic matter due to logging and broadcast burning operations. Long term site productivity is probably negatively affected on these sites, especially on the higher elevation units.

Recommendations: Develop target levels of site organic matter specific to plant series in the Little Applegate Watershed. McCrimmon and Atzet are currently working on finalizing these targets.

In areas deficient in organic matter, maintain as much organic matter as possible.

Data Gaps & Monitoring Needs: Effects of subsoiling on long-term site productivity and reduction of bulk density

Exclosure studies to determine effect of cattle grazing on recovery of vegetation on some sites.

Research on appropriate restoration methods on high elevation sites.

Establish soil monitoring plots in representative soils to follow recovery process through time.

5. Watershed Analysis Team

The core team for this analysis included:

Larry Zowada	BLM-Ashland RA	GIS
Mike Zan	USFS-Butte Falls RD	Hydrology
Dave Steinfeld	USFS-JHS Nursery	Geomorphology
Rachel Miller	USFWS-Portland	Biologist
Sue Livingston	USFWS-Portland	Biologist
Jerry Hellinga	USFS-Butte Falls RD	Vegetation
John Fertig	USFS-Applegate RD	Analyst/Documentation
Don Ferguson	BLM-Ashland RA	Facilitator/Fire
Matt Broyles	BLM-Ashland RA	Terrestrial Biology
Don Boucher	USFS-Prospect RD	GIS
Bob Bessey	BLM-Glendale RA	Aquatic Biology

The following persons made significant contributions to the analysis:

Jeanette Williams	USFS-Applegate RD	Range
Joan Seevers	BLM-Medford	Botany
Wayne Rolle	USFS-Rogue River NF	Botany & Range
Ed Reilly	USFS-Applegate RD	GIS
Barbara Mumblo	USFS-Applegate RD	Botany
Jeff LaLande	USFS-Rogue River NF	Environmental History
Pete Jones	USFS-Rogue River NF	Geology
Tom Jacobs	BLM-Medford	Range
Dave Green	USFS-Rogue River NF	Restoration Inventory
Ellen Goheen	USFS-Rogue River NF	Plant Pathology
Werner Bruckner	USFS-Rogue River NF	Silviculture
Tom Atzet	USFS-Siskiyou NF	Ecology

A large number of other BLM and Forest Service employees participated in data collection and analysis.

Stream surveys were contracted through the Oregon Department of Fish and Wildlife. Bryophyte and lichen data was collected by Dave Wagner, Ph.D. under contract. Stream flow and water quality data were collected by volunteers organized through Headwaters. Aquatic insect community analysis was contracted through Biological Associates.

We wish to especially thank Ben Gerwick, Fred Thomas, Ron and Judy Bertolami, and Richard Schaeff for allowing collection of water quality and fisheries data on their properties. Large gaps in our understanding of the current conditions in the watershed would have existed without their help.

6. Specialist Report Summaries

The primary scientific information used for the analysis of the Little Applegate Watershed is located in individual resource reports. The raw data is located in the watershed analysis files and geographic information systems located at the Applegate Ranger District Office and the Medford Bureau of Land Management Office.

The following reports have been written and contain specific data, data summaries, and more detailed logic on the development of this analysis.

6.1 Key Questions and Answers (25 pages)

This report lists the key questions used to guide the analysis, and gives responses and reference to the questions.

6.2 Environmental History (108 pages)

The Environmental History Report prepared by Jeff LaLande documents the history of the Little Applegate Watershed. It emphasizes the effects humans have had on shaping the ecosystem of the watershed. This is a 'stand alone' document. Due to it's thoroughness, the Environmental History Report was not summarized in this Watershed Analysis Report.

6.3 Geomorphology (39 pages)

This report describes components of the geomorphic landscape units identified in the analysis. It also includes an attachment on the influence of geology on the geomorphology of the watershed.

6.4 Mass Wasting (12 pages)

This report describes the influence of mass wasting on sediment yield and soil productivity in the watershed.

6.5 Site Productivity (44 pages)

This report describes the components of site productivity relating to soil porosity, compaction, and displacement including recovery mechanisms, strategies and trends.

6.6 Vegetation (60 pages)

This report briefly describes the current plant communities of the Little Applegate Watershed and discusses the influences of management activities and natural processes on the structure species composition of those plant communities

6.7 Wildlife (176 pages)

This report includes the following information on the Little Applegate Watershed: current and historic species richness; current status and predicted trends for vertebrates; a multi species habitat suitability analysis; special habitats; and biodiversity

6.8 Hydrology (60 pages).

This report describes hydrologic processes, conditions, and trends at work in the watershed. The report is divided into four sections: Hydrology; Watershed Condition; Water Quality; and Riparian Transition Zone.

6.9 Stream Ecosystem (93 pages)

This report discusses how natural processes and human activities have determined current stream habitat condition and the relative abundance of aquatic species. Expected future habitat and population trends are also discussed.

6.10 Watershed Restoration (7 pages)

This report summarizes the current status of watershed restoration efforts in the watershed involving BLM and Forest Service lands, and certain shared roads on both public and private lands. Inventory data is not included in the report.

6.11 GIS Layers (3 pages)

This report lists the various layers of data available for the Little Applegate Watershed. It also includes a listing of data bases utilized.

7. Glossary

ACS - Aquatic Conservation Strategy - ROD pages B9-32.

AMA - Adaptive Management Area - Most Public Lands within the Applegate Watershed were designated as an AMA under the Northwest Forest Plan, including all Federally managed land within the Little Applegate Watershed.

Anadromous Fish - Fish that are born and grow in freshwater, move to the ocean, mature, and return to freshwater to reproduce (salmon & steelhead).

Basal Area - The area of the cross section of a tree stem including the bark, at 4.5 feet above the ground.

Beneficial Uses - Reasonable use of water for a purpose consistent with the laws and best interest of the people of the state.

Biological Diversity - The variety of life forms and processes, including a complexity of species, communities, gene pools, and ecological functions.

BMP - Best Management Practices - Methods, measures, or practices designed to prevent or reduce water pollution. Usually, BMPs are applied as a system of practices rather than a single practice.

Category 2 candidate species - Species which the USFWS has determined may warrant listing as threatened or endangered, but lack of biological information on the species precludes a listing decision at this time.

CHU - Critical Habitat Unit - Areas designated by the USFWS as critical habitat for a species listed as threatened or endangered under the Endangered Species Act.

CWD - Coarse Woody Debris - Portion of a tree that has fallen or been cut and left in the woods. Usually for the purpose of providing habitat and/or nutrient cycling.

Culmination of Mean Annual Increment (CMAI) - The peak of average yearly growth in volume of a forest stand (total volume divided by stand age).

Diameter at Breast Height (DBH) - The diameter of a tree 4.5 feet above the ground on the uphill side of the tree.

Fire Hazard - Vegetation by the kind, arrangement, volume, condition and location that forms a special threat of ignition, spread, and resistance to control.

Fire Risk - The chance of an ignition source resulting in a fire that threatens valuable resources such as property and life.

GIS - Geographic Information System

LSR - Late Successional Reserve - A forest in its mature and/or old growth stage that has been reserved under the Northwst Forest Plan. Note: Only unmapped 100 acre sites around known spotted owl locations as of January 1, 1994, exist in the Little Applegate Watershed.

Late Successional Stage Forest - The stage in forest development that includes mature and old-growth forests.

Long-term site productivity: The ability of the land to sustain an inherent level of plant biomass over several forest rotations. For this analysis, only topsoil, soil porosity and organic matter were examined.

Pre-settlement - For this report it is considered the time period prior to settlement of humans of European descent in the vicinity of the Little Applegate Watershed.

Regeneration Harvest - Timber harvest conducted with the partial objective of opening a forest stand to the point where favored tree species will be reestablished.

REO - Regional Ecosystem Office

Resident Fish - Fish that are born and remain in freshwater their entire life.

Riparian Reserves - Legally designated riparian management zones on federal land designed to protect aquatic ecosystems and provide habitat for terrestrial species.

RTZ - Riparian Transition Zone - The ecological term for the interface between the aquatic ecosystem and the upland sites regardless of ownership. On Federal Lands this is essentially the same as Riparian Reserves.

ROD - Record of Decision for Amendments to Forest Service and Bureau of Land Management Planning Documents Within the Range of the Northern Spotted Owl.

S&Gs - Standard and Guidelines for Management of Habitat for Late-Successional and Old-Growth Forest Related Species Within the Range of the Northern Spotted Owl.

Successional Stage - A stage or recognizable condition of a plant community that occurs during its development from bare ground to climax.