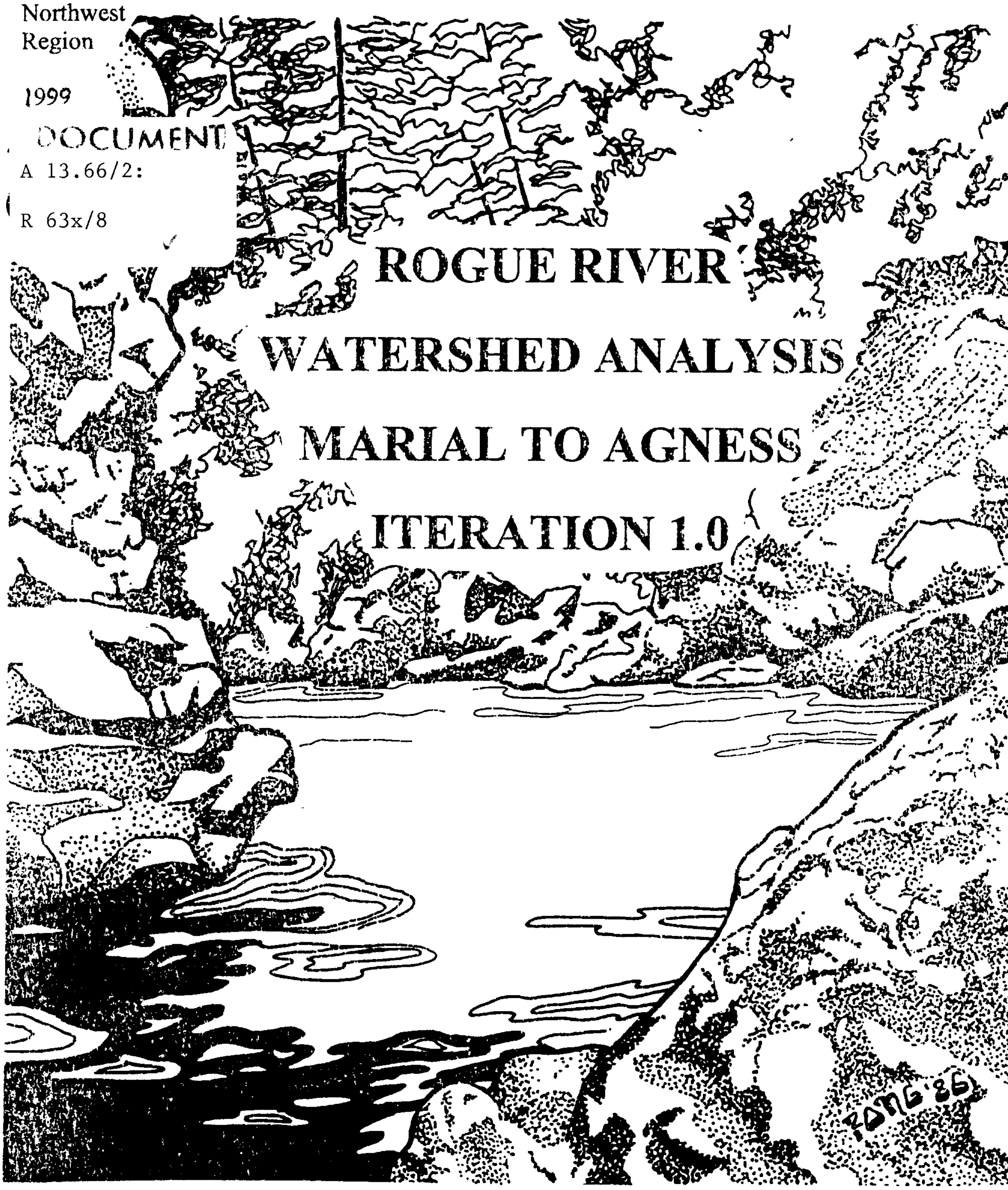
WS 22 and 23

S.O. Copy
LMP

United States
Department
of Agriculture

Forest Service
Pacific
Northwest
Region

1999



ROGUE RIVER
WATERSHED ANALYSIS
MARIAL TO AGNESS
ITERATION 1.0

United States
Department
of Agriculture

Forest Service
Pacific
Northwest
Region

1999

ROGUE RIVER

WATERSHED ANALYSIS

MARIAL TO AGNESS

ITERATION 1.0

I have read this analysis and find it meets the Standards and Guidelines for watershed analysis required by the Record of Decision for Amendments to Forest Service and Bureau of Land Management Planning Documents Within the Range of the Northern Spotted Owl (USDA and USDI, 1994).

Signed: /s/Michael Frazier Date: September 24, 1999
District Ranger
Gold Beach Ranger District
Siskiyou National Forest

TABLE OF CONTENTS

LIST OF TABLES

INTRODUCTION

The Rogue River Watershed Analysis, Marial to Agness, Iteration 1.0, was initiated to analyze the aquatic, terrestrial, and social resources of the watershed. The watershed analysis was completed by an interdisciplinary team using the six step process outlined in *Ecosystem Analysis at the Watershed Scale (Version 2.2, August 1995)*. The analysis includes the entire defined portion of the watershed, but focuses more detail on National Forest land. This document has the following components: the aquatic ecosystem, the terrestrial ecosystem, and social aspects.

The information gathered and analyzed will be used to guide future resource management, and ensure that Aquatic Conservation Strategy objectives and other Standards and Guidelines contained in the Record of Decision for Amendments to Forest Service and Bureau of Land Management Planning Documents Within the Range of the Northern Spotted Owl (USDA and USDI, 1994) will be met on Federal lands.

Rogue River Basin

The Rogue River is the third largest river in Oregon, after the Columbia and the Willamette. It is one of three rivers that originate in the interior Cascade Range and flow westward to the ocean. From its source in the high Cascade Mountains in southwestern Oregon near Crater Lake National Park, the Rogue River flows over 200 miles before entering the Pacific Ocean near the town of Gold Beach, Oregon.

The Rogue River Basin contains approximately 5,160 square miles, 97 percent in Oregon and 3 percent in California. Within Oregon, the basin includes nearly all of Jackson and Josephine Counties, a large part of Curry County, lesser portions of Klamath and Douglas Counties, and a small portion of Coos County. It also includes very small portions of Siskiyou and Del Norte Counties in northwest California. (See Vicinity Map and Site Map.)

Rogue River Watershed, Marial to Agness (River Mile 48.5 to River Mile 27)

This portion of the Rogue River watershed includes the Rogue River from the mouth of Mule Creek, but not including Mule Creek, to the mouth of the Illinois River, but not including the Illinois River. All streams entering the Rogue River between these two points and the land drained by those streams are included in this watershed analysis. (See Table 1 and Land Ownership Map).

Table 1. Land Ownership

Ownership	Acres	Percent
USDA Forest Service	78,507	96
USDI Bureau of Land Management	872	1
State of Oregon	217	<1
Private	1,828	2
Total	**81,424**	100

Management Direction

Direction for management of the National Forest land is provided by the Siskiyou Land and Resource Management Plan (LRMP, USDA, 1989) as amended by the Record of Decision and Standards and Guidelines for Management of Habitat for Late-Successional and Old-Growth Forest Related species Within the Range of the Northern Spotted Owl (ROD, USDA and USDI, 1994). Management areas for National Forest lands within the Rogue River, Marial to Agness watershed, are listed in Table 2 and on the Management Areas Map. The definitions and management strategy for these areas can be found in the ROD and in the LRMP.

The area addressed by the Rogue River, Marial to Agness Watershed Analysis includes the Shasta Costa Creek watershed which was designated as a Tier 1 Key Watershed in the ROD. Detailed information concerning this watershed may be found in the Shasta Costa Watershed Analysis (WA) completed in 1996. There are no other Key Watersheds within the Rogue River, Marial to Agness watershed. Other Watershed Analyses covering portions of this analysis area are Foster-Twomile Interim WA completed in 1996, and Stair Creek WA completed in 1999. The Foster-Twomile WA is incorporated in Appendix A – Subwatersheds, Shasta Costa and Stair Creek are included in overall data and watershed descriptions, but are not analyzed in detail in this document.

Table 2. Management Areas

Management Area	Acres	Percent
Wilderness	25,185	32
Wild River	207	
Botanical	409	
Unique Interest	88	
Supplemental Resource	3,895	5
Late-Successional Reserve	48,723	62
Total	**78,507**	

The US Geologic Survey (USGS) divided the United States into hydrologic units codes (HUC) according to the river system the land drains into. The USGS assigned numbers to the first four 2-digit fields. This Watershed Analysis area lies within the Hydrologic Unit Code 17100310, defined as:

Field 1 17 Pacific Northwest Region (primarily Oregon, Washington, and Idaho)
Field 2 10 Oregon-Washington Coastal
Field 3 03 Southern Oregon Coastal
Field 4 10 Lower Rogue

Other agencies have further divided these HUC watersheds into subwatersheds and smaller drainages. Agencies are moving toward a single set of boundaries and watershed numbers. At the time of this analysis, the subwatersheds included have different numbers assigned by the U.S. Environmental Protection Agency and the U.S. Forest Service.

Table 3. Subwatersheds

FIELD 5 EPA	FIELD 6 EPA	FIELD 5 USFS	FIELD 6 USFS	EPA NAME	STREAMS	FIELD 7 USFS
05		23		USFS Wild Rogue		
	01		S	Stair Creek	Stair Creek	all
	02		U (portion excluding Mule Creek)	Upper River	Blossom Bar Creek Burns Creek Johnson Creek Paradise Creek unnamed streams	3 4 1 2 1,5
	03		L	Lower River	Brushy Bar Creek Clay Hill Creek Dans Creek East Creek Fall Creek Flora Dell Creek Slide Creek Tate Creek Watson Creek unnamed streams	4 6 1 8-9 5 3 1 7 2 1,4
06		22		Rogue-Illahe		
	01		F	Foster Creek	Foster Creek	all
	02		M	Rogue-Illahe	Billings Creek Lone Tree Creek Scott Creek Slide Creek Twomile Creek Waters Creek unnamed streams	8 8 4 5-7 3 1,8
	03		S	Shasta Costa	Shasta Costa Creek	all

KEY FINDINGS

The geomorphology of the Rogue River, Marial to Agness, watershed is controlled by complex geologic relationships between rock types and structures (faults, fractures and folds). Topography and erosion processes are directly related to these relationships. Large, (covering up to several thousand acres) naturally occurring slump/earthflows, and the debris slides associated with them, are the predominant sediment producers to the stream systems. Hillslope stability and riparian areas are recovering from management related disturbances from 1960 through 1980. This recovery plus the inherent resistance of the many bedrock controlled channels in the system, minimized the impacts of 1996 storm events. Intensive (clear-cut) logging appears to reduce the stability and increase the rate of movement on large, deep-seated slump/earthflows underlain by the Lookingglass Formation.

Stream channel morphology and sediment transport and deposition processes are dominated by the large slump-earthflow features and debris slides in Billings, Foster, Twomile, Waters, Shasta Costa, and Snout Creeks. Sediment from these natural features is also responsible for periods of unseasonal turbidity in these streams.

Stream temperatures are warmer than optimum for fish in many of the streams in this analysis area.

Salmon and trout play an important role in the ecology, economy, politics, history and culture of natural and human systems in and near the watershed.

The mainstem Rogue River between Marial and Agness is a major migration corridor for anadromous fish. It is a link between the coast range, inland valleys and southern Cascade Mountains.

Few adults spawn in the mainstem, and redd success here is naturally very low. Powerful winter flows turn the gravels and destroy fish eggs.

Shasta Costa and Foster Creeks are the only tributaries in the watershed with extensive low-gradient reaches capable of producing salmon and steelhead in abundance.

Stair Creek is unique in that it provides extensive resident trout habitat.

The numerous small, steep face tributaries to the Rogue River generally produce a small number of **steelhead and cutthroat** in their lowest reaches. They can be important slack-water refuges from high winter storm flows in the mainstem. They are important sources of cool water to the mainstem during the summer.

The world's largest known population of the plant **Leach's Brodiaea** occurs in the Shasta Costa Creek watershed. The largest populations of **Bolander's onion** and **bensonia** in Oregon are found here, as well as the only known population of the moss subspecies *Encalypta brevicolla* var. *crumiana.*

The only sightings of the **common kingsnake** on the west side of the Siskiyou National Forest have been in the Rogue River corridor between Marial and Agness.

The watershed has the largest concentration of **elk** on lands administered by the Gold Beach Ranger District. The elk mostly use recent clearcuts, meadows, and open white/black oak savannas for forage. The higher elevation timbered areas in this watershed also provide good forage during the summer months.

The Rogue River watershed from Marial to Agness is one of the most diverse watersheds for **recreational use** on the Gold Beach Ranger District. The Rogue River corridor receives the highest number of recreational visitors for any one area on the District, although the lower river has a higher number of visitors than this watershed. Today, recreational activities include downriver floating with rafts, drift boats, canoes and kayaks, motor boating, viewing the river and scenery by tour boats, fishing, hiking, hunting, swimming, camping, and recreational driving.

Both the presence and absence of **fire** have shaped the vegetative characteristics, as well as any associated effects to dependent wildlife species within the watershed. History indicates that natural fire occurrence was likely to have been of moderate return intervals, of low to moderate severity, with intermittent events of high severity burning. The advent of European settlement (the mid-1800s) increased the frequency, size, and severity of fires in the watershed, likely to rates beyond the range of natural conditions. Beginning in the 1940s fire suppression reversed this trend, with policies to stop all fires at the smallest possible size. Present day policies will allow fire to play a more natural role once studies are completed and plans have been drafted.

Roads in the area are affected by the unstable landforms and need continual maintenance in order to remain open. Many culverts are reaching the end of their life and may fail, blocking roaded access as well as contributing to resource damage.

AQUATIC ECOSYSTEM NARRATIVE

Geology

Rogue River Basin

The Rogue River Basin overlays important geologic areas that have considerable implications for the diversity and migration of flora and fauna. This area includes the Cascade Geologic Province, the west Cascade sub-province and the Klamath Geologic Province. The Klamath Province links these areas to the Sierra Nevada of California to the south, Cascade Mountains to the east and the Oregon Coast Range to the west and north.

The Rogue River basin traverses all three geologic areas. The Klamath Province is the oldest geologic formation, formed 160 to 350 million years ago. Rocks of the west Cascade Province were formed 38 to 9 million years ago and those of the high Cascades were formed within the last 8 million years. Fossil evidence for salmonid fish dates back to 10 million years ago. These fish evolved during much of the uplifting and geological changes described below. During these times scientists theorize that the many inland seas and lakes that formed were of highly variable salinity. Salmonids adapted to these changing water conditions, and when access to the ocean was possible, adapted to the marine environment.

The Klamath Geologic Province includes the Siskiyou Mountains of Oregon, extending roughly from Roseburg, Oregon to Redding, California and west almost to the Pacific Ocean. The Klamath Province is a very old accretion of volcanic and sedimentary rocks that have undergone tectonic activity, altering their physical and chemical characteristics. Uplifting, faulting and shearing concomitant with erosional processes began to shape the present-day river basins over the last few million years. The last million years - the Pleistocene - set the present geomorphic structure over the older landscape with tectonic uplift, weathering and response to sea level and climate changes.

The north-south ridge in the Kalmiopsis Wilderness and the east-west ridge of the Siskiyou Crest (Mt. Ashland) have presented plants and animals with diverse aspects and microhabitats for millions of years. This link with the Coast Range to the north and the Klamath River basin to the south presents one of the more biologically diverse regions in North America. Inter-continental links occur with the migration of anadromous fish and neo-tropical birds.

Rogue River, Marial to Agness

Geologic and Geomorphic Setting

The watershed analysis area is part of the Klamath Geologic Province and includes a mixture of igneous, metamorphic, and sedimentary formations. Ground slopes are low to moderate, averaging 30 to 50 percent, with a band of steep to very steep slopes, averaging 50 to 90 percent which range in a northeast trending band through the eastern portion of the analysis area (see Slope Classes Map). Elevations range from approximately 90 feet near the confluence of the Rogue and Illinois Rivers, to over 5,300 feet at the summit of Brandy Peak on the southeast side of the Shasta Costa Creek watershed.

Rocks within the watershed are typical of those found in the northwestern portion of the Klamath Province. The Klamath geologic province, including the watershed area, was added, or accreted, to western North America through the progressive north-east movement of tectonic plates. The majority of the rocks are Jurassic-aged marine sediments and volcanics (135 to 165 million years old) or their metamorphic equivalents. Cretaceous-aged sediments (100 to 135 million years old) are found in the north and west portions of the watershed. Igneous rocks include both Jurassic volcanic rocks and Cretaceous-aged bodies that are found in the central part of the watershed. These rocks represent the product of millions of years of tectonic subduction and accretion in which pieces of ocean crust, island arc volcanos, and sedimentary basins collided with and were scraped or "underplated" onto the underside of the continental margin. Contemporaneous with this process, the rocks often underwent deep burial, folding, faulting and metamorphic processes. Overlapping the older rock types are Eocene marine sedimentary rocks (38 to 65 million years old) associated with the Coast Range geologic province. The Tyee and Lookingglass Formations have been structurally deformed but not metamorphosed. Thus the geologic setting found in the watershed area is highly diverse, with widely dissimilar rock types located adjacent to one another in complex faulted relationships (see Geology Map).

Steepness of hill slopes is directly related to the underlying rock type. Less steep slopes exist in areas underlain by formations containing marine sediments that have either not been metamorphosed, or have undergone a low-grade metamorphic process. The finer-grained components (siltstones and mudstones) of the Dothan, Flournoy and Tyee Formations are less resistant to erosion and form flatter slopes, ranging from 10 to 50 percent. These formations can temporarily maintain very steep cutslopes when protected from water and physical disturbance. This phenomenon can be noted in oversteepened inner stream gorges and along fresh road cuts. However, these are often areas of continual stream bank instability and road failures. Overall, the steepest slopes occur along a north-east trend of Jurassic age igneous rocks located in the east-central portion of the watershed. The underlying complex of metamorphosed gabbro, diorite, and volcanic rocks is relatively hard and resistant to erosion and forms rocky ridges and steep talus slopes. Where the Rogue River cuts through these underlying rocktypes, ancient trends of faults and fractures control the course of the river through tortuous loops and high, rock-walled canyons.

Lithology, Soil Development, Natural Processes

Geologic rock types were grouped for lithologic similarities and ease of mapping (Table 4). The following section outlines a brief description of these geologic rock types, the typical soil types that are derived from the geologic parent material, and a generalized slope stability description. (See Soil Depth and Parent Material Map.)

Quaternary deposits (Qal): Geologically recent alluvial, terrace and landslide deposits consist of unconsolidated sand, silt, and gravels deposited by water or erosional processes. Mineralogy is dependant on the source material of the deposits, and in the case of ancient terraces along the Rogue River, can be a complex mixture of materials transported from far upstream. Soils tend to have minimal profile development with irregular concentrations of organic materials depending on the time intervals between flood scour and deposit, or landslide events. Through the mechanics of their deposition, Qal deposits form relatively flat slopes. However, because of their position on the slope and poor consolidation, they are prone to stability problems from undercutting by streams or roads, surface erosion, and slide re-initiation from groundwater saturation or runoff.

Table 4. Geologic Rock Types

Formation or Rock Type	Map Symbol	Acres	Percent
Recent alluvium, terrace, landslide deposits	Qal	1,130	1
Tyee; bedded micaceous siltstone, sandstones	Tt	2,276	3
Marine siltstone, sandstone, conglomerate	Tmsc	22,516	28
Tertiary marine sandstone, siltstone	Tmss	7,402	9
Dothan; sandstone, conglomerate, siltstone	KJds	29,026	36
Myrtle; conglomerate, sandstone, siltstone	KJm	152	--
Galice; metamorphosed sedimentary rocks	Js	5,080	6
Galice; metamorphosed volcanic rocks	Jv	6,119	8
Peridotite, serpentine, ultramafics	Ju	5,243	6
Metagabbro, diorite and metavolcanics	JTrgd	2,485	3

Tyee Formation (Tt): The Tyee Formation forms high, exposed bluffs of greenish-gray, clay-rich sandstones with interbeds of mudstone and siltstone. Bluffs formed by Tyee sandstone are prone to rock topple; boulders and cobbles can be found immediately downslope, but weather rapidly to sandsize constituents. Periodic slope failures are common where headwall areas are underlain by steep slopes of poorly cohesive sandstones and siltstones, and can initiate debris torrents in stream channels. Root strength and cohesion from forest vegetation helps to maintain the marginal stability of these headwalls. Tyee Formation is exposed in a small area of the watershed, notably in the headwaters of Billings Creek.

Tertiary marine sandstones and conglomerates (Tmsc): This unit includes the Roseburg, Umpqua, and Lookingglass Formations. The Roseburg Formation represents the oldest unit in this group. It is located along the Rogue River above Agness and can be identified in exposures of steeply dipping beds of sandstone and conglomerate. Slopes underlain by the Roseburg Formation are steep and sparsely vegetated, reflecting shallow, coarse-textured soils. Although relatively stable in the limited area in which the formation is exposed, steep slopes where soil is disturbed by road construction experience chronic, small, shallow debris slides and surface ravel.

The Lookingglass Formation also has limited exposure in the study area, mostly in the Billings Creek area. However, slopes underlain by Lookingglass rhythmically-bedded siltstones and mudstones are notable for several large landslides that have contributed large quantities of fine-grained sediment to Billings Creek and the Rogue River. On upper slopes, Lookingglass mudstones commonly form steep slopes protected by more resistant Tyee sandstone. On mid and lower slopes, the combination of less permeable mudstone layers and deep colluvial soils has produced large slump-earthflows that have constricted or deflected Billings Creek and the lower portion of Foster Creek numerous times in the past. Several of these large, old failures remain intermittently active, contributing sediment to the creek usually as debris slides off the toe of the moving slide mass. There are also areas in Billings Creek of older catastrophic debris flows which have formed relatively stable, lobate deposits above the creek. Several large block glides, another form of slope failure sometimes found in bedded rocks of differing permeability, were noted in the lower part of the watershed. These blocks probably failed in ancient times under a combination of more severe climatic conditions and seismic activity, and now appear to have reached a stable configuration. Earthflow and slump blocks in the lower portion of Foster Creek have their own inherent instability compounded by the very extensive earthflow that encompasses the almost entire upper and middle Foster Creek watershed area.

Tertiary marine sandstone and siltstone (Tmss): In the analysis area, the Flournoy Formation consists of large expanses of siltstones with minor sandstone and conglomerate beds. It is exposed in the lower part of the Shasta Costa watershed, and is described in the Shasta Costa Creek Watershed Analysis, 1996. Massive conglomerate beds are well exposed along the Rogue River canyon above Flora Dell Creek through Foster Bar. The basal conglomerate beds of the Flournoy closely resemble conglomerate beds found within the Lookingglass Formation. Geologic maps and formation descriptions are not in agreement through this section of the river. Soil types reflect age of soil development. Young soils, which form on steep slopes, are shallow, silty, and poorly cohesive; soils on flatter and/or lower slopes are deeper and more clay-rich. Slope failure types correspond to this soil development. Shallow debris slides, debris torrents, and ravel predominate along areas of shallow contacts between bedrock and soil, and deep-seated rotational slides occur in older, thicker soils. Streambank instability is common in the inner gorge of Shasta Costa Creek, where stream action undercuts older, landslide deposits or erodes exposed bedrock of Flournoy siltstones.

Dothan sandstone and conglomerate (KJds): The Jurassic-Cretaceous aged Dothan Formation underlies the eastern portion of the analysis area, primarily in the Shasta Costa Creek watershed. Descriptions of geology, soils and erosional processes are included in the Shasta Costa Creek Watershed Analysis, 1996. In this area, the formation consists of well-consolidated sandstones, with less extensive, poorly sorted siltstones and rare volcanic flow units, all of which have undergone low-grade metamorphism. The predominant north-east structural trend is reflected in the trends of major drainages, ridges, and rock units. Geomorphology is consistent with underlying rock type; sandstones form steep, rocky ridgetops, and siltstones and mudstones develop rolling, hummocky slopes and prairies. Soils are generally moderately deep to deep, and landforms are stable in configuration. Exceptions occur along streambanks of the inner gorge of Shasta Costa Creek and tributary stream channels where undercutting has oversteepened deep soils on the lower slopes. Also notable are extensive slump-earthflows that have developed in deep, clay-rich and poorly drained soils in areas where Dothan mudstones are more common. Three large, chronically active slump-earthflows on the north side of Shasta Costa Creek have deflected the stream and also periodically offset Forest Service Road 23. A large slump or rotational slide was noted in the headwaters of Waters Creek within the Dothan Formation, and contiguous to faulted contacts between Dothan, Galice and serpentine rocks.

Galice medium- to fine-grained sedimentary rocks (Js): Rocks in the Galice formation are exposed in the far, western portion of the analysis area, from Foster Creek watershed and south. These sedimentary rocks have undergone some low-grade metamorphism, and are also more fractured and faulted than in other areas outside the analysis area underlain by this laterally extensive formation. Soils formed on Galice formation rocks are shallow to moderate in depth, or rocky, skeletal soils where slopes are steep. Steep slopes will form areas of ravel when disturbed, although deeper slump earthflows can also be seen within the Galice rocks. Frequently, those slump earthflows are found along faults and their associated shear zones, such as noted above in Waters Creek.

Galice metavolcanics (Jv) and metagabbro and diorite (JTrgd): This formation consists of primarily volcanic flow rocks (basalt to rhyolite) with some interlayered tuffs. The unit has undergone low-grade metamorphism, which has increased the hardness and resistance to erosion of these already resistent rock types. Areas underlain by Galice volcanics form the steepest slopes in the analysis area, and stand out as a broad, north-east trending band in the top center of the Slope Classes map. These resistent rocks underlie the sharp peaks at Inspiration Point and Pinnacle Peak, and the spectacular, steep walls of Mule Creek Canyon. This hard rock unit retains many of the topographic breaks from ancient faulting and fractures, and forms many of the most challenging falls and rapids on the Rogue River. The zone is also highly mineralized, and was a concentration for gold mining activities in the late 1800s.

Soils derived from these metamorphosed volcanic and intrusive rocks are typically shallow, usually forming from talus deposits off steep cliff faces, and have poor to moderate cohesion. The most common form of instability noted from a survey of aerial photos was shallow ravel. Debris torrents and stream scour can occur where soils are disturbed and fail from steep headwalls. Revegetation on these skeletal soils happens very slowly.

Peridotite, serpentine, ultramafics (Ju): Limited bodies of serpentine and serpentinized peridotite occur in the area; they are grouped on the geologic map as ultramafic rocks. The peridotite probably originated as lower ocean crust which was subsequently metamorphosed to serpentine minerals during faulting and accretion onto the continent. In the analysis area, the ultramafics occur concomitantly with fault and fracture zones, exposed along the Rogue River in the Pinnacle Peak area faulted against Galice metavolcanics. The ultramafic bands follow the general north-east structural trend.

Soils derived from peridotite and serpentine are commonly shallow in depth, reddish, and nutrient-poor, and characterized by a high clay content and plasticity. Where shallow soils are physically disturbed, surface ravel, the slow process of revegetation in serpentine soils can perpetuate compaction, rilling and gullying. Deeper soils are often formed in faulted areas that are zones of sheared rock and conduits for ground water. These conditions can develop into failure planes for earthflows, or localized pockets of slope instability.

Metagabbro, diorite and metavolcanics (JTrgd): The oldest rocks in the analysis area are the ultramafic rocks and the metamorphosed igneous rocks, which represent middle and upper ocean crust material, metamorphosed during accretion. The rock is relatively hard and resistant to erosion where protected, often forming small vertical exposures. When exposed to weathering, however, it decomposes readily, although appearing fresh in appearance at exposed rock faces. Soils derived from these rocks are typically shallow, coarse-grained, porous and non-cohesive. Shallow soils are prone to ravel. When saturated, deep soils or deposits can produce an abrasive fluid mixture. Therefore, debris torrents, initiated from bluffs or cliffs, disturbed steep slopes, or along road cuts and fills, can travel long distances scouring hillsides and stream channels.

Structure and Geomorphology

Numerous high-angle faults cut through the analysis area in both a north-south and north-northeast direction, including the large Coquille fault in the Big Bend area. This underlying structure, along with bands of differing rock types associated with the faults, define a preferred orientation of ridges and valleys. Diversity between resistance to erosion of the rock units has created a varied landscape and a steep, highly dissected topography. The Rogue River is defined as an antecedent stream; it possessed enough downcutting power to establish and maintain its course during uplift of the Klamath Mountains. Although the river generally maintains its western course, areas of steep, straight canyons and sharp twists and bends reflect the underlying geologic structure and differing lithologies.

Faults separate most of the rock formations with few if any conformable contacts between formations. Faults and fractures often create zones of sheared rock. There is a higher probability of slope instability within the zones because of differences in erosion rate between rock units, concentrations of sheared or less resistent rock such as serpentine, deeper soil development, and concentrations of ground or surface water following topographic lows. The large earthflow in the Foster Creek watershed is an excellent example of how a combination of the above factors can produce an unstable landform.

What are the dominant erosion processes in the watershed?

The dominant erosion processes in the watershed are landslides. Most landslides in the watershed analysis area, both in number, extent, and amount of sediment generated, are produced by natural causes. Surface erosion occurs on exposed surfaces such as roads, and from ravel off steep, unvegetated rock slopes and disturbed soil (typically in ultramafics), but the volume of material generated is minor compared to the material contributed from landslides. The largest slope failures in the analysis area are naturally occurring slump-earthflows, which often occur on slopes underlain by the Flournoy and Lookingglass Formations, or by ultramafic rocks. These include large features in Shasta Costa, Billings, Twomile, Waters, Slide and Foster Creek watersheds. The Foster Creek slide alone has been estimated to deliver 10,000 to 15,000 cubic yards of sediment per decade. A typical topographic feature of these failures can be seen in the hummocky terrain above Big Bend in the Watson and Scott Creek drainages. Rates and persistence of movement can be tracked by the offset and repair histories on Forest Service Roads 23 (Bear Camp) and 33 (Agness). Because of their mass, many large failures move downslope at a relatively constant rate, although the rate of movement can be accelerated by prolonged periods of heavy rainfall or concentration of ground or surface water. One massive, 16-acre failure in the Shasta Costa watershed (Section 33, Township 34 South) was reactivated after a period of intense rainfall in 1987. It is estimated that 70,000 cubic yards of material moved during the event, and caused a plume of sediment obvious in the Rogue River despite high background turbidity from the storm event itself.

The majority of sediment delivered to stream systems from these slump-earthflows comes from debris slides that typically occur in lateral margins (usually drainages) of the slides, and off the toe of the deposits. These fail by being oversteepened and undercut by high water, or from saturation by storm events or hydrologic changes caused by man. Because of their location and mode of failure, debris slides respond rapidly to heavy or prolonged rainfall and to rises in streamflow, where the earthflow itself may store moisture for long periods of time, moving when surface conditions may seem too dry. Earthflows typically develop in fine-grained, clay-rich soils. Therefore, much of the sediment they deliver is silt to clay size. Much of the sediment is transported rather than deposited during high flows, creating pulses of turbid streamflow. Because of their tendency to store moisture and fail long after a storm event, earthflows can also contribute fine sediments during the dry season, as has been noted during summer flows from Foster and Waters Creeks.

However, earthflows also play an important beneficial role in the health of stream systems. Because of their mass, over time they can transport large boulders or "knockers" of rock from upper slopes, cliffs and ridges which can create diversity in a stream channel. Large earthflows often have highly productive, deep soils that store and supply moisture and nutrients to vegetation and ultimately to stream systems. Many slump-earthflow features develop into optimal site conditions for growing large trees, which in time can also be delivered as large woody debris to the stream system.

Human activities affecting erosion processes

Erosion processes affected by human activities were surveyed using an aerial photo review. Photographs from 1939, 1940, 1969, 1986 and 1997 were reviewed to note presence of and changes in landslides and sediment delivery from debris slides, debris torrents and surface ravel.

Human activity in the 1939 and 1940 photos was limited to a few roads and scattered settlements in the Agness, Illahe and Marial areas, and livestock grazing in the upper reaches of Shasta Costa Creek. Much of the gold mining on the Rogue River occurred between the late 1800s and early 1900s. In the watershed area, it was concentrated around the settlement of Marial, with placer, lode and hydraulic mining of many of the tributaries to the Rogue River, including Solitude and Blossom Bars. Evidence of mining can still be seen as aggraded areas in streams, or in unstable and oversteepened streambanks, such as in Paradise Creek. Most logging was done to clear areas for grazing and pasture land, or to support mining operations. Many of the lower benches and deposits of large earthflows were cleared for orchards. Small-scale debris slides (cut slope and fill failures) were noted off the road accessing Agness and Illahe, especially where the road crosses or follows faults between rock formations. Many of these areas continue to be road maintenance problems.

(*Left: Along the Illahe road, near Twomile Creek, near-vertical dipping interbeds of mudstone and siltstone of the Lookingglass Formation continue to peel off and damage road and drainage structures.*)

Extensive areas of surface ravel were noted below Bob's Garden and Squirrel Camp area in the Shasta Costa drainage, probably as a result of large wildfires followed by intensive livestock grazing. Numerous stock trails can be seen criss-crossing the upper slopes. The evidence of large fires in these areas, and the practice of setting fire to increase forage for cattle are discussed under fire history in the Terrestrial section of the Shasta Costa Watershed Analysis of 1996. These wildfires may have increased groundwater and streamflows in the upper Shasta Costa Creek watershed, increasing streambank failures. There were also many fresh-appearing streambank failures in Squirrel Camp Creek associated with slump-earthflow deposits.

Review of photos from 1969 revealed greater amounts of sediment in the sandbars along the Rogue River, and large alluvial fans present at the mouths of Billings, Foster, and Shasta Costa Creeks. Road construction and commercial logging was heavily concentrated on the lower slopes above the Rogue River and its tributary streams, including logging on the benches and deposits of large earthflows and high stream terraces such as at Big Bend. Tractor logging was common, skid roads were closely spaced, all vegetation was removed, and steams and riparian areas were not buffered. Many channels were used as skid roads. Numerous debris torrents, streamside failures, and debris slides associated with both road and logging activities were noted. An increase in failures on unmanaged slopes was also seen, probably in response to the storm event in 1964 which contributed as well to the increase in sediment seen in the mainstem of the Rogue River. Large failures were noted in unmanaged areas of Shasta Costa, East, Fall, Slide, upper reaches of Billings, west fork Stair, and Blossom Bar Creeks. Paradise Creek had failures in the headwaters, and the lower quarter of the stream showed evidence of streamside failures, scour and aggradation. A similar response was noted in Paradise Creek on the 1997 photos. There is history of gold mining in Paradise Creek, which may have created undercut streambanks and stream channel deposits that are less stable under flood conditions.

By 1986, road and logging activities had moved upslope, especially into the steep upper reaches of Shasta Costa and Billings Creeks. A description of management practices and slope stability response in the Shasta Costa Watershed is covered in its Watershed Analysis. Streamside failures and debris torrents were associated with harvest within and along steep inner channels of streams. Some new failures were also noted off benches and toes of slump-earthflows that had been logged previously, and may reflect loss of root strength over time. Most new failures, however, were related to roads, including failures in road fills, along cut slopes, and at stream crossings. Often, failures initiated at a road will scour stream drainage; undercut and initiate lateral streambank failures, and aggrade lower stream reaches. Debris torrents and slides, especially those involving large road fills, deliver sediment that is of similar size, e.g. poorly graded. Unlike the diverse mix of organic and inorganic material that can be delivered by large slump-earthflows, a large pulse of coarse, poorly graded sediment can overwhelm a stream system and contribute to channel aggradation.

Aerial photos from 1997 were reviewed to assess stream changes and landslide response to the 1996 floods. In general, the watershed area appears not to have been severely affected by the storm event. Several large, older failures were reactivated, including debris slides in Billings, Watson, Waters, Tate, Slide, and Flora Dell Creeks, and a large failure above Big Bend. New failures were noted off Forest Service Roads 23 (Bear Camp), 33 (Agness), and 3730 (Illahe). Stream scour appears to be rare compared to scour evident in 1969 and 1986 photos, perhaps reflecting less material available in stream channels to act as scouring agents. Riparian vegetation, including areas recovered from failures associated with harvest and road activities, appeared intact. An exception was the mainstem Rogue River. Although most large conifers and hardwoods remained on floodplains, low terraces and sandbars, flood waters swept off much of the smaller brush and shrubs.

Based on the aerial photo review, the rate of management-related failures between 1969 and 1986 increased in direct proportion to the amount of road building, tractor-yarded clear-cut timber harvest, and logging in and through stream channels and swales. Much of the area has stabilized as slopes have revegetated. Landslides associated with the current road system, whether caused by inadequate drainage structures or improper placement, oversteepened fills or cutslopes, or location on inherently unstable areas, will continue to be a source of sediment to streams.

Erosion Process Summary: The dominant erosional processes in the watershed, in number, extent, and amount of sediment generated, are naturally occurring landslides. The largest features are slump-earthflows of finer-grained, cohesive soils underlain by Flournoy and Lookingglass Formations and ultramafic (serpentine) rocks. These landslides typically deliver sediments to the stream system through shallow debris slides which fail off the toe of the slide deposit, within lateral margins (often tributary stream channels), or where the slowly moving mass diverts streams against an opposite bank. Landslides related to road construction, timber harvest and mining peaked in number between the 1960s and 1980s. During this time, the number of management related failures was greater than the number of natural failures, however their average size and the amount of sediment generated was less. Based on interpretation of 1997 aerial photos and some field review, most managed areas have revegetated and stabilized. Failures related to the existing road system will continue adding sediment to streams, although at a decreasing rate as stability problems are identified and either reconstructed, stormproofed, or decommissioned. Naturally occurring slope failures and the sediment they produce will continue to affect the morphology of slope and channel, at approximately the same rate in the future as in the past.

A more detailed analysis of the Billings Creek, Foster Creek, and Twomile Creek Subwatersheds is located in Appendix A.

Information Needs: The geology mapping in the Forest Geographic Information System (GIS) needs to be updated. Geologic mapping in the watershed area is not consistent. The Geology map is a compilation of mapping from the State of Oregon, Curry County, and contract mapping projects. Although the mapping at the county and project level is adequately accurate and detailed, distortion in the state map has offset the location of rock formations by several miles, for example showing sandstones near Marial instead of greenstone. Maps generated for soil information based on parent material will reflect this offset. Soils and geology information is used by numerous resource specialists. The information stored in GIS files should be the most accurate possible.

Many of the landslides surveyed were related to roads, and are sites of chronic failure and sediment input to stream systems. Much data has been collected and mapped, both by contract and in-house, for landslides and wet areas, road failure sites, quarries and subsurface investigation with a goal of entering this information in GIS. A Geopoint/Watersite layer for GIS would be very helpful in planning access, reconstruction, and restoration opportunities, and should be incorporated into the national information database (NRIS) in the Terrestrial Module.

Comprehensive road condition surveys would help target failures and potential failures on the road system. These could be added to the geopoint GIS layer and NRIS database, and used to help prioritize use of reconstruction, restoration, and maintenance efforts.

Slope stability mapping of large, ancient and stabilized landforms should be completed in terrain underlain by the Lookingglass Formation. Failure forms within this rock type are typically extensive, deep-seated, slump-earthflows which represent earlier climatic and tectonic conditions not currently present. A stable drainage development and straight tree growth on the landforms indicate they are stable over hundreds of years. Based on depth of the failure plane, it has been assumed that timber removal and road construction will not substantially change groundwater influence on the stability of the slide mass. However, aerial photo review of failures in Snout, Billings and Shasta Costa Creek - all within areas underlain by Lookingglass mudstone, siltstone and fine-grained sandstone - indicates that intensive timber removal from the old failure forms reactivates movement in the failure deposit, downslope and into stream channels. This in turn has accelerated failures from the toe of the deposit, and created associated stream bank failures from areas onto which the stream has been diverted by the slide mass. Being aware of the presence of these older failure forms in terrain underlain by Lookingglass Formation will allow better resource and management decisions during future project planning.

Management Opportunities: Comprehensive road condition surveys need to be conducted in the roaded portions of the watershed analysis area. Reconstructing inadequate road drainage systems, stormproofing or decommissioning roads can reduce potential sediment delivery from the existing road system.

Rogue Basin Hydrology

Climate

The climate of the Rogue River basin varies because of its steep topography and interception of moisture from the Pacific Ocean. Lower temperatures and more precipitation occur on the west slope of the Cascades and in the Siskiyou Mountains. The valleys between these slopes are generally drier with high summer temperatures. Annual precipitation is high on the coast (over 100 inches near Gold Beach) and low in interior valleys (19 inches at Medford). About 80 percent of this precipitation occurs between October 15 and May 15. Snowfall is prevalent at Crater Lake with an average of more than 500 inches per year. Near the coast, cool and humid weather prevails throughout the year. Farther upstream, the effects of the marine climate are less pronounced and the weather is often hot and dry during the summer.

George Taylor, the State of Oregon Climatologist, has compiled annual rainfall data for Oregon that has been collected since 1850. By comparing each year's annual precipitation to the average for the period of record, he has found a precipitation cycle of 20 to 30 years. These precipitation cycles are reflected in streamflow records and fish population records (Taylor, 1999).

1896-1916	wet
1916-1946	dry
1946-1976	wet
1976-1996	dry

Channel Morphology

The river has three general morphology types. From its headwaters in the Cascades it flows through steep bedrock gorge terrain. As it crosses the central portion of the basin, the Rogue River meanders through a flat valley, known as the Rogue Valley, with agricultural, rural residential, and urban developments including Medford and Grants Pass. Approximately 15 miles downstream from Grants Pass, the river once more enters a bedrock gorge, with sharp ridges and steep tributary canyons. This river segment has a steeper gradient than the central valley segment of the river system and transports sediment and large wood to the estuary and ocean.

River Flow

The Rogue River had an average annual discharge into the Pacific Ocean of 5,661,000 acre feet prior to the construction of the Applegate and Lost Creek dams; and 3,974,000 acre feet per year since 1978.

Moderate to heavy runoff throughout the winter and early spring typifies stream flow patterns with low flows during the summer and fall. Many of the small tributary streams become completely dry during the fall.

Stream flow at the mouth of the Rogue River has varied from under 1,000 cubic feet per second (cfs) in the record drought years of 1931-1940 (before Lost Creek and Applegate Lake flood control projects) to over 500,000 cfs in the December, 1964 flood event. During the dry summer most of the stream flow is attributable to the high mountain snowpack areas in the Cascade and Siskiyou Mountains.

The largest flood of historical record occurred in 1861 and the second largest in 1890. More recent flood events were in 1955 and 1964. (See also discussion under Rogue River, Marial to Agness, Hydrology.) Gaging station number 14361500 at Grants Pass began collecting stage and flow data in 1938. Extreme peak flow stages from before 1938 have also been recorded, based on information from local residents.

Year	Month	Grants Pass Stage height (feet)
1861	December	43
1890	February	36
1927	February	32
1955	December	30

1964	December	35

From the 1920s through the 1950s storage reservoirs were constructed to supplement irrigation withdrawals (Fish Lake, Emigrant Lake, Agate Lake, Howard Prairie, Hyatt Lake). Timber harvest and road building were increased in the upslope, steep headwater areas of the Cascade and Siskiyou mountains after World War II. By 1955 there was considerable settlement in the interior and coastal valleys of western Oregon. Agriculture development had channelized many streams and removed instream scour elements like large wood and boulders. Much of the meandering and side channel habitat historically present had been eliminated.

Road development in association with timber harvest was occurring in the lower elevations by 1955; many roads were located in the lower stream valleys. Logging practices included placing and leaving log stream crossings, ground-skidding over compactable soils and low standard roads. Anecdotal accounts speak of debris removal and machine work in stream channels after the floods. Long sections of streamside roads were lost and replaced with riprap fortification. The reaction measures to these flood events were perhaps as catastrophic to fish habitat as the floods themselves. A strong bias against large wood in streams and stream meandering persisted from this period to today. In the 1970s and 1980s, the Lost Creek Dam and Applegate Dam were constructed with the objectives of flood control, recreation, and increasing summer streams flows for fish and irrigation. All of these activities had cumulative effects on sediment delivery to streams, summer and winter flows, stream temperatures, range of anadromous salmonids in the basin and other freshwater fish habitat components.

The Rogue River Basin has 24 gaging stations currently measuring stream flow. Fifteen of these also record water temperature.

Water Quality

Bacteria counts in the Rogue River have exceeded State standards for many years. The Oregon Department of Environmental Quality listed the Rogue River as water quality limited under 303(d) in 1996 and 1998. Segments that do not meet the standards are:

Table 5. Rogue River Water Quality Limited Segments

Rogue River Segment	**Parameter**
Little Butte Creek to Grave Creek	fecal coliform
Evans Creek to Mouth	temperature
Applegate River to Mouth	pH

<u>Rogue River, Marial to Agness</u>

What are the dominant hydrologic characteristics and processes in the watershed?

Natural Processes

From the State Precipitation Isohyetal map, average annual precipitation varies from 72 inches near the Rogue River to nearly 190 inches near Bear Camp in the southeast corner of subwatershed 22. This falls primarily during the winter months, and primarily as rain, with 65 percent of the watershed in the rain-dominated zone, 30 percent in the transient snow zone, and 5 percent in the snowpack zone. Winter storm intensities can range from 8 to 19 inches in 24 hours during a 25-year event to 9 to 23 inches in 24 hours during a 100-year event. Lower storm intensities lie along the Rogue River, with higher intensities along the ridge bordering the southeast edge of the Shasta Costa Creek drainage.

The only gaging station within the Marial to Agness subwatershed is Gage No. 14372300, Rogue River near Agness, 0.8 miles upstream of Shasta Costa Creek (approximate River Mile 29.6) See Temperature Monitoring Sites Map. This site records streamflow and temperature, which are transmitted to the USGS office in Portland, and available over the Internet. The period of record began in October 1960. The maximum flow recorded by the gage was an estimated 290,000 cfs on December 23, 1964. The minimum recorded flow was 608 cfs July 9 and 10, 1968. The flood event of January 2, 1997 was 250,000 cfs.

The 1964 calculated flow of 290,000 cfs would be slightly less flow than a 25-year event, according to the USGS Statistical Summaries of Streamflow Data in Oregon. The calculations used to estimate this flow may have overestimated the effects of ponding on the river stage, and the actual Rogue River flow may have been much larger.

Long-time residents of the Agness area have observed and recorded flood stages. One resident reported that 1927 was the highest flood his parents talked about. It came up to the porch on the old hotel at a site that is now the Rogue River trailhead, just upstream of Foster Bar. This would have put almost all of the Big Bend meadow under water. He said that 1955 was not a particularly big flood on the Rogue, maybe the size of the January 1997 flood. It moved a lot of debris and changed a lot of landmarks because there hadn't been a flood in a long time. In December 1964, water was up to within 4 inches of the top of the concrete side curbs on the Foster Creek bridge. He said that usually the Illinois River crests before the Rogue and has dropped by the time the Rogue high water reaches the confluence. But in 1964 both rivers crested simultaneously at the confluence. Copper Canyon couldn't handle the flow. Water backed up, forming a reservoir that extended upriver many miles. The 1973 flood was similar to the 1955 and 1997 floods. (Rutledge, Ernie, personal communication, May 5, 1997.)

Mr. H.C. Obye, Forest Supervisor of the Siskiyou National Forest, wrote in a January 4, 1957 letter, "I have made inquiries of some of the old-time residents in the Agness area as to the comparative crests of the Rogue River flood periods. They state that the 1955 and the 1927 floods crested at about the same height, but that the flood of 1890 was about 12 feet higher than either of these. They had no data on the 1861 flood but it was their opinion that the 1890 flood was the highest of all."

Since the gage was installed in 1960, five peak flows have exceeded the 181,700 cfs calculated by USGS to approximate a recurrence interval of five years. The first four of these, 1964, 1966, 1971, and 1974, were during a decade corresponding to the end of a wet cycle (see Climate under Basin Characterization, above). The fifth, 1997, was near the beginning of the following wet cycle. No flows exceeding the five-year recurrence were recorded during the intervening dry cycle. These data indicate that peak flows, as well as annual water yield, may reflect the cyclical weather patterns.

Human Influences

Flow upstream of the gaging station near Agness has been regulated since February 1977 by Lost Creek Lake and since December 1980 by Applegate Lake, with numerous diversions for irrigation and urban and domestic use.

Within this analysis area there are 70 water withdrawal permits, a total of 5.7 cubic feet per second, for domestic, irrigation, and livestock use. Five of these permits are for the Rogue River, a total of 1.0 cfs. There is also a permit for 5.5 acre-feet of water stored in Lost Creek Reservoir, for irrigation. The remaining permitted withdrawals are from tributaries and springs. (See Table 6, Water Withdrawal Permits.) The Oregon Department of Fish and Wildlife has an instream water right for 2,000 cfs for fish, dating from May 7, 1962.

Land use and developments also have the potential to affect the timing and magnitude of flows. Land clearing for agricultural and residential use, timber harvest, road construction, and urban pavement may concentrate flows. In a river system as large and complex as the Rogue, it is difficult to determine how much effect these activities may have had.

What are the basic morphological characteristics of stream valleys and channels and the sediment transport and deposition processes in the watershed?

The Rogue River flows through a bedrock canyon in this section. Long confined reaches transport all material through during high flows. In Mule Creek Canyon, the river winds its way through a narrow channel bounded on both sides by vertical rock faces rising as much as 2,000 feet above the water. The canyon is less than 20 feet wide in places. Canyon walls are also steep and narrow in Huggins Canyon, and according to river guides the water is 100 feet deep at Sturgeon Hole. Depositional bars have formed in short reaches where resistant bedrock has created a bend in the river. There are large alluvial terraces on both sides of the river near two major bends, Half Moon and Big Bend.

The lower extent of vegetation in the canyon is well defined on aerial photos, as extreme flow events have removed the soil that recolonizing plants would need. This line appears somewhat blurred with vegetation creeping downslope on the 1940 photos, but is sharply defined on the 1957, 1964, and 1969 photos, following the 1995 and 1964 flood events. On the 1986 photos, shrubs are again beginning to blur the high water line; in 1997 these have again been removed.

From the mouth of Watson Creek downstream to the mouth of the Illinois River, the general character of the landscape is open canyon with sides neither very steep nor high. There are several places where the banks rise sharply and then level off to create a large flat bench. Most of these locations have been converted to pasture or other agricultural and residential use. Although there are still some places where the old growth timber has not been harvested, most of it has been removed. The existing vegetation pattern is a combination of old growth Douglas-fir, young second growth Douglas-fir, hardwoods and grassy fields.

The river descends in a series of steps, with an average gradient of 0.2 percent through this section. The steepest extended portion is in Mule Creek Canyon, with an average gradient of about 25 feet per mile, or 0.5 percent.

Although these gradients are relatively low, large flows give the river the stream power to transport boulder-sized sediment and regularly rearrange depositional bars of cobble-sized material. The interaction between the river and its tributaries can be illustrated by the flow events of water year 1997. Following the November 1996 tributary flood event, large alluvial fans were observed at the mouths of tributaries. December 8, 1996 there was a storm that produced bankfull flows on both the Rogue and its tributaries. Following this event, the alluvial fans were either gone or greatly diminished, as the Rogue transported the material downstream. Following the January 1 and 2, 1997 Rogue River event, midstream and lateral gravel bars in the river had increased in depth an estimated 6 feet.

The backwater often created as high flows from the river extend upstream in the tributaries complicates these interactions. The sediment deposited in these quieter waters during floods may be predominantly from tributaries or material carried by the river from far upstream, depending on the relative flows and sediment delivering events.

Tributaries To The Rogue River, Marial To Agness

What are the dominant hydrologic characteristics and processes in the watershed?

Natural Processes

Tributaries of the Rogue River experience more frequent flood flows than the Rogue River, as they respond to smaller scale, local winter rainfall and rain-on-snow events. An example of the interactions at the mouths of these streams was during the flood events of water year 1997. The November 1996 storm was a coastal rainfall event that caused streams with headwaters near the first orographic divide east of the ocean to rise rapidly from their characteristic low autumn flows to overflowing their banks within 24 hours. The South Fork Coquille River, with headwaters adjacent to the northern boundary of this watershed, recorded a 75-year flood at the gaging station near Powers. The Rogue River at Agness did not exceed its banks during this event. Tributaries were observed shooting flow out into the river as if from a high-pressure hose.

The "New Year's flood" January 1 and 2, 1997 was a rain-on-snow event in the Cascades and higher elevations east of the Rogue Valley. The gaging station on the Rogue River near Agness recorded approximately a 12-year flood event. Tributaries to the Rogue in this section did not exceed their banks, and backwater from the Rogue River extended upstream in tributary channels.

Human Influences

Water withdrawal permits totaling 4.7 cfs have been issued for streams and springs tributary to the Rogue River within this analysis area. The extent to which these permitted withdrawals are utilized is unknown.

Table 6. Water Withdrawal Permits for Rogue River Tributaries, Streams and Springs.

Stream	Site	CFS
Billings Creek	springs	0.02
Billys Creek	stream	0.02
Billys Creek	springs	0.12
Brushy Bar Creek	stream	0.01
Brushy Bar Creek	spring	0.01
Clay Hill Creek	stream	0.07
Foster Creek	stream	0.52
Hog Eddy Creek	stream	0.04
Hog Eddy Creek	spring	0.01
Jackson Creek	stream	0.016
Johnson Creek	stream	0.525
Lone Tree Creek	spring	0.1
Paradise Creek	stream	0.005
Scott Creek	spring	0.1
Slide Creek	stream	0.02
Slide Creek	springs	0.02
Slide Creek (near Marial)	stream	0.02
Slide Creek	unnamed tributary	0.035
Smith Creek	stream	1.46
Snout Creek	stream	0.26
Tate Creek	spring	0.01
Taylor Creek	stream	0.29
Waters Creek	stream	0.01
Watson Creek	spring	0.01
unnamed tribs to Rogue	streams	0.2
unnamed tribs to Rogue	springs	0.775
Total		**4.7 cfs**

The other primary human influences on hydrologic processes are effects of roads and vegetation removal on peak flows. The following factors are indicators of areas where effects may have occurred (USFS, 1993). (See Watershed Analysis Areas Map, and Regeneration Harvest and Roads Map).

- More than 15 percent of a watershed analysis area (WAA) harvested in a 30 year period may have increased water yield and minor peak flows; more than 30 percent harvested is likely to have increased flow. Predominant hydrologic recovery is probable after 30 years.
- More than 20 percent of the transient snow zone harvested is likely to increase peak flows during rain on snow events. Hydrologic recovery is dependent on tree height in relation to surrounding forest, and is probable after 50 years.
- Road density less than 3.0 miles per square mile is considered low risk for channel network expansion sufficient to increase peak flows; 3.0 to 5.0 miles per square mile is considered moderate risk; over 5.0 miles per square mile is considered high risk for contribution to increased peak flows.

The watershed analysis area (WAA) that is most likely to have experienced flow alterations as a result of management activities within the past 30 years is 22M06W, the south side of upper Twomile Creek. In addition to the 36 percent overall harvest, 58 percent of the transient snow zone was harvested in the WAA, and it has a road density of 3.8 miles per square mile. Four road systems cross the drainage, three at upper and one at middle slopes, potentially compounding water concentration and increasing the potential for cascading road failures. Together with WAA 22M07W, 36 percent of the transient snow zone in the headwaters of Twomile Creek was harvested. The combination of these activities may have increased peak flows in Twomile Creek or its tributaries. The incised headwaters channels referred to under channel conditions below would be consistent with increased peak flows. Increased peak flows could also trigger landslide activity by cutting the toe of slides such as the one just upstream of Agness Road, Forest Service Road 33, at the Twomile Creek culvert. It is unknown whether harvest and roads have actually affected the erosional rate of this slide.

In the Foster Creek watershed 11 percent has been harvested, including 19 percent of the transient snow zone; and the road density is 3.3 miles per square mile. These amounts are not large. However, WAA 22F02W has a road density of 4.2 miles per square mile (though little harvest); WAA 22F05W has a road density of 3.2 miles per square mile and 20 percent of its transient snow zone harvested; and WAA 22F06W has a road density of 3.3 miles per square mile, total harvest of 25 percent in partial hydrologic recovery, and 41 percent of its transient snow zone harvested. These data indicate that streams in the Foster Creek drainage may have experienced increased peak flows. However, the high rate of natural landslide activity in this drainage could obscure evidence of effects of human activities.

Waters Creek, Lone Tree Creek, and portions of East Creek had over 20 percent of their transient snow zones harvested, but low overall harvest and low road densities. See Table 7, Timber Harvest and Roads by Watershed Analysis Areas.

I***nformation Needs:*** Stream channels need to be evaluated in the field to determine whether they have been affected by timber harvest and road construction. Priority watersheds are Twomile and Foster Creek.

Management Opportunities: Improve the road drainage on roads that are necessary for present and future access. Decommission roads that present a risk of resource damage and are no longer needed.

Table 7. Timber Harvest and Roads by Watershed Analysis Area.

Watershed	Name	Acres	Percent National Forest Ownership	Road Density Miles/SquareMile	Percent Harvested before 1970	Percent Harvested after 1970	Percent of Transient Snow Zone Harvested
22F01F	Foster Creek	1905	82	**3.33**	0	4	0
22F02W	Foster Creek	1284	98	**4.21**	0	7	0
22F03W	Foster Creek	860	100	2.91	9	4	7
22F04W	Foster Creek	1387	10	2.91	0	12	16
22F05W	Foster Creek	1699	100	**3.15**	6	8	**20**
22F06W	Foster Creek	602	100	**3.34**	10	16	**41**
TOTAL 22F	Foster Creek	7736	95	**3.31**	3	8	**19**
22M01F		3040	88	2.85	1	0	0
22M02W	Snout Creek	789	74	**3.75**	16	12	--
22M03W	Waters Creek	1000	99	0.31	0	4	**21**
22M04W	Slide Creek	358	92	0.71	0	0	--
22M05F	Twomile Creek	1201	98	2.06	1	5	--
22M06W	Twomile Creek	955	100	**3.83**	0	**36**	**58**
22M07W	Twomile Creek	1334	99	**3.32**	4	15	**24**
Total Twomile	Twomile Creek	3489	99	**3.03**	2	17	**36**
22M08F		2852	87	1.39	2	2	**26**
22M09W	Billings Creek	2235	97	1.79	0*	12	8
TOTAL 22M		13765	92	2.23	2	8	**26**
TOTAL 22S	Shasta Costa Cr	23416	100	1.53	5	5	8
TOTAL 22		44936	97	2.05	4	6	12
23L01F		3489	93	0.94	8	4	0
23L02W	Watson Creek	1912	99	1.03	26	2	15
23L03W	Flora Dell Creek	1099	94	1.34	0	11	14
23L04F		3325	99	0.20	0	0	0
23L05W	Fall Creek	1182	100	2.39	6	0	11
23L06W	Clay Hill Creek	1377	98	0	0	0	0
23L07W	Tate Creek	1369	100	0.01	0	3	11
23L08F	East Creek	2428	100	0.87	3	9	**38**
23L09W	East Creek	1547	100	0.44	1	5	13
TOTAL 23L		17728	98	0.73	5	4	14
TOTAL 23S	Stair Creek	10582	98	2.44	4	9	12
23U01F		2648	94	0	0	0	0
23U02W	Paradise Creek	1180	100	0	0	0	0
23U03W	Blossom Bar Cr	2058	93	0	0	0	0
23U04W	Burns Creek	827	79	0	0	0	0
23U05F		1465	78	0.44	0	0	0
TOTAL 23U		8177	90	0.08	0	0	0
TOTAL 23		36488	96	1.08	4	4	11

TOTAL 22+23		81424	96	1.62	4	5	12

What are the basic morphological characteristics of stream valleys and channels and the sediment transport and deposition processes in the watershed?

Sediment Transport and Deposition

Most of the tributaries to the Rogue River in this analysis area are steep, transport streams with gradients from 4 percent to over 50 percent. (See stream profiles in Appendix B.) Characteristically, the sediment delivered from the erosional processes described in the Geology section is transported through these streams to the Rogue River. Waters Creek, discussed below, is one example where sediment delivery exceeds transport capacity. The two largest streams, Shasta Costa Creek and Foster Creek, have flatter depositional reaches near their mouths. Foster Creek has a gradient of one to two percent in the first two miles upstream from its mouth; Shasta Costa Creek has a gradient of less than one percent to nearly two percent through the first six miles upstream from its mouth. However, both of these streams have sufficient flow energy to transport their sediment loads through these flatter gradient reaches. Some material is temporarily deposited, but deposits are mobile and change size and shape following high flows.

As discussed in the geology section of this document, effects to stream channels from the storm event of November 1996 were few. Although new failures were noted off Forest Roads 23 (Bear Camp), 33 (Agness Pass), and 3730 (Illahe), stream scour was rare. Riparian vegetation, including areas recovered from failures associated with harvest and road activities, appeared intact.

Channel Conditions, Wild Rogue (Below Mule Creek to above Billings Creek)

Streams between Mule Creek and Billings Creek have had little timber harvest or road construction. They were subject to mining activities primarily from 1850 to 1940. Access was by boat or pack trail. Debris chutes are visible in the steep, rocky headwaters of Blossom Bar and Paradise Creeks as early as the 1940 photos. One large debris slide in the headwaters of Blossom Bar Creek, just below Hanging Rock, appears quite fresh on these photos, which is unusual for this time. This was generally a low-activity landslide era, accompanying a drier climate cycle. It is unknown whether these debris chutes are solely the result of natural rock fall off the Tyee bluffs, or whether some mining activity took place in these steep headwaters that triggered the slides.

The river corridor terraces were settled, and natural openings and additional clearing established pastures and orchards. These homesteads are visible in the 1940 aerial photos, but there is little evidence of effects on stream channels.

As late as the 1964 aerial photos, after the 1955 storm, lower Paradise Creek had an intact riparian area, and it was difficult to find the creek in the photos, even though the channels in the upper forks of the stream were scoured by slides. In the 1969 photos, following the storms of 1964, the upper channel appears to be revegetating, with a narrower riparian opening than 1964. But the riparian canopy opened up in the lower channel, perhaps as material from the slides in 1955 was transported downstream. The lower quarter of the channel has streamside failures, scour and aggradation. Healing and rescouring can be seen comparing the 1986 and 1997 photos. In 1997 the channel is scoured from the headwaters forks to the river with no riparian cover for the upper half of the stream, and partial vegetation in the lower channel. The riparian opening appears twice as wide in the steep, over 10 percent gradient stream upper stream reaches, as it does in the 4 to 10 percent gradient lower stream reaches.

Small-unmanaged streams such as Burns Creek had slides appear on the 1969 photos, with no apparent channel disturbance. Fall Creek had some scouring.

The road to Green Knob (now 2300700) was constructed in the early 1960s, and there was subsequent timber harvest in upper Stair Creek and East Creek that may have contributed to channel scour that is visible in Stair Creek in the 1969 aerial photos. However, there is also channel scour in the west fork of Stair Creek, which did not have harvest or roads. These channels have mostly revegetated on recent photos.

Channel Conditions, Rogue Illahe (Billings Creek to above mouth of Illinois River)

(Foster Creek, Billings Creek, and Twomile Creek channel conditions are discussed in the Subwatersheds Appendix.)

The Civilian Conservation Corp (CCC) constructed the Illahe Road (now County Road 375 and Forest Service Road 3730) in the 1930s, providing overland access upstream as far as Billings Creek and Big Bend, and downstream to the Illinois River. In the 1940 photos most channels in this part of the analysis area appear stable and well vegetated. Exceptions are discussed below under specific streams.

In the 1957 photos, following the 1955-flood event, there are isolated debris chutes and occasional short reaches of exposed channel, but most riparian areas still appear well vegetated. By this time there are large clearcuts on both sides of the Rogue River near Big Bend. These were in the lower drainages of Billings Creek, Watson Creek, Dans Creek, and smaller unnamed streams. The river was crossed by a low-water bridge. Timber was harvested by tractor, and typically low-gradient stream channels were used as skid roads. Eroded channels are visible on the photos, but effects are not as great as in other watersheds on the Gold Beach District, for example North Fork Lawson Creek. On more recent photos, disturbed channels near Big Bend appear stable and revegetated.

Waters Creek is a small tributary to the Rogue River, with a drainage area of 1000 acres. The main channel of Waters Creek is in poor condition. This is the result of natural unstable areas in the drainage, which are delivering sediment in an amount that exceeds what the stream can transport. Pools are filled with fine grain sediment and the water clarity is milky or turbid at various times during the year. The milky color is visible from the Agness Road. The source of this material is a large natural slide at the headwaters, which first failed, in the early 1980s (Joe Genre, personal communication, 1990). Another large slide just down stream has not been active in recent years.

Slide Creek main channel was in good condition in a 1990 survey, with some reaches in fair condition. A lack of large woody material in the channel was noted. (S. Lightcap, personal communication, 1990). Hardwoods dominate the riparian vegetation in the lower reach. This may be the result of early logging on private ground, which has also probably contributed to the shortage of large wood.

Lone Tree Creek had a fair to excellent channel condition rating in 1990, with no observable effects of excess sediment delivery as a result of human activities. Although effects were noted in the past, some recovery has occurred since that time.

The **Snout Creek** drainage is underlain by rhythmically interbedded beds of mudstone, siltstone, and sandstone of the Lookingglass Formation. Two large, ancient landslide forms are located on the north and south banks of Snout Creek approximately one mile upstream. These slides are in alignment with the large, active slide readily visible from Bear Camp Road on the south side of Shasta Costa Creek. Thin beds of mudstone and siltstone underlie the three failures, with mudstone above the siltstone. The alignment of the failures may be correlated to bedding attitude, the proportion of mudstone to siltstone, or the influence of a possible fault through this section of the Lookingglass. Further field investigation would be necessary to determine the failure mechanism. In Snout Creek upstream of these failures, and presumably upsection in the formation, the number and thickness of siltstone and sandstone beds increases in relation to the mudstone. This increases resistance to erosion and can create a steeper stream gradient.

What beneficial uses dependent on aquatic resources occur in the watershed? Which water quality parameters are critical to these uses?

The Rogue River and its tributaries in this watershed provide habitat and migration routes for anadromous fish, some species of which are listed as Threatened or Endangered (see Fisheries section). They also provide water for domestic use and irrigation. The river provides access to residences and lodges, as well as recreational boating, fishing, and swimming.

Turbidity

Typically, coastal Siskiyou streams run clear during most of the year, with turbidity during winter storms that clears within a few days. Exceptions to this are streams with large slump-earthflow features and active landslides at their toes. Waters Creek, Foster Creek, and Billings Creek are examples of streams that have this longer duration turbidity when their earthflows are active. The Foster Creek slide is discussed in the Geology section and in Appendix B, Subwatersheds.

Large earthflow features dominate the Billings Creek watershed. The steep inner gorge of the channel in the lower half of the watershed has active toe landslides that regularly contribute fine sediments. Residents that have lived near Billings Creek for many decades have observed the creek running muddy at times when most other streams in the analysis area were clear.

Temperature

This section of the Rogue River was listed as water quality limited for temperature and pH in the 1996 and 1998 Oregon Department of Environmental Quality listing. Foster Creek and Shasta Costa Creek were listed as water quality limited for temperature, exceeding the state standard for this area of 64 degrees. Recording thermometers have monitored temperatures since 1989.

Table 8. 7-Day Average Maximum Temperatures

Stream	**Site**	**Years**	**Range of 7-Day Max**
Rogue River	above Illinois River	1993-1995	70.9 to 78.7
Rogue River	below Clay Hill Rapids	1994-1995	72.8 to 77.1
Rogue River	below Payton Riffle	1994-1995	74.3 to 77.6
Shasta Costa Creek	mouth	1989-1999	65.9 to 75.6
Shasta Costa Creek	mile 0.5	1991 and 1996	68.7 to 69.8
Shasta Costa Creek	mile 2.0	1996	66.8
Shasta Costa Creek	mile 5.5	1997	63.1
Shasta trib at mile 5.5	mouth	1989	62.1
Twomile Creek	mouth	1993	61.7
Foster Creek	mouth	1990-1999	66.6 to 71.2
Foster Creek	Above NF Foster	1999	64.6
North Fork Foster Creek	Mouth	1999	66.1
Billings Creek	mouth	1998-1999	73.8*
Billings Creek	1 mile above mouth	1999	68.0*
Watson Creek	mouth	1997	60.9
East Creek	mouth	1997	64.4
Blossom Bar Creek	mouth	1997	61.3

* Exceptionally high temperatures for a stream with this small drainage area. This is probably caused by the continuous inner gorge slides that prevent growth of shading vegetation, as discussed under Channel Conditions.

Release of water from dams constructed at Lost Creek and Applegate during the summer months may affect stream temperature. Increased flow and release of water from the lower portions of the reservoirs would both have a cooling effect. Data on pre-dam temperatures have not been found.

Information Needs: Riparian vegetation should be evaluated for actual versus potential effects on stream shade.

Management Opportunities: Treat riparian stands that have the potential to increase shade by thinning overstocked areas and/or planting trees in under-stocked areas.

What is the character of fish populations in Rogue River, Marial to Agness?

Salmon and trout in the Rogue River, Marial to Agness, are members of the lower Rogue River stocks. They share life histories and population trends with salmonids produced from the mouth of the Rogue River upstream to near Stair Creek at river mile (RM) 43 of the Rogue, excluding the Illinois River, which enters at Rogue RM 27.

Most fish production in the lower Rogue basin occurs in tributaries. Winter flows in the mainstem are believed to be too powerful to allow successful incubation of fish eggs in all but the very mildest of winters. High storm flows can mobilize the bottom of the stream and destroy eggs laid in the gravel. The lower Rogue River is predominantly a canyon with short, steep tributaries. Few tributaries have well-developed habitat for salmonids. Between Marial and Agness, only Shasta Costa, Foster and East Creeks offer more than a half-mile of salmonid habitat.

Characteristics of lower Rogue River salmonids are that fish spawning here tend to enter the river at the end of the adult migration runs; the juveniles enter the ocean earlier than upriver fish; and, in the ocean, they migrate south and stay close to shore (Rivers, 1991 and Meehan and Bjornn, 1991).

Lower Rogue River fish have shared the historic decline in numbers witnessed throughout the Rogue River since the late 1800s. The most telling example of the decline is the output of the salmon canning industry centered in Gold Beach. Fish caught in the river from the mouth up to Lobster Creek were the basis of the industry. In 1861, entrepreneurs in the fish canning industry labeled Rogue River runs as large, or larger, as any in Alaska. A canning industry thrived at Gold Beach into the 1930s. At the peak of fish canning, packs contained up to 82,500 adult chinook in 1917 and 50,500 adult coho in 1928. However, when the state legislature finally banned commercial fishing on the Rogue River in 1935, the action was virtually unopposed because fish were so scarce the canning industry could not support itself (Rivers, 1991). Besides over harvest, factors contributing to this initial steep decline of Rogue River fish included climatic changes, dams, mining and water diversions in the upper basin (Rivers, 1991). From 1922 to 1935, 6 million pounds of salmon were canned (Jerry’s Rogue Museum).

Four species of the genus *Oncorhynchus* (Pacific salmon and trout) use Rogue River, Marial to Agness. Coho (*O. kisutch*) and chinook (*O. tshawytscha*) are the traditional Pacific salmon. All individuals must migrate to the ocean and each adult is capable of making only one spawning run from the ocean, after which it must die. *O. mykiss* (the Latin name for both steelhead and rainbow trout) and *O. clarki*, cutthroat trout, have more flexible life histories. Both resident and anadromous populations of each exist in the Rogue River, Marial to Agness. Individuals of these species can make more than one return migration to freshwater and can spawn more than once in their lifetime. These life histories are typical of the species throughout their ranges, not just in this section of the Rogue River.

Because of the diversity of salmonid stocks using the Rogue River there are adult fish between Marial and Agness throughout the year. These fish are the basis of both a world-class fishery and of the culture of the human communities along the Rogue River. Anglers support a large portion of the economies of the communities of Agness and Gold Beach. Numerous lodges and guide businesses have developed to serve these anglers.

Non-salmonid species of fish in Rogue River, Marial to Agness include the anadromous Pacific lamprey (*Lampetra tridentata*), whose populations are suspected to be in decline throughout their range, yet about which very little is known. There are potentially three species of sculpin (genus *Cottus*) in Rogue River, Marial to Agness: coast range (*C. aleuticus*), prickly (*C. asper*) and reticulate (*C. perplexus*). Redside shiners (*Richardsonius balteatus*), a non-native minnow, were first detected in Jump Off Joe Creek in the 1950s (Rivers, 1963). Three-spined sticklebacks (*Gasterosteus aculeatus*), brook lamprey, squawfish, and small mouth bass also occur in Rogue River, Marial to Agness (Ernie Rutledge, personal communication).

In addition to naturally spawning fish, culture has been a historic part of the watershed. A hatchery operated at the mouth of Foster Creek until the 1970s, and a small hatch box operation still exists at Santa Anita Lodge, between Lone Tree and Foster Creeks.

Coho Salmon

Coho in Rogue River, Marial to Agness are part of the Southern Oregon/Northern California group, which was listed as Threatened in 1997 under the federal Endangered Species Act. The distribution of these coho extends from the Elk River in Oregon south to the Mattole River in California. The estimated abundance of these coho ranged from 150,000 to 400,000 spawning fish. Today, the group is down to approximately 10,000 naturally produced adults. The Rogue River is one of the major remaining coho producers (NMFS, May 6, 1997). Within the Rogue River, coho predominantly spawn and rear in the upper Rogue and the Illinois Rivers. The Rogue population is mostly hatchery fish. Most wild coho production in the Rogue occurs in the Illinois River tributaries. The population of adult spawners in the Rogue River was calculated for the years 1990 through 1996 based on mark and recapture seining at Huntley Park, river mile (RM) 8. During that time, coho adults averaged 3,401 individuals, with a low of 174 in 1993 and a high of 5,386 in 1996 (Nickelson, 1998). The same report estimates that a total of 5,400 adult spawners are needed to fully seed the best habitat. Because of the lack of classic coho habitat features, lower Rogue coho spawners are believed to be strays from the upper Rogue River or Illinois River groups and not remnants of a discrete lower Rogue River population. However, it is likely that when coho populations were higher, a larger number of strays used the marginal habitat available in Foster and Shasta Costa Creeks.

Adult coho enter Foster and Shasta Costa Creeks in the late fall to spawn. Eggs incubate in gravel streambeds until early spring when the fry emerge. Juvenile fish will stay in their natal streams for over one year congregating in the medium-sized streams. They migrate out of the system in late spring of their second year of life. Most Rogue River coho spend two years in the ocean before returning to spawn (Rivers, 1991). Since juvenile coho spend a full year in mid-sized streams they depend on high quality habitat features throughout that year. High summer water temperatures (in the upper 60 degrees Fahrenheit), little instream cover or slackwater areas to escape high flows in winter and a general low-density of instream wood are habitat features of the mid-sized streams that do not promote coho production. (See Temperature Section.) These conditions are typical of mid-sized streams in the coast range of southern Oregon, where coho production is low. These conditions do not affect other salmonids to the degree that coho are affected. Chinook migrate out of tributary streams by mid-summer and do not overwinter there, avoiding high water temperatures and high flows. Steelhead and cutthroat rely on smaller tributaries, which are cooler than larger streams in summer and have lower flows in winter.

Fall Chinook

Rogue River fall chinook are part of the Southern Oregon and Northern California Coastal Evolutionarily Significant Unit (ESU). The range of this ESU is from Cape Blanco, Oregon south to the Klamath River in California. This ESU was proposed for listing as Threatened under the Federal Endangered Species Act. In September 1999, it was determined to not warrant listing.

Fall chinook salmon in the upper Rogue River were identified by NMFS, March 9, 1998 as the only relatively healthy population in the entire ESU. This is a stream-type stock, meaning that juveniles typically enter the ocean during the second year of life, migrate further distances in the ocean, enter freshwater as spawners early in the fall and then migrate long distances to headwater streams (Healy, 1983). Lower Rogue River chinook (including those in Rogue River, Marial to Agness) are ocean-type fish. They typically enter the ocean within the first year of life and stay relatively close to shore, then enter freshwater to spawn late in the fall and occupy habitat low in the system.

During the late 1980s, the combination of drought, stream habitat degradation, low ocean survival and high ocean exploitation rates in the Klamath Management Zone resulted in a severe decline in chinook populations in all of the Oregon coastal basins south of Elk River. River angling for chinook in several southcoast basins, including the lower Rogue River, was closed during this time. Populations began to improve in 1991 with a sharp curtailment in ocean harvest coupled with the end of drought conditions by 1993 (ODFW, 1997). Juvenile trapping data show a positive trend in smolt production in lower Rogue River tributaries since the early 1990s. Prior to September 30, the fishery in the lower mainstem is targeting chinook, which spawn in the upper Rogue River.

Adult fall chinook enter the Rogue River in late summer and disperse throughout the watershed to spawn as streamflow allows. Spawning is usually completed by the end of December, after which all chinook die. Fry emerge from the gravel in the spring and start migrating downstream almost immediately. Downstream migration peaks between the end of May and the middle of July and then continues at a declining rate throughout the summer (ODFW, 1997). During mild winters some juveniles can stay in the river. In the spring of 1998, 123 one-year old chinook were caught in the Lobster Creek juvenile migrant trap (ODFW, 1998). After migrating out of freshwater, these chinook will spend two or three years in the ocean before returning to spawn.

Summer Steelhead

The Rogue River produces the largest run of summer steelhead in Oregon, outside of the Columbia River system. The only other Oregon coastal streams that produce summer steelhead are the Hood, Siletz and North Umpqua Rivers. The Rogue River is also unusual in that it supports three forms of *Oncorhynchus mykiss* sympatrically: resident rainbow trout, winter steelhead and summer steelhead.

Adult summer steelhead enter the Rogue River from the ocean between May and October. An early run, 10 percent of the population, enters in May, June or July. The late run, 90 percent of the population, enters in August, September or October. Adults hold in pools, completing sexual maturation, until they spawn in the winter (December through March). Fry emerge from gravel nests between April and June. Juveniles rear in tributary streams for two to four years before migrating to the ocean. Summer and winter steelhead have some overlap in time and space for egg laying and rearing activities. They are distinguished from each other mainly by the timing of their adult runs and the degree of gonad maturity upon entering freshwater.

Summer steelhead do not spawn or rear in the segment of the Rogue River between Marial and Agness nor its tributaries. They are a middle and upper Rogue River fish, with important spawning and rearing grounds in tributaries of that segment including the Applegate River.

Adult summer steelhead migrate upstream through the Marial to Agness section of the Rogue River between May and October. Pre-smolt juveniles migrate downstream from their natal streams to the estuary between April and June.

Rogue River summer steelhead also exhibit an interesting, non-spawning migration known as the "half-pounder" run. Half-pounders are small, sexually immature steelhead 11 to 16 inches long. They return to freshwater with the late-running adults in August and September, after only three to four months in the ocean. Instead of migrating upstream to spawning tributaries, half-pounders stay in the lower and middle Rogue River mainstem over the winter, then return to the ocean in the spring. Half-pounder steelhead are found in the Rogue River, between Marial and Agness during the autumn and winter.

While 95 percent of summer steelhead exhibit the half-pounder migration pattern, it is not exclusive to them. Approximately 30 percent of the winter steelhead population in the Rogue River will also make a half-pounder run. The reason for the half-pounder run is not well understood. One theory is that these fish followed spawning spring Chinook into the rivers to take advantage of the large food resource provided by Chinook eggs. Another is that the half-pounders are escaping adverse ocean conditions. Other than the Rogue River, half-pounders are found only in the Klamath and Eel Rivers of Northern California.

Summer steelhead use many of the same streams winter steelhead use for spawning and rearing but also spawn in smaller streams, often spawning in streams that dry up during the summer.

Because summer steelhead are in freshwater as adults during the time of lowest flow and highest temperature, they require pockets of cool water. In the section of the Rogue River between Marial and Agness, summer steelhead will hold up in deep pools or at the mouths of tributaries that have cool water. Before the Lost Creek Dam was completed in the early 1970s, the summer water temperature of the mainstem Rogue River was two to three degrees warmer than the Illinois River, which enters immediately downstream of Agness. Summer steelhead would stay in the lower Illinois River until the Rogue River cooled in the fall, and then continue up the Rogue River. Now Lost Creek Dam reserves and releases cool water into the Rogue River, and summer water temperatures are usually cooler in the Rogue than the Illinois. As a result, summer steelhead no longer hold up in the Illinois River.

Summer steelhead that spawn in the Rogue River system, especially in the middle Rogue, are the weakest population of the Klamath Mountains Province steelhead ESU. Census information collected at Huntley Park shows a 25 percent decrease in population size since the mid-1980s.

Both summer and winter steelhead are propagated at Cole Rivers Hatchery and released into the Rogue River. Wild fish are not incorporated into the brood stock and little interaction between wild and hatchery stock is thought to occur on the spawning grounds.

Winter Steelhead

Winter steelhead in the Rogue River are part of the Klamath Mountains Province (KMP) ESU. This ESU was proposed as Threatened under the Endangered Species Act in 1996. However, in 1998 the ESU was determined to not warrant such a listing, based on recovery efforts in the states of Oregon and California. The ESU extends from the Elk River in Oregon south to the Klamath River in California. The NMFS estimates the current abundance of this ESU to be 85,000 with an historic abundance of greater than 275,000 (NMFS, July 1996). The ODFW estimates that the population of winter steelhead in the Rogue River between 1970 and 1987 averaged 44,000 adult spawners annually. The same estimate since 1990 is 55,000 adults, which indicates a positive trend in the population (RVCOG, 1997).

Winter steelhead spawn in tributaries throughout the Marial to Agness section of the Rogue River. Steelhead have a more variable life history than coho or chinook. They can spend one to several years rearing in freshwater and can survive reproduction to return to the ocean. In streams their sleek body proportions allow them to ascend steeper gradients and use smaller streams for spawning and rearing. They also roam more within a basin to locate suitable spawning habitat. Winter steelhead enter the Rogue River to spawn in the late fall and spawning continues into April. Fry emerge from late spring to early July. Most steelhead will spend almost two full years rearing in tributaries before smolting and migrating to the ocean in the spring. After typically two years of ocean rearing they will return to spawn. A small percentage of the population will return to freshwater after only one year. These so-called “half-pounders” are sexually immature and will return to the ocean again before making a spawning run.

Anadromous Cutthroat Trout

Both resident and anadromous cutthroat trout occur in this section of the Rogue River. Multiple age-classes of cutthroat are consistently present in coastal Oregon streams, and forces driving their complex life histories are poorly understood (ODFW, April 1997). Anadromous cutthroat usually rear in freshwater for two, three or four years before smolting. Yearling cutthroat appear to be displaced from prime habitat by other salmonid yearlings, probably because they emerge later and are, therefore, smaller. They commonly return to freshwater to overwinter without spawning. Females begin spawning at age four and can survive to spawn up to four or five times. Spawning occurs in late winter and early spring (Trotter, 1997).

Resident Trout

Both rainbow and cutthroat trout occur in resident forms in this section of the Rogue River. They occupy the uppermost reaches of most tributaries and commingle with the anadromous forms throughout the basin.

What is the character of fish habitat in the watershed?

Fish habitat in the analysis area is shown on the Fish Distribution map and can be grouped into three general categories: the mainstem Rogue River, the large tributaries and the small tributaries. Each has a distinct physical and biotic regime.

Mainstem Fish Habitat

The dominant habitat feature in the watershed is the mainstem Rogue River, which provides 20.5 miles of primarily migration habitat for fish. This is a major river, with a low stream gradient, a wide active channel and powerful winter streamflows. It flows through a narrow, alluvial canyon. Active floodplain development is minimal and restricted to the confluences with the larger tributaries. Perched terraces also occur near the tributaries and are remnants of an older baseline.

The region receives a high amount of precipitation between October and June and very little the remainder of the year. This results in a flow regime of extremes to which fish respond. In late autumn, winter and spring the entire channel is submerged. Only the inactive terraces are above water. To escape the force of the flow, fish hold on the margins of the channel, in submerged tributary mouths and in eddies behind boulders. Spawning is restricted to the tributaries, where streamflows are lower and do not wash away fish eggs incubating in gravel streambeds.

By late summer the river is reduced to only a fraction of the total channel width in many places, revealing wide gravel and cobble bars. Water temperatures rocket into the 70s during late summer, and fish hold in cooler water found at the bottom of deep pools and at the tributary mouths. During low flow conditions, the river is separated from the influences of forest riparian vegetation by bare rocks. Seasonal emergent rushes, willows and herbs line the channel margins. By mid-summer, mats of filamentous green algae have developed in shallow water and provide nutrients and structure for photosynthetic, invertebrate and amphibian organisms.

Large wood is absent from the mainstem channel. Powerful storm flow and a wide channel result in large wood being flushed downstream, out of the watershed. Structural habitat diversity is provided by boulders and bedrock outcrops. Deep pools and turbidity provide instream cover.

Between Billings and Blossom Bar Creeks, occasional backwater areas are formed in shallow channel margins. During the winter they function as escape refugia from high flows and during the summer they become pondlike, although they do not all lose total connection with the mainstem. The waters here are warm and almost stagnant. It is in this reach that small mouth bass have been seen.

Boat Use

A highly visible element of mainstem fish habitat is the extensive boat use. Boaters are drawn to the lower Rogue River for its celebrated fishery, scenic beauty and whitewater reputation. They bring a wide variety of watercraft and dominant uses change with the seasons.

During the summer thousands of float craft make their way down the Rogue River. Most of the floaters put in at Grave Creek, in the middle of the Rogue River watershed, and pull out at the mouth of Foster Creek. A permit system regulates their use, spacing them out to a steady flow of tens of rafts and kayaks a day passing a single point during peak season (July and August). Most of the rafters spend several days making the trip, camping on sand bars or staying in lodges. Adventure seeking kayakers and rafters occasionally ply the mainstem during high spring and winter flows. Anglers use drift boats during all angling seasons from Foster Creek downstream to Agness and beyond. Motorized angling boats travel both upstream and downstream during the fishing seasons. During peak angler season, the number of drift and motorized angling boats on the mainstem downstream of Foster Creek can be quite high. Another type of boat that fish encounter is the summer tour boats. These are larger craft, carrying up to 38 passengers. During summer, several trips are made daily. Small, personal use jet boats travel the mainstem year round for transportation.

This level of boat use is not limited to the Marial to Agness section of the Rogue River. Downstream of this section, motorized boat use is higher and rafting is much lower. Upstream of this section, both floating and motorized boating continue up into the Grants Pass area.

Studies of the effects of boats on fish have been made, some specifically on the Rogue River. Direct observations were made on fish subjected to a variety of boats in the Rogue River. Fish greater than 5 meters away from a boat generally had no response, fish responded more to oar boats than to motorboats, and no fish were found stranded on the bank in the wake of a boat (Satterthwaitte, 1994). In Alaska, it was found that in shallow water jet motors can destroy redds (Horton, 1994). Horton also observed that adult sockeye salmon seldom responded to motorboats, and when they did, they returned to their redds within seconds. He also observed that adult sockeyes always moved off their redds when bears or people walked into the river and did not return for several minutes. Research on boating effects on fish and other aquatic life is not complete enough at this time to have reached definitive conclusions.

Effects on the channel by boat use appear to be limited to channel modifications made to improve boat passage. Many obstacles such as boulders and bedrock were removed from the center of the channel many years ago. In recent years channel modification has been limited to gravel removal near Illahe Island. This is done under permit from the Oregon Department of State Lands and the Army Corps of Engineers.

Boat docks and launch pads exist in several places throughout the watershed. From a human convenience standpoint, the first choice for launch locations is at cobble and gravel bars, which are abundant throughout the watershed. These are naturally resilient places, and the launch facilities require little habitat modification. In other rivers with banks of fine, easily eroded soil, motorized boats have decreased bank stability and increased turbidity (Lindsay, 1992). This is not a concern in the Rogue River, where banks are either armored with cobbles or solid bedrock.

Large Tributaries

Three tributaries in the Marial to Agness section of the Rogue River are large enough to allow consistent salmon spawning and/or significant trout rearing. The remaining tributaries have very small drainage areas and are generally too steep to support fish in all but their very lowest reaches.

Shasta Costa Creek, which enters the Rogue at river mile 29, is by far the largest tributary in the Marial to Agness watershed. Nearly all of the fish production in the watershed occurs here. Shasta Costa provides 3.4 miles of salmon habitat, 10.2 miles of steelhead habitat and an additional 7 miles of resident trout habitat. It is in nearly pristine condition and was designated a Key Watershed for its ability to support salmonid fish. Shasta Costa is one of the top producers of salmonid fish in the entire Lower Rogue basin. Because of its high value, the Forest Service completed a separate Watershed Analysis for Shasta Costa Creek in 1996. That document fully addresses all aspects of Shasta Costa Creek. Therefore, other than to note the relative importance of Shasta Costa to the larger watershed, this analysis will not address Shasta Costa Creek.

Stair Creek is the second largest tributary to the Marial to Agness section of the Rogue River. Due to a series of waterfalls (or "stairs") at its mouth, it is inaccessible to anadromous fish. It provides nearly 10 miles of high quality resident trout habitat. Such an expanse of resident trout habitat is unique in the lower Rogue River and Oregon south coast basins. The Galice Ranger District of the Siskiyou National Forest is completing a separate Watershed Analysis of Stair Creek. It will not be addressed at length here.

Foster Creek

Foster Creek is a fifth order stream with a palmate stream configuration. It provides 2.4 miles of salmon spawning and rearing habitat, 5 miles of steelhead habitat and an additional 5 miles of trout habitat. From the perspective of the entire lower Rogue River, or certainly from that of Oregon's south coast region, Foster Creek is not a significant producer of salmonid fish. However, because so few of the tributaries between Marial and Agness can support fish at all, Foster Creek is important at the level of this analysis. Additionally, the Marial to Agness reach of the Rogue River is something of a transitional reach. Downstream are the Illinois River and the marine-influenced, coastal portion of the lower Rogue River. Upstream are the Applegate River and Upper Rogue. The ecological significance of the spawning habitat in Foster Creek (as well as Shasta Costa Creek) may be greater than mere miles can explain because of their transitional location.

Coho regularly spawn in low numbers in Foster Creek. Along with all coho spawning in lower Rogue River tributaries, these coho are thought to be strays from upper Rogue stocks and not remnants of a once-larger lower Rogue stock. The other salmonid species using Foster Creek are fall chinook, winter steelhead, anadromous cutthroat trout and resident trout, both rainbow and cutthroat.

From its mouth to the County Road 375 bridge, Foster Creek has a bedrock bottom with only small patches of gravel and cobble on the surface. The channel here is highly confined in a narrow gorge cut through uplifted terraces on both the north and south bank. It is a highly erosional habitat that has trapped little large wood or gravel. This bedrock stream bottom is typical of the tributaries south of Foster Creek and is a result of the underlying geology. Unlike the other tributaries, however, Foster Creek has developed low gradient reaches upstream of this bedrock bottomed reach and is capable of supporting spawning salmon and steelhead. Since there is little holding or spawning habitat in this lower 0.5-mile reach, it is mainly used as a migration corridor for fish. Small pockets of rearing habitat occur throughout this reach.

The next reach (river mile 0.5 to 2.4) is not as confined and, therefore, holds more gravel and wood, increasing the value for fish habitat. A mixture of cobbles, gravels, sand and small boulders line the stream bottom. The mixture of particle sizes is a result of the earthflow located just 2 miles upstream of this reach. Large wood occurs at a rate of 15 pieces per mile and is a mixture of natural trees and cut logs tied in place as part of a stream enhancement project in 1985. The valley is wider in this reach and a few homes and a small vineyard occupy the terraces above the stream. The riparian forest is a mixture of conifer and hardwood trees. This reach is a productive spawning and rearing reach for chinook, steelhead, trout and coho. A tributary flows from the north into this reach and provides steelhead and trout spawning and rearing habitat.

Between river mile 2.4 and 3.0 the valley narrows and the stream gradient increases to 4 to 10 percent. Pocket pools interspersed in cascades provide spawning and rearing habitat for steelhead and anadromous cutthroat trout. Salmon do no use this stream reach.

Beyond river mile 3.0 the stream gradient increases steadily to 20 to 60 percent and the main channel splits into numerous tributaries. The stream channels flow through an earthflow, and small and large boulders dominate the channel bottom. Anadromous fish do not use this habitat, but resident trout persist nearly a mile into each of the three larger tributary channels.

Smaller Tributaries

Other than Shasta Costa, Stair and Foster Creeks, the remainder of the tributaries in the watershed are short, steep and provide limited fish habitat. Those that support steelhead in their very lower reaches are Twomile, Billings, East Creek (which also has limited chinook use), and Blossom Bar Creek. Each of these supports resident trout upstream of the steelhead habitat. Those tributaries which support resident trout alone are Snout, Waters, Slide, Watson, Dans, Flora Dell, Clay Hill, Tate, Stair, Brushy Bar, Johnson, Paradise and Burns Creek. Very little is known about their habitat or populations.

Information Needs: The culvert at Snout Creek on Road 33 is suspected to be a barrier to steelhead and should be investigated.

Management Opportunities: There is a need to prevent sediment delivery from roads throughout the basin, especially in those tributaries known to support fish. Many culverts are reaching the end of their life and threaten streams with mass delivery of sediment. Many roads that are no longer needed can be modified or decommissioned to reduce hydrologic effects.

Some riparian forest stands have been cut and reforested and are now overstocked and stunted. Those adjacent to fish-bearing streams need to be thinned to allow growth of large conifers. This would increase the potential for shade and large wood in streams.

Fire suppression has increased the amount of forested land and decreased the amount of meadow or grasslands in the watershed. Streams that flow through meadows provide different aquatic and riparian habitat and nutrients than those which flow through forests. Restoring meadows to their former range in the watershed would recover the meadow aquatic and riparian processes that have been lost to fire suppression. Aquatic and riparian diversity in the watershed would be restored.

RIPARIAN ECOSYSTEM NARRATIVE

What are the riparian processes in the watershed?

Stream Types

The character of a riparian area is inseparable from the character of the water body it surrounds. In this section of the Rogue River, streams are the dominant type of water body. Streams can be grouped, based on the surface flow regime, into three broad categories: ephemeral, intermittent and perennial streams. Likewise, riparian processes and functions can be grouped along the same lines.

.

An intermittent channel is defined by the ROD (USDA and USDI, 1994) as "any nonpermanent flowing drainage feature having a definable channel and evidence of annual scour or deposition" (ROD, B-14). This definition includes both "ephemeral" channels and "intermittent" channels. Ephemeral channels carry only stormflow, while intermittent channels are supplied by groundwater during part of the year (Reid and Ziemer, 1994).

Most ephemeral channels contain water for only a few days of the year and may not support riparian vegetation, so they are unlikely to have much direct significance for riparian-dependant species. Their major role is their influence on downstream channels. They supply sediment, water, and organic materials. Depending on the contrast between the ephemeral channels and the surrounding upland areas, they may or may not be significant migration corridors or unique wildlife habitat. (Reid and Ziemer, 1994).

Intermittent channels are important as seasonal sources of water, sediment, allochthonous material, and large wood. Because intermittent channels can form a high proportion of the entire channel system in a watershed, they contribute significantly to downstream reaches (Reid and Ziemer, 1994). It is therefore important to maintain their function of allochthonous material sources. These small streams are easily influenced by forest management activities and manipulations of the canopy or streambank vegetation can influence the stream's energy supply (Chamberlain et al., 1991). Because they do not have surface flow during late summer, intermittent streams are not a source of warm water to the summer stream network.

Intermittent channels can be important to those amphibian species which do not need open water throughout the year. These streams may be particularly important as nursery areas for amphibians because these sites support fewer aquatic predators than perennial channels (Reid and Ziemer, 1994).

The more different a riparian area is from its surrounding upland - in structure, humidity, thermal regime or nutrient availability - the more important the riparian area is for riparian-dependant species. When riparian areas are distinct from surrounding uplands, they can function as travel corridors and provide microclimatic refuge for riparian-dependant species (Reid and Ziemer, 1994). The distinctive vegetation and higher moisture content of these sites can also modify fire behavior, so their distribution can affect the patchiness of large burns. Since the watershed does not experience long, cold winters, riparian areas here are not critical for providing thermal protection from winter extremes.

Intermittent channels and their riparian zones are highly variable in their ability to provide habitat that is different from the surrounding uplands. Some riparian areas around intermittent channels are identical to the surrounding upland and some have a vastly different character.

Perennial streams, because they have surface flow throughout the year, generally support a riparian area quite distinct from the surrounding upland. The continually wet habitat they provide allows the fuller development of riparian-dependant plant and animal communities. During late summer and early autumn, when the surrounding uplands are typically quite hot and dry in this section of the Rogue River, riparian areas along perennial streams become especially important for riparian-dependant species. Organisms, which were previously dispersed into the riparian areas along intermittent streams or into upland areas, congregate along perennial streams to find suitable conditions.

Nutrient Routing

There are two sources of the nutrients necessary to support riparian-dependent species: **autochthonous sources** (produced on site, usually from photosynthesis), and **allochthonous sources** (produced off-site and transported into the area). Aquatic and riparian ecosystems increase in complexity with the progression from headwater tributaries downstream to the mouths of the mainstem rivers. Allochthonous sources dominate in the upper reaches of the watershed and the availability of autochthonous sources increases further downstream.

Autochthonous sources of energy are affected by stream size, gradient, and exposure to sunlight. Allochthonous sources of energy contribute organic matter to the stream by four main pathways: litterfall from streamside vegetation; groundwater seepage; soil erosion; and fluvial transport from upstream. Organic matter from these sources differs in when and how it enters the stream, how it decays, and where it predominates (Murphy and Meehan, 1991).

Most animals require food with a Carbon to Nitrogen ratio (C:N) less than 17:1. Almost all forms of allochthonous organic matter have higher C:N ratios, so they require microbial processing to enhance food quality. The quality of various forms of organic matter varies widely, as measured by the C:N ratio. At the low nutritional end of the spectrum are woody debris and conifer needles (wood has a C:N ratio of 1,343:1); at the high end of nutritional quality are periphyton, macrophytes, and fast-decaying deciduous leaves (macrophytes 8:1 and alder leaves 23:1) (Murphy and Meehan, 1991).

What are the vegetative types of riparian areas in the watershed?

Riparian zones in this section of the Rogue River can be stratified into four distinct categories based on vegetative characteristics. These are conifer forest, hardwood forest, meadows, and riparian areas on soils developed in serpentinite and peridotite (ultramafic soils). Each category has its own processes for sediment delivery, channel formation, hydrologic regime, susceptibility and response to change, microclimate qualities, flora, fauna, and migration habitat qualities.

Conifer Forest Riparian

The most abundant riparian type in the Rogue River, Marial to Agness, watershed is the conifer forest riparian. It is generally located on soils with high to moderate productivity, where water supply is not limiting growth and topography tends to exclude frequent or intense fire. Abundant, tall conifers dominate these riparian areas. Douglas-fir is by far the most common overstory conifer, with Port-Orford-cedar often present. Pacific yew has very scattered distribution.

The stand canopy is closed in these areas and many stands have multi-layered canopies. Hardwood trees are often an important mid-layer component. Conifers, with the exception of cedars, create more acidic soils through litterfall than hardwoods. The evapotranspiration associated with the numerous large trees is high. Air temperatures are cool and diurnal fluctuations are moderated throughout the year. These riparian ecosystems maintain important microclimates.

The stands are generally very stable. Tanoak seldom reaches climax condition due to the time-span required for this succession and the longevity of dominant conifers (200 to 300 years). Fire does not start or carry well in most of these stands. Light disturbance from windthrow, land movement, wind or snow damage leads to continual recruitment of conifers. In the event of large-scale disturbances these riparian stands are slow to recover to a mature state. Where Port-Orford-cedar is present in the riparian zone, roads and streams are important conduits for *Phytophthora lateralis* (Port-Orford-cedar root disease).

Conifer stands often have a higher percentage of perennial streams than other vegetation types. Root strength and often-dense undergrowth contribute to generally stable stream banks. However, riparian conifer stands can develop on earthflows, and exhibit features of deep-seated instability. Earthflows can be important sources of structure for stream channels by providing boulders and large wood. Throughout conifer riparian areas, large wood in the form of limbs and boles is continuously delivered to and incorporated into the channels. Stream temperatures tend to be cool throughout the year. Tall trees can shade even moderately wide channels in summer.

Where coniferous riparian areas are surrounded by similar upland stands, they are important water sources for interior habitat-dependent wildlife. When they are dissimilar to the surrounding upland habitat, they are important uphill-downhill dispersal corridors for interior species. Stable air temperatures make them valuable thermal refugia in extreme weather for many wildlife species. These riparian stands can be important habitat for spotted owls.

Conifer riparian areas can have a moist microclimate and be important to organisms requiring cold, wet environments. For example, Pacific giant salamanders utilize headwater streams to lay their eggs (Stebbins, 1966), and talus habitat in these moist areas can be important for Del Norte salamanders. Meadow and hardwood riparian areas usually receive more solar energy and favor species adapted to more sunlight, lower humidity and warmer temperatures.

Riparian stands of red alder are generally an early to mid-seral stage of the riparian conifer forest. These stands were usually created by stand replacement events such as timber harvest, debris flows, inner gorge landslides, and floods. In some areas red alder is an important component of a mature conifer riparian ecosystem. These alder stands can be important habitat for white-footed voles, and alder leaves are a good source of nutrients for the aquatic ecosystem.

Because of its abundance and high value wood production, more land use activities have occurred in conifer riparian stands than in any of the other riparian types. Therefore, conifer riparian stands are most likely to be candidates for restoration.

Hardwood Forest Riparian

Hardwood-forested riparian stands tend to replace conifer-forested riparian stands where water is limiting or where a regime of either frequent low intensity or high intensity fires has disturbed the riparian zone. Hardwood riparian stands are usually dominated by tanoak trees, with madrone, myrtle, chinquapin, knobcone and sugar pines often present. Scattered conifers such as Douglas-fir will grow directly out of the stream channel, where there is more water, but they are anomalies in these stands.

Although the canopy is closed, the single-storied structure does not have the insulating qualities of the conifer forest. Humidity is much lower and air temperatures vary a great deal with the seasons. The microclimate differs little from surrounding upland. Fire will both start and carry well in the riparian stands. These stands have low resistance to change from fire and wind and snow damage. Yet their closed canopy, single-storied structure is quick to regenerate. Ground cover is usually low, leading to more surface erosion than conifer riparian stands, but their characteristic stump sprouting after disturbance leads to consistent bank stability.

Hardwood riparian stands are generally similar to their upland surroundings, making them valuable watering sites for local wildlife. They are less important for thermal cover and migration corridors than coniferous riparian stands. Their acorn crop makes them important foraging areas for mast-dependent wildlife.

The economic value of the hardwoods is much lower than conifers, so far less timber harvest has occurred in these riparian areas. As a result, restoration opportunities in this riparian type are few.

Meadow and Oak Savanna Riparian

The majority of meadow riparian areas are open canopy areas. As a result, these types of riparian areas receive high amounts of solar radiation; have high diurnal temperature fluctuations, little microclimate differences, and a narrow range of influence beyond the active channel. Fire will start and carry very rapidly through meadow riparian areas. They are dependent upon frequent fire for maintaining their open canopy characteristics.

Light vegetative covering makes easily destabilized banks prone to downcutting and headwall erosion following disturbance. Water temperatures show a strong diurnal fluctuation, similar to air temperatures. On-site diversity in these areas is low, yet may include highly specialized or unique species. Downstream aquatic diversity is increased because of the different types of production occurring at these sites.

Riparian areas bordering meadows provide important water sites for meadow-dependent wildlife species. Their location along the edge of the forest/meadow ecotone increases the on-site diversity of terrestrial species. The meadow riparian areas provide connection corridors for meadow-dependent species.

Ultramafic Riparian

At these sites high levels of magnesium relative to calcium, high levels of nickel and chromium, and low levels of available soil water limit plant species to those tolerant of these conditions. These specialized communities contribute to the overall biological diversity of the watershed.

Most stands have an open to moderately closed canopy (20 to 70 percent). Understory vegetation cover varies from open to dense. The typically unstable slopes of ultramafic derived soils create high disturbance frequency, contributing to the sparseness of the canopy. Because of the more open canopy, seasonal and diurnal temperatures fluctuate more than in other riparian stands. However, ultramafic riparian stands provide a cooler, contrasting microclimate to the harsh upland ultramafic areas often dominated by open Jeffrey pine stands.

Port-Orford-cedar is often the primary overstory component in riparian areas. Port-Orford-cedar grows slowly on these sites, generally reaching 30 inches in diameter in 400 years on seasonal streams and 30 inches in 200 to 300 years in perennial wet sites. It will remain standing long after it dies. While Port-Orford-cedar has a slow decomposition rate, the sparse vegetative cover on ultramafics creates a low fuel load. This, in turn, results in low intensity fires when fire occurs.

Phytophthora lateralis is an introduced pathogen that kills Port-Orford-cedar, reducing shade and concentrating the delivery of large wood. Mortality rates in well-established disease sites are generally higher in the flat, wet sites and lower on steeper stream sections where spores cannot catch on to roots as easily. The rate at which Port-Orford-cedar dies from the introduced root disease could likely cause the population size to fall outside the range of natural variability.

Ultramafic rocks weather to produce landforms with unique topography and hydrology, often prone to mass wasting and erosion in areas with heavy precipitation. The highly sheared structure and low water permeability of the ultramafic rocks result in frequent springs and bogs, flashy flows, inner gorge landslides, and highly erodible stream channels which are sensitive to ground disturbance. The interaction of stream flow with large boulders and resistant outcrops can result in diverse channel morphology. Because ultramafic riparian areas have fewer trees than conifer or hardwood riparian, there is less large wood providing structure in the stream channel. However, when large Port-Orford-cedar is delivered to the channel, it decomposes slowly and functions as structure for a longer period of time than a similar piece of Douglas-fir. Because of the open canopy, stream temperatures are usually much warmer than in streams bordered by dense conifer or hardwood forest. The soil chemistry results in naturally higher pH water than in streams that flow through other soil types.

Although plant diversity is high, terrestrial vertebrate diversity and abundance is low. This is a result of the low thermal cover and low availability of forage. Most use by terrestrial vertebrates is seasonal. Riparian areas are important both as water sources and as travel corridors.

Restoration and enhancement attempts in sparsely vegetated ultramafic areas have had limited success. Development of disease-resistant Port-Orford-cedar and five-needle pine species could improve the success of revegetation in disturbed ultramafic riparian areas.

What is the character of the different sections of the watershed?

Waters Creek to Billings Creek

A band of ultramafic rocks and soils extends across the western portion of the watershed. Subwatersheds containing the ultramafics include Waters, Slide, Twomile, Lone Tree, Foster and Billings Creeks. Riparian processes associated with ultramafic soils are described in the previous section.

The Foster Creek slide and other large slump/earthflow features discussed in Geology sections of the subwatershed descriptions create high frequencies of disturbance to the streams that characteristically form their margins or flow along their toes. These riparian areas have higher delivery rates for sediment (including turbidity), large wood, and other nutrients. They also have a more open canopy than other riparian types.

Riparian areas that extend up to the tops of the ridges in these subwatersheds provide connectivity from the Fish Hook/Galice Late-Successional Reserve to the Lobster Creek portion of the Northwest Coast Late-Successional Reserve.

There is a low divide between the Rogue River and South Fork Coquille River located at the top of Billings Creek. During summer, cool, moist air from the Coquille watershed will often spill over this divide into the otherwise hot, dry Rogue watershed. Thus, the divide associated with Billings Creek Riparian Reserves is a connection between the Klamath Mountains and Oregon Coast provinces.

Foster and Twomile Creeks have been infected with *Phytophthora lateralis,* which has killed Port-Orford-cedar (POC) located within the riparian areas of the mainstems and many of their tributaries. Loss of riparian shade may be increasing summer stream temperature. In August 1990, an aerial survey was conducted to map the extent of the dead and dying Port-Orford-cedar. It showed the amount of infection to vary within the drainage from lightly scattered to large pockets consisting of 10 or more trees. The main concentrations were found on the main stem of Twomile Creek and three of its tributaries located in sections 23, 25 and 26. As the infection continues to spread in the drainage, short and long term impacts will increase.

A 1990 proposal to restore stream shade by planting coniferous and deciduous seedlings in affected riparian areas has not been implemented because the KV funds were not generated. Impacts can be reduced by replanting infected areas with a mix of hardwoods for short-term stream shade recovery and conifers and resistant species of cedar for long-term recovery and diversity. Helicopter salvage of selected pockets of POC in heavily infected areas would cause a minimum of disturbance within the riparian area and could facilitate replanting for restoration shade, provided site-specific prescriptions were followed. This would leave scattered dead trees to provide woody material for the stream and act as sediment traps.

The Waters Creek subwatershed is notable because it has uninfected stands of Port-Orford-cedar.

Rogue River Corridor

The riparian zone along the Rogue River provides a regional-scale connection from the Cascades to the Pacific Ocean for wildlife, plants, and humans. The Rogue River corridor from Marial to the Illinois River provides low elevation habitat for plants and animals unique to the coast range.

Aquatic

The river transports sediment, large wood, nutrients, and pollutants from the Cascades, the interior valleys, agriculture lands, and urban population centers. Patterns of stream flow, including peak flows, are influenced by Cascade snowpack, by Lost Creek dam on the upper Rogue River and by Applegate dam on that middle Rogue River tributary.

All anadromous fish that use the Rogue River and its tributaries use this section of the river as a migration route to and from the Pacific Ocean. The river also provides warm water for non-native species introduced upriver, such as redsided shiners and bass.

Plants

The flood zone, the area from summer water level to the elevation of extreme flood events, experiences periodic flow events that maintain early seral vegetation of willows, alders, and other tolerant species.

Yellow star thistle and purple loosestrife are both highly invasive noxious weeds, which are transported downstream into the watershed from the infested agricultural areas of the Upper Rogue and Applegate valleys.

Wildlife

Populations of inland species like the common kingsnake and California kingsnake that are unique on the coastal side of the Siskiyou National Forest inhabit the meadows and open woodlands (black/white oak savannas) found in this section of the Rogue River corridor.

Populations of bald eagles and osprey rely on the riparian area for nest and roost sites near the food supply of the river. Pond turtles use the summer calm of back eddies and shallow water where it occurs scattered along the margins of the main flows in the canyon.

Social

The river has provided a transportation corridor for humans for as long as humans have lived in the area, from prehistoric times to today. It is a low elevation route with plentiful wild food sources. Because of the rugged topography, road construction was limited during the period of Euro-American settlement. Residences and lodges still rely on the river for sole access, primarily by boat although foot access is possible along the Rogue River Trail, which is in the riparian zone.

Low Elevation Meadows

Stringers of meadows and rocky, open areas occur on the lower reaches of south-facing slopes in the watershed. Meadow riparian features and processes are described above. These areas are located primarily on mudstone-derived soils above the north bank of the mainstem Rogue River, between Billings and Mule Creek, and above the north bank of Shasta Costa Creek. These meadows and their associated Riparian Reserves are, in many aspects, an extension of the open, rocky habitat found along the mainstem Rogue River. Fire suppression has allowed the surrounding forests to encroach upon and reduce the size of these meadows.

High Elevation Sites

Located on the eastern boundary of the watershed are ridges that reach up to 5,316 feet in elevation. Areas greater than 4,000 feet in elevation are generally not influenced by winter rains, and accumulate a snow pack that persists into late spring and early summer. Along Bear Camp Ridge, between Brandy Peak and Bear Camp Peak, and also in the area of Bob's Garden Mountain, pockets of unique habitat persist on north-facing slopes. Small cirques, carved by glaciers, and scattered avalanche chutes support riparian communities tolerant of cold, damp conditions. The Alaska yellow cedar and true-fir plant associations found in these areas are rare in the Oregon South Coast region and are more typical of the interior Cascades Mountains. Disjunct populations of other species isolated from their normal ranges that are found here include tufted saxifrage, Hall's isopyrum, Umpqua frasera, six species of penstemon, five species of currant, four species of stonecrop, the moss *Encalypta brevicolla* var. *crumiana,* and at least 13 genera of the lily family. Such large aggregations of these groups are highly unusual. The Bear Camp Botanical Area was established to protect these unique features. Although they occupy only a small percentage of the watershed, the high elevation communities contribute to its overall diversity. Additional information is in the Shasta Costa Watershed Analysis, page 43.

Another riparian specialty associated with higher elevation bands in the watershed is found on the high ridges in the eastern portion of the watershed. Riparian zones above 3,500 feet in elevation support the rare plant, *Bensoniella oregana*. This small flowering plant grows on the margins of streams and moist meadow riparian areas. It is found mainly on steep, north-facing slopes in colluvial deposits. Bensoniella is an inconspicuous member of the saxifrage family. It is found in the Coast Range Mountains from Douglas County, Oregon south to Humboldt County, California. There were 72 known populations in 1988, all but 15 of which were on the Siskiyou National Forest, and over half of which were found in the Shasta Costa subwatershed (Lang, 1988).

How much timber harvest has occurred in riparian reserves?

From PMR vegetation data (wildlife groupings) and managed stand data:

Table 9. Riparian Condition

Subwatershed	Percent Mature and Old Growth	Percent Harvested
22F Foster Creek	45	16
22M	45	9
22S Shasta Costa Creek	53	11

23L	57	6
23S Stair Creek	59	7
23U	46	0

Within these subwatersheds, some WAAs had as much as 50 percent harvested. Most of this harvest was more than 20 years ago, and some riparian areas are now well shaded by hardwoods and small conifers. Individual assessment of stream channels would be needed to determine the current shade condition.

The percent of mature and old growth riparian vegetation within individual WAAs ranges from 35 percent to 75 percent. None are at the 80 percent level usually considered to be the natural condition, even though some WAAs had little to no harvest.

Information Needs: There is a need to conduct site-specific analysis and surveys to support management activities within Riparian Reserves, as described in the Record of Decision for Amendments to Forest Service and Bureau of Land Management Planning Documents Within the Range of the Northern Spotted Owl (USDA and USDI, 1994). There is a need to determine whether previous riparian buffers were effective in protecting riparian processes.

Management Opportunities: There is an opportunity to implement management activities within Riparian Reserves which preserve the critical riparian processes, and meet the objectives of the Aquatic Conservation Strategy; and to restore riparian processes where they are not properly functioning.

Specifically:

> Meadows and Oak Savannas have been encroached upon by conifers due to the exclusion of fire. Riparian ecosystem processes that have been described above should be maintained during restoration efforts.

Riparian thinning and/or RIPARIAN ECOSYSTEM NARRATIVE

What are the riparian processes in the watershed?

Stream Types

The character of a riparian area is inseparable from the character of the water body it surrounds. In this section of the Rogue River, streams are the dominant type of water body. Streams can be grouped, based on the surface flow regime, into three broad categories: ephemeral, intermittent and perennial streams. Likewise, riparian processes and functions can be grouped along the same lines.

.

An intermittent channel is defined by the ROD (USDA and USDI, 1994) as “any nonpermanent flowing drainage feature having a definable channel and evidence of annual scour or deposition” (ROD, B-14). This definition includes both “ephemeral” channels and “intermittent” channels. Ephemeral channels carry only stormflow, while intermittent channels are supplied by groundwater during part of the year (Reid and Ziemer, 1994).

Most ephemeral channels contain water for only a few days of the year and may not support riparian vegetation, so they are unlikely to have much direct significance for riparian-dependant species. Their major role is their influence on downstream channels. They supply sediment, water, and organic materials. Depending on the contrast between the ephemeral channels and the surrounding upland areas, they may or may not be significant migration corridors or unique wildlife habitat. (Reid and Ziemer, 1994).

Intermittent channels are important as seasonal sources of water, sediment, allochthonous material, and large wood. Because intermittent channels can form a high proportion of the entire channel system in a watershed, they contribute significantly to downstream reaches (Reid and Ziemer, 1994). It is therefore important to maintain their function of allochthonous material sources. These small streams are easily influenced by forest management activities and manipulations of the canopy or streambank vegetation can influence the stream's energy supply (Chamberlain et al., 1991). Because they do not have surface flow during late summer, intermittent streams are not a source of warm water to the summer stream network.

Intermittent channels can be important to those amphibian species which do not need open water throughout the year. These streams may be particularly important as nursery areas for amphibians because these sites support fewer aquatic predators than perennial channels (Reid and Ziemer, 1994).

The more different a riparian area is from its surrounding upland - in structure, humidity, thermal regime or nutrient availability - the more important the riparian area is for riparian-dependant species. When riparian areas are distinct from surrounding uplands, they can function as travel corridors and provide microclimatic refuge for riparian-dependant species (Reid and Ziemer, 1994). The distinctive vegetation and higher moisture content of these sites can also modify fire behavior, so their distribution can affect the patchiness of large burns. Since the watershed does not experience long, cold winters, riparian areas here are not critical for providing thermal protection from winter extremes.

Intermittent channels and their riparian zones are highly variable in their ability to provide habitat that is different from the surrounding uplands. Some riparian areas around intermittent channels are identical to the surrounding upland and some have a vastly different character.

Perennial streams, because they have surface flow throughout the year, generally support a riparian area quite distinct from the surrounding upland. The continually wet habitat they provide allows the fuller development of riparian-dependant plant and animal communities. During late summer and early autumn, when the surrounding uplands are typically quite hot and dry in this section of the Rogue River, riparian areas along perennial streams become especially important for riparian-dependant species. Organisms, which were previously dispersed into the riparian areas along intermittent streams or into upland areas, congregate along perennial streams to find suitable conditions.

Nutrient Routing

There are two sources of the nutrients necessary to support riparian-dependent species: **autochthonous sources** (produced on site, usually from photosynthesis), and **allochthonous sources** (produced off-site and transported into the area). Aquatic and riparian ecosystems increase in complexity with the progression from headwater tributaries downstream to the mouths of the mainstem rivers. Allochthonous sources dominate in the upper reaches of the watershed and the availability of autochthonous sources increases further downstream.

Autochthonous sources of energy are affected by stream size, gradient, and exposure to sunlight. Allochthonous sources of energy contribute organic matter to the stream by four main pathways: litterfall from streamside vegetation; groundwater seepage; soil erosion; and fluvial transport from upstream. Organic matter from these sources differs in when and how it enters the stream, how it decays, and where it predominates (Murphy and Meehan, 1991).

Most animals require food with a Carbon to Nitrogen ratio (C:N) less than 17:1. Almost all forms of allochthonous organic matter have higher C:N ratios, so they require microbial processing to enhance food quality. The quality of various forms of organic matter varies widely, as measured by the C:N ratio. At the low nutritional end of the spectrum are woody debris and conifer needles (wood has a C:N ratio of 1,343:1); at the high end of nutritional quality are periphyton, macrophytes, and fast-decaying deciduous leaves (macrophytes 8:1 and alder leaves 23:1) (Murphy and Meehan, 1991).

What are the vegetative types of riparian areas in the watershed?

Riparian zones in this section of the Rogue River can be stratified into four distinct categories based on vegetative characteristics. These are conifer forest, hardwood forest, meadows, and riparian areas on soils developed in serpentinite and peridotite (ultramafic soils). Each category has its own processes for sediment delivery, channel formation, hydrologic regime, susceptibility and response to change, microclimate qualities, flora, fauna, and migration habitat qualities.

Conifer Forest Riparian

The most abundant riparian type in the Rogue River, Marial to Agness, watershed is the conifer forest riparian. It is generally located on soils with high to moderate productivity, where water supply is not limiting growth and topography tends to exclude frequent or intense fire. Abundant, tall conifers dominate these riparian areas. Douglas-fir is by far the most common overstory conifer, with Port-Orford-cedar often present. Pacific yew has very scattered distribution.

The stand canopy is closed in these areas and many stands have multi-layered canopies. Hardwood trees are often an important mid-layer component. Conifers, with the exception of cedars, create more acidic soils through litterfall than hardwoods. The evapotranspiration associated with the numerous large trees is high. Air temperatures are cool and diurnal fluctuations are moderated throughout the year. These riparian ecosystems maintain important microclimates.

The stands are generally very stable. Tanoak seldom reaches climax condition due to the time-span required for this succession and the longevity of dominant conifers (200 to 300 years). Fire does not start or carry well in most of these stands. Light disturbance from windthrow, land movement, wind or snow damage leads to continual recruitment of conifers. In the event of large-scale disturbances these riparian stands are slow to recover to a mature state. Where Port-Orford-cedar is present in the riparian zone, roads and streams are important conduits for *Phytophthora lateralis* (Port-Orford-cedar root disease).

Conifer stands often have a higher percentage of perennial streams than other vegetation types. Root strength and often-dense undergrowth contribute to generally stable stream banks. However, riparian conifer stands can develop on earthflows, and exhibit features of deep-seated instability. Earthflows can be important sources of structure for stream channels by providing boulders and large wood. Throughout conifer riparian areas, large wood in the form of limbs and boles is continuously delivered to and incorporated into the channels. Stream temperatures tend to be cool throughout the year. Tall trees can shade even moderately wide channels in summer.

Where coniferous riparian areas are surrounded by similar upland stands, they are important water sources for interior habitat-dependent wildlife. When they are dissimilar to the surrounding upland habitat, they are important uphill-downhill dispersal corridors for interior species. Stable air temperatures make them valuable thermal refugia in extreme weather for many wildlife species. These riparian stands can be important habitat for spotted owls.

Conifer riparian areas can have a moist microclimate and be important to organisms requiring cold, wet environments. For example, Pacific giant salamanders utilize headwater streams to lay their eggs (Stebbins, 1966), and talus habitat in these moist areas can be important for Del Norte salamanders. Meadow and hardwood riparian areas usually receive more solar energy and favor species adapted to more sunlight, lower humidity and warmer temperatures.

Riparian stands of red alder are generally an early to mid-seral stage of the riparian conifer forest. These stands were usually created by stand replacement events such as timber harvest, debris flows, inner gorge landslides, and floods. In some areas red alder is an important component of a mature conifer riparian ecosystem. These alder stands can be important habitat for white-footed voles, and alder leaves are a good source of nutrients for the aquatic ecosystem.

Because of its abundance and high value wood production, more land use activities have occurred in conifer riparian stands than in any of the other riparian types. Therefore, conifer riparian stands are most likely to be candidates for restoration.

Hardwood Forest Riparian

Hardwood-forested riparian stands tend to replace conifer-forested riparian stands where water is limiting or where a regime of either frequent low intensity or high intensity fires has disturbed the riparian zone. Hardwood riparian stands are usually dominated by tanoak trees, with madrone, myrtle, chinquapin, knobcone and sugar pines often present. Scattered conifers such as Douglas-fir will grow directly out of the stream channel, where there is more water, but they are anomalies in these stands.

Although the canopy is closed, the single-storied structure does not have the insulating qualities of the conifer forest. Humidity is much lower and air temperatures vary a great deal with the seasons. The microclimate differs little from surrounding upland. Fire will both start and carry well in the riparian stands. These stands have low resistance to change from fire and wind and snow damage. Yet their closed canopy, single-storied structure is quick to regenerate. Ground cover is usually low, leading to more surface erosion than conifer riparian stands, but their characteristic stump sprouting after disturbance leads to consistent bank stability.

Hardwood riparian stands are generally similar to their upland surroundings, making them valuable watering sites for local wildlife. They are less important for thermal cover and migration corridors than coniferous riparian stands. Their acorn crop makes them important foraging areas for mast-dependent wildlife.

The economic value of the hardwoods is much lower than conifers, so far less timber harvest has occurred in these riparian areas. As a result, restoration opportunities in this riparian type are few.

Meadow and Oak Savanna Riparian

The majority of meadow riparian areas are open canopy areas. As a result, these types of riparian areas receive high amounts of solar radiation; have high diurnal temperature fluctuations, little microclimate differences, and a narrow range of influence beyond the active channel. Fire will start and carry very rapidly through meadow riparian areas. They are dependent upon frequent fire for maintaining their open canopy characteristics.

Light vegetative covering makes easily destabilized banks prone to downcutting and headwall erosion following disturbance. Water temperatures show a strong diurnal fluctuation, similar to air temperatures. On-site diversity in these areas is low, yet may include highly specialized or unique species. Downstream aquatic diversity is increased because of the different types of production occurring at these sites.

Riparian areas bordering meadows provide important water sites for meadow-dependent wildlife species. Their location along the edge of the forest/meadow ecotone increases the on-site diversity of terrestrial species. The meadow riparian areas provide connection corridors for meadow-dependent species.

Ultramafic Riparian

At these sites high levels of magnesium relative to calcium, high levels of nickel and chromium, and low levels of available soil water limit plant species to those tolerant of these conditions. These specialized communities contribute to the overall biological diversity of the watershed.

Most stands have an open to moderately closed canopy (20 to 70 percent). Understory vegetation cover varies from open to dense. The typically unstable slopes of ultramafic derived soils create high disturbance frequency, contributing to the sparseness of the canopy. Because of the more open canopy, seasonal and diurnal temperatures fluctuate more than in other riparian stands. However, ultramafic riparian stands provide a cooler, contrasting microclimate to the harsh upland ultramafic areas often dominated by open Jeffrey pine stands.

Port-Orford-cedar is often the primary overstory component in riparian areas. Port-Orford-cedar grows slowly on these sites, generally reaching 30 inches in diameter in 400 years on seasonal streams and 30 inches in 200 to 300 years in perennial wet sites. It will remain standing long after it dies. While Port-Orford-cedar has a slow decomposition rate, the sparse vegetative cover on ultramafics creates a low fuel load. This, in turn, results in low intensity fires when fire occurs.

Phytophthora lateralis is an introduced pathogen that kills Port-Orford-cedar, reducing shade and concentrating the delivery of large wood. Mortality rates in well-established disease sites are generally higher in the flat, wet sites and lower on steeper stream sections where spores cannot catch on to roots as easily. The rate at which Port-Orford-cedar dies from the introduced root disease could likely cause the population size to fall outside the range of natural variability.

Ultramafic rocks weather to produce landforms with unique topography and hydrology, often prone to mass wasting and erosion in areas with heavy precipitation. The highly sheared structure and low water permeability of the ultramafic rocks result in frequent springs and bogs, flashy flows, inner gorge landslides, and highly erodible stream channels which are sensitive to ground disturbance. The interaction of stream flow with large boulders and resistant outcrops can result in diverse channel morphology. Because ultramafic riparian areas have fewer trees than conifer or hardwood riparian, there is less large wood providing structure in the stream channel. However, when large Port-Orford-cedar is delivered to the channel, it decomposes slowly and functions as structure for a longer period of time than a similar piece of Douglas-fir. Because of the open canopy, stream temperatures are usually much warmer than in streams bordered by dense conifer or hardwood forest. The soil chemistry results in naturally higher pH water than in streams that flow through other soil types.

Although plant diversity is high, terrestrial vertebrate diversity and abundance is low. This is a result of the low thermal cover and low availability of forage. Most use by terrestrial vertebrates is seasonal. Riparian areas are important both as water sources and as travel corridors.

Restoration and enhancement attempts in sparsely vegetated ultramafic areas have had limited success. Development of disease-resistant Port-Orford-cedar and five-needle pine species could improve the success of revegetation in disturbed ultramafic riparian areas.

What is the character of the different sections of the watershed?

Waters Creek to Billings Creek

A band of ultramafic rocks and soils extends across the western portion of the watershed. Subwatersheds containing the ultramafics include Waters, Slide, Twomile, Lone Tree, Foster and Billings Creeks. Riparian processes associated with ultramafic soils are described in the previous section.

The Foster Creek slide and other large slump/earthflow features discussed in Geology sections of the subwatershed descriptions create high frequencies of disturbance to the streams that characteristically form their margins or flow along their toes. These riparian areas have higher delivery rates for sediment (including turbidity), large wood, and other nutrients. They also have a more open canopy than other riparian types.

Riparian areas that extend up to the tops of the ridges in these subwatersheds provide connectivity from the Fish Hook/Galice Late-Successional Reserve to the Lobster Creek portion of the Northwest Coast Late-Successional Reserve.

There is a low divide between the Rogue River and South Fork Coquille River located at the top of Billings Creek. During summer, cool, moist air from the Coquille watershed will often spill over this divide into the otherwise hot, dry Rogue watershed. Thus, the divide associated with Billings Creek Riparian Reserves is a connection between the Klamath Mountains and Oregon Coast provinces.

Foster and Twomile Creeks have been infected with *Phytophthora lateralis,* which has killed Port-Orford-cedar (POC) located within the riparian areas of the mainstems and many of their tributaries. Loss of riparian shade may be increasing summer stream temperature. In August 1990, an aerial survey was conducted to map the extent of the dead and dying Port-Orford-cedar. It showed the amount of infection to vary within the drainage from lightly scattered to large pockets consisting of 10 or more trees. The main concentrations were found on the main stem of Twomile Creek and three of its tributaries located in sections 23, 25 and 26. As the infection continues to spread in the drainage, short and long term impacts will increase.

A 1990 proposal to restore stream shade by planting coniferous and deciduous seedlings in affected riparian areas has not been implemented because the KV funds were not generated. Impacts can be reduced by replanting infected areas with a mix of hardwoods for short-term stream shade recovery and conifers and resistant species of cedar for long-term recovery and diversity. Helicopter salvage of selected pockets of POC in heavily infected areas would cause a minimum of disturbance within the riparian area and could facilitate replanting for restoration shade, provided site-specific prescriptions were followed. This would leave scattered dead trees to provide woody material for the stream and act as sediment traps.

The Waters Creek subwatershed is notable because it has uninfected stands of Port-Orford-cedar.

Rogue River Corridor

The riparian zone along the Rogue River provides a regional-scale connection from the Cascades to the Pacific Ocean for wildlife, plants, and humans. The Rogue River corridor from Marial to the Illinois River provides low elevation habitat for plants and animals unique to the coast range.

Aquatic

The river transports sediment, large wood, nutrients, and pollutants from the Cascades, the interior valleys, agriculture lands, and urban population centers. Patterns of stream flow, including peak flows, are influenced by Cascade snowpack, by Lost Creek dam on the upper Rogue River and by Applegate dam on that middle Rogue River tributary.

All anadromous fish that use the Rogue River and its tributaries use this section of the river as a migration route to and from the Pacific Ocean. The river also provides warm water for non-native species introduced upriver, such as redsided shiners and bass.

Plants

The flood zone, the area from summer water level to the elevation of extreme flood events, experiences periodic flow events that maintain early seral vegetation of willows, alders, and other tolerant species.

Yellow star thistle and purple loosestrife are both highly invasive noxious weeds, which are transported downstream into the watershed from the infested agricultural areas of the Upper Rogue and Applegate valleys.

Wildlife

Populations of inland species like the common kingsnake and California kingsnake that are unique on the coastal side of the Siskiyou National Forest inhabit the meadows and open woodlands (black/white oak savannas) found in this section of the Rogue River corridor.

Populations of bald eagles and osprey rely on the riparian area for nest and roost sites near the food supply of the river. Pond turtles use the summer calm of back eddies and shallow water where it occurs scattered along the margins of the main flows in the canyon.

Social

The river has provided a transportation corridor for humans for as long as humans have lived in the area, from prehistoric times to today. It is a low elevation route with plentiful wild food sources. Because of the rugged topography, road construction was limited during the period of Euro-American settlement. Residences and lodges still rely on the river for sole access, primarily by boat although foot access is possible along the Rogue River Trail, which is in the riparian zone.

Low Elevation Meadows

Stringers of meadows and rocky, open areas occur on the lower reaches of south-facing slopes in the watershed. Meadow riparian features and processes are described above. These areas are located primarily on mudstone-derived soils above the north bank of the mainstem Rogue River, between Billings and Mule Creek, and above the north bank of Shasta Costa Creek. These meadows and their associated Riparian Reserves are, in many aspects, an extension of the open, rocky habitat found along the mainstem Rogue River. Fire suppression has allowed the surrounding forests to encroach upon and reduce the size of these meadows.

High Elevation Sites

Located on the eastern boundary of the watershed are ridges that reach up to 5,316 feet in elevation. Areas greater than 4,000 feet in elevation are generally not influenced by winter rains, and accumulate a snow pack that persists into late spring and early summer. Along Bear Camp Ridge, between Brandy Peak and Bear Camp Peak, and also in the area of Bob's Garden Mountain, pockets of unique habitat persist on north-facing slopes. Small cirques, carved by glaciers, and scattered avalanche chutes support riparian communities tolerant of cold, damp conditions. The Alaska yellow cedar and true-fir plant associations found in these areas are rare in the Oregon South Coast region and are more typical of the interior Cascades Mountains. Disjunct populations of other species isolated from their normal ranges that are found here include tufted saxifrage, Hall's isopyrum, Umpqua frasera, six species of penstemon, five species of currant, four species of stonecrop, the moss *Encalypta brevicolla* var. *crumiana,* and at least 13 genera of the lily family. Such large aggregations of these groups are highly unusual. The Bear Camp Botanical Area was established to protect these unique features. Although they occupy only a small percentage of the watershed, the high elevation communities contribute to its overall diversity. Additional information is in the Shasta Costa Watershed Analysis, page 43.

Another riparian specialty associated with higher elevation bands in the watershed is found on the high ridges in the eastern portion of the watershed. Riparian zones above 3,500 feet in elevation support the rare plant, *Bensoniella oregana*. This small flowering plant grows on the margins of streams and moist meadow riparian areas. It is found mainly on steep, north-facing slopes in colluvial deposits. Bensoniella is an inconspicuous member of the saxifrage family. It is found in the Coast Range Mountains from Douglas County, Oregon south to Humboldt County, California. There were 72 known populations in 1988, all but 15 of which were on the Siskiyou National Forest, and over half of which were found in the Shasta Costa subwatershed (Lang, 1988).

How much timber harvest has occurred in riparian reserves?

From PMR vegetation data (wildlife groupings) and managed stand data:

Table 9. Riparian Condition

Subwatershed	Percent Mature and Old Growth	Percent Harvested
22F Foster Creek	45	16
22M	45	9
22S Shasta Costa Creek	53	11

23L	57	6
23S Stair Creek	59	7
23U	46	0

Within these subwatersheds, some WAAs had as much as 50 percent harvested. Most of this harvest was more than 20 years ago, and some riparian areas are now well shaded by hardwoods and small conifers. Individual assessment of stream channels would be needed to determine the current shade condition.

The percent of mature and old growth riparian vegetation within individual WAAs ranges from 35 percent to 75 percent. None are at the 80 percent level usually considered to be the natural condition, even though some WAAs had little to no harvest.

Information Needs: There is a need to conduct site-specific analysis and surveys to support management activities within Riparian Reserves, as described in the Record of Decision for Amendments to Forest Service and Bureau of Land Management Planning Documents Within the Range of the Northern Spotted Owl (USDA and USDI, 1994). There is a need to determine whether previous riparian buffers were effective in protecting riparian processes.

Management Opportunities: There is an opportunity to implement management activities within Riparian Reserves which preserve the critical riparian processes, and meet the objectives of the Aquatic Conservation Strategy; and to restore riparian processes where they are not properly functioning.

Specifically:

> Meadows and Oak Savannas have been encroached upon by conifers due to the exclusion of fire. Riparian ecosystem processes that have been described above should be maintained during restoration efforts.

Riparian thinning and/or planting in existing managed stands is a possible management opportunity. Silvicultural practices should be used in these riparian areas to control stocking, reestablish and manage stands, and acquire desired vegetation characteristics needed to attain Aquatic Conservation Strategy objectives. planting in existing managed stands is a possible management opportunity. Silvicultural practices should be used in these riparian areas to control stocking, reestablish and manage stands, and acquire desired vegetation characteristics needed to attain Aquatic Conservation Strategy objectives.

TERRESTRIAL ECOSYSTEM NARRATIVE

Vegetative Characterization

The Rogue River watershed from Marial to Agness contains a diverse assortment of plant communities and vegetation types. This watershed lies in the drier inland Siskiyou habitats. In addition, the watershed has a wide variation in aspect, elevation, slope and soil types.

Much of the watershed is vegetated by Douglas-fir forest with hardwoods and brush in the understory. Douglas-fir/white fir are found at higher elevations in the watershed. Ultramafic soils in the western portion of the watershed analysis area support a variety of conifers, including Jeffrey pine, western white pine, and incense cedar on the drier upper slopes and Port-Orford-cedar in wet areas.

Ninety-seven percent of the watershed in National Forest and Bureau of Land Management ownership is in management allocations that will promote late-successional habitat; 60 percent Late-Successional Reserve, 31 percent Wilderness, 5 percent Supplemental Resource and less than 1 percent Wild Rogue River, Botanical and Unique Interest. Private ownership comprises 3 percent of the watershed.

Timber harvest has occurred on approximately 10 percent of the watershed. Most harvest activities have occurred within the Twomile, Foster, Billings, Stair and Shasta Costa Creek drainages. Nearly 7,219 acres or 9 percent of the watershed are now managed as conifer plantation. Although most plantations are established, some newer reforestation efforts are ongoing. Partial cut or shelterwood harvest activities have been implemented on approximately 1,110 acres.

Late-Successional forest is present on approximately 50 percent of the watershed. Young forest occurs on an estimated 26 percent of the watershed. Seedling-sapling-pole forest occurs on 21 percent, shrub and grass/forb habitat comprises 2 percent, rock 1 percent and water less than 1 percent of the watershed.

Approximately 409 acres of the Bear Camp Botanical Area lies within the Shasta Costa and Stair Creek watersheds. This area contains a variety of *Ribes* spp. (*bracteosum, binominatum, cruentum, lacustre, sanguineum*) and at least 5 species of *Penstemon* (*anguineus, cardwellii, deustus, parvulus, rupicola*) in close proximity to one another. In addition a few plant species uncommon to southwest Oregon such as *Stenanthium occidentale, Frasera umpquaensis, Chamaecyparis nootktensis* (Alaska yellow-cedar), *Isopyrum hallii and Saxifragia caespitosa* are found in the area.

Port-Orford-cedar is found on approximately 14,187 acres, mostly in the western portion of the watershed analysis area. Approximately 18 percent of this acreage is infected with Port-Orford-cedar root disease, *Phytophthora laterali*s. The most infected areas are Twomile Creek, Foster Creek, North Fork of Foster Creek, Watson Creek, and Fall Creek. Limited information is available on Port-Orford-cedar distribution and disease on privately owned land.

Wildlife Habitat Characterization

The Rogue River watershed from Marial to Agness contains a large portion (21 percent) of the larger Fish Hook/Galice Late-Successional Reserve (LSR). The watershed analysis area is just east of the known range of the marbled murrelet. The late-successional habitat in the watershed provides important habitat for the American marten, pileated woodpecker and the threatened northern spotted owl, which are indicator species, meaning they represent other species that use similar habitat types. This version of the Rogue River (Marial to Agness) Watershed Analysis includes areas covered by Pacific Meridian Resources (PMR) data, which is primarily National Forest Lands with some private, BLM and other lands. Currently 50 percent of the 81,424-acre watershed is late-successional habitat.

Early successional habitat (grass/shrub/seedling-sapling-pole) in the watershed is found in recent clearcut areas, meadows, open woodland areas and brushfield areas. Twenty-three percent, 18,585 acres, of the watershed is currently in this condition. However, only a portion of this early successional habitat is in an open canopy condition, which will provide the pioneer habitat for species that require grass/forb, low shrub, open seedling-sapling-pole habitat for all or part of their life history. The majority of the existing clearcut areas that are currently open enough to provide this type of habitat will grow out of this condition within the next ten years. The meadow habitat is being encroached by trees. Pioneer successional habitat provides habitat for black-tailed deer, Roosevelt elk and other species that utilize grass/forb, shrub and open sapling-pole plant communities.

Compared with other watersheds, a relatively large portion of the watershed is sparsely vegetated or covered with rock (784 acres or 1.0 percent). This watershed contains an estimated 267 acres or 0.3 percent water. The remaining 26 percent of the watershed is in young successional habitat, which typically is smaller diameter trees with closed canopy.

What is the historic and existing late-successional habitat in the watershed?

Historic levels of late-successional forest (pre-1850 to 1950) have fluctuated over time due to climatic changes and human influence (Atzet and Martin, 1991). The Regional Ecosystem Assessment Report (USDA, 1993) estimated historic levels of late-successional habitat between 45 and 75 percent for the Lower Rogue Basin. This portion of the Rogue Watershed (Marial to Agness) is at the low end of this range.

Approximately 50 percent of the portion of the Rogue River (Marial to Agness) watershed is presently in late-successional forest (see Seral Stages Map). Historical vegetation mapping shows 69 percent of the Rogue River (Marial to Agness) watershed provided late-successional habitat in the 1940s, prior to any timber harvest (see 1940 Vegetation Map). Burning by Native Americans and early Euroamerican settlers probably reduced what could have been late-successional habitat in 1940 to lower levels. The exact percentage or level cannot be determined.

Late-successional forests are one facet of overall biological diversity. However, late-successional forests require special consideration because their integrity as functioning ecosystems and their ability to provide habitat to species associated with the forest interior may be strongly influenced by stand size (Rosenburg and Raphael, 1986). Logging in the Pacific Northwest has reduced the size of late-successional forests, resulting in regionwide changes in wildlife species composition (Rosenberg and Raphael, 1986). On the Siskiyou National Forest much of the timber harvested has been on productive lower elevation sites. The amount of late-successional habitat on the Forest has been reduced nearly 26 percent since 1940 (USDA, 1989, Forest Plan FEIS, Chapter III-Affected Environment, page III-115).

Stands of late-successional forests are becoming isolated as harvest, fire and other activities disrupt connections between large, contiguous blocks of this habitat. This fragmentation threatens the ecological value of the remaining late-successional forests, including their value as habitat for forest interior plants and animals. The full impact of fragmentation of late-successional forests is not completely understood, but the populations and numbers of species associated with mature and late-successional forests can decrease if fragmentation, isolation, and reduction in stand size continues.

Interior forest habitat includes those portions of the late-successional forest areas that are not influenced by "edge effect." Edge effect is the result of changes in microclimate and species composition, which are caused by an increased exposure to sun and wind. Edge effect penetrates a forest edge for approximately two tree lengths or about 400 feet into the forest interior, which is a guideline for the Pacific Northwest (Harris, 1984; Franklin and Forman, 1987). The preliminary results of current research (Spies et al., 1990) generally support this approximate distance.

Interior late-successional habitat was analyzed using GIS seral stages from stand level data. Interior habitat was determined by buffering in from openings in the forest. Buffering distances used were 400 feet from clearcuts or natural openings less than 40 years old. Because stands on ultramafic soils are largely open, and do not contain the same microclimates typical of closed canopy late-successional stands, these stands were not included as interior late-successional habitat. A 400-foot buffer from these stands was not applied. Some of these stands may provide typical microclimates associated with closed canopies, but an analysis of each stand was not feasible. Current interior old-growth habitat is shown on the Interior Late-Seral Habitat Map.

Table 10. Distribution of Interior Late-Successional Forest Blocks within the Rogue River (Marial to Agness) watershed.

	Historic (1940)		Current Condition		Future (2040)	
Block Size in Acres	**Number of Blocks**	**Total Acres**	**Number of Blocks**	**Total Acres**	**Number of Blocks**	**Total Acres**
1-25	3	26	29	489	734	3,662
26-50	1	26	18	624	44	1,476
51-100	5	413	16	1,153	28	1,879
101-300	12	2,249	6	1,127	13	2,086
301-500	6	2,344	6	2,483	4	1,652
501-700	8	4,875	0	0	0	0
701-900	5	3,976	0	0	2	1,487
>900	17	22,914	1	1,499	5	8,398
Total Interior Acres		**36,823***		**7,375***		**20,640***

* Historic interior old growth acres are based on broad scale timber typing from 1940 aerial photos. Current condition interior old growth acres are based on analysis of 30-meter pixel data from satellite imagery (PMR data). The difference in detail between the two sources accounts for most of the difference in interior old growth acres between these two dates. Increases in future interior old growth acres are based on projected growth of large stands of young conifers in the watershed.

These stands originated during extensive stand replacement fires prior to the era of fire suppression that began in the early 1900s.

The National Forest Management Act (36 CFR 219.19) requires the maintenance of viable populations of vertebrate species well distributed throughout their current geographic range. Late-Successional Reserves have been designated to accomplish this direction for species that use this habitat type (USDA and USDI, 1994). Sixty percent of the watershed has been designated Late-Successional Reserve and another 37 percent of the watershed will be managed towards a late-successional habitat condition through other land allocations. The remaining 3 percent of the watershed is in private ownership.

The above tables show that there are currently lesser amounts of late-successional habitat in the Rogue River Watershed (Marial to Agness) than there were in 1940. Future projections indicate that the amount of late-successional habitat is expected to increase on federal lands, but remain low on private lands. This increase in late-successional habitat is consistent with the ROD (USDA and USDI, 1994) for federal lands (see 1940 Interior Late-Seral Habitat Map, 1995 Interior Late-Seral Habitat Map and 2040 Interior Late-Seral Habitat Map).

The ROD (USDA and USDI, 1994) further indicates that thinning or other silvicultural treatments may occur inside these Late-Successional Reserves if the treatments are beneficial to the creation and maintenance of late-successional forest conditions.

Management Opportunities: Development of late-successional structure can be accelerated through treatment of managed and natural stands in LSR and other allocations not programmed for timber harvest. Approximately 7,219 acres of managed stands in the watershed could be treated to improve habitat for the northern spotted owl and other species that use late-successional habitat. The opportunity exists to prioritize which of these stands would benefit late-successional species the most (i.e. stands within home range of owls or within potential habitat connections).

The highest priority for commercial stand treatment to improve late-successional habitat are those stands that have mid-seral habitat adjacent to existing large late-successional habitat blocks (see Figure 13, Seral Stages Map). Treatment in these stands would result in the achievement of late-successional characteristics at an earlier time than if allowed to progress at a natural rate.

What are the special and unique habitats in the watershed and how are they changing?

During the past ten years a number of important but relatively small Special Wildlife Sites (Management Area 9) on the Forest have been identified as unique wildlife habitats and small botanical sites (Siskiyou LRMP, USDA 1989, page IV-113). A total of 4,968 acres have been designated in the Rogue River watershed from Marial to Agness (See Special Wildlife Site Areas Map). These sites constitute important components of overall wildlife habitat diversity and botanical values within the watershed.

Table 11. Special Habitat Sites (Management Area 9)

Type of Site	Number of Sites	Acres
Botanical	1	15
Dispersed Late-Successional	14	781
Elk Areas	2	2
Lakes and Ponds	3	20
Meadows and Meadow Buffers	50	2,634
Rock Bluffs/Talus	36	1206
Tanoak Areas	1	26
Wildlife Areas	3	284
Total		**4968**

The Siskiyou National Forest Plan designated 409 acres of Botanical areas (Management Area 4) within the Rogue River watershed from Marial to Agness. This includes a portion of the Bear Camp Botanical Area. Appendix F of the Siskiyou LRMP EIS (USDA, 1989) provides a description of this Botanical Area. Another area, Green Knob, was recognized as botanically unique, but was not selected as a botanical area during the Siskiyou EIS process (USDA, 1989, Appendix F page 90-91 has a description of this site).

This watershed also contains a portion of the Devils Half Acre Ridge Unique Interest area. Although the site does not contain any known sites for sensitive plants, it does have a healthy native grass component, and is recognized as botanically valuable.

Meadows and Open White/Black Oak Savannas

Oregon white oak, *Quercus garryana*, and California black oak, *Quercus kellogii*, are found in open oak savanna communities in the Rogue River Watershed, Marial to Agness. Oak communities are valuable for their function in providing landscape diversity. Several components of oak woodlands are especially valuable to wildlife, including mast-producing trees, cavity tees, and perches. They often occur as ecotones - interfaces between coniferous forests and prairies or other habitat (Ryan and Carey, 1995). Meadows and oak savannas in the Rogue River watershed from Marial to Agness are known to have sensitive wildlife and plants.

Open oak savanna communities often depend on fires for their maintenance. In the absence of fire, many Oregon white oak stands are invaded and eventually overtopped by Douglas-fir. Without disturbance, black oak is eventually crowded out of the best sites and remains only as scattered remnants in mixed-conifer forests (Burns and Honkala, 1990). The savannas within the watershed are decreasing in size, as apparent from historical photos, from anecdotal reports by long-time residents, and from field examination of young Douglas-fir stands that are overtopping remnant oaks. This is part of a trend throughout the California to British Columbia range of the white oak, and the California to Oregon range of the black oak (Burns and Honkala, 1990; Niemic et al, 1995; Ryan and Carey, 1995).

Meadows, sometimes referred to locally as prairies, are also decreasing in size. Historically Native Americans maintained meadows and open oak savannas by augmenting natural wildfires with burning, and early settlers may have reduced conifer encroachment rates on these open areas with heavy grazing and burning. Natural fires may have also opened many ridgetop environments to meadow, or meadow-like conditions. Since the early 1900s, when fire suppression became effective in the watershed, the meadows and open oak savannas have increasingly become overgrown with conifer tree species, primarily Douglas-fir.

Analysis was completed comparing meadows visible on the historical (1940) aerial photographs with current photographs and projecting trends into the future. Meadows and open oak savannas are projected to continue to decrease in size due to vegetative encroachment and lack of high intensity fire events, unless encroachment is reduced through manual methods (girdling and cutting trees) and through burning.

The Southwest Oregon LSR Assessment (USDI and USDA, 1995, page 143) identified meadow and oak savanna habitat within the Late-Successional Reserves as important elements of habitat diversity. "Maintenance of these areas ensures this habitat continues to function and provide biological diversity. Though the maintenance of this habitat is contrary to late-successional conditions, the limited area, arrangement, and importance of this habitat niche does not adversely impact the objectives of the late-successional reserves, and does improve ecosystem resilience by increasing diversity".

Other Special Wildlife Sites

Existing lakes, ponds, springs, talus areas, and rock outcrops with associated caves and cliffs are not expected to have changed very much from historic (1940) conditions. Wildlife associated with these habitats include red-legged frog, southern torrent salamander and western toad (lakes, ponds, springs), Del Norte salamander (talus habitat), peregrine falcon, common raven, golden eagle, cliff swallow (cliff habitat), western fence lizard, sagebrush lizard, ringtail, porcupine, marten (rock outcrops), bats, bear, bobcat, cougar, and woodrat (cave habitat). Rock quarry development has slightly reduced the amount of talus and rock outcrop habitat in the watershed.

Information Needs: Inventories of the meadows and oak savanna areas need to be completed to determine species composition, amount of encroachment, the best methods to restore the meadow/savanna habitat, and the best methods to improve or restore native grasses and other species. Potential special and unique sites need to be surveyed to determine if they meet Management Area 9 (Special Wildlife Site) criteria.

Management Opportunities: There is an opportunity to return meadows and oak savannas to historic conditions.

Some specific projects on National Forest land include:
- Big Bend Meadow - reduce the amount of Himalayan blackberries within the meadow by mowing and or burning.
- Fuel Hazard Reduction Project - reduce the fuel loading near the town of Agness and restore meadows and oak savanna habitat in the lower ends of Fall Creek, Snout Creek and Shasta Costa Creek.
- Noxious weed control - reduce and eventually eliminate invader species like Scotch broom, thistle, loosestrife and tansy ragwort.

What is the relative abundance and distribution of the species of concern in the watershed (e.g., threatened or endangered species, special status species, species emphasized in other plans)? What is the distribution and character of their habitats?

Proposed endangered, threatened and sensitive (PETS) species

The Siskiyou National Forest has three species listed as *endangered* or *threatened* under the Endangered Species Act: the (1) bald eagle, (2) northern spotted owl, and (3) marbled murrelet. Bald eagles, which are classified as threatened, are known to nest near the Rogue River within this watershed analysis area. Marbled murrelets, also classified as threatened, have not been detected in this watershed analysis area. The Rogue River (Marial to Agness) watershed contains the median home range (1.3 mile radius around a nest or activity center) of 10 spotted owl pairs.

Peregrine falcons were removed from the list of Endangered and Threatened wildlife on August 25, 1999 (USDI, 1999). They were subsequently listed as a sensitive species by the Forest Service (USDA, 1999). There are two nests of peregrine falcons in the watershed, out of only six on the Siskiyou National Forest.

The late-successional habitat in Rogue River watershed (Marial to Agness) contains the activity centers of the 7 owl pairs in the watershed. The viability of owls within the watershed should remain stable. See indicator species section below.

This watershed will continue to contribute to the viability of bald eagles and peregrine falcons.

Sensitive Species

Plants: The watershed has numerous occurrences of several sensitive plant species. The following species of sensitive plants are known in the watershed: *Arctostaphylos hispidula* (Howell's manzanita), Illiamna latibracteata (California globemallow), *Salix tracyi* (Tracy's Willow), *Triteleia hendersonii* variety *leachiae* (Leach's Brodiaea) and *Bensoniella Oregana* (Bensonia). (See also Riparian Ecosystem Narrative, High Elevation Sites).

Also occurring in the watershed are *Allium bolanderi (Bolander's Onion), Hieraceum bolanderi* (Bolander's hawkweed), Mimulus douglasii (Douglas' Monkeyflower), and *Smilax californica* (Greenbriar). These five species were removed from the Sensitive Species list in May 1999.

The watershed is particularly important for Bensonia and Leach's Brodiaea. Bensonia is an inconspicuous member of the saxifrage family. It is found in the coast ranges from Douglas County, Oregon south to Humboldt County, California, where 72 populations were known through 1988. All but 15 of the known populations are on the Siskiyou National Forest, and over half occur in the Shasta Costa Watershed (Lang, 1988). Leach's Brodiaea, although locally common in this watershed, has a very limited range with the bulk of the world's population in this watershed analysis area. The Species Management Guide for *Triteleia hendersonii* var. *leachiae* (Titus, 1995) lists the 10 most significant populations. The four largest populations occur in this watershed, including the world's largest population with more than 50,000 plants in Shasta Costa drainage, a Fall Creek population, a Foster Creek headwaters population, and a Snout Creek population. The species management guide also lists fire suppression and related successional events, logging, and road construction as important threats to the species. It also lists meadow management as critical for the continued survival of this taxon. The guide also states the species is expected to be very fire hardy.

California globemallow occurs often in disturbed sites along streams and wet areas. It can be shaded out and sites along streams in clearcuts in this watershed may need management. Trees and brush growing adjacent to some of the populations in this watershed are shading out the species. Manual release of these plants would be necessary to maintain the populations.

Amphibians and Mammals: Del Norte salamanders, Townsend's big-eared bats, Northwestern pond turtles, California kingsnakes, and common kingsnakes are documented in the watershed. This is the only watershed on the Gold Beach Ranger District where common kingsnakes have been seen. Riparian areas in the watershed provide potential habitat for white-footed voles. Wolverine have not been sighted in the area and none have been detected on snow track surveys. Red-legged frogs have not been detected in the watershed area.

Neotropical Migratory Birds: The few large, relatively unfragmented blocks of habitat remaining within the watershed provide good nesting sites for birds, such as the willow flycatcher, pacific-slope flycatcher and hermit warbler. These birds are vulnerable to parasitism by brown-headed cowbirds. Cowbirds, edge specialists, are particularly attracted to human habitation and cattle, both of which are present in Agness, Big Bend and Paradise Bar areas. These sites act as reservoirs for brown-headed cowbirds. Current numbers of cowbirds at these sites have been as high as 40 birds at Agness and Big Bend. There is only one sighting at Paradise Bar.

Willow flycatcher, a species of special concern, nests along the river corridor. They are known only from the Rogue River and Chetco River on the westside of the Siskiyou National Forest.

Indicator Species

Seven forest wildlife species, and one group, have been selected as management indicator species. An indicator species represents all other wildlife which utilize the same habitat type. Indicator species act as barometers for the health of various habitats (Siskiyou LRMP IV-10, USDA, 1989).

Bald Eagle and Osprey

Bald eagle and osprey utilize habitat corridors along major rivers, sometimes nesting up to one mile (occasionally further) from rivers in large green trees or dead trees. The Rogue River

(Marial to Agness) watershed is important to the viability of bald eagles and osprey and both species nest here. The Siskiyou LMRP (USDA, 1989) has Standards and Guidelines (4-4 and 4-9) for maintaining potential nesting habitat.

Spotted Owl, Pileated Woodpecker, and American (Pine) Marten

The northern spotted owl represents over 150 other wildlife species, which use late-successional forest habitat for all or part of their life cycles (Guenther and Kucera, 1978, Brown, 1985). Spotted owls are strongly associated with dense mature and old-growth Douglas-fir forests. These habitats provide the structural characteristics required by the owls for food, cover, nest sites, and protection from weather and predation. Pileated woodpeckers and pine marten represent the composite needs of over 160 wildlife species which utilize mature forest (Guenther and Kucera, 1978, Brown, 1985). The Siskiyou LRMP (USDA, 1989) had designated areas for the pileated woodpecker and pine marten within Lobster (Management Area 8, Forest Plan, Chapter IV-Forest Management Direction, page IV-105). However, the ROD (USDA and USDI, 1994) amended MA-8, and created Late-Successional Reserves which account for these species and the species they represent.

Existing sighting data from the Wildlife Observation (WILDOBS) database was analyzed. The geographical information system (GIS) was used to analyze stand level vegetation data to calculate historical, existing, and future levels of habitat for these species (Table 12). Mature and old-growth seral stages were used for pileated woodpecker and marten habitat. For the spotted owl analysis, mature and old-growth seral stages on ultramafic soil types were not included.

Table 12. Habitat Trends for Selected Indicator Species

	Spotted Owl Habitat		Pileated Woodpecker/Marten Habitat	
Year	**Acres**	**Percent Watershed**	**Acres**	**Percent Watershed**
1940	32,224	73	34,684	79
1993	9,900	31	10,969	34
2040	11,179	35	12,653	39

Spotted owls, pileated woodpeckers and marten have been documented in the Rogue River (Marial to Agness) watershed (see PETS section for more details). The future in the Rogue River (Marial to Agness) watershed looks bright for these indicator species and the species they represent as habitat continues to increase.

Woodpeckers: The composite snag needs of woodpeckers represent all wildlife species that use cavities for nesting or denning (Siskiyou LRMP FEIS, pages III-104, III-105, USDA, 1989). On the Forest, and most likely in Rogue River (Marial to Agness) watershed, there are over 75 species which use snag habitat (Guenther and Kucera, 1978, Brown, 1985). Siskiyou Forest Standard and Guideline 4-13a states that habitat capability of woodpeckers should be continually maintained in areas managed for timber production at not less than 60 percent of potential population levels.

Woodpeckers are dependent upon snags and down wood for roosting, nesting, and foraging habitat. High intensity fires killed large conifers and hardwoods. The variation in amounts left after fires is not known. There were areas shown on 1940 aerial photos, where large brushfields did not contain visible large snags. These were mainly found in areas that likely had frequent fires, i.e. placed high up on ridges on south facing slopes. Smaller snags were created in stand development where competition between densely spaced trees and brush caused mortality.

Deer and Elk: Elk and deer use all successional stages to meet their habitat needs for cover, forage, and reproduction. Natural or created openings provide the majority of the feeding habitat, which is assumed to be the most restrictive habitat component in this region (Forest Plan FEIS, Chapter III-Affected Environment pages III-106 through III-107). Elk and deer represent more than 180 wildlife species that need young successional stages to meet all or some of their requirements (Guenther and Kucera, 1978 and Brown, 1985).

The Rogue River (Marial to Agness) watershed has the largest concentration of elk on lands administered by the Gold Beach Ranger District. The elk mostly use recent clearcuts, meadows and open white/black oak savannas for forage. The higher elevation timbered areas in this watershed also provide good forage during the summer months.

Deer are found throughout the watershed, though an accurate estimate of their population is unavailable. Local residents report that populations are far smaller now than they were ten to twenty years ago. Deer use newly harvested areas and natural meadows for foraging. They also feed on acorns from oak trees throughout the area and use the riparian areas during fawning season and summer.

To estimate the amount of deer and elk habitat, the amount and quality of forage and cover was analyzed. GIS was used to analyze seral stages at the stand level. Tables 13 and 14 list the acres of each type of habitat estimated for the Rogue River (Marial to Agness) watershed.

Table 13. Historic Elk Habitat Type (1940)

Habitat Type	Percent of Watershed
Optimal/Thermal Cover	77
Hiding Cover	13
Forage	3

Table 14. Current Elk Habitat Type (1995)

Habitat Type	Percent of Watershed
Optimal/Thermal Cover	76
Hiding Cover	11
Forage	12

Existing conditions for elk habitat were evaluated using a model developed for use in Western Oregon. The model was based on the interactions of four variables: (1) size and spacing of forage and cover, (2) road density, (3) cover quality, and (4) forage quality (Wisdom et. al., 1986). Optimal cover modifies ambient climate, allows escape from human harassment, and provides forage. Thermal cover functions similarly to optimal cover, but it does not provide forage. Hiding cover allows elk to escape human disturbances (Wisdom et. al., 1986). The quality of forage is as important as the amount of forage available. Human disturbance allowed by motor vehicle access reduces elk use of habitat adjacent to roads (Wisdom et. al., 1986).

Currently the Rogue River (Marial to Agness) watershed does not meet LRMP 4-11, which requires that 20 percent of the watershed should be maintained in forage areas. As a requirement under NFMA, 219.19, the Siskiyou National Forest, Forest Plan FEIS, p. III-102, designated elk and deer as indicator species in the Siskiyou National Forest, Forest Plan FEIS. Deer and elk were selected because they are commonly hunted and they represent other species that utilize early successional forest. There are more than 180 wildlife species that need young successional stages to meet all or some of their requirements (Brown, 1985). NFMA, 219.19 states, "In order to insure that viable populations will be maintained, habitat must be provided to support, at least a minimum number of reproductive individuals and that habitat must be well distributed so that those individuals can interact with others in the planning area." Because the percentage of forage acres is projected to decline, populations of wildlife species that are associated with this habitat type will decline on National Forest lands.

Information Needs: Pacific Meridian Research (PMR) vegetation data needs to be ground verified to ensure validity. The correlation between certain vegetation types, seral stages and wildlife use of those habitats needs to be verified. This can be completed by continuing to do surveys for presence of indicator and PETS species.

Management Opportunities: Forage seeding could be used where timber harvest occurs to enhance the forage value for elk. Encroaching trees in open meadows and oak savanna areas can be cut and removed or girdled (See Special Wildlife Site Section). Open meadows and oak savanna areas can be burned to remove encroachment and benefit native species. Areas of exposed soil can be seeded with native species. A potential specific project is to create some quality forage/early successional habitat within immature and mature stands by thinning to a wide spacing, creating 1 to 2 acre openings, underburning, and seeding with native species.

What are the locations and risk of spread for noxious weeds in the watershed?

Gorse, Scotch broom, French broom, Teasel, Yellow Star Thistle, Malta Star Thistle, Purple Loosestrife, Meadow Knapweed, Fennel, English Ivy, Tansy Ragwort, Canada Thistle, and Bull Thistle have invaded the watershed and are increasing in numbers (See Noxious Weed Sites Map). Their aggressive nature threatens to destroy native plant communities. Many colonies have been discovered and destroyed, but many of these sites are still active, because seeds left from mature plants germinate after the site has been treated. New colonies of these species are expected to continue to be found as seed is carried into the watershed from neighboring lands, especially upriver colonies of Purple Loosestrife and Yellow Star Thistle along Rogue River corridors. The proximity to high concentrations of loosestrife and yellow star thistle upriver in Josephine and Jackson Counties is one of the reasons why there is such a high number of weed sites in this watershed.

Pampas grass and Italian thistle have been found in neighboring watersheds but have not yet been observed in this watershed. Their numbers in neighboring watersheds have not yet been great enough to spread seeds to the watershed. There is a danger that equipment from sites out of the local area could bring propagules to this watershed.

Canada thistle, bull thistle, and tansy ragwort commonly occur in disturbed sites. They pose a lesser threat to the area because they have long occupied many of the watershed's disturbed sites.

Biological controls, including a flea beetle and the cinnabar moth, have been introduced to reduce the number of tansy ragwort plants in the watershed.

Management Opportunities: It is especially important to control the brooms and gorse because they are just beginning to expand into the watershed and could potentially occupy much greater areas than they do now. It is also important to quickly treat any new colonies of new noxious weeds such as Yellow Star Thistle if they appear in the watershed, in order to prevent them from becoming well established.

Treatment of infected areas is needed to reduce, control and/or eliminate the further spread of noxious weeds in the watershed. It will be necessary to survey disturbed areas to detect new populations of noxious weeds before they become well established. Treatment opportunities include cutting, pulling, or burning noxious weeds, introducing biological controls, closing roads, cleaning construction machinery before moving onto National Forest lands and before leaving infested sites, using only "clean" fill material, and using only certified weed-free hay. Seeding disturbed areas with native plant species will reduce opportunities for weeds to become established, and biological controls may be necessary to control widely distributed weed populations. Follow-up surveys of treated sites will be necessary to detect noxious weed population regeneration. Before ripping roads in contaminated areas, it should be determined if doing so would encourage noxious weeds to take over disturbed sites.

What are the locations and risk of spread of Phytophthora lateralis (Port-Orford-cedar root disease) in the watershed?

Role of Port-Orford-cedar in the watershed

Port-Orford-cedar (Chamaecyparis lawsoniana) is an important component in this watershed, occurring mostly in the western half of the watershed, primarily within riparian areas. Of the 78,507 acres of National Forest within this watershed, approximately 14,187 acres (18 percent) contain some Port-Orford-cedar (see Port-Orford-cedar map).

The natural range of Port-Orford-cedar is limited to northwestern California and southwestern Oregon but is found on many geologic zones and soil types, ranging from skeletal to productive soils. It is often the dominant tree in ultramafic riparian areas and frequently codominant with Douglas-fir in riparian areas of other geologic types. Crown closure by the species ranges from 0 to over 40 percent. Generally, however, throughout most of its range, it is restricted to areas with consistent water seepage within a meter of the soil surface. Port-Orford-cedar is valuable both ecologically and economically.

Port-Orford-cedar provides shade, large wood, and vegetative diversity on riparian and upland sites. It is fairly tolerant of shade and competition in natural stands, and can occur as a pioneer, late seral or climax species within the same stand. Growth is usually slower than Douglas-fir except in ultramafic substrates. Frequently, in mixed species stands, other species will grow taller and out compete them within 25 years of establishment. However, Port-Orford-cedar retains the ability to respond after dominants die.

In old stands, Port-Orford-cedar seems as tolerant of fire as Douglas-fir. Older trees develop thick bark and survive large, deep, fire scars. The wood has a high resistance to decay and insects. It can be especially valuable as large wood in riparian areas, remaining in streams longer than equal-sized logs of associated species. It can also have lesser value for cavity-nesters due to its decay resistance. If utilized, cavity-nesters seem to prefer dead Port-Orford-cedar over green.

Port-Orford-cedar timber brings higher prices than almost any other conifer in the United States due to log export to Japan. It is the only species than can be exported from federal lands within the Pacific Northwest. Its domestic price as lumber, however, is low to moderate when compared to the price of cedar species such as western red cedar or incense. Port-Orford-cedar boughs are used commercially for floral arrangements and have been collected along the road system in the watershed.

Effects of Port-Orford-cedar root disease (*Phytophthora lateralis*) on the watershed

Around 1952, an exotic root disease fungus or water mold, Phytophthora lateralis, was introduced into the Pacific Northwest from an unknown source. Both Port-Orford-cedar and Pacific yew (Taxus brevifolia) are susceptible to this disease, but yew are not readily killed.

This root disease lives within infected roots and wet wood/soils. It can be spread either by infectious "swimming" zoospores or thick-walled "resting" spores. These spores are spread by gravity, water, infected soil or woody debris. The disease can spread locally by root-to-root grafting. The infectious spore (zoospore) is only formed in water or when soils are saturated. They are capable of moving a few millimeters through water or saturated soils to reach a fine root of a host tree by use of their small tail. This microscopic movement is directionally triggered by a chemical attraction to Port-Orford-cedar.

These zoospores attach to the live, fine roots (less than 1 mm in diameter) of Port-Orford-cedar that are normally abundant near the soil/water interface. After they are attached, they extend hyphae and grow throughout the root system and phloem up to the root collar of the tree. These hyphae give off enzymes that break down the cells of the cambium of the tree. Once introduced into the cambium of the tree, this disease will grow until the entire root system is colonized and the tree dies from desiccation generally in the spring or summer.

During adverse conditions such as dry weather, the fungus produces thick-walled spores (resting spores). These spores are the principal fungal forms in mud, and enable longevity of the fungus by providing a mechanism for surviving inhospitable conditions. Dry conditions reduce the danger of spread by spores but do not kill the fungus or its resting spores. Limited data indicates that infected soil can contain viable spores for approximately three years after the last host tree has died. Host tissue killed by this disease can also harbor thick-walled resting spores that can survive for up to approximately seven years while the Port-Orford-cedar host material decays. Under favorable conditions (saturated soils, cool soil temperatures, etc.) these resting spores produce the infectious zoospores.

A single introduction of the root disease into a waterway occupied by host trees can result in the spread of this disease to any adjacent, downstream, riparian area via water movement. However, the uphill distribution of this disease is slow because without an outside vector (carrier), this disease can only spread by root-to-root contact between infected and uninfected host trees. Discontinuity of host tree root systems is a barrier to its uphill spread.

Since 1952, this disease has been spreading throughout the range of Port-Orford-cedar primarily by the movement of infected plant materials or contaminated water or soil spread by gravity, equipment, vehicles, humans, or domestic and wild animals. The potential for loss of all Port-Orford-cedar stands to this root disease is low because of the existence of numerous protected populations representing both the environmental extremes and the middle of the species range. Currently, however, there is no identified genetic resistance or established chemical control for this disease. Prevention seems to be the most effective control strategy.

This disease appears to have infected most riparian areas containing Port-Orford-cedar within the watershed between Marial and Agness. Places that currently appear to be uninfected by Port-Orford-cedar root disease are the Waters Creek, Flora Dell Creek, Clayhill Creek, Stair Creek, Scott Creek, Walker Creek, and Shasta Costa Creek watersheds (see Port-Orford-cedar Map).

Risk of disease spread

There are several land management allocations within the watershed (see Table X). Management areas such as LSR and Wilderness have fewer or less intensive management activities and are less at risk than areas such as Matrix allocations which tend to have more frequent or intensive management activities. Port-Orford-cedar areas below roads are in greatest risk of becoming infected.
In general, areas at greatest risk for infection by Phytophthora lateralis root disease are Port-Orford-cedar or Pacific yew stands that have the greatest number of the following characteristics:
- associated with riparian areas and perennial water,
- experience frequent or intensive land management activities,
- experience frequent activities within or adjacent to riparian areas,

- have high road densities and vehicle use,
- are near native surface roads,
- have high use by people or migrating animal species,
- have high wet weather use,
- are located downslope of or accessed through active, root disease, infection areas,
- have high and continuous density of susceptible species,
- are downstream of active, root disease, infection areas.

The primary vectors for spread of this root disease have been infected Port-Orford-cedar plant materials, waterflow, human transmission (such as root disease spores being introduced via the mud on vehicles, equipment, tools or boots), and animal transmission (such as hooves of horses, cattle or migrating wild animals such as elk). The greater the potential for one of these vectors to move from an infected area to an uninfected area with these spores, the greater the risk of infecting an uninfected area. The spread of this root disease, therefore, is a function of the number of vectors, the risk that the vector has picked up spores, the proximity of the infected area to an uninfected area, and the likelihood that a vector will move from an infected area into an uninfected area.

Spread of the disease in the future will most probably be associated with spore introduction via either unwashed heavy equipment or general vehicle traffic during the wet season. General traffic can spread this disease over long distances. Mud has been observed to stay on vehicles for trips over 30 miles, including trips of 15 miles on four-wheel drive roads (Forbes, 1993). Within riparian areas this disease will continue to spread to areas where water provides a vector for the spores. Additionally the disease will be spread through activities such as hiking, horseback or mountain bike riding, hunting, collecting special forest products such as mushrooms, beargrass, Christmas trees, and animal migration. Many of these activities occur primarily during the fall wet-season when the risk of spread is high.

Sanitation treatments (i.e. killing or cutting Port-Orford-cedar trees) and seasonal or year-around road closure can be effective in maintaining uninfected Port-Orford-cedar populations or limiting the spread of this disease. Year-around road closures within infected or uninfected areas and sanitation of stands containing Port-Orford-cedar adjacent to roadsides have been implemented within this watershed. Dry season operations, aggregate surfacing of some roads, use of uninfected water and earth, and pre-operation washing of vehicles and equipment have also been implemented. These latter measures can be effective in preventing the spread of the root disease, and are the preferred project-level control measures.

Table 15. Road Closures that affect Port-Orford-cedar (see Port-Orford-cedar map).

Road Number	Road Length (Miles)	Portion of Road Closed (Approx. Miles)	Type of Closure Device	Period of Closure	Status of Closure
2300.650	1.81	0.20	Earth Barrier	Year-round	Unknown
2300.748	0.27	0.27	Gate	Year-round	Unknown
2300.770	0.90	0.90	Earth Barrier	Year-round	Unknown
2300.820	2.27	0.20	Earth Barrier	Year-round	Effective
2300.840	1.48	1.47	Gate	Wet Weather	Unknown
2300.860	1.88	1.88	Cross	Year-round	Effective

Road Number	Road Length (Miles)	Portion of Road Closed (Approx. Miles)	Type of Closure Device	Period of Closure	Status of Closure
			Ditch/Natural		
2300.864	0.70	0.70	Earth Barrier	Year-round	Effective
2300.911	0.65	0.65	Earth Barrier	Year-round	Breached
2300.990	0.40	0.40	Gate	Wet Weather	4X4 By-Pass
2308.260	1.33	0.03	Earth Barrier	Year-round	Breached
3577.090	0.64	0.64	Earth Mound	Year-round	Effective
3336.037	0.37	0.37	Natural	Year-round	Unknown
3336.050	4.07	4.07	Gate	Seasonal	Effective
3340.111	0.54	0.12	Natural	Year-round	Unknown
3340.112	0.20	0.20	Natural	Year-round	Unknown
3730.060	5.72	0.50	Earth Mound	Year-round	Breached
3730.069	0.09	0.09	Earth Mound	Year-round	Breached
3730.110	0.08	0.08	Earth Mound	Year-round	Effective
5520.026	0.82	0.82	Decommissioned	Year-round	Effective
Total		**13.59**			

In addition, sanitation of Port-Orford-cedar has occurred adjacent to Forest Service Road (FSR) 2308, 1/4 mile east of its junction with FSR 2308260 and the last 1/2 mile of FSR 3730080.

Information needs: The primary uninfected tributaries need to be monitored for disease on a periodic basis. Annually update the mapping of both Port-Orford-cedar and Port-Orford-cedar root disease. Periodically monitor the effectiveness of pre-operation washing, sanitation and road closure as control measures (coordinate with Southwest Oregon area pathologist), or of fire as an eradication measure. Determine if there are genetically resistant Port-Orford-cedar varieties, and if so, plant genetically resistant seedlings.

Billings Creek, Dans Creek, Hicks Creek, and Flea Creek need field evaluation to confirm that they are not infected with Port-Orford-cedar root disease.

Management opportunities: Continue with pre-operation washing of vehicles and equipment, use of uninfected water, soil or rock, sanitation of Port-Orford-cedar, and seasonal or year-around road closures as well as other reasonable control or prevention measures.

The following roads are potential candidates for seasonal or annual closure, or sanitation, in order to protect Port-Orford-cedar, based on mapped data. They need field evaluation to determine actual risk. The proposed period of closure, seasonal or annual, or the need for sanitizing will be determined through the interdisciplinary process (see Port-Orford-cedar Road Map).

Table 16. Potential Candidates for Seasonal or Permanent Closure, or sanitation to Protect Port-Orford-cedar.

Road Number	Length of Road (Miles)
3336071	0.31
3336074	0.20

3336075	0.23
3336076	0.11
3340113	0.66
3340115	1.66
3340116	0.54
3340117	1.42
3340120	1.15
5325523	0.44
5325570	0.59
3730080	1.30
3730081	0.65
3730060	5.72
3730061	0.26
3730068	0.31
TOTAL	**15.55**

General Management Requirements

The following general requirements should be implemented in order to prevent the spread of this root disease.

- Clean equipment, vehicles, tools, boots, etc. before entering uninfected areas. Inspect for cleanliness prior to use.
- Restrict management activities to the dry season whenever practical.
- Use uninfected water for road dust abatement, fire fighting, and other water using activities, or treat infected water with Clorox®.
- Wash vehicles and equipment with Clorox® treated water.
- Use uninfected rock or soil whenever needed.
- Place uninfected aggregate surfacing on native-surfaced roads or small, scattered, infected road sites to reduce risk of vehicles picking up spores by driving through muddy areas.
- Plant *Phytophthora lateralis* resistant seedlings (if and when they become available).
- Plan project work so that work in uninfected areas precedes work in infected areas.
- Monitor the effectiveness of root disease prevention or control strategies.
- Permanently or seasonally close roads to prevent the spread of this root disease.
- Cut or kill Port-Orford-cedar along roadsides in order to provide a roadside buffer for areas with significant amounts of uninfected Port-Orford-cedar.

What is the fire history of the watershed and what is the future role of fire in the watershed?

As with the majority of the Klamath Province, there is evidence of past fires throughout the landscape. Fires with both natural and human causes have influenced the area for thousands of years.

The topography, vegetation, and weather of the area are typical of the inland canyon areas of southwestern Oregon. Slopes range from moderate (40 percent) to very steep (80+ percent), with a very small amount of flatter ground located along the river benches. Mixed conifer stands, with a heavy hardwood shrub and tree component, dominate the landscape. Naturally occurring fuel loads are moderate, with relatively low rates of spread under average fire season conditions, but can burn much more severely under dryer late season conditions or in years of prolonged drought.

Managed stands are distributed throughout the western portion of the watershed, and along the major ridge tops and road systems found in the watershed, outside of the Wild Rogue Wilderness.

The summertime climate of the watershed is dominated by the hot and drier airmass that prevails over the inland areas. Cooler/moister marine air, which will generally invade watersheds closer to the coast, will rarely penetrate into the reaches of the upper Rogue canyon and its major tributaries. Ridge winds are experienced at the higher elevations, and the lower points in the drainages feel the effects of the winds in the main canyons. The entire watershed is subject to the diurnal wind influence that is created by heating and cooling each day, generally down canyon winds during the early hours of the day, and up canyon winds during the afternoon and evening hours. During the late summer and into the fall, atmospheric conditions bring hot and dry east winds to the entire area. These winds generally over-power the local winds, move at unusually high velocities, while maintaining very high temperatures and low humidity for 24 hours a day. Lightning storms in the watershed are often accompanied by light to moderate rainfall, which will often extinguish fires or prevent them from growing before suppression action has been taken. During the past 80 to 90 years, human-caused fires have accounted for the vast majority of the number of fires and the acreage burned.

Range of Conditions and Trends: From prehistoric times through the early part of this century, fires were allowed to burn unchecked. Weather and natural terrain features were the only things that affected the spread of wildfire. Up until the 1930s and 1940s most fires were simply monitored, as effective fire suppression resources and tactics did not exist. From that time forward, fire detection and suppression capabilities have become more effective and fire suppression policies mandated that all fires would be controlled. Because of the low frequency of fire occurrence and the success of fire suppression, the majority of natural stands remaining throughout the watershed have evolved for most of the past half-century without the opportunity for fire to play out its natural role.

Although there is little historical evidence of natural-caused wildfire in the watershed, many stands reveal evidence of what can only be interpreted as prehistoric fire. Charring and fire scars on old-growth conifers can be found almost anywhere in the watershed. Stand composition characteristics, particularly homogenous stands of either younger conifers or mixed hardwoods, would indicate that a stand resetting disturbance such as fire has occurred in some areas. It is known that Native Americans used fire during prehistoric times, to enhance forage for game which they hunted and to stimulate the growth of plant species used both for food and to make baskets. It is likely that open meadows areas of the watershed were maintained in this manner. Early settlers also used fire for similar reasons, and to maintain grazing land for their livestock, as well as clear vegetation for mineral exploration. Settlers were often irresponsible in their use of fire, causing fires to burn far outside of the desired areas. The main Rogue River canyon, Foster Creek, Billings Creek, and Shasta Costa Creek drainages were all subject to the indiscriminate use of fire up to the mid 1930s. Although not supported by solid documentation, a major fire was said to have swept through the Southern Oregon coastal mountains in 1864.

Studies of fire records from 1910 to the present, for both National Forest and private lands in the watershed, indicate a low frequency of natural fire occurrence during this period. Prior to 1940 there were 9-recorded lightning fires, 3 were larger than 10 acres in size and burned approximately 1,170 acres collectively. During this same time period there were 84 human-caused fires reported, 38 were larger than 10 acres each and burned a total of approximately 25,530 acres. Since 1940 the number of fires exceeding 10 acres in size has dropped off dramatically. Out of a total of 38 lightning-caused fires, none grew beyond 9 acres, with most fires being one acre or less in size. Out of the approximately 63 human-caused fires since 1940, only one grew large enough to exceed 10 acres in size.

The total number of human-caused fires (1910 to 1991) in the watershed is difficult to estimate due to the detail of the mapping of the times, however it is estimated that there was in excess of 150 fire starts, approximately 70 originated within a half mile of the Rogue river. There were numerous fires associated with the early occupation of the Marial area; many of these were in the Tucker Flat area and further up-river from Marial.

Typical of fires west of the Cascade crest, the effects of burning appear to be more severe on the south and east aspects, and at higher elevations than on the north and west aspects, and at the lower elevations. Aerial photographs (circa 1940) and the panoramic photographs taken from several of the lookout points surrounding the area (circa 1934) reveal evidence of fires which are not documented in the known records. Several of these fires have the appearance of having been high severity, stand-resetting disturbances, particularly on the southern aspects and along the ridge tops. This same photography, covering areas of known historical fires, will often show little or no signs that a fire has passed through the northern and/or western aspects of an area, supporting the conclusions that a lower intensity fire normally burns on these sites. On a much broader scale, there is a noticeable increase in fire severity in the eastern portion of the watershed, when compared to the western portion.

Summary Of Historic Fire Activity

- Of the total land base within the watershed, approximately 23,000 (28 percent) has burned at least once.
- Of the total land base within the watershed, approximately 4,000 (5 percent) has burned at least twice.
- The records indicate a total of approximately 27,000 acres having been burned.
- Of the 200 +/- fire starts recorded, less than 25 percent (47 fires) have been started by lightning and account for less than 5 percent of the acres burned (approximately 1,250 acres). The other 95 percent of the fire starts are human-caused.
- Six percent of the lightning started fires (3) accounted for more than 95 percent of the acres burned (1,170 acres).
- Of the 200 +/- fires recorded, either natural or human caused, 93 (47 percent) burned prior to 1940, accounting for almost 99 percent of the total acres burned.

Present Day Fire Suppression

This watershed is allocated almost entirely to management areas where preplanned suppression strategies and acre objectives are set to control fires at a minimum size (Siskiyou LRMP, USDA, 1989). For Late-Successional Reserves the ROD (USDA and USDI, 1994) has set Standards and Guidelines which emphasize the prevention of loss due to large-scale fires. Under the ROD and the South West Oregon LSR Assessment, fire may be used for its beneficial effects to the ecosystem once a specific Fire Management Plan has been written for the area. Until then, rapid wildfire suppression will remain the operative plan for the majority of the watershed.

In the Wild Rogue Wilderness all fires occurring at fire intensity level 2 or above (flame lengths of 2 to 4 feet, or greater) shall be controlled at 90 acres or less, 90 percent of the time. Fire suppression activities will be conducted with the maintenance of Wilderness values in mind; this philosophy may limit the use of power equipment and aerial support, on a case-by-case basis. Prevention activities are appropriate and hazard reduction is encouraged around heavily used sites. The use of prescribed fire is encouraged, using both planned and unplanned ignitions, to reduce the risks and consequences of fire within the Wilderness, or escaping from the Wilderness.

For the past decade, funding for firefighting resources has been declining; leaving only limited resources available in the local area to respond for initial fire attack. Aerially delivered firefighting resources (rappelers) can also respond to the area in about 30 to 40 minutes, from their base in Merlin, when available. A cooperating agency, Coos Forest Protective Association, off-Zone agency personnel, contractors, and air tankers can be called upon when and if fire situations exceed the control capabilities of these initial attack resources. Private land holdings, within and adjacent to the watershed, are protected by Coos Forest Protective Association. Under a reciprocal mutual aid agreement, Forest Service firefighting resources share in protecting these lands; utilizing the closest forces concept.

Mutual risks exist with a community (Agness/Illahe) and private lands surrounded by National Forest System (NFS) lands. A wildfire originating on NFS lands could be a threat to the privately owned lands, under severe burning conditions, and similarly, a fire originating on the private lands could pose a threat to the surrounding NFS lands under similar conditions.

Interpretation

Until about 60 years ago, fires have burned without human efforts at control. "…our temporal window is small. Disturbance regimes of the last 300 years hardly give the range our ecosystems have experienced" (Atzet and Martin, 1991). Since natural fire events are random and chaotic in nature, we do not know what the fire cycles are, or what the pre-historic "status-quo" was. Atzet and Martin indicate we do not have a clear picture of the natural range of conditions, as it pertains to the role of fire in the Klamath Province. Prior to 1850, information about climate, fire regime, and Native American activities is scarce. Conditions since 1850 poorly represent natural conditions due to the influence of early settlement. The study of historic fire records supports this uncertainty in establishing the range of natural conditions. Records indicate that multiple, low intensity underburns were more prevalent than individual high severity stand re-setting fire events throughout the Klamath Province; however there is much evidence to the contrary within the watershed.

Fire cycles west of the Cascade Mountains are estimated to be considerably longer than those found east of the Cascades, particularly in Northeastern Oregon. This effect is even more pronounced along the westside of the Coast Range. Conditions in Northeastern Oregon (the forest health situation and the effects that fire exclusion has had on it) can be used to point to a similar path of events that may be occurring in Southwestern Oregon, on a much longer timescale. It is only in the past 60 to 75 years that man has attempted to alter this course through suppression policies and active intervention. Atzet and Martin suggest that this intervention has increased the mean interval between fires, in the Douglas-fir series. Continued suppression may cause an "unnatural" build up of fuels, resulting in a greater proportion of high-intensity fires when an area finally burns.

Fires will continue to occur and will continue to be suppressed within our limited capabilities, but not all fires will be contained at low acreages. If a fire occurs under moderate weather conditions, and in areas where fuel and weather conditions are such that the fire burns with a lower intensity, the forest in general could benefit and the values associated with Late Successional Reserves will remain intact and/or be enhanced. However, fires burning under hotter and dryer conditions can evolve into stand replacement disturbances, producing undesirable effects on a very broad scale. As time passes and the amount of fuel on the forest floor continues to increase, so will the severity of wildfire.

When we compare the time frame in which fire has essentially been excluded from the watershed with what we estimate the natural cycle of fire to be (50 to 90 years), it may be that we are not yet outside the natural historical range. It is probable that during the early part of the 20th century, the number of fires (due to human influence) was on the high end, or perhaps beyond the estimated natural range of conditions for the area.

Similarly, it is also probable that areas which were burned by the aboriginal inhabitants of the watershed and areas which typically support a more diverse community of fire dependent species have begun to feel possible adverse effects from fire exclusion.

Information Needs: Historic fire information is drawn from copies of the Regional Fire Atlas and Record (1910 to 1959, with data gaps) and from individual fire reports from 1960 to 1991 (with data gaps). The records cover a total time span of 81 years, 64 years of which can be accounted for. There are 6 data gaps, totaling 17 years, for which no records can be located at this time.

Site-specific fire information could be obtained to improve the understanding of the role of fire in the vegetative succession of the watershed.

Management Opportunities: The Southwestern Oregon LSR Assessment does allow fires to burn in the Late Successional Reserve (LSR) areas under site-specific objectives. A Regional Ecosystem Office (REO) review of this assessment confirms this. The LSR Assessment recognizes that fire can be used for the enhancement of fire dependent species and prevention of stand replacement fire events. These objectives can be met using either natural-caused or management-ignited prescribed fire, under the proper conditions. In the interest of reducing the mutual threat to both public and private lands in the watershed, prescribed fire can also be used to reduce the fire hazard of selected areas, where its use can be implemented in a safe and effective manner. Such an action would give the limited fire suppression resources of the area a more manageable situation for preventing wildfire from generating effects beyond those considered beneficial to the resource, as well as aid in protecting the interests of those living in the area surrounded by National Forest lands.

SOCIAL ASPECTS

The following characterization and key questions were developed to describe the past, present and potential future human uses of the Rogue River Watershed, Marial to Agness.

Cultural Characterization

The Rogue River Watershed, Marial to Agness, can be characterized as a dynamic landscape. For millions of years, the Rogue River existed without the influence of humans. Over the last several thousand years, Native Americans and early settlers discovered and utilized the river and the surrounding terrain, functioning as integral parts in the evolution of the watershed as it appears today.

The river, the land, and the resources available have set limits and provided opportunities for prehistoric and historic inhabitants alike. Interactions between natural and human forces have shaped the human use of the area. Flat, open land, preferred for human use, is limited within the watershed. Aggregations of people are limited by topography.

Prehistorically, the stream and river corridors were used as resource procurement areas dealing with shell and anadromous fishes. Upland areas were also seasonally used as procurement areas and as travel routes. In historic times, the lure of mineral wealth or land to settle attracted people to this difficult terrain.

The history of human use within the Rogue River Watershed can be reconstructed and interpreted by examining the physical remains of previous inhabitants as well as observable changes which are the results of human activities. Remains, examined in conjunction with information provided by the natural environment and historical records, can reveal patterns of human behavior and adaptation. The Rogue River watershed from Marial to Agness contains both prehistoric and historic sites which represent every cultural milestone in the local history. Archaic to historic contact period prehistoric sites, early settlements, Indian war, mining, Depression Era sites and early Forest Service sites can all be found within the watershed.

The prehistory and history of the watershed are treated in Stephen Beckham's Cultural Resource Overview of the Siskiyou National Forest (Beckham, 1978). Additionally, Dodge, Peterson and Powers have compiled general histories of the region and fragmentary local histories exist in the form of oral histories, family journals, manuscripts and photo collections.

What were the prehistoric uses of the watershed?

Paleo-Indian to Northwest Coast Culture

The archeological record attests to a continuous human occupation of Southwest Oregon for at least the last eight to nine thousand years. Study of the Marial site (35CU84, Griffin, 1983) on the Rogue River provides several carbon-14 dates beginning at 8560 before present (B.P.), clearly establishing the antiquity of human life in this portion of southwest Oregon. Excavations carried out near the mouth of the Illinois River at the Tlegetlinten site (35CU59, Tisdale, 1986) unearthed materials from a later ancient culture, possibly dating from two major periods of use at 6000 and 2000 years ago. Human adaptations in southwest Oregon appear to have changed from a moderately mobile, hunting-gathering life-style to more sedentary, specialized economies. These changes are likely to have been influenced by the effects of population displacement and growth as a result of changing climates and environments in southwestern Oregon as well as in other areas.

The Northwest Coast Culture

Ethnographically, the Tututni and the Takelma are representatives of the final cultural period in southwestern Oregon. These Native American groups either inhabiting or using the general vicinity consisted of several groups speaking different languages. Coastal groups, whose territories also extended up the coastal rivers, spoke dialects of the Athabaskan language. Collectively these Athabaskans are referred to as the Tututni or Coast Rogues, although each band had its own name. Inland, the Dagelma or "those living along the river" spoke a dialect of Takelma-Kalapuyan, a sub-grouping of the Penutian stock. The Takelma were also divided into two distinct groups: the Dagelma and the Latgawa ("those living in the uplands") and their territory included two isolated islands of Athabaskan speakers.

The Athabaskan peoples inhabited much of southwestern Oregon from the beaches to the upland forests. They occupied the region from south of Bandon, Oregon to northern California and extending up the major drainages like the Smith, Chetco, Pistol, and the Rogue Rivers. The bands were numerous and the locations diverse.

According to an 1854 map and census compiled by J.L. Parrish, Indian Agent for the Port Orford District, the lower portion of the watershed analysis area was utilized by a Tututni band called the Shasta Costa (also called the Chasta Costa or Shas-te-koos-tees). The map compiled by Parrish attempted to locate the approximate territories of the native peoples. According to this map, the Shasta Costas occupied the area surrounding the Rogue River from the Illinois to Big Bend and up the Illinois River. Whether these groups maintained strict territorial boundaries delineating upland resource areas is unclear. Parrish describes the band's holdings as "reaching back from the coast indefinitely". The 1854 census by Parrish reported the "Shas-te-koos-tees" numbered 146 individuals with their major "chief" being Yah-chum-see.

The lands occupied by the Takelma included much of the watershed of the upper Illinois River and its tributaries as well as the watershed of the Rogue River upstream from the Big Bend and encompassing the watershed analysis area from Big Bend to Marial. Unfortunately, none of the early contacts with these peoples recorded detailed ethnographic notes on the Takelma while they yet lived in their old villages.

The general pattern of Tututni settlement indicates that large winter villages, containing 50 to 150 individuals, were established along coastal areas, rivers and major streams. The permanent, winter shelter of the Takelma differed little from their neighbors to the west. Houses constructed at village settlements were substantial, consisting of semi-subterranean structures with bark or plank walls and gabled roofs about twelve to sixteen feet square. Each house had a central fire area with a small smoke hole above. The earthen floor was packed solidly to keep out moisture and was often covered with mats of cattail fibers. Another structure constructed in the village site was the sweathouse. Built by the men of the village, this was a semi-subterranean, earth covered structure with an entry on one side and a hole for dropping down fire heated rocks on the other. The sweathouse could be sealed to more effectively hold in the heat. These villages served as semi-permanent habitation spots, where foods collected throughout the year could be stored for use in the winter. In the summer, when traveling to fishing sites or food gathering locations these people erected simple brush shelters around a central fire pit.

Major Shasta Costa (Tututni) villages were known to have existed at the confluence of the Rogue and Illinois Rivers (tle' geet-tlinten, 35CU59), the point of land which is now the town site of Agness (cecl-gut tun'ne), at Big Bend (se-e'ltanitcu) and the terrace above the mouth of Shasta Costa Creek (yetce'wet, 35CU161) (Waterman, 1921).

The Shasta Costa village site was located at the south end of the terrace opposite a riffle in the river which provides an excellent fishing spot. A long time resident who lived along Shasta Costa Creek at the turn of the century, reported twenty-two housepit depressions, about 15 to 20 feet across and 2 to 3 feet deep at this location. Burials and trade beads were reported coming from this site, as well as abundant fresh water mussel shells (Lucas interview, 1971). Excavations at this site indicate that Shasta Costa terrace was a significant habitation site over a very long period of time. Cultural materials thirty feet below river laid sediment suggest the antiquity of the site, although no date can yet be assigned to the lower component. The detailed descriptions of the site at the turn of the century, which include reports of intact housepits, fire rings, and mussel shell mounds as well as local reports of Indian fishing practices at Shasta Costa riffle suggest that the site was occupied near the time of contact. Cultural investigations indicate that the site has several components, and has a complex range of artifacts relating to various tasks and demonstrating at least three stone working technologies. One of these technologies involves flaking river cobbles and using the flakes, a practice not previously recognized at sites investigated along the Rogue River. This technology may possibly be related to fish processing.

This site has been repeatedly disturbed. Early settlers reportedly cleared the flat of trees around the turn of the century, and later farmers leveled some areas along the top of the terrace (Rusty Hill interview, 1987). The 1964 flood inundated the terrace and deposited 6 to 18 inches of silt as other, older floods must also have done. Bank erosion has also been heavy in the past. This prehistoric site has also been repeatedly vandalized. Four recent potholes are visible on site.

The western boundaries of the Takelma remain unclear. The extent of their occupancy of the Rogue River Canyon is not identified in the limited ethnographic literature. However, if we assume that the Big Bend is the dividing line between the coastal and inland natives then Takelman people would have occupied villages at Paradise Bar (SK-1112), Half Moon Bar (SK-179), Gleason Bar (35CU177), and Brushy Bar (SK-002).

Generally, both the Takelma and the Tututni were hunter-gatherers, subsisting on a diet consisting primarily of salmon and acorns and supplemented by a variety of game and collected food items. A seasonal round of activities was practiced which is characterized by dispersed, small task-specific groups utilizing the upland areas during the spring and summer months. These hunting and gathering groups would traverse the upland areas in search of game, plants, nuts, berries and other raw materials. Temporary camps in the uplands consisted of grass covered, brush or animal hide shelters. Fall signaled the time for communal fishing and acorn gathering and the occupation of winter villages by multi-family groups. In winter, these people would subsist largely on stored resources collected during the summer and fall.

The material found in the various sites in the watershed indicates considerable use of the river corridor and the resources contained in and adjacent to the river. Like other Indians along the northwest coast of this continent, the tribes of southwest Oregon made extensive use of fish resources, especially the salmon. The fish of the Rogue River and its tributaries were the most important animal foods. Communal fish weirs and fishing scaffolds were erected in the waterways where, due to the abundance of the fish runs, the basic food resources for an entire year could be procured in a few weeks of work. These people used many techniques for taking fish: dip nets, basketry fish traps, hook and line, nets and spears were all used to collect this important resource.

In addition, the coastal Athabaskans also had access to a vast array of subsidiary animal foods provided by the shoreline environment. Woman and children easily collected chitons, limpets, clams, snails, barnacles, sea urchins and crabs in the estuaries and tide pools. Sea mammals such as seals and sea lions were other marine animals exploited by the coastal natives along with an occasional beached whale.

For the Athabaskans and the Takelmans living away from the coast, especially those in the canyon of the Rogue River, the dependence upon camas and acorns was much more significant than for the residents along the sea. For inland peoples, the acorn became the most important staple in the diet. The Takelma preferred the black acorn while the Athabaskans preferred the acorns of the tanoak. The acorns were ground into flour by use of a stone with a basket hopper with a open bottom. The acorns were then leached free of tannic acid by placing the flour in a bed of sand and repeatedly pouring hot water over the flour. The dough was then stone boiled in a basket to produce a mush. Camas and brodelia bulbs were baked in stone lined pits and were also important plant foods.

The hunting of big game, especially deer, elk and bear were also of great importance to the diet. Covered pits, and game drives utilizing deer fences and snares were commonly employed as well as the bow, arrow and spear. Small game, seeds, insects, berries, birds and eggs also rounded out the diet of these inventive peoples.

Various tools and other artifacts not only establish site locations, but also reveal the types of resources being utilized and the types of technologies being performed. Numerous sites and isolated finds have been located within the watershed and are representative of the common upland site types found in the Siskiyou National Forest. These include temporary campsites related to hunting and gathering activities such as SK-272, the Big Bend Lithic Scatter, 35CU206, the Big Bend Pasture Lithic Scatter #1, and 35CU172 the Billings Creek Site. Artifacts found in these temporary campsites include lithic debitage, the waste material from the manufacture of stone tools, and the tools themselves, such as projectile points and scrapers. Temporary campsites are often located on or near major ridgelines, which were used as travel routes, or in areas where diverse vegetation encouraged the collection of unique resources. Meadow areas for the gathering of grass seeds or flowering tubers such as camas are an example of the latter mentioned site locations.

Another upland site type common on the Forest but not found in this watershed analysis area is the lithic quarry. It represents a site where the procurement of raw materials for the production of stone tools was the focus of activity. Pits dug into outcrops of chert, a cryptocrystaline stone capable of being knapped, and extensive surface rubble from lithic reduction activities typify this site type. Debitage is predominantly large blocky shatter and flake fragments typical of early core shaping activities. Hammerstones of a material not native to the site are also common. These hammerstones range from softball to pebble size. This range represents the lithic reduction sequence from course quarrying work to the fine work required to shape a biface.

Other types of sites, which can be found within the watershed, offer insights to the religious and spiritual nature of the Native Americans in the area. SK-101, the Green Knob Vision Quest Site, and SK-180, the Willis Vision Quest Site are examples of this site type. SK-101, the Green Knob Vision Quest Site, consists of six pits situated on a large sandstone outcrop providing a commanding view of the Shasta Costa and Rogue River drainages. The vision quest pits are circular depressions carved into bedrock and surrounded by a wall of stones two to four levels high. The pits are large enough to contain one person and are arranged in a semi-linear orientation.

The vision quest was one of the most fundamental and widespread religious concepts of North American Indians, including the inhabitants of southwest Oregon. Certain rites of passage were key in the life cycle of these aboriginal people, the vision quest being one of the most important. Young men and women performed this rite at puberty on the bald peaks and headlands of the region. The vision quest was undertaken to seek a guardian spirit and to obtain supernatural power. The vision seeker sought the aid of the spirit world through prayer, dreaming, fasting, dancing and going without sleep until a guardian spirit came to the candidate in a vision. An individual could undertake more than one vision quest in his or her lifetime in search of spiritual aid and guidance.

The Green Knob Vision Quest Site has been disturbed by both natural and human means. Some of the pits have been partially overgrown causing portions of the stone walls to fall inward. Another pit on the southernmost side shows evidence of the rock walls apparently pushed over the adjacent bluff. This site is an outstandingly significant, Class I cultural resource as it represents a traditional socio-religious practice of the native peoples. Not many of these vision quest sites have been found in southwest Oregon.

Another type of site, which provides clues to the spiritual lives of the earliest residents of southwestern Oregon, are the petroglyphs carved into the rocks of the Rogue River. Only two petroglyph sites have been discovered in southwestern Oregon and both are located within the watershed analysis area: SK-010, the Twomile Petroglyph Site and SK-1105, the Brushy Bar Petroglyph Site. The Twomile Site consists of approximately twenty boulders which have holes, called cupules, and designs pecked into their surfaces. It is thought that the site was used in connection with fishing rituals and that such places were spiritual gathering points for tribal members seeking improved fishing. There also are indications that fertility rituals occurred there as well. It is theorized that the site is more similar to those in California than the Pacific Northwest.

The major ridge tops, which surround the watershed, were also used by the aboriginal inhabitants as trade and travel routes. As previously mentioned, temporary campsites are often located along these ridgetops. Evidence of trade can be assumed from the artifacts found in various sites. The presence of material such as obsidian, not native to the area, is proof of intercourse with the interior regions. Sourcing of obsidian from various excavations indicates a widespread trade network reaching into northern California, south central Oregon and the central Cascades. In exchange, coastal products such as shells, dried salmon, salmon oil, deerskins and wapato root found their way inland. Historically, trails and later roads often followed these aboriginal travel routes.

Glimpses of these people and their way of life have been made known to us through ethnographic information, the journals and manuscripts of the early white explorers and settlers, records and accounts from the Rogue Indian Wars and the archaeological record as it pertains to the

Northwest Coast Culture area. The ethnographic information that exists for these people was acquired from research conducted at Siletz and Grande Rhonde reservations and the Smith River rancheria. However, by the time the interviews or ethnographic sketches were compiled in the late 1800's and the early part of this century, most sources of information were already a generation removed from tradition.

What were the historic uses of the watershed?

The historic period in this portion of southwestern Oregon begins as early as the 16th and 17th centuries with the voyages of the Spanish explorers. The earliest recorded contact between the coastal natives and Europeans is noted in the log of Captain George Vancouver in 1792. Within the next quarter century trappers and traders, including North West Company fur trader Peter Corney and an American party of trappers led by Jedidiah Smith, appeared in southwestern Oregon. Russian traders and whaling ships of various nations also had contact with the native people on this portion of the coast.

The Gold Rush

Some of the first Euro-american settlers in the area were miners attracted to the region during the gold rush era. In 1849 gold was discovered at Sutter's Mill in California and miners flocked through the inland valleys following the California -Oregon Trail. Very quickly, the richest gold producing areas of California were claimed and late coming prospectors spread out into the surrounding countryside in their quest for precious metals. By 1851 the prospectors had reached southwest Oregon and in that year the first discovery of gold in Oregon occurred on Josephine Creek. Other gold strikes were soon to follow. Gold was first discovered on the coast at places like Whiskey Creek and Gold Beach, named for the gold rich, black sand deposits found there. Later, gold deposits were found in the Rogue River. Early prospectors left little of the local country unexplored and in the ensuing years every area along the Rogue River with gold in sufficient concentrations was mined. Mining within the watershed lasted from the middle of the nineteenth century through the 1940s.

One of the earliest prospectors in the watershed analysis area was Charles Foster. The site of his cabin, SK-111, was near the mouth of Foster Creek on the south end of the Big Bend. There are no remains to this site. Foster also had an Indian wife, and the cabin site was a scene of one of the earliest conflicts between the intruding white population and the native inhabitants.

Initial contact between Euro-american and native cultures along the southwestern Oregon coast relations can be characterized as generally friendly, or at least the cultures avoided one another. However, this situation rapidly deteriorated. During the period between 1840 and 1855 thousands of transient miners and permanent settlers entered southwest Oregon. Merchants, packers and farmers soon followed them. Encouraged by the Donation Land Act of 1850, the majority of the newcomers who would become permanent residents entered the area in the years between 1850 and 1855. The consequence of this increased emigration was competition between the cultures for space and resources. This situation, coupled with racial and ethnocentric biases, eventually lead to armed conflict in 1853. Ultimately, ill feelings between the native populations and the Euro-americans exploded into the Rogue River Indian Wars of 1855-56.

The Rogue River Indian Wars

A significant part of the Rogue River Indian Wars took place within the watershed analysis area. The Battle of Big Bend was the last significant battle between the United States Army and the various tribes of southwest Oregon. The battle occurred in May 1856 along the Rogue River at Big Bend, site #ORCU003.

Following a treaty meeting at Oak Flat on the Illinois River, (site SK-107) Captain A.J. Smith and a reinforced company of Army Dragoons proceeded to the Big Bend of the Rogue River to accept the surrender of several Indian bands. On the evening of May 26, 1856, Smith was informed that his company might be attacked, and he withdrew his forces to the ridge line to the west of the Big Bend meadow. The following morning an Indian force composed of various inland and coastal bands and led by Chief John, an Applegate River Takelma, advanced on the soldiers and surrounded their defensive position. The fighting continued for 30 hours and although the soldiers were able to maintain their position their casualties approached 30 percent of the force. It was only the arrival of Captain C.C. Auger with a company of infantry that saved the embattled force as the Indians were forced to withdraw from the field.

For the Indian warriors the battle became a defeat snatched from the jaws of victory. For the soldiers the battle was, at best, not a defeat. Nevertheless, the result of the battle broke the fighting spirit of the Indians and essentially concluded The Rogue River Indian War. The bands soon surrendered and the "hold-outs" were tracked down and captured. The majority of the native population was forcibly removed to the Siletz and Grande Ronde reservations. Some individuals escaped relocation or were allowed to return to their homelands, mainly because of intermarriage with the white settlers. Some individuals returned to their homelands after the enactment of the Dawes Act which opened public domain allotments to Indian peoples. In 1938, twenty-three allotments were in existence in Curry County. With the removal of the native inhabitants at the conclusion of the war, the area was opened to settlement.

Euro-american Settlement

Early settlers and miners trickled into the Rogue River area during the 1860s. They often built their homes on the same river or stream terraces that had provided homes for the native inhabitants. The remoteness and difficult access precluded extensive development and most people followed a subsistence-oriented way of life. This life-style made maximum use of the available fish and game, supplemented with produce grown and animals raised on small farms. The grassy ridge tops were attractive to early stockmen and are often the sites of early homesteads. Goods and services were traded, bartered and scavenged. Cash earning activities were limited and population densities low. Small scale mining, and the sale of livestock and fish provided some income to local residents. Archeological sites which chronicle historic settlement within the watershed include cabin remains, trails, mines and camps used by miners, homesteaders and packers.

In the summer of 1868 a pack train carrying supplies, children and pregnant women slowly made their way to the site that would become Agness, at the downstream end of the watershed analysis area. About twenty men, women and older children walked and drove a few cattle along with the pack train. Younger children were stowed away with the baggage. This group of emigrants hailed from the Klamath River gold country, but tired of poor mining results there, they would chance better opportunities on the Rogue River. Names such as Billings, Fry, Southard and Rumley, all members of the pack train, would live on in the Rogue River canyon until this day. The travelers and their children would scatter throughout the river canyon, finding places to plant fruit trees, break trails, build cabins and mine the ground.

John Billings and his Karok Indian wife, Adeline, settled first at Agness and later on the north end of the Big Bend meadow (SK-114) in 1878. John Billings established one of the first grist mills in this portion of the Rogue River canyon around 1882, building the mill about 200 yards up Billings Creek. Jake Fry also established his homestead at Big Bend. The Root Cabin, SK-134, was the home of Sinnah Fry Foster Root, also a Karok Indian and a member of the original emigrant train. Sinnah was able to claim an Indian Allotment (No. 74) adjacent to Charles Foster's homestead along Foster Creek.

Many of the cabins found in the upper reaches of the analysis area are associated almost strictly with prospecting and mining. Only a handful of settlers and miners (and later Chinese miners) were living in the Rogue River region in the late Nineteenth century and almost all were involved in some type of prospecting activity. Mining related sites and features found within the watershed include: SK-278, the Blossom Bar House, SK-279, the Blossom Bar Mine, SK-274, the Hicks Creek House, and SK-275, the Solitude Bar Mine.

The first post office in the area opened at Illahe in 1895. The settlement at Illahe was generally known as Big Bend before the official postal designation. The Agness post office soon followed in 1897. Agness, at the confluence of the Rogue and Illinois Rivers, served as the end of the riverboat supply and mail run from Gold Beach. The lack of roads throughout the area caused riverboats and pack trains to serve as the principal forms of transportation in the region. Reminders of the early settlement days can be found in such sites as SK-213, the Illahe Schoolhouse and SK-105, the Foster Creek Cemetery.

The U.S. Forest Service

The Siskiyou National Forest was established on October 5, 1906. Henry Haefner, an early forester in the area states, "In 1909 the National Forest area was about as the Indians had left it. Nothing of importance had been done to improve the property or even find out what it contained in the way of timber or other natural resources." The early forester's duties included mapping, estimating the amount of timber and agricultural land, law enforcement, fire protection, as well as a multitude of other jobs involved with the administration of a large timberland. The rangers often built their own stations and headquarters. Sites, which represent early Forest Service administration within the watershed, include administrative sites such as SK-119, the Agness Ranger Station. The Agness Ranger Station was built in 1936 to replace the Shasta Costa Ranger Station, located in the nearby Shasta Costa Creek drainage, and became the headquarters for District 2 of the Siskiyou National Forest.

Various trails, lookouts, camps, guard stations and telephone lines were constructed within the watershed during the first three decades of this Forest's history. Bear Camp Basin Lookout was first established as a camp and guard station in 1911. By 1915 the guard station had been improved to the status of a ranger station and a shake cabin was constructed on site in 1924. This structure was replaced in 1932 with a standard L-4 lookout cabin which remained in service until it was destroyed in 1965. Bobs Garden Lookout was another example of a lookout structure in the watershed. Built in 1941, Bobs Garden was also a standard L-4 cabin. However, it was mounted on a 40-foot tall pole tower. It remained in service until abandoned in 1954. Communications in the watershed consisted of primitive phone lines connecting the various lookouts to the ranger stations and the town of Gold Beach.

An important component of the historic fabric of the watershed is the trail system. These transportation corridors were the first travel routes within the watershed. Many of these paths followed older aboriginal routes. "Chief" Elwin Frye identified the Bobs Garden Trail (SK-595) as an Indian travel route. Frye was a packer for the Forest Service and the grandchild of early Rogue River settlers John and Adeline Billings. Other historic trails within the watershed include: SK-740, the Bear Camp Ridge Trail, and Green Knob Way. Trail systems effectively linked the coastal area with the interior of the Forest, and the interior with the Rogue Valley. Many were routes that the miners, and the packers that supplied them, established to get their materials to and from the prospects. Others were used to drive cattle to summer pasture. During the first three decades of this National Forest's history, the trail systems were improved and expanded. Today many Forest roads follow these historic trail routes. Other remnants of this trail system form a portion of today's recreational trail system.

The Depression Era

The Depression of the 1930s brought an influx of people to the public forest lands. Numerous out of work individuals sought survival in the mountains undertaking a subsistence economy life-style just as the earlier settlers had. These people were also engaged in prospecting and small-scale mining, encouraged by the revaluation of gold. Some of the older claims and gravel bars along the river were re-worked at this time.

In the 1930s the federal government created through New Deal legislation a number of programs of work-relief to combat the impact of the depression. In southwest Oregon the development of the Civilian Conservation Corps (CCC) formed another important chapter in the local history. Fire prevention and suppression, timber stand improvement, range improvement, soil conservation, road building and forest facilities construction were all undertaken by the CCC volunteers. The Civilian Conservation Corps provided employment and a measure of financial relief for men and their families.

After completing their basic training at Fort Lewis, Washington, the first CCC units were assigned to Agness, Oregon (SK-695). The original contingent of thirty men was soon reinforced by more and more CCC units. At Agness the challenges involved the difficulty of getting supplies, equipment and materials to the project areas. One of the most difficult tasks accomplished by this CCC unit was the moving of a massive Cleric tractor up the Rogue River from Gold Beach to Agness. The tractor was barged up the riffles of the Rogue River in the spring of 1933 to take advantage of the high water. Three riverboats were used to pull the heavy burden from dawn until nightfall.

The most monumental job of the CCC's on the Siskiyou National Forest was the building of the road from Agness to Illahe and the Agness-Powers Road. This was accomplished by men stationed at the CCC camps at Agness and China Flats, on the South Fork Coquille River. During their first summer and fall the Agness unit cut the first cat road between Agness and Illahe. During the same time period, they also constructed a new suspension bridge across the Rogue River, layed out an airport in Illahe, constructed their own camp and erected four new buildings at the Agness Ranger Station (SK-119). The Agness Ranger Station is a premiere example of Civilian Conservation Corps construction methods, materials and techniques.

The Modern Era

In the early decades of the Twentieth century, recreational use of the streams, rivers and forests has added a new economic emphasis to the area. Guides and packers often adapted older cabins and camps to their new enterprises. Hotels such as the Big Bend Hotel (SK-270) from the early decades of the twentieth century and lodges such as Scott Creek (SK-281), built in the 1930s and used until the early 1960s added a new alternative to the local economy. Agness maintained its position as an important terminus for the river boats and enjoyed the added benefit of income generated by tourists. As roads were constructed in the area, logging became a contributor to economic growth throughout the region.

Even though the historic element is by far more tangible than that of the prehistoric, much of this cultural fabric within the watershed is little known. Many of the sites in the watershed have not been formally documented or evaluated for their historic significance.

Does the watershed contain any culturally significant traditional use areas?

There is no evidence which suggests that the area within the watershed is presently used for traditional activities by local Indian groups. Recognized tribes consulted (Tolowa, Karok, Coquille and Siletz) did not provide any additional information regarding traditional use in the watershed analysis area.

The Confederated Tribes of Siletz in conjunction with the Confederated Tribes of the Lower Rogue have, for the past few years, used the Big Bend Meadow and the Billy's Creek area for their yearly "Gathering of the People" (Pow wow) ceremonies under a special use permit with the Gold Beach Ranger District. It is their intention to continue this practice and, if possible, establish a permanent site where they could construct a ceremonial lodge and camp. The tribe has also expressed an interest in gathering traditional forest products such as pine nuts, lodge poles and beargrass. If requested, the gathering of forest products would be administered by the standard permit system.

Information Needs: The complete status and number of cultural sites in the watershed are unknown. Formal site evaluations of many sites have not been conducted.

Management Opportunities: Cultural resource surveys will precede all ground disturbing projects. All sites discovered will be documented and added to the Forest inventory. The significance of inventoried sites shall be evaluated for eligibility for the National Register of Historic Places. Suitable cultural resource properties may be interpreted for recreational use and educational benefit of the general public. There is an opportunity for partnership with the recognized tribes in the development of recreational and educational programs.

What are the major recreational uses in the watershed and where do they occur?

The Rogue River watershed from Marial to Agness is one of the most diverse watersheds for recreational use on the Gold Beach Ranger District. The Rogue River corridor receives the highest number of recreational visitors for any one area on the district, although the lower river has a higher number of visitors than this watershed. Today, recreational activities include downriver floating with rafts, drift boats, canoes and kayaks, motorboating, viewing the river and scenery by tour boats, fishing, hiking, hunting, swimming, camping, and recreational driving.

The Rogue River was one of the eight original rivers designated as Wild and Scenic by Congress in 1968. From Marial to Watson Creek, the Rogue is classified as "Wild." From Watson Creek to Agness, it is classified as “Recreational”. Congress designated the Wild Rogue Wilderness in 1978, in part to protect the wild section of the Rogue River. The management plan for the Wild and Scenic Rogue River was written jointly by the Bureau of Land Management and the U.S. Forest Service and was completed in 1972. It states, "One of the key reasons for including the Rogue River in the National Wild and Scenic River system was to protect and enhance the recreational values which the river possesses." (Rogue River Plan, 1972).

Historic Recreational Uses

The Rogue River is internationally known for its fisheries and accounts for much of the early recreation on Rogue River. Drift boats were used for salmon and steelhead fishing through the Rogue River canyon and motorboats were used to bring people upriver. In the 1920s and 1930s, the Rogue became famous for sport fishing, due in part to pioneer river guides like Glenn Wooldridge and the writing of Zane Grey. The number of people fishing and recreating increased to support lodges along the river and in Agness, with lodges in the Wild Section becoming established in the 1950s and 1960s. Fishing continues to provide an important segment of recreational use on the Rogue River. People continue to fish the wild section with drift boats, while fishing from motorboats occurs primarily from Agness to Watson Creek, although some does occur in the Wild Section.

A segment of recreational use that has increased over time in the Wild Section of the Rogue River is rafting. Before the 1960s, downriver boating was with drift boats. Since then rafting has increased on the Rogue River with the heaviest use from May through October. With improved equipment in the 1990s, some rafting can occur almost year-around.

Commercial tour boats provide another major recreational use of the Rogue River in this watershed. Tour boats take visitors up the river to view and experience its whitewater, scenery, wildlife, and other resources. Tour boats began with the Rogue River Mailboats taking passengers as well as mail from Gold Beach to Agness. This started in 1938 and became more popular in the 1940's after an article about the trip was published in Sunset magazine (Personal communication with Ed Kammer, September, 1999). In 1962, Shasta Costa rapids were dug and blasted, allowing motorboats to travel above Agness to Blossom Bar rapids without portaging. The first 104-mile tour boat trip was made in 1962 (Jerry's Rogue Jets Museum, 1999). Although Blossom Bar rapids were also blasted in the 1950s, larger boats cannot negotiate this area, and it is the upper limit of the tour.

Trails in the watershed provided access for Native Americans, followed by miners and settlers. A map of the Siskiyou National Forest in 1911 shows a trail along the Rogue River. New portions of the trail were constructed in the 1910s, leveling the grade. The 1919 map shows a trail connecting the Bear Camp trail near Bob's Garden down to the Half Moon area. The 1924 map shows a trail from near Green Knob down to the Rogue River across from Dans Creek and a trail connecting the Panther Ridge trail down to the Clay Hill area. Of these trails only the Rogue River trail has received maintenance over the years. The use of the trail has increased over time as it has became more well known and as the popularity of hiking as a recreational activity has increased.

The Rogue River and the trails described above provided the primary access in the watershed until the Civilian Conservation Corps (CCC) arrived in Agness in the 1930s. Trails were improved and a road was constructed from Agness to Illahe and from Agness to Powers. Beginning in the 1950s and continuing to the 1990s, roads were constructed primarily for timber harvest activities. With these roads, and the road from Gold Beach to Agness being completed in the early 1960s, recreational driving, hunting, and camping increased as a recreational activity.

Current Recreational Use

River Use

During the late 1960s and 1970s, the Forest Service, the Bureau of Land Management, the State of Oregon, and various river user groups recognized the increased crowding and user conflicts on the Rogue River. During the next several years the agencies and user groups worked on various methods to define, permit and limit the number of users on the Rogue River. In 1972, the Bureau of Land Management, Medford District and the Siskiyou National Forest issued a joint management plan for the Wild and Scenic Rogue River. This document recognized the existing types of uses of the Rogue River, including floating craft and motorboats, and determined use should be capped at existing levels (Rogue River Management Plan, 1972). In 1973, commercial guide activity was regulated for the first time and in 1978, private floating was regulated.

Currently, for floating in the Wild Section, there is a regulated season from May 15 to October 15 for private boaters and May 15 to November 15 for the 38 commercial outfitter/guides. A total of 120 person starts are available per day during the May 15 to October 15 period on a basis of roughly 50 percent private and 50 percent commercial split. Maximum party size is 20 persons. Actual use in 1998 was 7,500 private floaters and 6,100 people floating the river through commercial guides. The amount of use has been fairly consistent over the last few years as well as the percentage of non-commercial to commercial use which has been 55 percent to 45 percent.

There are two tour boat companies that operate out of Gold Beach. They feature trips to Agness (64 mile round trip), Watson Creek (80 mile round trip), and to the pool below Blossom Bar rapids (104 mile round trip). There are six tour boats per day permitted in the Wild Section of the Rogue River (104 mile trip) and ten permitted to Watson Creek (80 mile trip). Approximately 16,000 to 18,000 people visit the wild section annually and 12,000 to 13,000 people travel to Watson Creek.

Private motorboat permits into the Wild Section are limited to six per day from May 15 to November 15. For the last three years, almost 200 permits are issued annually during the permitted season. In 1998 approximately 750 people went on these trips, which was approximately 225 people less than the previous year. Commercial fishing trips by motorboat into the Wild Section are limited to eight permittees. In 1998, these permittees made about 120 trips with 250 people into the Wild Section. This use has also been fairly consistent the last few years.

In the past, the four lodges and six recreational cabins in the Wild Section have had unlimited ingress and egress to their private property for transport of supplies, staff, family and friends. In 1998, Paradise Lodge entered into a special use permit that allowed the transport of commercial guests to their lodge. The lodge was limited to two round trips from Foster Bar to the lodge per day and a daily limit of 12 commercial passengers. In 1998, Paradise reported making about 140 round trips with about 400 commercial passengers and 280 non-commercial passengers. The other three lodges decided to continue with unlimited ingress/egress to their lodge with no provision for transporting commercial passengers. This special use permit process did not involve the private recreational cabins, and their unlimited ingress/egress continues.

Information Needs: The number of commercial fishing guide trips and clients in the Agness to Watson Creek area has not been tabulated separately from that of the lower river. The number of private recreational boat trips and passengers in the Agness to Watson Creek area is not known. The number of private recreational trips in the Wild Section from November 15 to May 15 is not known. The number of ingress/egress trips taken to the private lodges and recreational cabins is not known. The last user survey of the Wild Section of the Rogue River was completed in 1992. This could be updated with a new questionnaire or study to determine current issues in this section of the river.

River Campsites

There are about 18 sites where boaters camp along the river in the wild section. Hikers use the sites that are on the north side of the river, plus four sites that are near the trail and away from the river. In 1997, 12 pit toilets were installed at the campsites where toilets needed to be added or replaced. The only toilet on the south side of the river is at Gleason Bar. Some boaters stop at gravel bars for lunch where there are no toilets. At these locations, human waste is left on the gravel bars. After the Foster Bar restroom facility is constructed, human waste will be required to be packed out, which should alleviate this problem.

Some black bears come into the campsites along the river searching for food. They have become very adept at taking food from floater's coolers and campsites. They often will come back into the same campsites after being chased away, and occasionally some bears have exhibited aggressive behaviors while trying to get camper's food. Two years ago at Camp Tacoma, Solitude, and Brushy Bar, the Forest Service installed electric fences where campers could place their coolers for protection from the bears. Food hoists were installed at Blossom, Tate Creek, Tacoma and Brushy Bar. These measures have been successful when people use them. Additional electric fences and bear-proof lockers are planned to be installed next year.

River Lodges

Within the watershed, there are five lodges located in the Wild Section. They are Marial Lodge, Paradise Lodge, Half Moon Bar Lodge, Clayhill Lodge, and Wild River Lodge. All the lodges offer accommodations and meals for downriver floaters. Motorboats access all the lodges except Marial, the only lodge in this section that has road access. Paradise and Half Moon have grass air strips on the properties that are used occasionally. There are two lodges in the vicinity of Foster Bar: Illahe Lodge and Santa Anita Lodge. These lodges also accommodate the downriver floaters and motorboats, and are accessed by the Illahe Road (County Road 375).

Foster Bar and Illahe Road

Most of the downriver floaters take-out at Foster Bar and many motorboats launch there as well. Currently there is a raft pad, a boat ramp that is used by motorboats and rafters, a gravel parking lot and one lane entry road with turnouts. In the winter of 1997, floodwaters collapsed the vaults of the restroom facility. In August 1999, a contract was awarded for construction of a new restroom facility closer to the launching area for the convenience of the users. The new facility will include a “SCAT” machine where users will be able to dispose of human waste collected on their river trip.

Future plans for the facility include paving the parking lot and entry road. In the past, there have been numerous complaints about the dust problem at the site and paving the parking area should improve the maintenance problems that occur after flood events. A new boat ramp is planned that will allow launching year around and would be accessed from the parking lot. The raft pad would be expanded, and a floating dock would be installed. Mooring sites for a few motorboats are also planned.

The Federal Highways Administration is working with Curry County and the U.S. Forest Service to reconstruct the Illahe Road (County Road 375). Currently the road is one lane with turnouts. This project would improve sight distances; turnouts would be constructed and paved; the number and size of culverts would be increased; and drainage would be improved. The combination of this project with the Foster Bar entry road project will improve driving conditions and safety for the people who use these facilities, and will improve the drainage of the road.

Trails

The 42-mile Rogue River Trail from Grave Creek to Big Bend has been designated a National Recreational Trail. Within this watershed, the trail is 14 miles long, starting at Marial and ending at Big Bend. It parallels the north side of the river and in many places it was constructed through rock cliffs, providing spectacular views of the river below. This trail is one of the few "hiker-only" trails on the Gold Beach Ranger District. The recreational use of the trail has increased over time. Currently the use is estimated at 3,000 to 5,000 hikers a year.

A reconstruction and maintenance project is being planned for the Rogue River trail. The bridges at Dans, Hicks, Clayhill, Tate, Jackson/Johnson, and Billings Creeks, and Billings Creek overflow would be replaced. The materials for the bridges would be brought in by helicopter and/or boat. Tread work and brushing would occur along the trail from Marial to Big Bend. Drainage would be improved and some down logs would be cleared. There are also plans to reconstruct a portion of the trail around a large earthflow between Dans Creek and Hicks Creek.

Recently, a segment of the old trail along the Rogue River from Brushy Bar to downstream of Paradise Lodge over Devil's Backbone Ridge was reopened. Volunteers from the American Hiking Society completed this project. Local residents have relocated the historic trail from Bob's Garden to Half Moon Bar. The current condition is rough in places and it is not recommended for public travel. The historic Clayhill trail has also been relocated and is in similar condition. The Clayhill trail does receive some use from hunters coming into the Wild Rogue Wilderness from the Panther Ridge trail. Although local trail enthusiasts have tried to relocate the trail from Green Knob down to Wild River Lodge, they have not been successful.

Manage*ment Opportunities:* There is an opportunity to re-open the historic Clayhill trail, which would create a loop trail opportunity in combination with the Rogue River trail, the Panther Ridge trail, and the Mule Creek trail.

Campgrounds and Dispersed Recreation

The only developed campground in the watershed is Illahe Campground. This campground is located on the Illahe Road about 1 mile southwest of Foster Bar. It has 14 sites on two loops, with picnic tables, fire rings, restrooms, and drinking water. There is a short trail to the river that provides access for fishing, however there is not a good swimming hole at this location. This campground does not receive heavy use and is only full on holiday weekends. In 1998, 610 people used the campground, their length of stay ranged from 1 to 8 days.

Dispersed camping sites, other than the river sites already mentioned, are at Foster Bar, Billings Creek, Billys Creek, Twomile Creek, Waters Creek, and near the mouth of Shasta Costa. Most of these sites became established because of their river and/or creek access, and its associated fishing and swimming. Foster Bar has 8 to 10 camping sites and receives the most use of the dispersed sites.

Other dispersed recreational activities include driving to view scenery, hunting, bank fishing, swimming, wildflower viewing, and other activities. Road 33 from Gold Beach through Powers to Highway 42 has been designated as the Rogue-Coquille National Scenic Byway. The portion of the Byway within the watershed goes from Agness to Agness Pass and provides beautiful views of the Rogue River and the Wild Rogue Wilderness.

Information Needs: The amount of dispersed recreation use is not known. Monitoring trips to determine the amount and types of use can be completed if funding is available.

Management Opportunities: There is an opportunity to improve Illahe Campground by paving the roads at the campground. Picnic tables and fire rings could be replaced. There is an opportunity to improve the Foster Bar camping area by installing picnic tables, fire rings, and restrooms. Interpretive panels could be installed at stops along the Rogue-Coquille Scenic Byway.

What commodities can be produced from the watershed?

Timber

Timber harvest has occurred on approximately 10 percent of the watershed. Most harvest activities have occurred within the Twomile, Foster, Billings, Stair and Shasta Costa Creek drainages. Partial cut harvest activities have been implemented on approximately 1,110 acres and regeneration harvest activities on approximately 7,219 acres. The reforested regeneration harvest areas are currently managed for late-seral structure.

Commercial timber harvest activities would be limited to improving tree encroachment from meadows and oak savannas; stand treatment to accelerate growth and development of early and mid-seral stands into stands with late-seral structure; salvage of hazard trees adjacent to open roads; and salvage of trees if catastrophic events (fire or wind) occur in the future.

Special Forest Products

Impacts to the resources of the watershed have been minimal. The watershed receives a moderate amount of personal use Christmas tree harvest. Special forest products include: boughs, vine maple, huckleberry brush, Christmas trees, mushrooms, firewood, and some beargrass and salal.

Management Opportunities: Special forest products may continue to be collected as the market dictates and in accordance with management area objectives and requirements. Christmas trees for personal use will continue to be an opportunity in the watershed.

Mining

Mining began in the watershed during the gold rush era of the 1850's and 1860's. Prospectors used pans, sluice boxes, flumes and hydraulic nozzles known as "giants" to obtain gold. The towns of Marial and Illahe became established due the mining activity that took place in these areas. The Rogue River and the Rogue River trail were the main travel routes for the miners to carry supplies and the minerals that had been collected. Large equipment, such as arrastras and stamp mills, were floated and carried into the Rogue canyon. Some of the relics of this equipment remain today. The work of the hydraulic "giants" is still very much evident around Marial and at other locations in the watershed. Trees and shrubs have grown where this mining activity occurred, but the ditches and areas where the land was cut away by the "giants" is still apparent.

An example of these placer mines was the Gold Bar Mine, near the town of Illahe. Beginning in 1856, miners worked the gravel and cobble deposits on old river terraces, removing gold dust and flakes.

The Illahe Group was an example of another type of mining activity in the area. This was a group of eleven chromite claims in the serpentine bands extending from Twomile Creek northward to Rock Creek in the South Fork Coquille watershed.

When the Rogue River was designated Wild and Scenic, the Wild Section of the river was withdrawn from mineral entry except to valid mining claims. The same policy exists for the land within the Wild Rogue Wilderness, and at the Foster Bar administrative site. Today, there are no active mining claims in the watershed. Exploration and panning by individuals is known to occur.

Grazing

Cattle were brought into the watershed with the early settlers. Meadows and grass lands at Marial, Big Bend, Agness, Paradise and Half Moon, and in the lower Shasta Costa drainage were all used for grazing. Today, grazing only occurs on private land in Agness and Paradise Lodge, and on three cattle allotments on National Forest: Big Bend, Shasta Flat, and Agness Guard Station. Eighteen cow/calf pairs are permitted to graze at Big Bend from April through October; three cattle are permitted to graze year-around at Shasta Flat; and, six cow/calf pairs and one bull are permitted to graze from March through September at Agness Guard Station.

Management Opportunities: Fencing and spring development at the grazing allotments needs to be maintained. Himalayan blackberry and other noxious weeds need to be controlled at these sites by brushing, burning, and hand pulling. Burning of the meadows should occur in accordance with the allotment management plan.

Which roads are needed for future access in the watershed and which roads need treatment to protect the resources of the watershed?

History

The river has provided a transportation corridor for humans for as long as humans have lived in the area, from prehistoric times to today. The major ridge tops which surround the watershed were also used by the aboriginal inhabitants as trade and travel routes. Because of the rugged topography, road construction was limited during the period of Euro-American settlement. The lack of roads throughout the area caused riverboats and pack trains to serve as the principal forms of transportation.

Trails and later roads often followed the aboriginal travel routes. For the mining activities from 1850-1940 the primary access was by boat, with pack trails in the corridor and on the ridgetops. Residences and lodges still rely on the river for sole access, primarily by boat, although many hikers use the Rogue River Trail.

The Illahe Road (now County Road 375 and Forest Service Road 3730) was constructed by the Civilian Conservation Corp (CCC) in the 1930s, providing overland access upstream as far as Billings Creek and Big Bend, and downstream to the Illinois River. This road can be seen in 1940 photos, with a bridge crossing the Rogue River just above the mouth of the Illinois River, opposite the present junction to the Oak Flat Road. Human activity in these photos was limited to a few roads and scattered settlements in the Agness, Illahe and Marial areas.

After World War II roaded-access increased to accommodate the rapid expansion of timber harvest. On the 1957 photos, the road crossing Billings Creek (now FS Road 3353060) had been constructed, and another spur road left the Illahe Road, going southwest into the Foster Creek drainage. The Agness Road (FS Road 33) and the road to Green Knob (now FS Road 2300700) were constructed some time between 1957 and 1963. By 1969 road construction and commercial logging were heavily concentrated on the lower slopes above the Rogue River and its tributary streams. By 1986, road and logging activities had moved upslope, especially into the steep upper reaches of Shasta Costa and Billings Creeks.

Today the Agness Road (33) and Illahe Road (3730) provide roaded access from Agness to Agness Pass, connecting to the town of Powers and Highway 42 in the Coquille River valley to the north. The Agness Road is part of the Rogue-Coquille Scenic Byway, which parallels the Rogue and Coquille Rivers. The Bear Camp Road (23) and Burnt Ridge Road (2308) provide a travel route through the forest, connecting Coast Highway 101 to the interior valley Interstate 5.

Road Maintenance

The instability discussed in the Geology section of this watershed analysis has affected the roads constructed on this terrain from the time of their construction to the present. On 1940 photos small-scale debris slides were noted off the road accessing Agness and Illahe, especially where the road crosses or follows faults between rock formations. Scour trails from Agness Road 33 can be seen in the 1969 photos, shortly after the road was constructed. Many of these areas continue to be road maintenance problems.

Rates and persistence of movement of the large slump-earthflow features in the analysis area can be tracked by the offset and repair histories on Forest Service Roads 23 (Bear Camp) and 33

(Agness). The Agness Road (Road 33) was constructed across the upper part of the Foster Creek Slide. Approximately 300 feet of the road prism has settled at least six feet (plus the depth of fill placed for repair) since construction. The Bear Camp Road has several areas where the road was constructed through slide areas. Two areas that will need future maintenance are near mile post 34.0, commonly known as Greens Camp, and near mile post 36.4. The Greens Camp site is within a large landslide and no long-term repairs are planned. The site at mile post 36.4 is within a slump area and may be repaired with a retaining wall type structure.

Aerial photos from 1997 were reviewed to assess stream changes and landslide response to the 1996 floods. In general, the watershed area appears not to have been severely affected by the storm event, but new failures were noted off Forest Service Roads 23 (Bear Camp), 33 (Agness), and 3730 (Illahe). These road damage sites were primarily culvert failures caused by inadequate or blocked drainage.

The Illahe Road constructed by the CCC in the 1930s is still the main access route between Agness and Illahe. This portion of the road is now paved, but high, steep slopes and unstable rock types contribute to continual maintenance problems. Near Twomile Creek, near-vertical dipping interbeds of mudstone and siltstone of the Lookingglass Formation continue to peel off and damage road and drainage structures. The existing road is narrow and has numerous blind and sharp curves eroding hillsides and roadway embankments, and steep drop-offs that contribute to unsafe conditions along the road. The road pavement has deteriorated to the point that maintenance-type repairs are not cost effective. There are utility poles in or near the shoulders; some of which are being undermined by unstable slope conditions. The lack of drainage facilities leads to undermining of the roadbed and erosion of fill slopes. Major storms in recent years have led to segments of the road being washed out (Evans, 1998).

Proposed Future Projects

- Road 33 from milepost 31 to milepost 42 could be increased to a two-lane road width and paved if traffic increases significantly.
- Repair Road 33 at milepost 31.6.
- Complete the Federal Highways Illahe Road Improvement Project. (County Road 375 and FS Road 3730).
- Construct a retaining wall on FS Road 23 at milepost 36.4.
- Decommission FS Road 2300900.
- Improve FS Road 3700250 which provides access to Foster Bar.
- Repair FS Road 3730 at milepost 1.3.

Information Needs: Comprehensive road condition surveys need to be conducted. Many culverts are reaching the end of their life and may fail, blocking roaded access as well as contributing to resource damage. Roads need to be evaluated for their contribution to access, with changing patterns of use in the watershed. Roads that are no longer needed can be examined to determine the need for hydrological stabilization. Roads that cross headwalls and old fills with debris flow potential would be high priority sites. Potential debris flows from older roads may be identified from air photos and field inventory. Landslides associated with the current road system may be caused by inadequate drainage structures or improper placement, oversteepened fills or cutslopes, or location on inherently unstable areas. Other high priority sites would be areas of "stacked roads." One of these areas is in the Twomile Creek watershed where three road systems cross the drainage, at upper, midslope, and lower slopes.

Management Opportunities: Roads that are needed for present and future access can be stormproofed to reduce the potential for both road damage and resource damage. Roads no longer needed for access can be decommissioned. Waste areas should be identified and developed as appropriate in the watershed.

Road Data (Gold Beach Ranger District portion of watershed only)

Table 17. Roads Summary

Category	Number	Miles	Percent of Miles
Management Level 5	1	4.5	3
Management Level 4	1	10.6	7
Management Level 3	5	26.3	18
Management Level 2	84	94.8	66
Management Level 1	15	7.4	5
PRIVATE	2	0.9	1
TOTAL	108	144.5	100
Transportation Network Analysis Primary	8	44.2	30
Transportation Network Analysis Secondary	14	42.8	30
Transportation Network Analysis Candidate	69	57.5	40
Known Closures	28	25.5	18
Obliterated	5	2.3	NA

Table 18. Roads List

Road Number	Length (miles)	Maintenance Level	Transportation Network Analysis (TNA) Class	Notes
23	10.59	4	Primary	
2300491	0.68	2	Candidate	
2300650	1.81	2	Candidate	closed by barrier
2300700	4.51	2	Secondary	
2300710	0.29	2	Secondary	blocked
2300712	0.29	2	Candidate	
2300713	0.35	2	Candidate	
2300715	0.19	2	Candidate	
2300716	0.41	2	Candidate	
2300730	2.25	2	Candidate	
2300731	0.90	1		
2300735	0.05	2	Candidate	
2300736	0.49	2	Candidate	
2300740	1.59	2	Secondary	
2300744	0.24	2	Candidate	
2300748	0.27	2	Candidate	closed
2300770	0.90	1		closed, revegetated, stable drainage
230820	2.27	1		closed
2300824	0.14	1		
2300840	1.48	2	Candidate	closed
2300842	0.11	1		
2300844	0.17	1		
2300850	0.06	1		

Road Number	Length (miles)	Maintenance Level	Transportation Network Analysis (TNA) Class	Notes
2300860	1.30	1		closed
2300864	0.70	1		closed
2300870	0.03	2	Candidate	
2333874	0.03	2	Candidate	
2300900	0.19	2	Candidate	
2300910	0.60	2	Candidate	
2300911	0.65	1		closed
2300990	0.40	2	Candidate	closed
2300992	0.50	1		closed
2300995	0.10	2	Candidate	
2308	12.41	2	Secondary	
2308110	0.60	2	Candidate	
2308130	0.12	2	Candidate	
2308200	1.40	2	Candidate	
2308206	0.15	2	Candidate	
2308210	0.36	2	Secondary	
2308230	0.55	2	Candidate	
2308240	1.27	2	Candidate	
2308250	0.92	2	Candidate	
2308255	0.03	2	Candidate	
2308260	1.33	2	Candidate	closed
"	0.09	1	Candidate	
2308261	1.04	2	Secondary	
2308270	1.12	2	Candidate	closed
2308330	0.87	2	Candidate	
3577	5.54	2	Secondary	
3577040	0.77	2	Candidate	
3577090	0.64	2	Candidate	
33	4.51	5	Primary	
"	10.96	3	Primary	
3310120	0.5	2	Candidate	
3310650	0.5	2	Candidate	
3336	8.2	3	Primary	
3336010	2.22	2		
3336013	0.07	2	Candidate	
3336014	0.09	2	Candidate	
3336016	0.26	2	Candidate	
3336017	0.55	2	Candidate	
3336018	0.43	2	Private	
3336019	0.12	2	Candidate	
3336020	0.16	2	Candidate	

Road Number	Length (miles)	Maintenance Level	Transportation Network Analysis (TNA) Class	Notes
3336040	0.92	2	Candidate	
3336043	0.07	2	Candidate	
3336060	0.55	2	Candidate	
3336065	0.42	2	Candidate	
3336066	0.32	2	Candidate	
3336070	2.27	2	Candidate	
3336071	0.31	2	Candidate	
3336072	0.66	2	Candidate	
3336073	0.37	1		closed
3336074	0.20	2	Candidate	
3336075	0.23	2	Candidate	
3336076	0.11	2	Candidate	
3336077	0.23	2	Candidate	
3336079	0.23	2	Candidate	
3336090	0.29	2	Secondary	
3340	6.7	3	Primary	
3340010	0.35	2	Candidate	
3340040	0.65	2	Secondary	
3340090	0.31	2	Candidate	
3340110	3.67	2	Secondary	
3340111	0.54	2	Candidate	closed
3340112	0.20	1		closed
3340115	1.66	2	Candidate	
3340116	0.54	2	Candidate	
3700250	0.24	3	Primary	
3700300	0.21	3	Primary	
3730	5.84	2	Secondary	
3730060	5.31	2	Secondary	
"	0.41	1		
3730061	0.26	2	Secondary	
"	0.54	PVT		
3730064	0.77	2	Candidate	
3730067	0.12	2	Candidate	
3730068	0.31	2	Candidate	closed
3730069	0.09	1		
3730070	0.08	2	Candidate	
3730080	1.34	2	Candidate	
3730100	1.92	2	Secondary	
3730101	0.14	2	Candidate	
3730110	0.08	1		closed
5325	2.5	2	Primary	

Road Number	Length (miles)	Maintenance Level	Transportation Network Analysis (TNA) Class	Notes
5325520	1.99	2	Candidate	
5325525	0.63	2	Candidate	
5325570	0.59	2	Candidate	

Appendix A

Subwatersheds

SUBWATERSHED SUMMARIES

This section contains some of the material that is also covered under Key Questions earlier in the Watershed Analysis. It also includes portions of the Foster-Twomile Interim Watershed Analysis that are still current, and other more detailed information. Streams discussed in this section are Foster Creek, Twomile Creek, Billings Creek, and the Rogue River Corridor. Additional material on these streams is in the main watershed analysis document.

Foster Creek

The Foster Creek watershed contains 7,735 acres. Ninety three percent is managed as Late Successional Reserve, one percent near the ridgeline is Unique Interest Area, one percent near the mouth is Supplemental Resource, and five percent is privately owned.

Geology and Sediment

The Foster Creek drainage is influenced by a major fault contact, the Coquille River Fault, and numerous smaller faults and fractures that splay out from the main fault line. Several rock types are unconformably juxtaposed together; volcanic and sedimentary rocks of the Dothan Formation, and rocks of the Dothan and the Lookingglass Formation. Highly sheared serpentine rocks have been intruded into the various fault and fracture zones. This combination of sheared serpentine and less competent and fractured sedimentary rocks is the foundation for the Foster Creek Earthflow. The slide scarp extends to the ridgetop with lateral exposures along the Agness Pass Road of Dothan volcanic rock on the south and sandstone on the north. This extensive slide mass moves at various rates within multiple lobes. Slide movement has not been consistently monitored throughout its extent, but could be roughly inferred from road maintenance and reconstruction history of the road. Based on orientation of tree growth, the earthflow itself probably moves as constant, slow creep. Sediment delivery to Foster Creek and its tributaries occurs as debris slides off the toe of the failure deposits and lobes, and as streambank instability as the slide mass diverts streams into adjacent, unconsolidated slide deposits. A stream gradient change at approximately 3 miles upstream from the mouth of Foster Creek marks the terminal lobe of the earthflow deposit, and the site of numerous ancillary debris slides.

Sediment Delivery Processes

Sediment delivery in Foster Creek is dominated by a landslide which is informally called the Foster Creek Slide, located within T 34 S, R 12 W, section 11 along the mainstem of Foster Creek. This slump-earthflow is actively failing from the margin of an ancient debris basin, moving a distance of approximately one-half mile to Foster Creek. The slump-earthflow is naturally-occurring and is estimated to be 25-50 feet deep. The Agness Road (Road 33) was constructed across the upper part of the Foster Creek Slide sometime between 1957 and 1963. Evidence that the slide was active prior to road construction includes field observations of anomalous conifer growth and topographic features, historical aerial photography, and downed trees which were salvaged above the road in 1963. Approximately 300 feet of the road prism has settled at least 4-6 feet (plus the depth of fill placed for repair) since construction.

Theoretically, harvest within the groundwater influence area of a landslide can reduce evapotranspiration enough to cause groundwater levels to rise until the new stand of trees is established. A surficial field investigation showed that it is highly unlikely that either timber harvest or road construction have influenced the level of activity of the slump-earthflow. This conclusion is based on the small size of the road prism relative to the slide mass, the lack of additional drainage carried by the road ditch into the two streams which feed the southern margin of the slide, the apparent depth of the slide and the small percentage of the groundwater influence area which has been harvested. Field investigation also provided evidence that the tractor-based yarding used for the 1963 salvage accelerated the shallow debris slides and gullies along the scarp of the slump-earthflow. Historical aerial photos show that a small part of the road cutbank failed within a few years following construction, and that the road fill failed above the southern stream (probably during the 1964 storm).

Debris slides from the toe of the slump-earthflow deliver sheared serpentinite to Foster Creek. Predominantly silty fine sand is delivered by failure and gullying from these debris slides. This silty material has the same texture and color as that sampled from fish habitat areas in Foster Creek. The earliest aerial photos available from 1941 show one relatively small debris slide where today three larger slides are coalescing into one. The rate of debris sliding and delivery of sediment to Foster Creek is difficult to determine from periodic aerial photographs, but may have accelerated since the mid-1970s. Movement along the road prism near the upper part of the slide does not necessarily result in debris sliding at the toe. This is due to the interaction of numerous blocks of slide debris evident from pressure ridges, scarps, and tension cracks between the blocks. Thus, sliding at the toe of the slump-earthflow may be delayed for long periods of time following movement above. Due to the relatively gentle slope of the slump-earthflow surface, the probability of catastrophic failure of the entire one-half mile length is very low. However, there is a high probability of a large debris slide within the next ten years delivering enough sediment to cover aquatic invertebrates, fish spawning sites, and young fish. Field observations suggest that when this material is delivered during high flows, it may be flushed out rather than depositing in these areas. Thus, it is expected that this material would be removed during high streamflows the following season.

Due to the fine particle size of the sheared serpentinite, the sediment results in turbidity in Foster Creek. Sudden increases in turbidity have been observed in the summer, when rainfall could not have triggered a slide. When sediment is delivered after streamflows have decreased, it may be deposited in Foster Creek. Turbidity problems were cited as having begun in 1984 and continued through 1986 in a letter from David F. Werschkul (August 4, 1986). Active failures by flowing and gullying were also observed at the toe during the winter of 1988-89. It seems likely that turbidity has been a natural periodic effect of this slide for centuries. However, it may not be possible to determine whether turbidity events have begun to occur more frequently as a result of more frequent post-stormflow movement of the toe.

Information Need:

The stability features of the slump-earthflow and vicinity need to be mapped in more detail to delineate the area that is unsuitable for timber harvest due to irreversible soil loss.

Large Woody Material and Snags

Coarse woody material is abundant on the forest floor due to the introduction of *Phytophthora lateralis* and mortality of Douglas-fir and of Jeffrey pines on surrounding upland ultramafic terrain. The Port-Orford-cedar (POC) population within the watershed has been greatly impacted by *Phythophthora lateralis*. The majority of streams within the watershed have been infested. This has resulted in many POC snags in various stages of decay along these streams. In addition, many sugar pine trees have been killed in the uplands by white pine blister rust. The vast majority of these snags are too old to be used for lumber. Generally where harvest has occurred in the past, the area is below the recommended levels for snags and down woody material. Where harvest has not occurred, the area exceeds the recommended minimum levels.

Large Wood Delivery to Streams

The root strength of forest vegetation helps to maintain the marginal stability of headwalls on the Tyee Formation. Windfirm buffers are required to protect the natural distribution of debris flows that deliver large wood.

Large ancient landslide deposits deliver large wood to the unstable drainages along their margins.

The contribution of Port-Orford-cedar (POC) to root strength is declining along streams which are infected with *Phytophthora lateralis*. The abundance of dead and dying POC may also have accelerated the rate of supply of large wood to the stream channels.

Hydrology

The Foster Creek watershed receives 80 to 110 inches of precipitation per year, with 70 percent of the area in the rainfall-dominated zone, and 30 percent in the transient snow zone.

Approximately 11 percent of the watershed has been harvested, including 19 percent of the transient snow zone; and it has a road density of 3.3 miles per square mile. These amounts are not large. However, WAA 22F02W has a road density of 4.2 miles per square mile (though little harvest); WAA 22F05W has a road density of 3.2 miles per square mile and 20 percent of its transient snow zone harvested; and WAA 22F06W has a road density of 3.3 miles per square mile, total harvest of 25 percent in partial hydrologic recovery, and 41 percent of its transient snow zone harvested. These data indicate that streams in the Foster Creek drainage should be evaluated on site for evidence of altered flows.

Stream Flow

Foster Creek streamflow has been measured during summer low flows, where the Illahe Road crosses the stream near the mouth.

Year	Month	Flow, cubic feet per second
1989	July	8.8
1993	September	9.1
1999	July	9.1

There are 5 permitted water rights for Foster Creek, totaling 0.52 cfs. One of these is for the Forest Service campground, below the point where the flow was measured. Two rights have lapsed through non-use. The two remaining private water rights, totaling 0.1 cfs, are upstream of the flow measurement point.

Channel Condition

Foster Creek channel conditions are dominated by the effects of the large slump-earthflow that occupies much of its watershed. The magnitude of sediment delivered is discussed under geology, and is evidenced by the large alluvial fan where Foster Creek enters the Rogue River.

In the 1940 photos, an inner gorge landslide is on the sharp bend about a mile upstream of the mouth, but the rest of the channel appears stable and well-vegetated. On the 1957 photos privately owned land between North Fork Foster and the mainstem (part of the earthflow, but north of “Foster Slide”), has been harvested, with tractor trails and a road from the Illahe Road. The active slide that has bare ground today doesn't show up yet. Short segments of the riparian canopy have opened up, probably as a result of the 1955 storm, and short debris flows can be seen in tributary channels, but most of the channel is still well vegetated.

Scour trails from Agness Road 33 can be seen in the 1969 photos, shortly after the road was constructed, but these are shallow and would have had little effect on channel conditions. The 1996 storm event washed out portions of several fills over culverts, but little effect to channels appears on the 1997 aerial photos.

Most of the streams that drain the Foster Creek watershed have steep, transport gradients of over ten percent. The Foster Creek mainstem has a depositional gradient of one to two percent in the first two miles upstream from its mouth. However, it has sufficient flow energy to transport sediment loads through this reach. Some material is temporarily deposited, but deposits are mobile and change size and shape following high flows.

Turbidity

Foster Creek, with its large natural earthflow feature, has longer periods of turbidity than is characteristic of streams in the western Siskiyous. The fine particle size of the sheared serpentinite in the slide creates turbidity when sediment is delivered to Foster Creek. Sudden increases in turbidity have been observed in the summer, when rainfall could not have triggered a slide. Active failures by flowing and gullying were also observed at the toe during the winter of 1988-89. It seems likely that turbidity has been a natural periodic effect of this slide for centuries.

Temperature

Temperatures have been monitored with a max-min thermometer in 1987, and with recording thermometers at the mouth of Foster Creek during the summer months since 1990. Foster Creek was listed by the Oregon Department of Environmental Quality in the 1996 and 1998 303(d) listings as water quality limited for temperature, exceeding the state standard for this area of 64 degrees.

Year	**7-day average maximum**
1987	66.2
1990	67.8
1991	67.6
1992	68.1
1993	65.0
1994	67.7
1995	66.6
1996	68.7
1997	69.5
1998	71.2
1999	68.6 at the mouth 64.6 above the North Fork 66.1 in North Fork at mouth

These temperatures are warmer than optimum for salmonids. Several factors may contribute to these warm temperatures. There are two road crossings and two harvest units along this stream. One unit with no riparian buffer borders 1000 feet of stream, but this stream may not flow during the late summer when stream temperatures are highest. The other unit borders 800 feet of stream, but has a 100 foot riparian buffer. The lower mile of Foster Creek has residential and agricultural developments which may have removed streamside shade. On the 1988 aerial photos, the major influence on streamside shade appears to be sparse vegetation caused by the geology and the earthflow along most of the stream length. It is likely that this natural feature is the primary contributor to stream warming.

Fisheries

Foster Creek is a fifth order stream with a palmate stream configuration. It provides 2.4 miles of salmon spawning and rearing habitat, 5 miles of steelhead habitat and an additional 5 miles of trout habitat. From the perspective of the entire lower Rogue River, or certainly from that of Oregon's south coast region, Foster Creek is not a significant producer of salmonid fish. However, because so few of the tributaries between Marial and Agness can support fish at all, Foster Creek is important at the level of this analysis. Additionally, the Marial to Agness reach of the Rogue River is something of a transitional reach. Downstream are the Illinois River and the marine-influenced, coastal portion of the lower Rogue River. Upstream are the Applegate River and Upper Rogue River. The ecological significance of the spawning habitat in Foster Creek (as well as Shasta Costa Creek) may be greater than mere miles can explain because of their transitional location.

Coho regularly spawn in low numbers in Foster Creek. Along with all coho spawning in lower Rogue River tributaries, these coho are thought to be strays from upper Rogue stocks and not remnants of a once-larger lower Rogue stock. The other salmonid species using Foster Creek are fall chinook, winter steelhead, anadromous cutthroat trout and resident trout, both rainbow and steelhead.

At its mouth (Rogue River to County Road 375 bridge) Foster Creek has a bedrock bottom with only small patches of gravel and cobble on the surface. The channel here is highly confined in a narrow gorge cut through uplifted terraces on both the north and south bank. It is a highly erosional habitat that has trapped little large wood or gravel. This bedrock stream bottom is typical of the tributaries south of Foster Creek and is a result of the underlying geology. Unlike the other tributaries, however, Foster Creek has developed low gradient reaches upstream of this bedrock bottomed reach and is capable of supporting spawning salmon and steelhead. Since there is little holding or spawning habitat in this lower 0.5 mile reach, it is mainly used as a migration corridor for fish. Small pockets of rearing habitat occur throughout this reach.

The next reach (river mile 0.5 to 2.4) is not as confined and, therefore, holds more gravel and wood, increasing the value for fish habitat. A mixture of cobbles, gravels, sand and small boulders line the stream bottom. The mixture of particle sizes is a result of the earthflow located just 2 miles upstream of this reach. Large wood occurs at a rate of 15 pieces per mile and is a mixture of natural trees and cut logs tied in place as part of a stream enhancement project in 1985. The valley is wider in this reach and a few homes and a small vineyard occupy the terraces above the stream. The riparian forest is a mixture of conifer and hardwood trees. This reach is a productive spawning and rearing reach for chinook, steelhead, trout and coho. A tributary flows from the north into this reach and provides steelhead and trout spawning and rearing habitat.

Between river mile 2.4 and 3.0 the valley narrows and the stream gradient increases to 4 to 10 percent. Pocket pools interspersed in cascades provide spawning and rearing habitat for steelhead and anadromous cutthroat trout. Salmon do no use this stream reach.

Beyond river mile 3.0 the stream gradient increases steadily to 20 to 60 percent and the main channel splits into numerous tributaries. The stream channels flows through an earthflow and small and large boulders dominate the channel bottom. Anadromous fish do not use this habitat, but resident trout persist nearly a mile into each of the three larger tributary channels.

In addition to naturally spawning fish, culture has been a historic part of the watershed. A hatchery operated at the mouth of Foster Creek until the 1970s.

Riparian Processes

The Foster Creek watershed contains a band of ultramafic rocks and soils, with areas of riparian vegetation characteristic of both wetter and drier ultramafic sites.

The Foster Creek slide and other large slump/earthflow features discussed in Geology sections of the subwatershed descriptions create high frequencies of disturbance to the streams that characteristically form their margins or flow along their toes. These riparian areas have higher delivery rates for sediment (including turbidity), large wood, and other nutrients. They also have a more open canopy than other riparian types.

Data stored in GIS indicate that 45 percent of the riparian vegetation in this subwatershed is mature and old growth conifer, and 16 percent of the riparian reserve acres have been harvested.

Wildlife

Proposed, Threatened and Endangered Species

The Foster watershed has two northern spotted owl nest sites (#271 and #237). Both sites are located in the Late-Successional Reserve (LSR) land allocation.

Bald Eagles have been sighted in the watershed, but no nests have been seen.

Marbled murrelets have not been detected within the watershed boundary. No peregrine falcons have been sighted in the watershed. No known nests occur within the watershed.

Sensitive Species

One sensitive animal species has been found in the watershed, the Del Norte salamander.

Currently about 10 percent of the watershed is in a pioneer successional (open canopy) condition (6 percent clearcut, 2 percent FS meadows, 2 percent private). Two meadows were identified as MA-9 in the Siskiyou National Forest LRMP. Meadow #241 is approximately 37 acres and meadow #243 is approximately 16 acres. Both meadows have been encroached by trees and would benefit from encroachment reduction. This type of habitat provides forage for deer and elk. Forest Plan Standards and Guidelines call for 20 percent of the watershed to be in forage producing habitat (see S&G 4-11).

One of the four largest known populations of the plant *Triteleia hendersonii* var. *leachiae* is in the headwaters of Foster Creek (Titus,1995). The species management guide lists fire suppression and related successional events, logging, and road construction as important threats to the species. Meadow management is listed as criti
cal for the continued survival of this taxon. The guide also states the species is expected to be very fire hardy.

Noxious Weeds

Five noxious weed species currently inhabit the watershed. Noxious weed populations have likely increased as the road mileage in the watershed increased. Most populations are currently restricted to disturbed areas including roadsides, disturbed woodlands, landing sites, and streambeds. Brooms (Cytissus sp.) occur in the Foster Creek watershed and their aggressive nature threatens to destroy native plant communities. Gorse is found nearby in the Lobster watershed and is likely to be found in the watershed in the near future. Gorse and broom are highly flammable and may become fire hazards. Gorse has dangerous thorns. Star thistle has been found in the eastern portion of the watershed. Canada thistle, bull thistle, and tansy ragwort are established in the watershed and pose a lesser threat because they have already long occupied many of the watershed's disturbed sites. (See Noxious Weed Map)

Fire

Foster Creek is one of the subwatersheds along the Rogue River, Marial to Agness, where natural fires were probably augmented by Native Americans to enhance forage for game and to stimulate the growth of plant species used both for food and to make baskets. Early settlers also used fire for similar reasons, and to maintain grazing land for their livestock, up to the mid 1930s.Historical fire activity in the Foster Creek watershed was driven primarily by human influence. The documented occurrence of natural fire starts, and the amount of acres burned, are very low. Of the 2500 to 3000 acres burned by six different fires in the upper reaches of Foster Creek, only one fire was documented as started by lightning, burning fewer than 300 acres.

Between 1900 and the 1930s multiple overlapping human caused fires burned across the upper reaches of the drainage, from Ophir Mountain to the east for several miles. The 1939/40 aerial photographs of the area indicate that the result of these fires was stand elimination on the southern aspects, leaving stringers of surviving conifers and hardwoods in the riparian areas. The northern aspects, typic ally having a cooler micro-climate, show little sign of a fire having burned through the area.

The Foster Creek area was subject to much prospecting and actual mining, and many of the fires, which burned during the early part of the century, were associated with this activity. As the mining activity diminished and fire suppression became more effective, the number and size of wildfires dropped dramatically.

Today, while the risk of lightning caused fires has not changed over the period of fire records, the risk of human caused fires has not only dropped, but has been spatially focused along the primary travel routes and the main river corridor. Fire prevention measures are concentrated in these areas, and suppression guidelines, which call for controlling wildfires to minimize catastrophic affects, are applied to the majority of the Foster Creek watershed.

Management Opportunities**:** Conifer stocking in riparian areas can be examined to determine whether or not the opportunity exists to increase the amount of future large wood available to streams by planting conifers or thinning crowded areas.

Roads can be examined to determine the need for hydrological stabilization. Headwalls crossed by roads, and old fills with debris flow potential would be the highest priority sites. Roads not needed for management can be considered for decommissioning.

The fish habitat improvement structures have been inventoried and are periodically monitored. This monitoring needs to continue so that maintenance or modification needs can be addressed.

Treatment of infested noxious weed areas is needed to reduce, control or eliminate the further spread of these plants in the watershed. Treatment opportunities include cutting, pulling or burning noxious weeds, closing roads, cleaning heavy construction machinery before and after work at construction sites, using only "clean" fill material, and using only certified weed-free hay. Soil disturbance activities such as ripping of roads in contaminated areas should be evaluated to determine how to minimize the spread of weeds. Control methods are limited for thistles and tansy because of their wide distribution. Reduction of soil disturbance and biological controls (tansy ragwort) will help control their populations. Seeding disturbed areas with native plant species will reduce opportunities for weeds to become established. Disturbed areas should be surveyed to detect new populations of noxious weeds before they become well established. Follow-up surveys of treated sites will be necessary to detect noxious weed population regeneration.

Allocation of a one-acre pond as MA-9, in T34S, R12W, Sec 11, NW of SW of SE would be beneficial. This area is currently designated as Late-successional reserve.

Meadow enhancement activity would be beneficial in meadow numbers 241, 243, and 246, and in the smaller meadows (less than 1 acre) scattered throughout the watershed, and areas to the west of meadow 246 between FS Roads 3336 and 33.

Cultural

One of the earliest prospectors in the Rogue River watershed between Marial and Agness was Charles Foster. The site of his cabin, SK-111, was near the mouth of Foster Creek on the south end of the Big Bend. There are no remains to this site. Foster also had an Indian wife, and the cabin site was a scene of one of the earliest conflicts between the intruding white population and the native inhabitants.

The Root Cabin, SK-134, was the home of Sinnah Fry Foster Root, a Karok Indian and a member of the original emigrant train. Sinnah was able to claim an Indian Allotment (No. 74) adjacent to Charles Fosters homestead along Foster Creek.

Reminders of the early settlement days can be found in such sites as SK-213, the Illahe Schoolhouse and SK-105, the Foster Creek Cemetery.

Recreation

The Forest Service maintains one campground within the Foster Creek watershed, near Foster Bar. There are also dispersed recreation and camping sites along Foster Creek above the Illahe Road.

Twomile Creek

The Twomile watershed contains 3,489 acres. Ninety eight percent of this is managed as Late Successional Reserve, one percent near the mouth as Supplemental Resource, and one percent is privately owned.

Geology and Sediment

The watershed is divided by the South Fork Coquille River Fault, with younger Tertiary rocks of the Coast Range Geologic Province to the east, and older Jurassic rocks of the Klamath Mountain Geologic Province to the west (see process records for Soil Conservation Service 1990 contract geologic map).

Landslides are most abundant along faults and contacts between different rock types in the watershed. Because Twomile Creek and its tributaries generally follow faults, streambank debris slides are relatively common. Road-related landslides are associated primarily with sites where the Agness and Lake of the Woods road cross faults (see SCS 1990 contract stability features map).

In some areas, landslides from headwalls have entered channels as debris flows, scouring long unvegetated tracks. Where visible from the Rogue River, these debris flow tracks may attract attention due to the reflective silver color from the Colebrooke schist bedrock. Potential debris flows from older roads may be identified from air photos and field inventory.

Hydrology

The Twomile watershed receives 85 to 100 inches of precipitation per year, primarily as rainfall. Approximately 85 percent is within the rainfall dominated zone below 2500 feet elevation, and 15 percent is in the transient snow zone.

Nearly 20 percent of the watershed has been harvested. The watershed analysis area (WAA) that is most likely to have experienced flow alterations as a result of timber harvest within the past 30 years is 22M06W, the south side of upper Twomile Creek. Additionally, 58 percent of the transient snow zone was harvested in the WAA, and it has a road density of 3.8 miles per square mile. Combining this WAA with 22M07W, 36 percent of the transient snow zone in the headwaters of Twomile Creek was harvested. The combination of these activities may have increased peak flows in Twomile Creek or its tributaries. Increased peak flows could trigger landslide activity by cutting the tow of slides such as the one just upstream of Agness Road 33 at the Twomile Creek culvert.

Channel Conditions

Three road systems cross the drainage, at upper, midslope, and lower slopes. Field observations in 1990 found localized effects to upper tributaries, including incised channels from harvest and road construction.

Stream Temperature

Using a max/min thermometer water temperature in Twomile Creek was recorded at the junction with Forest Service Road 33 (Agness Road) in mid-July 1990, approximately one-half mile above the confluence with the Rogue River. The maximum temperature was 62 degrees Fahrenheit (F). A recording thermometer place near the mouth in 1993 recorded a 7-day average maximum of 61.7 degrees F.

The Twomile Creek Drainage has been infected with *Phytophthora lateralis*, which has killed Port-Orford-cedar located within the riparian areas of the mainstem and many of its tributaries. Loss of riparian shade may be increasing summer stream temperature.

In August 1990, an aerial survey was conducted to map the extent of the dead and dying Port-Orford-cedar. It showed the amount of infection to vary within the drainage from lightly scattered to large pockets consisting of 10 or more trees. The main concentrations were found on the main stem of Twomile Creek and three of its tributaries located in sections 23, 25 and 26. As the infection continues to spread in the drainage short and long term impacts will increase.

Management Opportunities: A 1990 proposal to restore stream shade by planting coniferous and deciduous seedlings in affected riparian areas has not been implemented because the KV funds were not generated. Impacts can be reduced by replanting infected areas with a mix of hardwoods for short-term stream shade recovery and conifers and resistant species of cedar for long-term recovery and diversity.

Fisheries

The Twomile Creek basin contains approximately 17 miles of perennial and intermittent streams. The channel morphology of Twomile Creek is a cascade with many step pools. Steelhead and/or resident cutthroat populations are found in the lower sections, but no salmon were observed.

A stream survey was conducted on Twomile Creek in 1990 from the mouth to 0.9 miles upstream. The pool/riffle ratio is 20/74 with 6 percent glides, therefore pool habitat appears to be lacking. However, small step pools were not broken out from some of the cascades in the stream survey. The substrate consists of gravel and small boulder. The floodplain vegetation consists of small trees and large trees which are bigleaf maple, madrone, alder, and oak. The large woody material is 42 pieces/mile which is slightly lacking for coastal streams.

Wildlife

Proposed, Threatened and Endangered Species

The Twomile watershed has one northern spotted owl nest site (#327) and contains habitat within the mean home range of two additional pairs (#237 and #317).

Bald Eagles have been sighted in the watershed, but no nests have been seen.

Marbled murrelets have not been detected within the watershed boundary. No peregrine falcons or nests have been sighted in the watershed, although the watershed is within the foraging range of a peregrine falcon nest.

Sensitive Species

California Mountain Kingsnake (one observation) and Del Norte salamanders have been reported.

Currently, 26 percent of National Forest lands in the watershed are in a pioneer successional (open canopy) condition. Half of this is a result of timber harvest that has occurred since 1980, the remaining half is a result of serpentine influenced meadows or clearcuts on serpentine-influenced soils. A ten-acre portion of meadow MD-246, as well as approximately 100 acres of serpentine-influenced meadows, have been encroached by trees and would benefit from encroachment reduction. This type of habitat provides forage for deer and elk. Forest Plan Standards and Guidelines call for 20 percent of the watershed to be in forage producing habitat (see S&G 4-11).

Large Woody Material and Snags

Coarse woody material is abundant due to the introduction of *Phytophthora lateralis* and mortality of Douglas-fir and of Jeffrey pines on surrounding upland ultramafic terrain. The Port-Orford-cedar (POC) population within the watershed has been greatly impacted by *Phytophthora lateralis*. The majority of streams within the watershed have been infested. This has resulted in many POC snags in various stages of decay along these streams. In addition, many sugar pine trees have been killed in the uplands by white pine blister rust. The vast majority of these snags are too old to be used for lumber. Generally where harvest has occurred in the past, the area is below the recommended levels for snags and down woody material. Where harvest has not occurred, the area exceeds the recommended minimum levels.

Noxious Weeds

Five noxious weed species currently inhabit the watershed. Noxious weed populations have likely increased as the road mileage in the watershed increased. Most populations are currently restricted to disturbed areas including roadsides, disturbed woodlands, landing sites, and streambeds. Brooms (*Cytissus sp.*) occur in the watershed and their aggressive nature threatens to destroy native plant communities. Gorse is found nearby in the Lobster watershed and is likely to be found in the watershed in the near future. Gorse and broom may become fire hazards. Gorse has dangerous thorns and both are highly flammable. Star thistle has been found in the eastern portion of the watershed. Canada thistle, bull thistle, and tansy ragwort are established in the watershed and pose a lesser threat because they have already long occupied many of the watershed's disturbed sites. (See Noxious Weed map)

***Management Opportunities*:** Conifer stocking in riparian areas can be examined to determine whether or not the opportunity exists to increase the amount of future large wood available to streams by planting conifers or thinning crowded areas.

Roads can be examined to determine the need for hydrological stabilization. Headwalls crossed by roads, and old fills with debris flow potential would be highest priority sites. Roads not needed for management can be considered for decommissioning.

Treatment of infested noxious weed areas is needed to reduce, control and/or eliminate the further spread of these plants in the watershed. Treatment opportunities include cutting, pulling or burning noxious weeds, closing roads, cleaning heavy construction machinery before and after work at construction sites, using only "clean" fill material, and using only certified weed-free hay. Reduction of soil disturbance (i.e. ripping of roads) in contaminated areas should be evaluated to determine how to minimize/eliminate the spread of weeds. Control methods are limited for thistles and tansy because of their wide distribution. Reduction of soil disturbance and biological controls (tansy ragwort) will help control their populations. Seeding disturbed areas with native plant species will reduce opportunities for weeds to become established. Survey disturbed areas to detect new populations of noxious weeds before they become well established. Follow-up surveys of treated sites will be necessary to detect noxious weed population regeneration.

BILLINGS CREEK

Geology

In the headwaters of Billings Creek the Tyee Formation forms high, exposed bluffs of greenish-gray, clay-rich sandstones with interbeds of mudstone and siltstone. Bluffs formed by Tyee sandstone are prone to rock topple; boulders and cobbles can be found immediately downslope, but weather rapidly to sandsize constituents. Periodic slope failures are common where headwall areas are underlain by steep slopes of poorly cohesive sandstones and siltstones, and can initiate debris torrents in stream channels. Root strength and cohesion from forest vegetation helps to maintain the marginal stability of these headwalls.

.

The Lookingglass Formation has limited exposure in the Rogue watershed, mostly in the Billings Creek area. Slopes underlain by Lookingglass rhythmically-bedded siltstones and mudstones are notable for several large landslides that have contributed large quantities of fine-grained sediment to Billings Creek. On upper slopes, Lookingglass mudstones commonly form steep slopes protected by more resistant Tyee sandstone. On mid and lower slopes, the combination of less permeable mudstone layers and deep colluvial soils has produced large slump-earthflows that have constricted or deflected Billings Creek numerous times in the past. Several of these large, old failures remain intermittently active, contributing sediment to the creek usually as debris slides off the toe of the moving slide mass. There are also areas in Billings Creek of older catastrophic debris flows which have formed relatively stable, lobate deposits above the creek. Several large block glides, another form of slope failure sometimes found in bedded rocks of differing permeability, were noted in the lower part of the watershed. These blocks probably failed in ancient times under a combination of more severe climatic conditions and seismic activity, and now appear to have reached a stable configuration.

The geomorphology of the lower drainage is shaped by large, slump-earthflows and both large and small debris slides. Debris torrents have periodically scoured through deep, benchy deposits above the stream to expose cliffs above and bedrock in the channel. Areas of slow to moderate soil/landslide creep are also present in the area, and form hummocky meadows. Downslope of the more active areas, the course of Billings Creek is diverted. Based on tree growth and drainage development noted in both the field and on aerial photo review, the larger landslide forms appear to be stable over hundreds of years, with wildfire and climatic changes (increased periods of precipitation) as reactivating agents.

Aerial photos from 1997 were reviewed to assess stream changes and landslide response to the 1996 floods. One of the few changes noted was that several large, older failures were reactivated, including debris slides in Billings Creek. A review of landslide activity on 1939, 1986 and 1997 aerial photos showed that intensive timber management appears to mimic the effects of wildfire and climate by increasing available ground water and decreasing stability. Current stream gradients in Billings Creek reflect areas of landslide deposits and scour episodes, which are in turn reflections of climatic change, wildfire, and areas of intensive timber harvest.

Channel Condition

Billings Creek has a long, narrow watershed with two land forms. Both are dominated by slump-earthflows, but the upper half has long, sloping benches with low, gentle stream banks. The lower half has a deep inner gorge with a steep channel. The change in channel morphology between these two is reflected in the stream gradient, which is concave from the steep headwaters, flattening near the bottom of the upper segment, then drops off steeply in a second concave profile before flattening again near the mouth (see stream gradient graphs, in appendix).

In the 1940 and 1957 photos the upper channel, from the headwaters near Bald Knob downstream half way to the mouth, appears well-vegetated, with riparian canopy completely covering the channel. In the 1969 photos a large debris slide in the steepest part of the headwaters has scoured out the channel, removing the riparian canopy and exposing the channel all the way down. By 1997 most of the headwaters slide has revegetated, with only a short segment still open; the rest of this half of the channel is well-healed.

About halfway to the Rogue River, the channel of Billings Creek makes a sharp jog to the east. On the second corner of this jog an inner gorge slide appears on the 1940 photos. This is at the toe of one of the slump-earthflow features in the Billings drainage. This segment of channel has a gradient of approximately 50 percent, with near-vertical bedrock banks in places nearly 50 feet high, and a stream bed dominated by large boulders. From here to the mouth, the channel condition changes little over the 50 years to the 1997 photos, although individual landslides increase and decrease in size. This is above the road and clearcuts that appear on the 1957 photos, and may indicate that the channel has a naturally unstable inner gorge from here to the mouth. There are numerous inner gorge slides that appear to remain active, inhibiting vegetation growth. In 1997, some vegetation provides partial shade to this lower channel.

On the 1957 photos the road crossing Billings Creek (now 3353060) has been constructed and half of section 7, and most of section 8 have been harvested. Smaller streams may have been affected by this tractor harvest.

Water Quality

The primary beneficial use is water contributed to the anadromous fishery in the Rogue River. Water withdrawal permits for private residences are for springs tributary to the creek.

Evidence of cattle grazing can be seen on the open meadows and savannas of the benchy earthflow terrain of the lower watershed. The steep, rocky inner gorge prevents cattle from entering the stream except near the mouth.

Typically, coastal Siskiyou streams run clear during most of the year, with turbidity during winter storms that clears within a few days. Exceptions to this are streams with large slump-earthflow features and active landslides at their toes. The Billings Creek watershed is an example of this. The steep inner gorge of the channel in the lower half of the watershed has active toe landslides that regularly contribute fine sediments. Residents that have lived near Billings Creek for many decades have observed the creek often running muddy at times when most other streams in the analysis area were clear.

Temperature was monitored with recording thermometers during the summers of 1998 and 1999. The maximum 7-day average at the mouth was 73.8 in 1998; one mile upstream of the mouth the 7-day average maximum was 68.0 in 1999. These are exceptionally high temperatures for a watershed of this small size, and are probably attributable to the unvegetated riparan area in the ravelly inner gorge of lower half of the mainstem, and the shallow, aggraded quarter mile of channel above the mouth. Following the debris flow of 1964, which removed vegetation throughout the entire length of the channel, there was a dramatic increase in the temperature of the stream before it entered the aggraded section (Ernie Rutledge, oral communication, 1989).

Riparian Processes

A low divide between the Rogue River and South Fork Coquille River is located at the top of Billings Creek. During summer, cool, moist air from the Coquille watershed will often spill over this divide into the otherwise hot, dry Rogue watershed. As a result, the Billings Creek Riparian

Reserves may function as a connection between the Klamath Mountains and Oregon Coast provinces.

Fisheries

Billings Creek provides approximately one mile of rugged fish habitat. Steelhead, anadromous cutthroat trout, and resident trout spawn and rear here. It is too steep and spawning areas are too small and dispersed to support salmon.

Cultural

Evidence of early use of the watershed was identified at a temporary campsite near the mouth of Billings Creek, 35CU172 the Billings Creek Site.

John Billings was a member of the pack train that arrived in the summer of 1868, from the Klamath River gold country. He and his Karok Indian wife, Adeline, settled first at Agness and later on the north end of the Big Bend meadow (SK-114) in 1878. John Billings established one of the first grist mills in this portion of the Rogue River canyon around 1882, building the mill about 200 yards up Billings Creek.

ROGUE CORRIDOR

The geology and hydrology of the Rogue River corridor are described in the main document.

Fisheries

All anadromous fish that use the upper Rogue River and its tributaries use this section of the river as a migration route to and from the Pacific Ocean. This is a major river, with a low stream gradient, a wide active channel and powerful winter streamflows. It flows through a narrow alluvial canyon. Active floodplain development is minimal and restricted to the confluences with the larger tributaries. Perched terraces also occur near the tributaries and are remnants of an older baseline.

The region receives a high amount of precipitation between October and June and virtually none the remainder of the year. This results in a flow regime of extremes to which fish respond. Late autumn, winter and spring result in the entire valley submerged. Only the inactive terraces are above water. To escape the force of the flood, fish hold on the margins of the channel, in submerged tributary mouths and in eddies behind boulders. Spawning is only successful in the tributaries, where streamflows are lower and do not wash away fish eggs incubating in gravel streambeds.

By late summer the river is, in many places, reduced to only a fraction of the valley width, revealing wide gravel and cobble bars. Exposed to the sun, mixed water temperatures rise into the 70s during late summer, and fish hold in cooler water found at the bottom of deep pools and at the tributary mouths. During low flow conditions the river channel is separated from the influences of forest riparian vegetation by bare rocks. Seasonal emergent rushes, willows and herbs line the channel margins. By mid-summer, mats of filamentous green algae have developed in shallow water and provide nutrients and structure for photosynthetic, invertebrate and amphibian organisms.

Large wood is absent from the mainstem channel. Powerful storm flow and a wide channel result in large wood being flushed downstream out of the watershed. Structural habitat diversity is provided by boulders and bedrock outcrops. Deep pools and turbidity provide instream cover.

Between Billings and Blossom Bar Creeks occasional backwater areas are formed in shallow channel margins. During the winter they function as escape refugia from high flows and during the summer become pondlike, although they do not all lose total connection with the mainstem. The waters here are warm and almost stagnant. It is in this reach that small mouth bass have been seen. The river also provides warm water for non-native species introduced upriver, such as redsided shiners and bass.

Riparian Processes

The riparian zone along the Rogue River provides a large-scale, low elevation travel corridor from the Cascades to the Pacific Ocean, for wildlife, plants, and humans. It is a piece of the regional-scale connection network, and has brought many species unique to this coastal area. The climate of the Rogue corridor tends to be warmer and drier than the surrounding marine-influenced landscape, as down-canyon winds bring air from the interior Rogue Valley on warm summer days. This downstream extension of the interior climate influences the vegetation and habitat, and the wildlife that they support.

The river transports sediment, large wood, and nutrients from the Cascades, the interior valleys, agriculture lands, and urban population centers. Patterns of stream flow, including peak flows, are influenced by Cascade snowpack, by Lost Creek dam on the Upper Rogue River and by Applegate dam on that middle Rogue River tributary.

The flood zone, the area from summer water level to the elevation of extreme flood events, experiences periodic flow events that maintain early seral vegetation of willows, alders, and other tolerant species.

Plants: Yellow star thistle is a noxious weed that has migrated downstream along the Rogue River into this area.

Wildlife: Populations of interior species like the common kingsnake and California kingsnake that are unique on the coastal side of the Siskiyou National Forest have probably migrated downstream through the meadows and open woodlands (black/white oak savannas) that provide habitat, almost like a piece of the middle Rogue River extending into this area.

Populations of bald eagles and osprey rely on the riparian area for nest and roost sites near the food supply of the river. Pond turtles use the summer calm of back eddies and shallow water where it occurs scattered along the margins of the main flows in the canyon. Deep pools in the narrow canyons support populations of sturgeon.

Access: The river has provided a transportation corridor for humans for as long as humans have lived in the area, from prehistoric times to today. It is a low elevation route with plentiful wild food sources. Because of the rugged topography, road construction was limited during the period of Euro-American settlement. Residences and lodges still rely on the river for sole access, primarily by boat although foot access is possible along the Rogue River Trail, which is in the riparian zone.

Low Elevation Meadows

Stringers of meadows and rocky, open areas occur on the lower reaches of south-facing slopes along the Rogue River. Meadow riparian features and processes are described in the main document. These areas are located primarily on mudstone-derived soils. These meadows, and their associated Riparian Reserves, are in many aspects an extension of the open, rocky habitat found all along the mainstem Rogue River. Fire suppression has allowed the surrounding forests to encroach upon and reduce the size of these meadows.

Fire

Historical fire activity in the Rogue corridor portion of the watershed was driven primarily by human influence. The documented occurrence of natural fire starts, and the amount of acres burned, are very low. Of the 8,500 to 9,500 acres which appear to have been burned as a result of fires started in the corridor (7 different large fires), only one fire was documented as started by lightning, burning less than 400 acres.

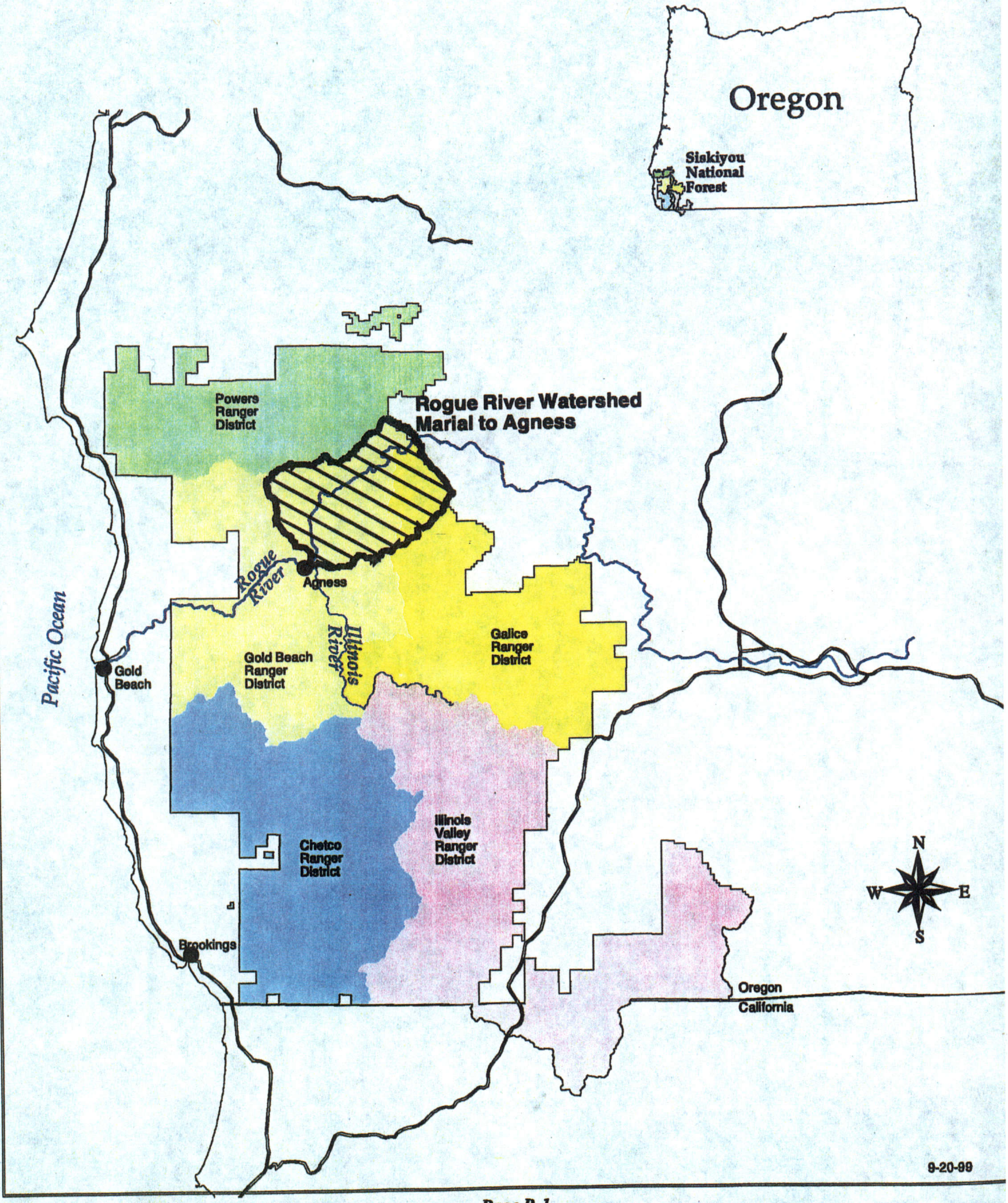
Between 1900 and the 1930s multiple overlapping human-caused fires on the north side of the river (south facing aspects) burned from the canyon bottom to the top of Panther Ridge. The 1939/40 aerial photographs of the area show the southwest faces of Devils Backbone and Mule Mountain as having been severely burned. Large fires which burned on the south side of the Rogue River (on northern aspects) and one large fire which burned in the Flora Dell Creek area depict a less severe burning pattern, leaving behind a mosaic of fire effects.

The river corridor area was subject to much prospecting and actual mining, and many of the fires which burned during the early part of the century were associated with this activity. As the mining activity diminished and fire suppression became more effective, the number and size of wildfires dropped dramatically. In more modern times, recreational activity has been the source of many fire starts, although few have grown beyond one acre in size. A total of approximately 70 human-caused fires have been recorded within one-half mile of the river itself.

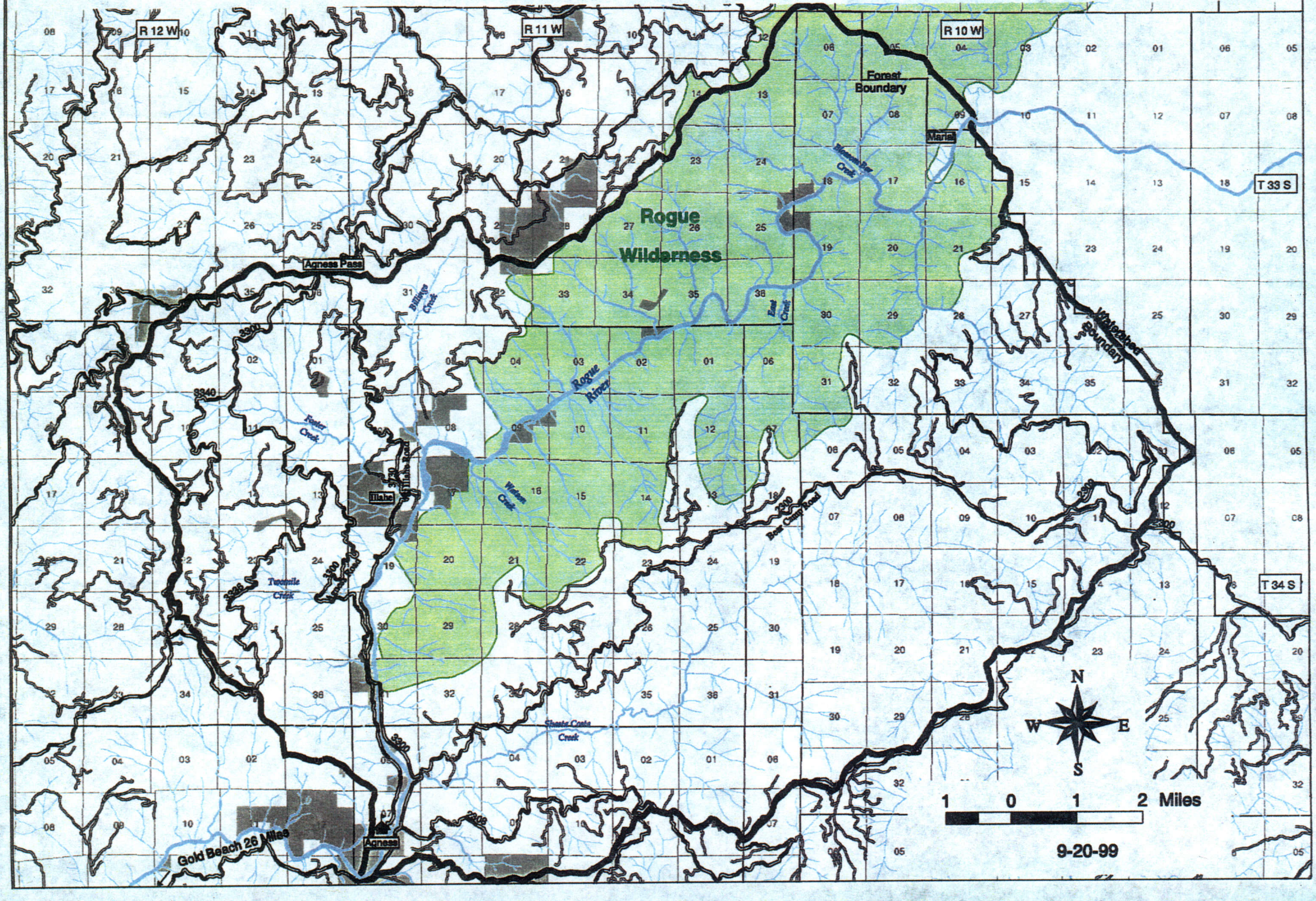
Today, while the risk of lightning-caused fires has not changed since fire records began, the risk of human-caused fires remains high because of the heavy recreation use of the river corridor. Fire prevention measures are heavily emphasized in this area, and restrictions prohibiting the use of open fire are often put into effect during the late summer months. Suppression guidelines which call for controlling wildfires at low acreages and minimizing catastrophic effects of fire are applied to the river corridor area.

Appendix B

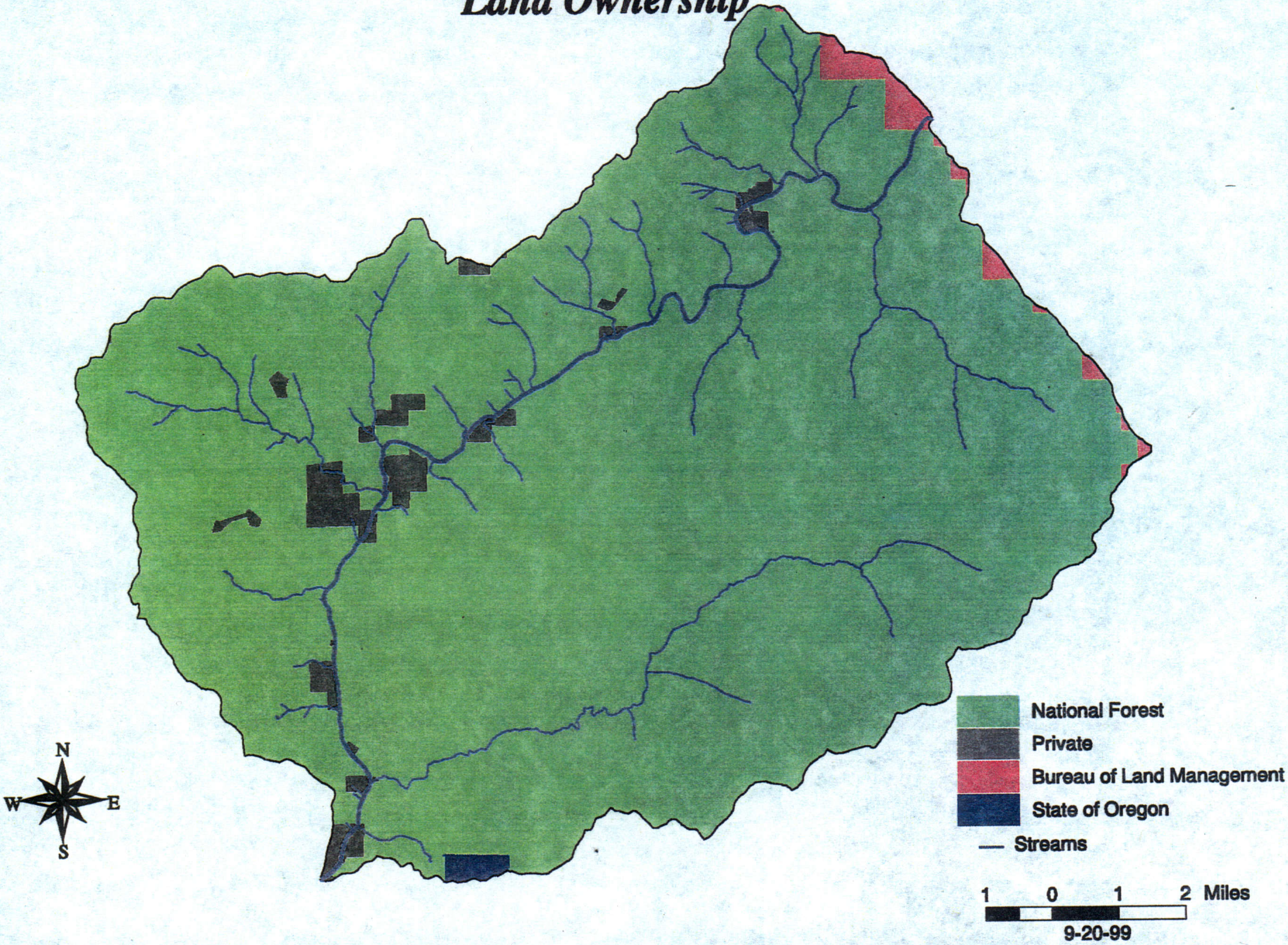
Rogue River Watershed, Marial to Agness
Vicinity Map



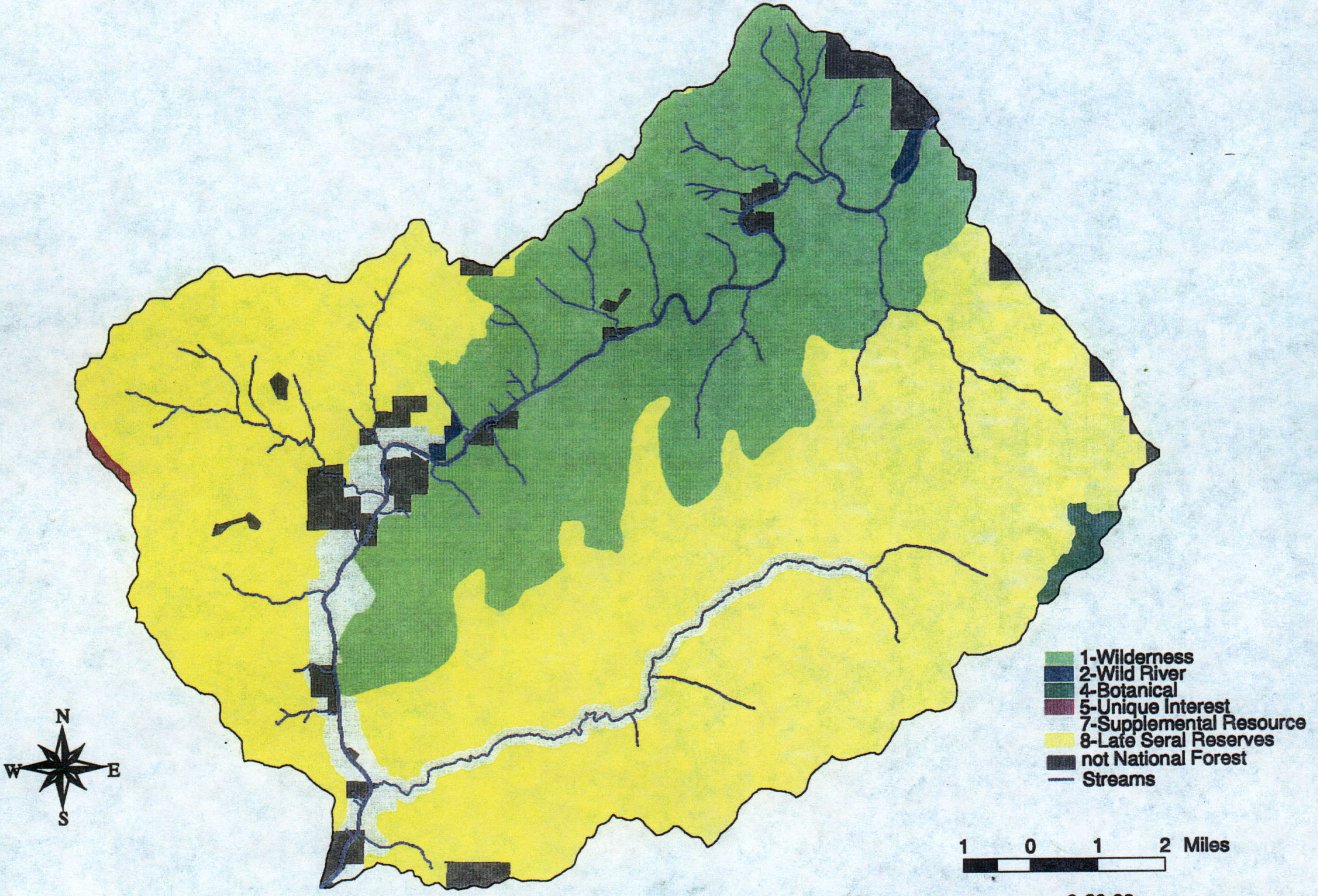
Rogue River Watershed, Marial to Agness
Site Map



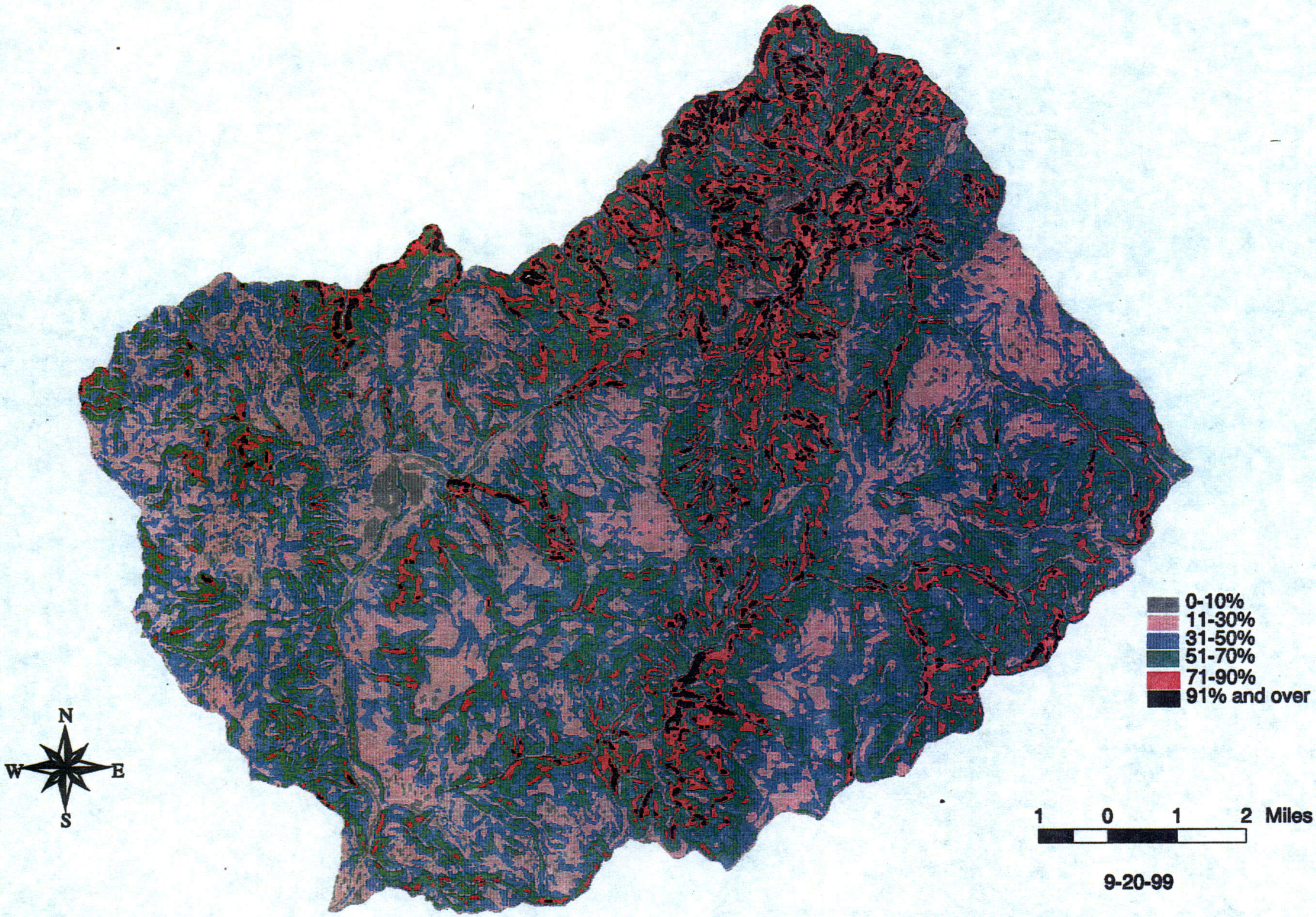
Rogue River Watershed, Marial to Agness
Land Ownership



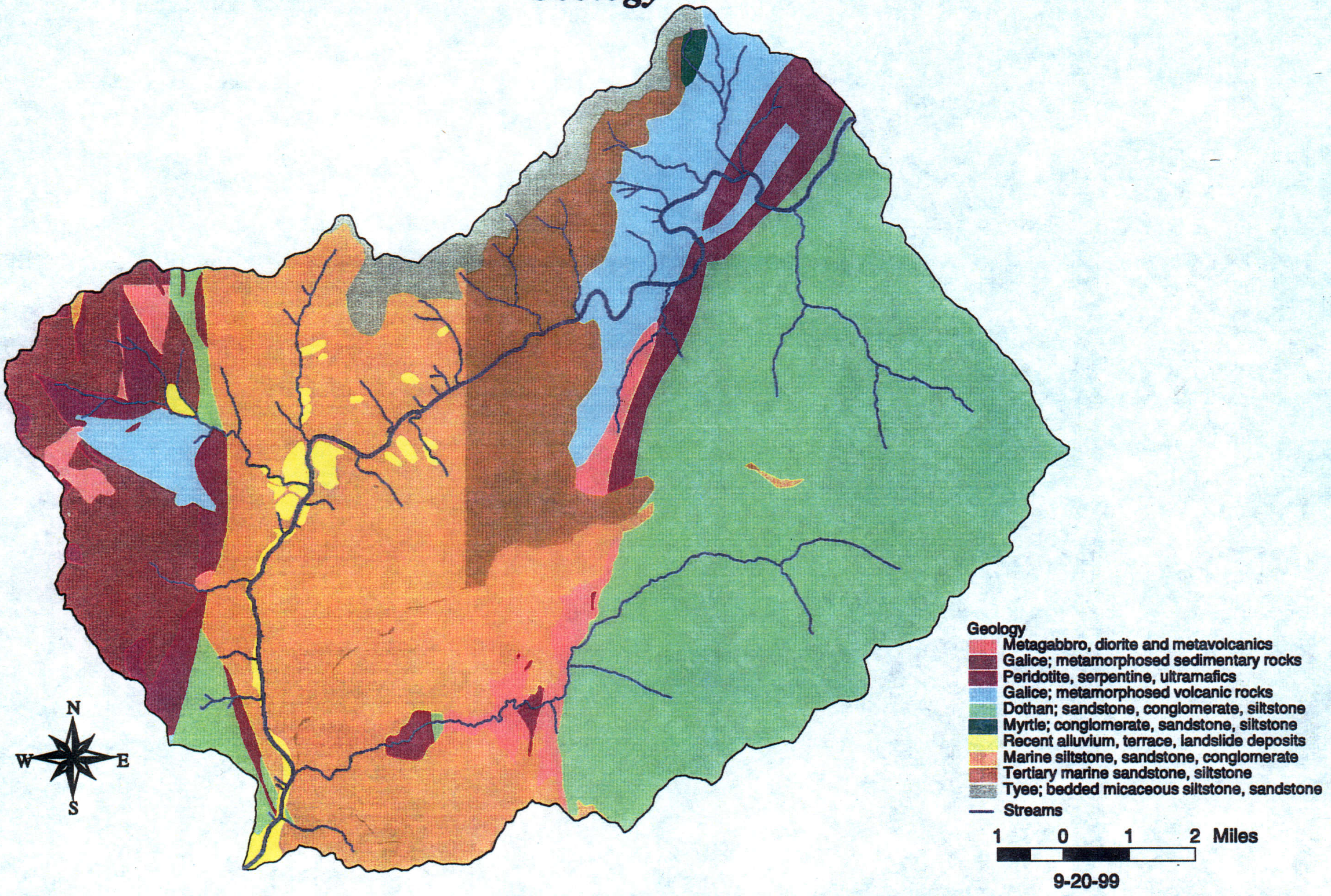
Rogue River Watershed, Marial to Agness
Management Areas



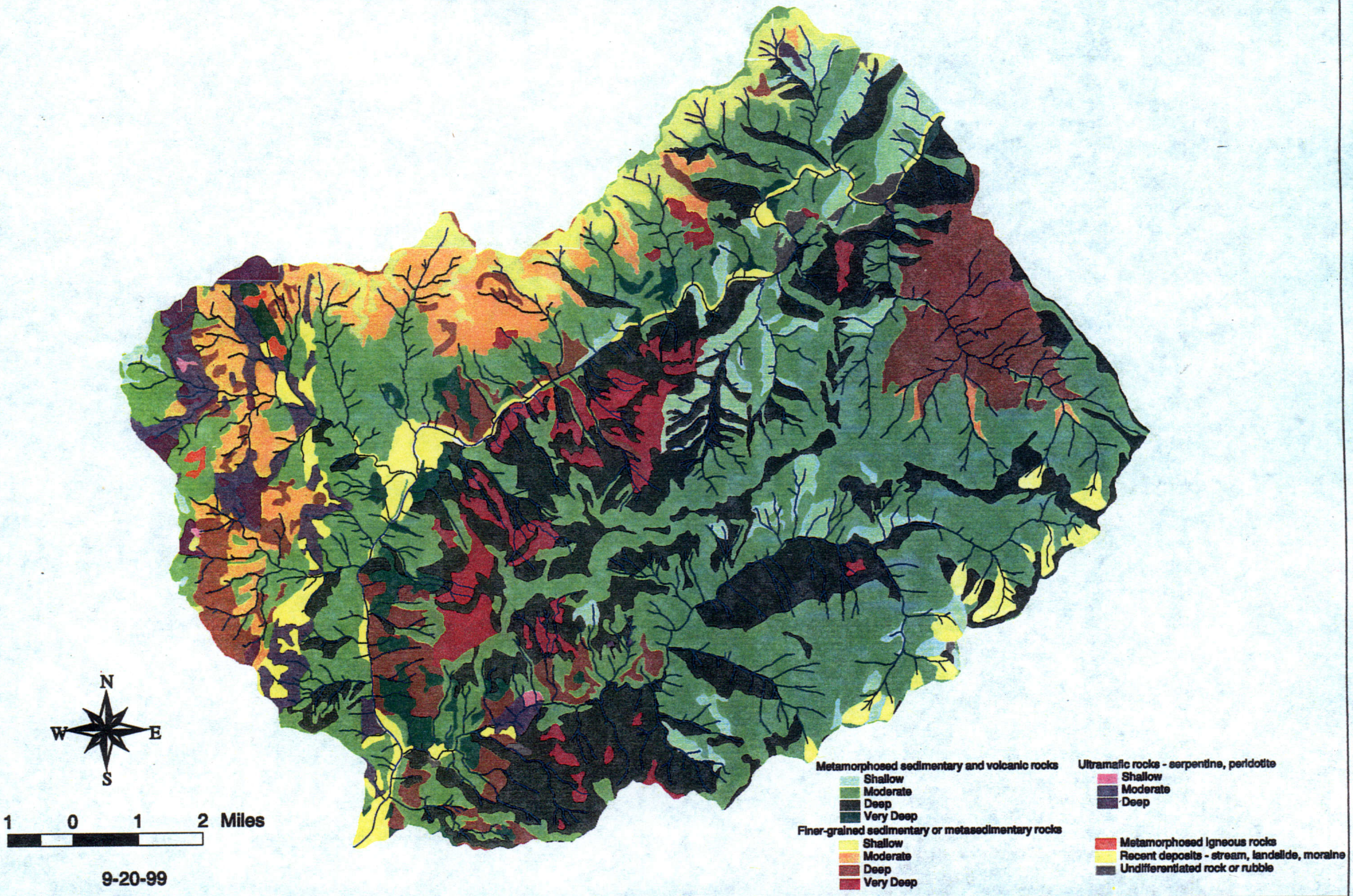
Rogue River Watershed, Marial to Agness
Slope Classes



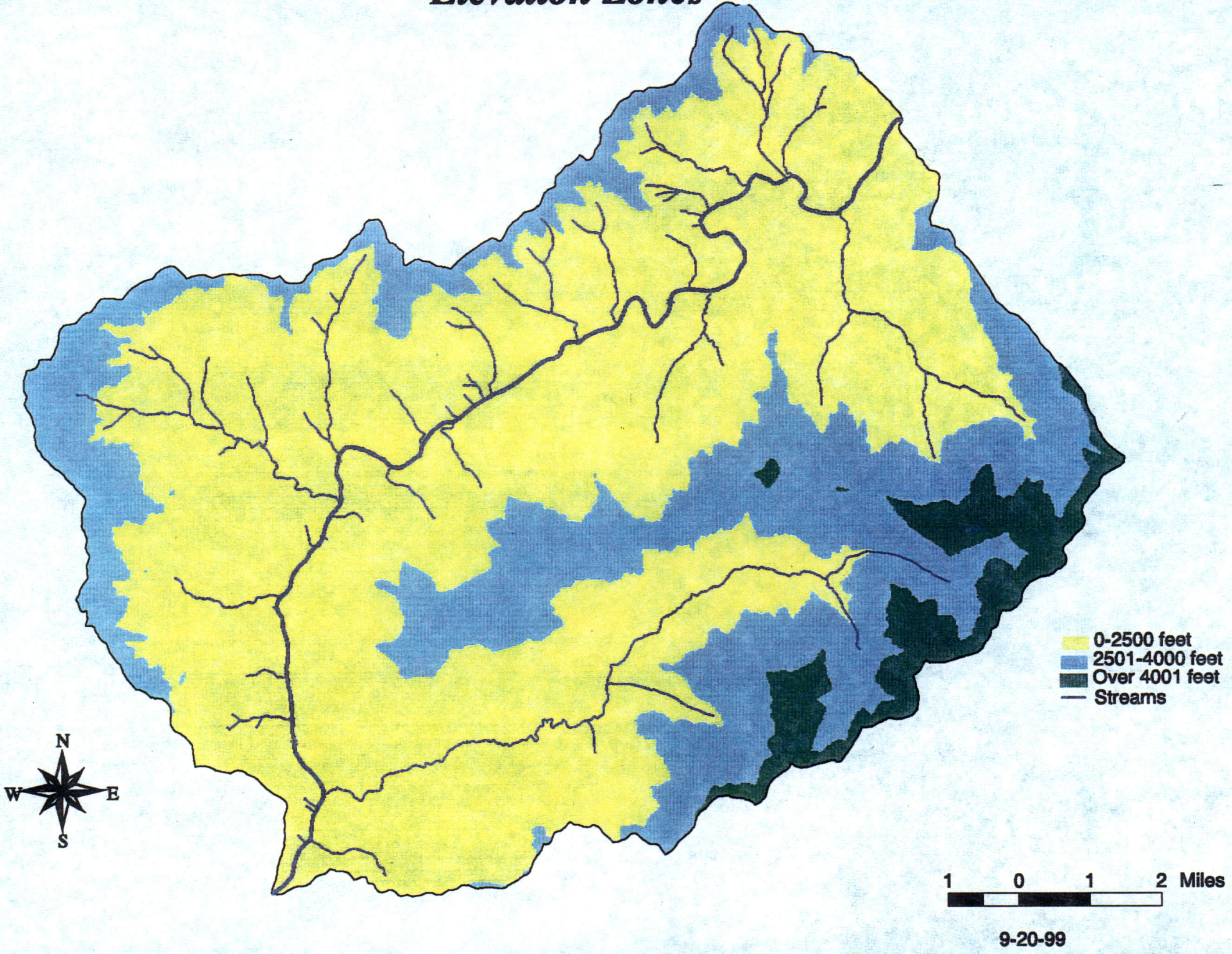
Rogue River Watershed, Marial to Agness
Geology



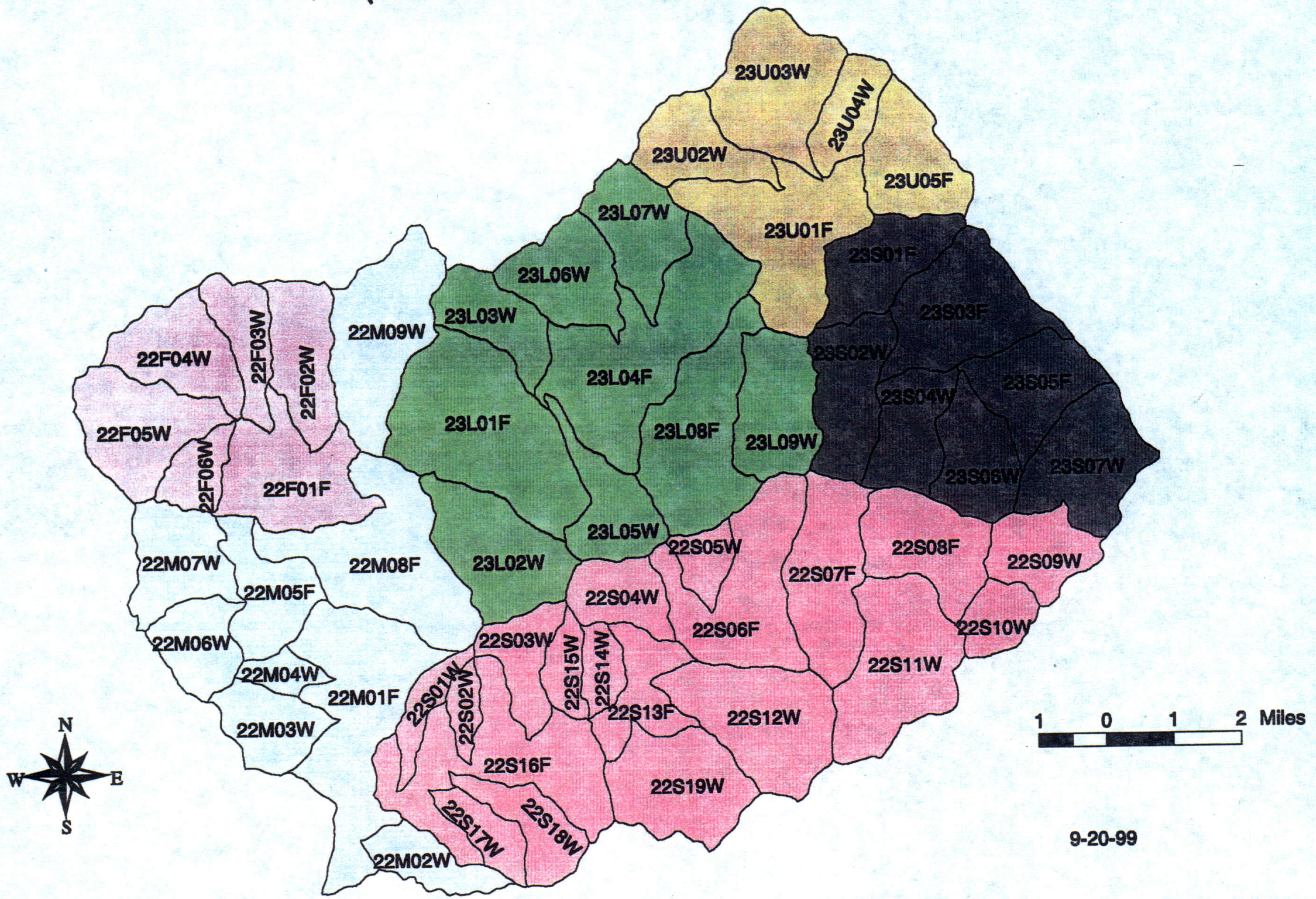
Rogue River Watershed, Marial to Agness
Soil Depth and Parent Material



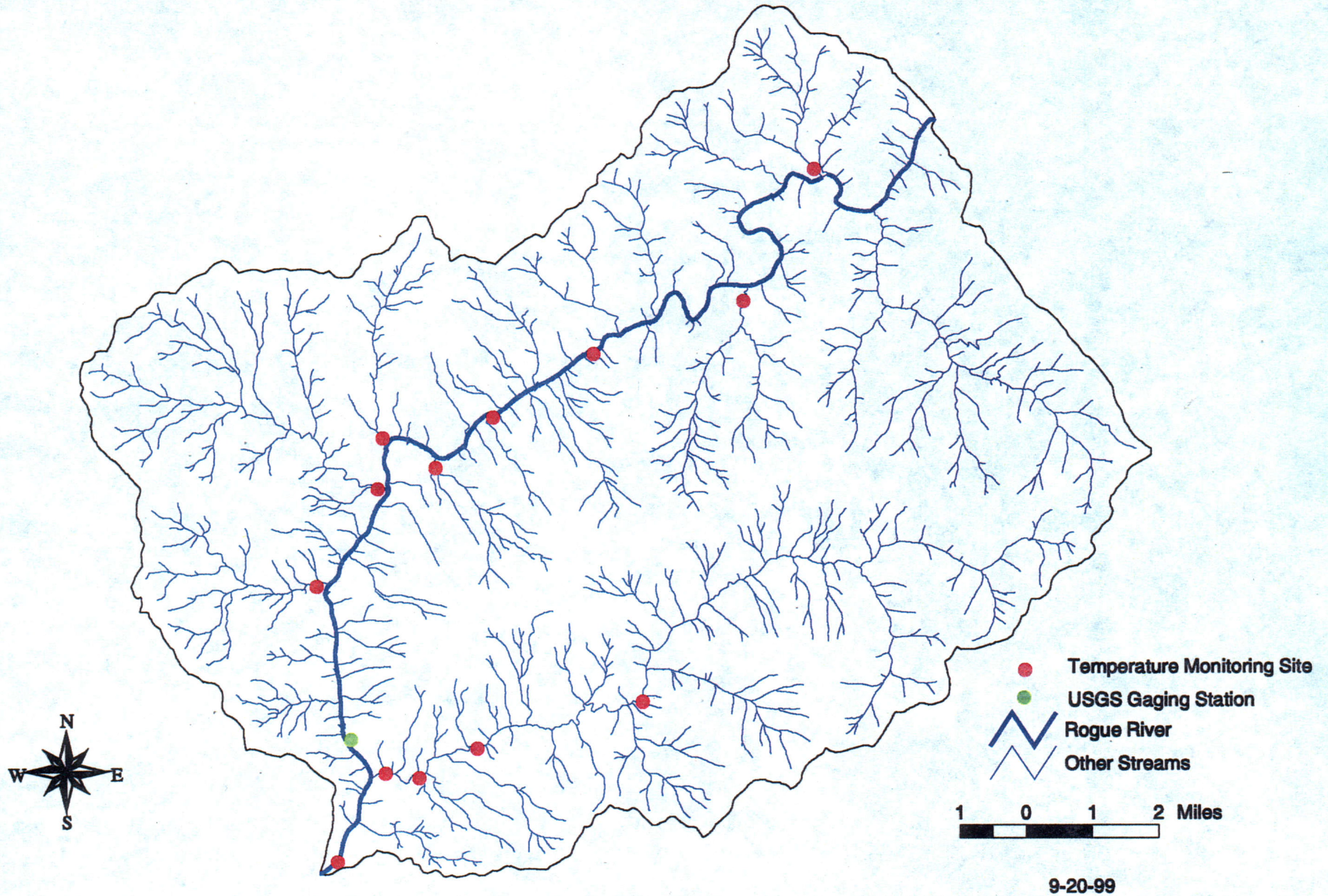
Rogue River Watershed, Marial to Agness
Elevation Zones



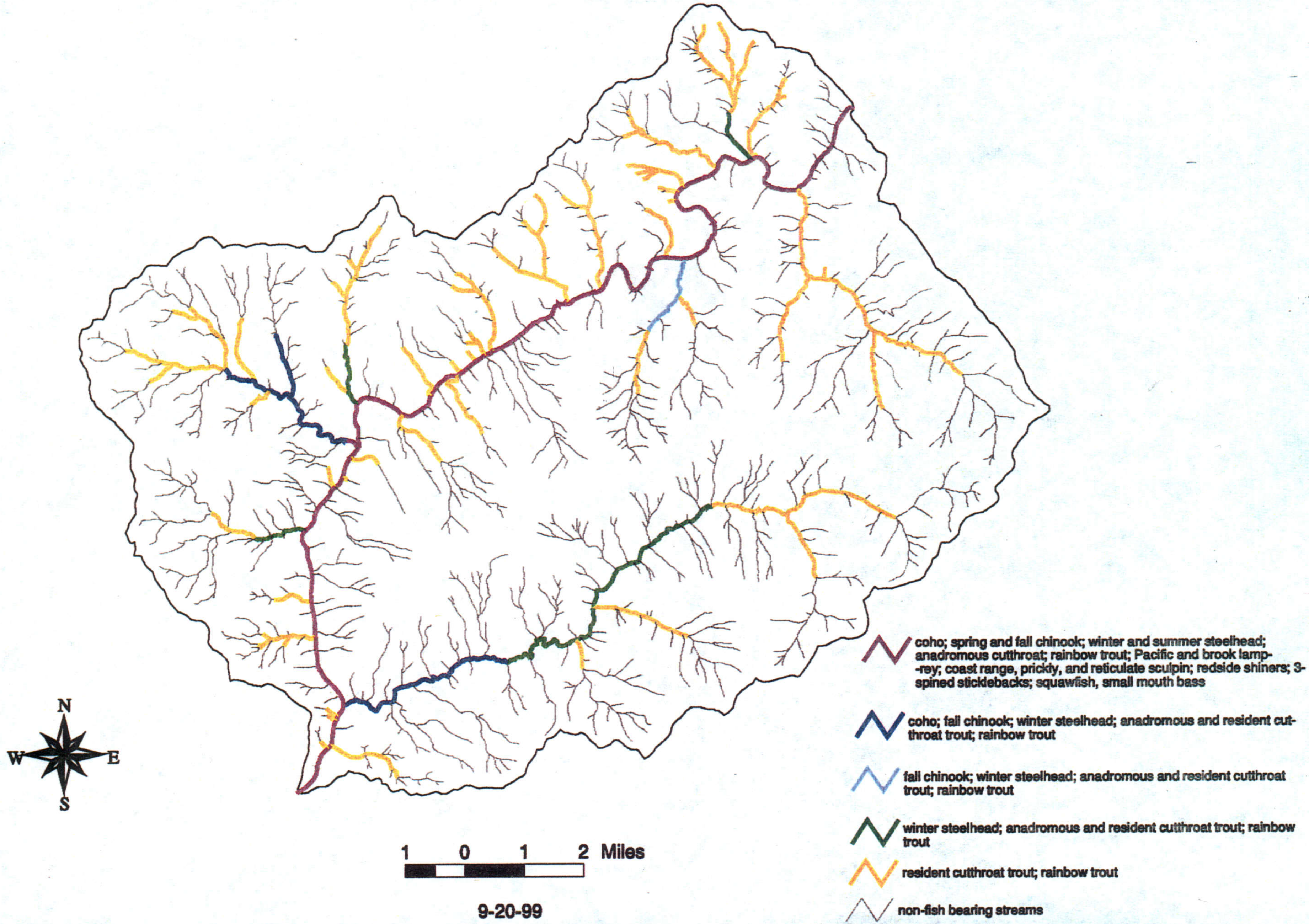
Rogue River Watershed, Marial to Agness
Watershed Analysis Areas
(Seventh Field Watersheds)

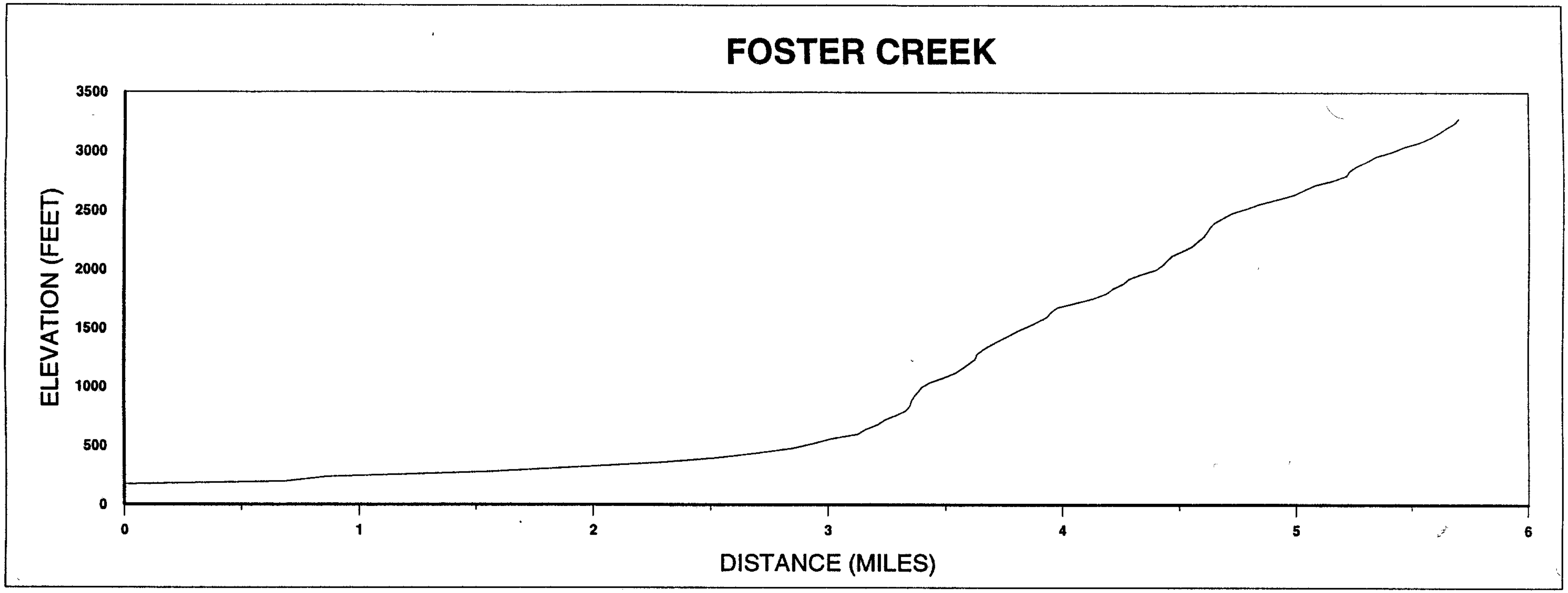


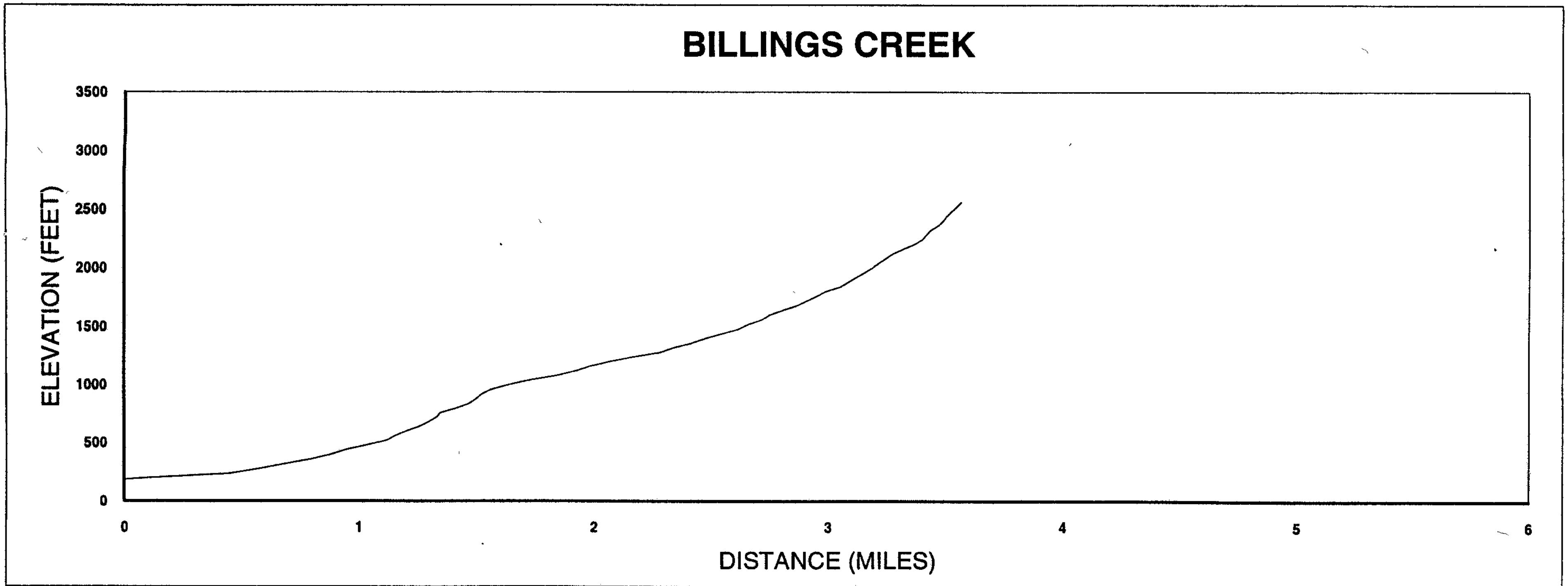
Rogue River Watershed, Marial to Agness
Temperature Monitoring Sites

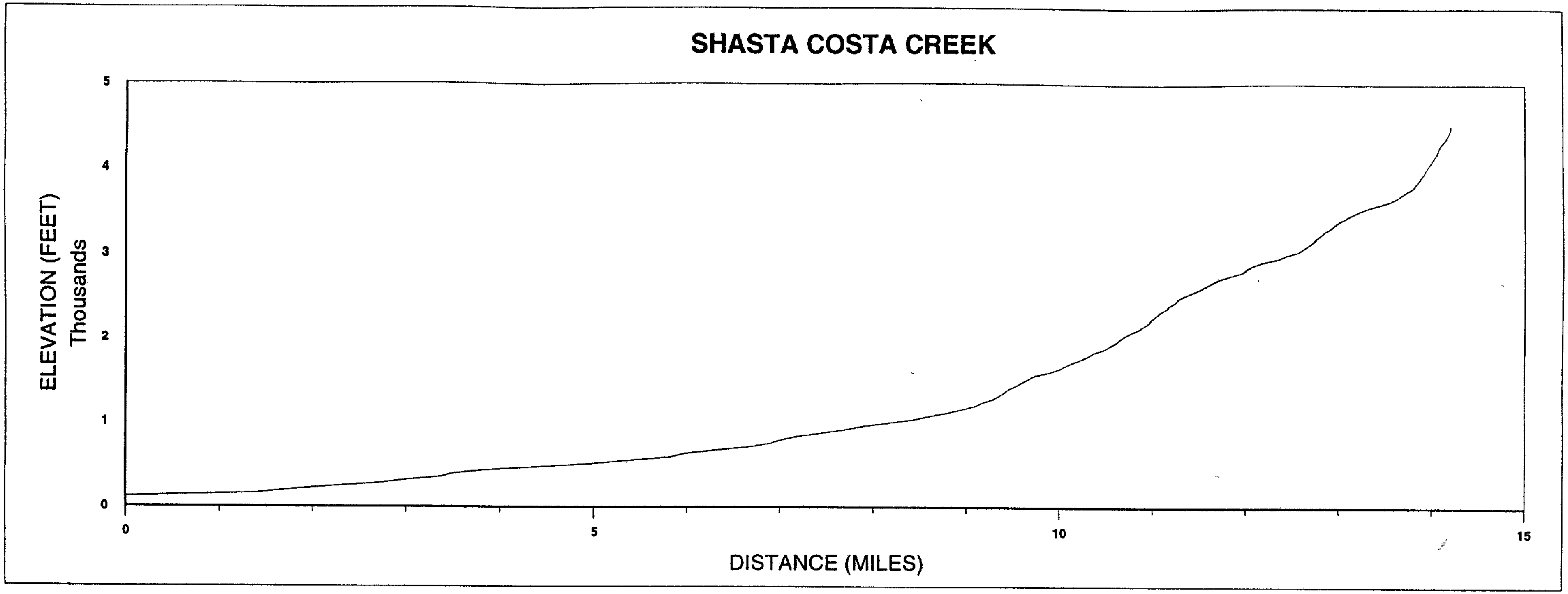


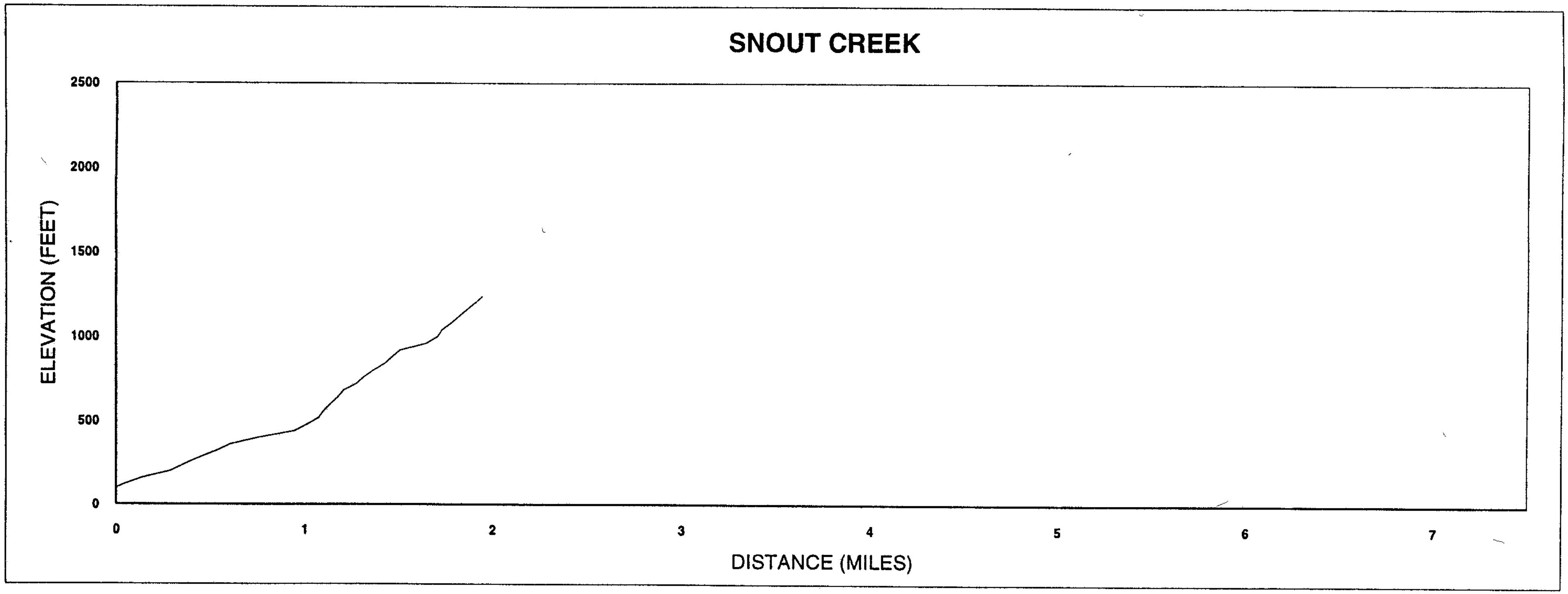
Rogue River Watershed, Marial to Agness
Fish Distribution



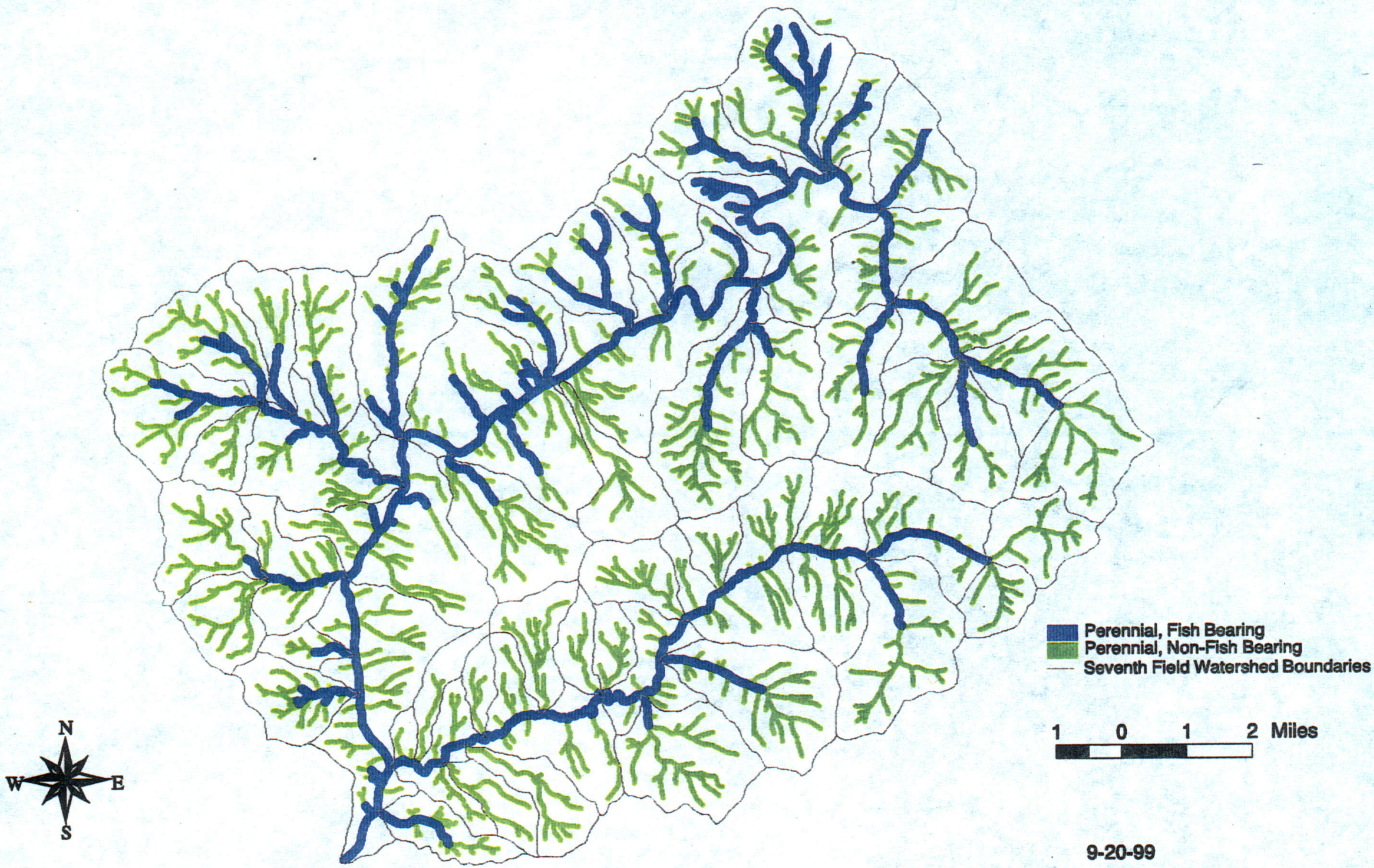

FOSTER CREEK
ELEVATION (FEET)
3500
3000
2500
2000
1500
1000
500
0
0
1
2
3
4
5
6
DISTANCE (MILES)


BILLINGS CREEK
ELEVATION (FEET)
3500
3000
2500
2000
1500
1000
500
0
0
1
2
3
4
5
6
DISTANCE (MILES)

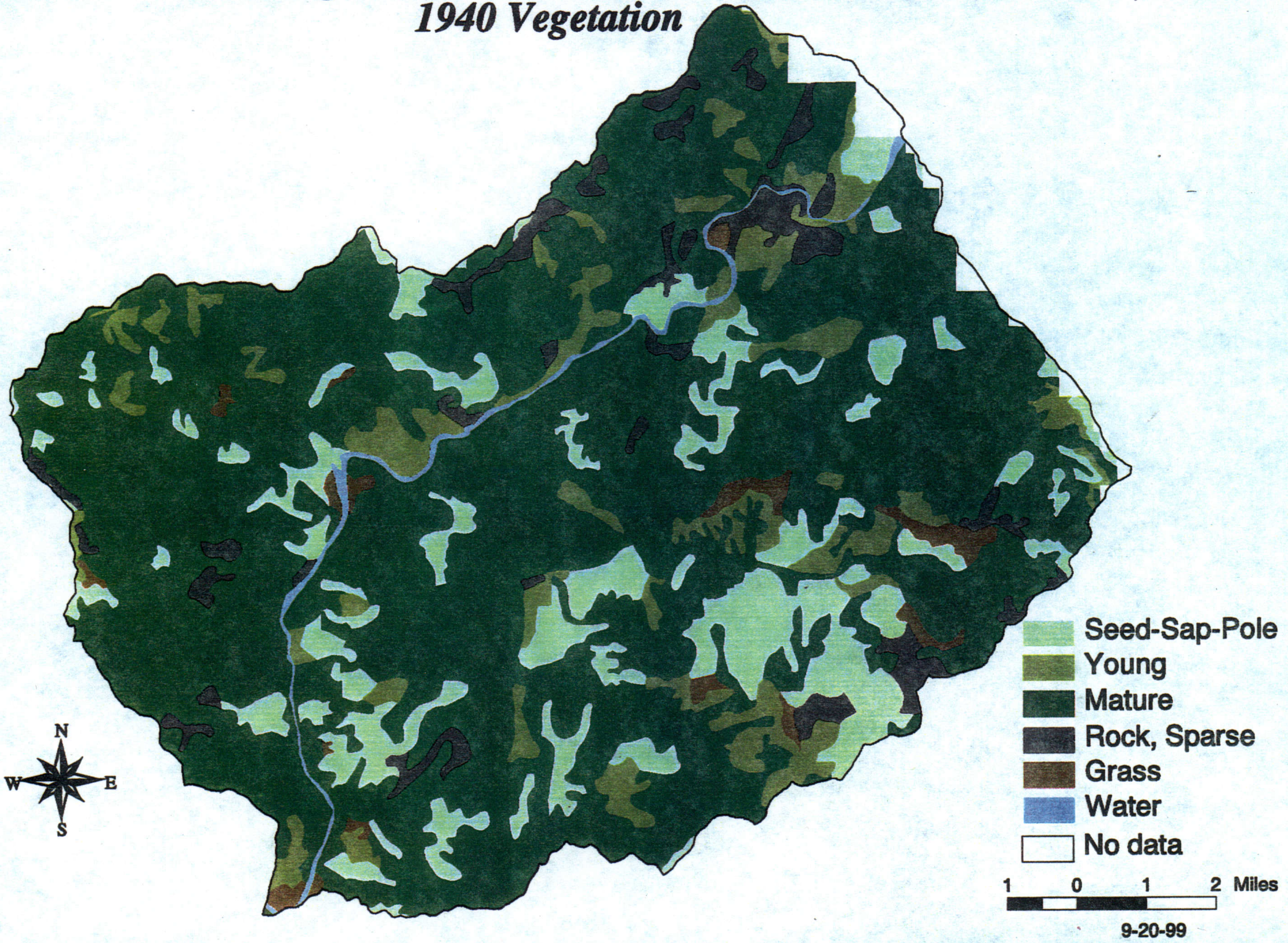

SHASTA COSTA CREEK
ELEVATION (FEET)
Thousands
0
1
2
3
4
5
0
5
10
15
DISTANCE (MILES)


SNOUT CREEK
ELEVATION (FEET)
0
500
1000
1500
2000
2500
0
1
2
3
4
5
6
7
DISTANCE (MILES)

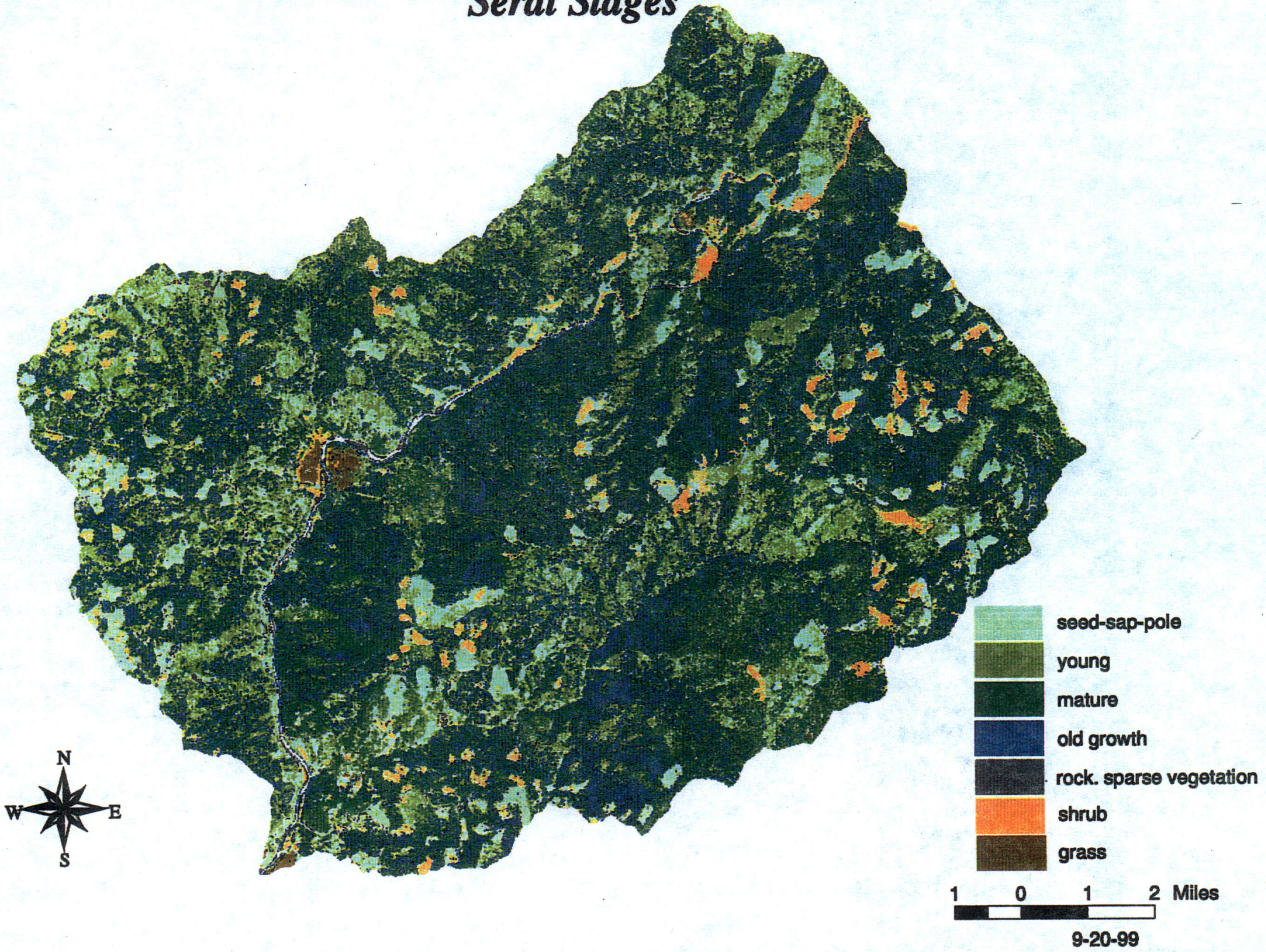
Rogue River Watershed, Marial to Agness
Riparian Reserves



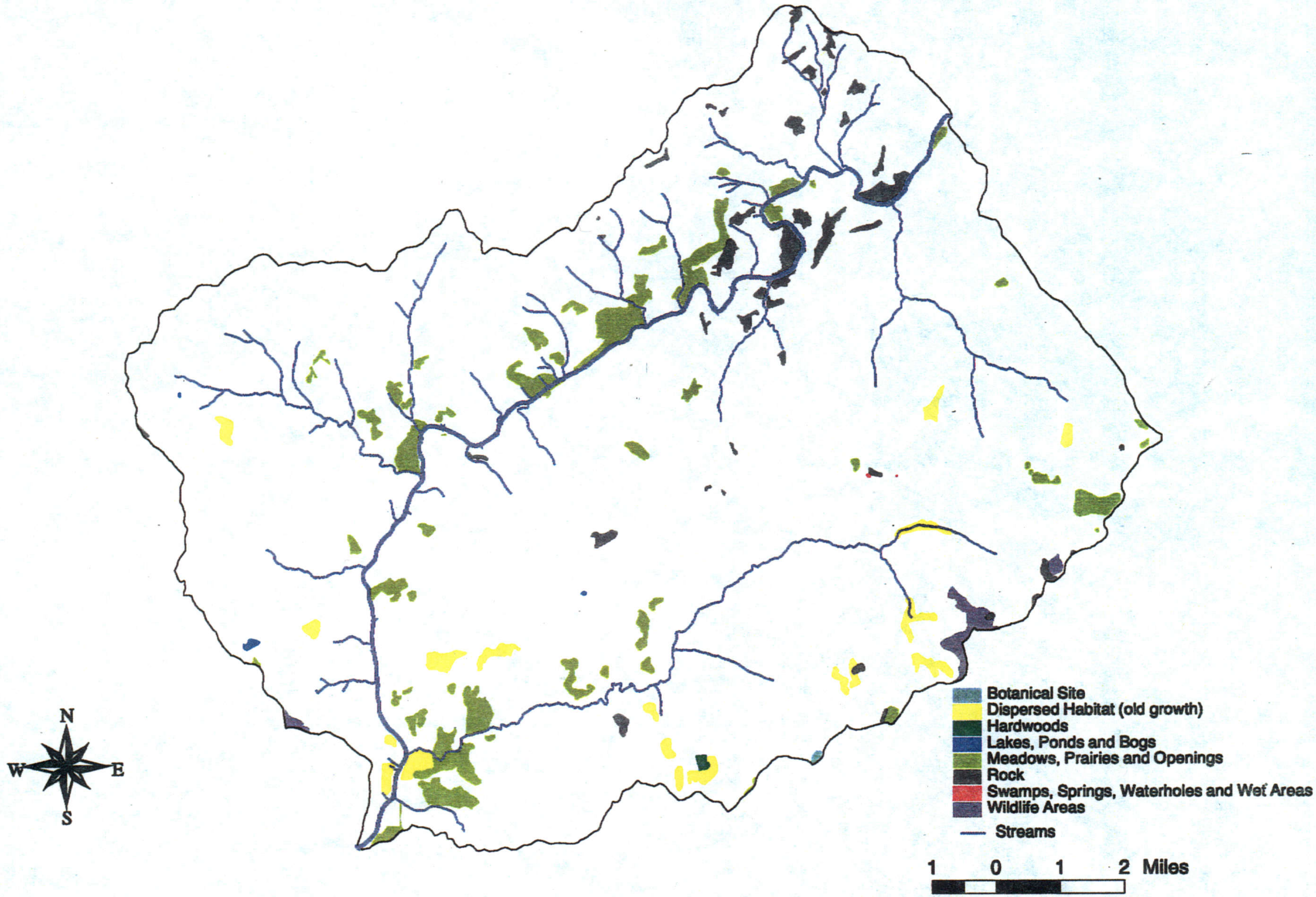
Rogue River Watershed, Marial to Agness
1940 Vegetation



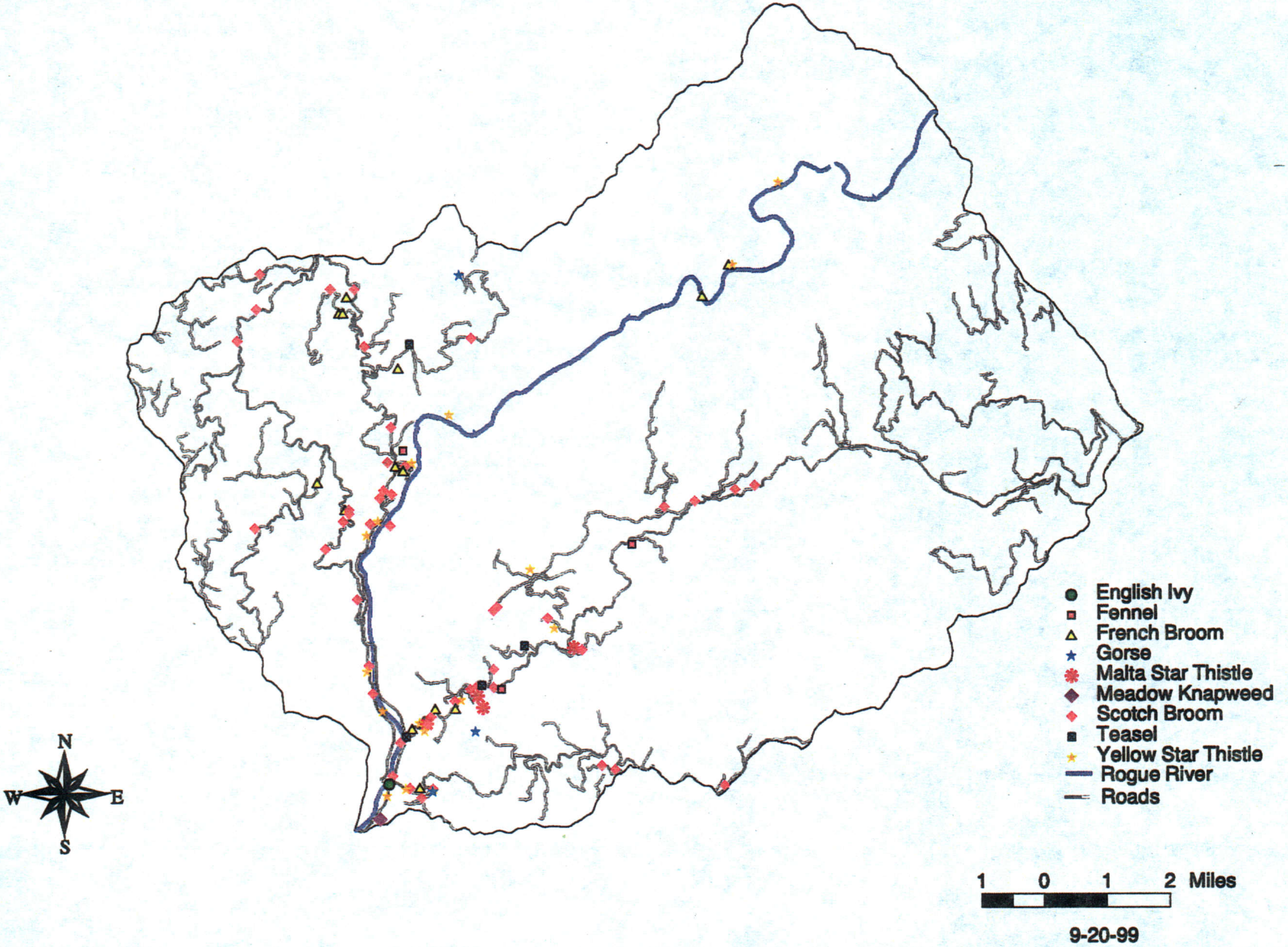
Rogue River Watershed, Marial to Agness
Seral Stages



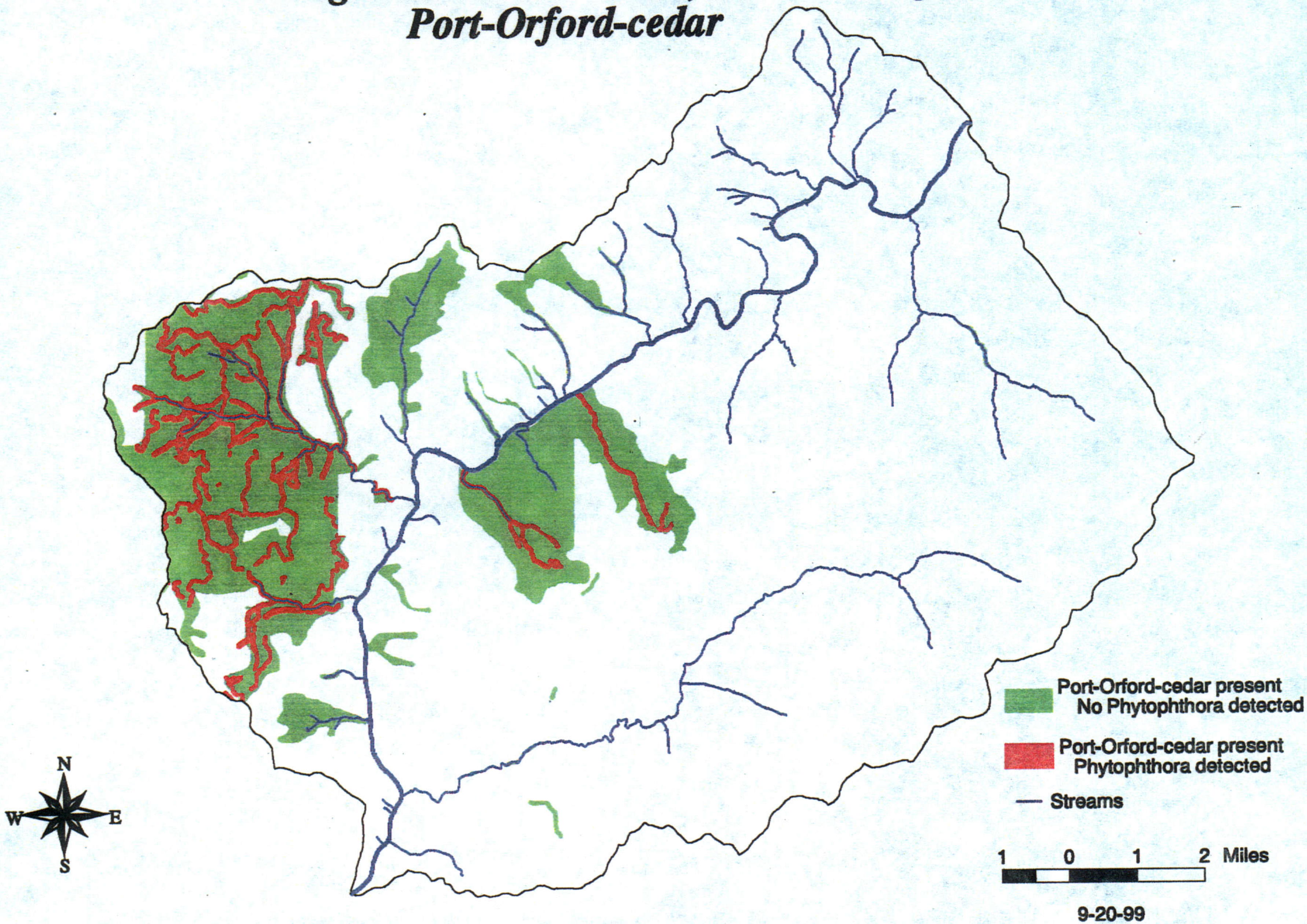
Rogue River Watershed, Marial to Agness Special Wildlife Sites



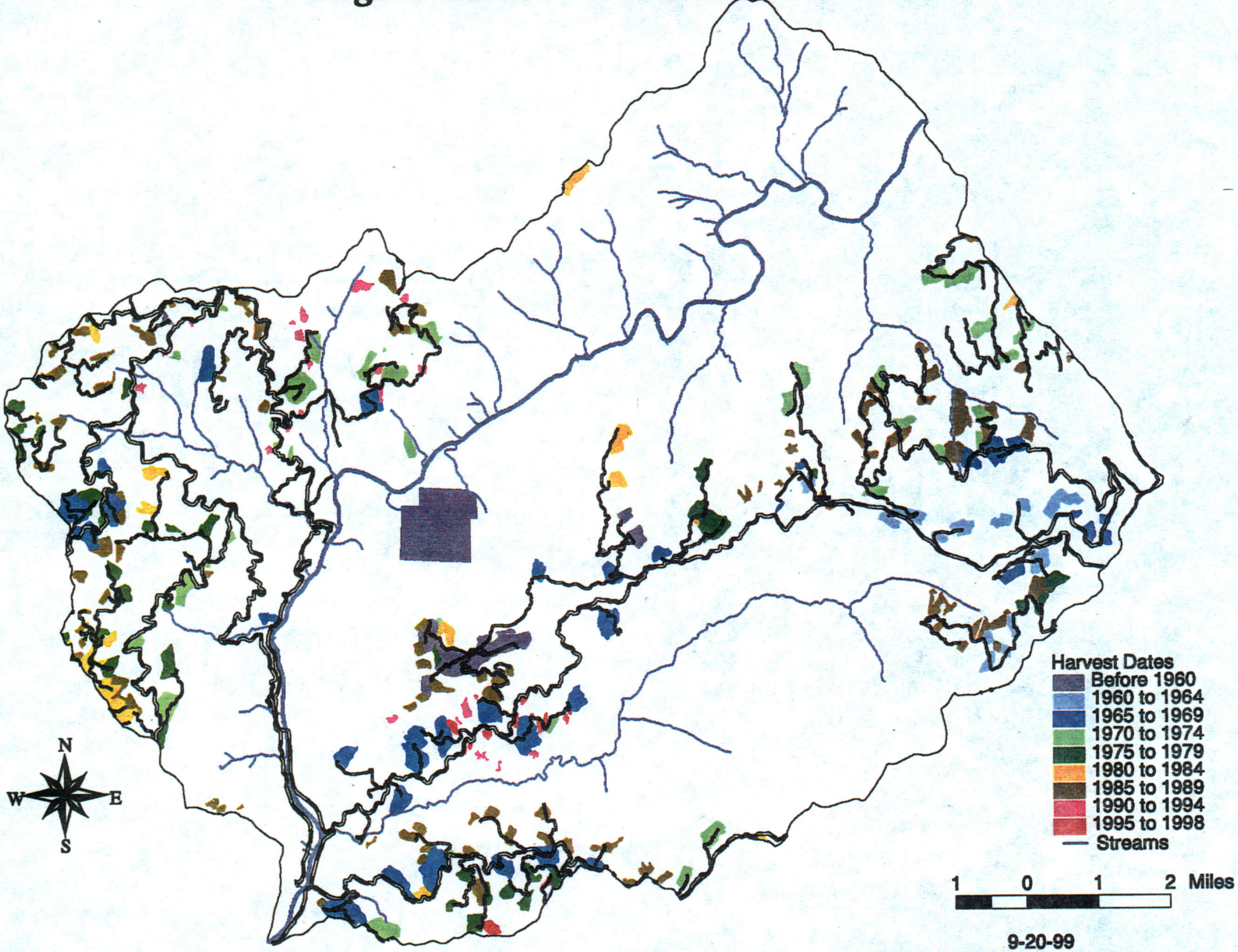
Rogue River Watershed, Marial to Agness
Noxious Weed Sites



Rogue River Watershed, Marial to Agness
Port-Orford-cedar



Rogue River Watershed, Marial to Agness
Regeneration Harvest and Roads



Rogue River Watershed, Marial to Agness
Streams