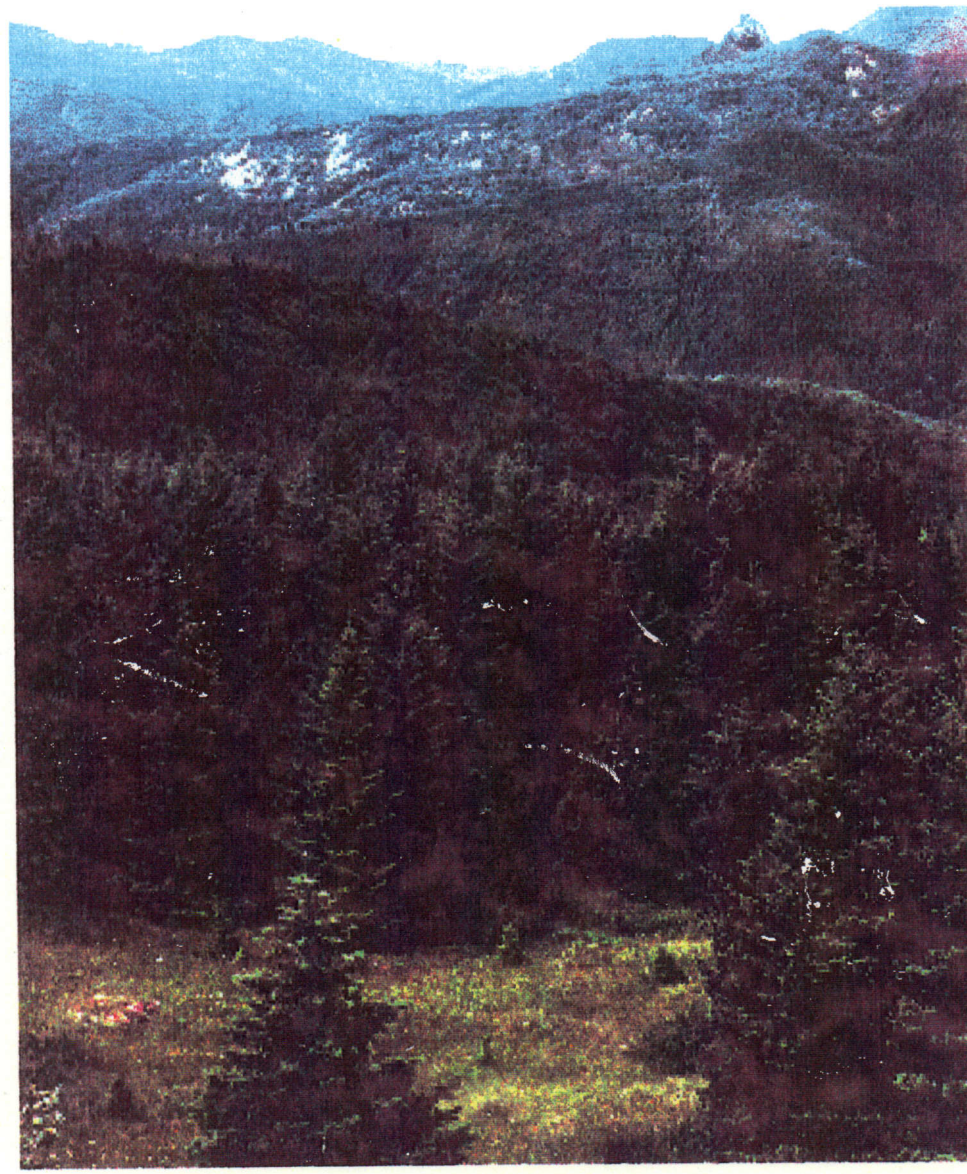
United States
Department of
Agriculture

Forest Service

Pacific
Northwest
Region

Sixes River Watershed Analysis



Siskiyou National Forest

Powers Ranger District

Iteration 1.0

United States
Department of
Agriculture

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Pacific
Northwest
Region

1997

SIXES RIVER WATERSHED ANALYSIS

ITERATION 1.0

I have read this analysis and it meets the Standards and Guidelines for watershed analysis required by an amendment to the Forest Plan (Record of Decision dated April 1994). Any additional evidence needed to make a decision will be gathered site-specifically as part of a NEPA document or as an update to this document.

SIGNED W. Carl Lindemann DATE 9/22/97

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Sixes River Watershed Analysis

WATERSHED OVERVIEW

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WATERSHED OVERVIEW

I. INTRODUCTION

The Sixes River Watershed Analysis summarizes key information for the Sixes River beginning at the headwaters and ending at its mouth on the Pacific Ocean seven miles north of the city of Port Orford. Among the important values of the Sixes River drainage are its fish, wildlife, aesthetics, mining, timber and recreation. The watershed is representative of forested ecosystems along the southern Oregon coast, and includes habitat for old-growth associated species such as the Northern spotted owl and the marbled murrelet. In this discussion, "Sixes" or "watershed" refers to the Sixes River analysis area. (Figure O-1)

The analysis followed the six steps of the Federal Guide for Watershed Analysis (Version 2.2) and considered the physical, biological and social conditions and trends relevant to the Sixes River watershed. Information and ideas from several federal, state and local agencies as well as the public were included in the analysis. Information was collected about lands under the management of the Forest Service, Bureau of Land Management and some private lands. Additional analysis documentation includes data files, maps, computer model runs, specialist reports, lists of data gaps, monitoring recommendations and process records. New information will be added as it is collected, as the watershed analysis is considered an ongoing process.

II. PURPOSE AND OBJECTIVES

Watershed analysis is essentially *ecosystem analysis at the watershed scale.* As one of the principal analyses for implementing the Aquatic Conservation Strategy (ACS) set forth in the Northwest Forest Plan (*Record of Decision* (ROD) *for Amendments to Forest Service and Bureau of Land Management Planning Documents Within the Range of the Northern spotted owl* (USDA, USDI 1994)) it provides the watershed context for fishery protection, restoration, and enhancement efforts. The understanding gained through watershed analysis is critical to sustaining the health and productivity of natural resources. Healthy ecological functions are essential to maintain and create current and future social and economic opportunities.

The objectives of the analysis are to:

- identify principle issues,
- identify ecological processes and describe existing conditions within the watershed,
- apply technically rigorous procedures to interpret information,
- define activities that need to be modified to achieve the desired condition and,
- outline monitoring and restoration opportunities.

VICINITY MAP

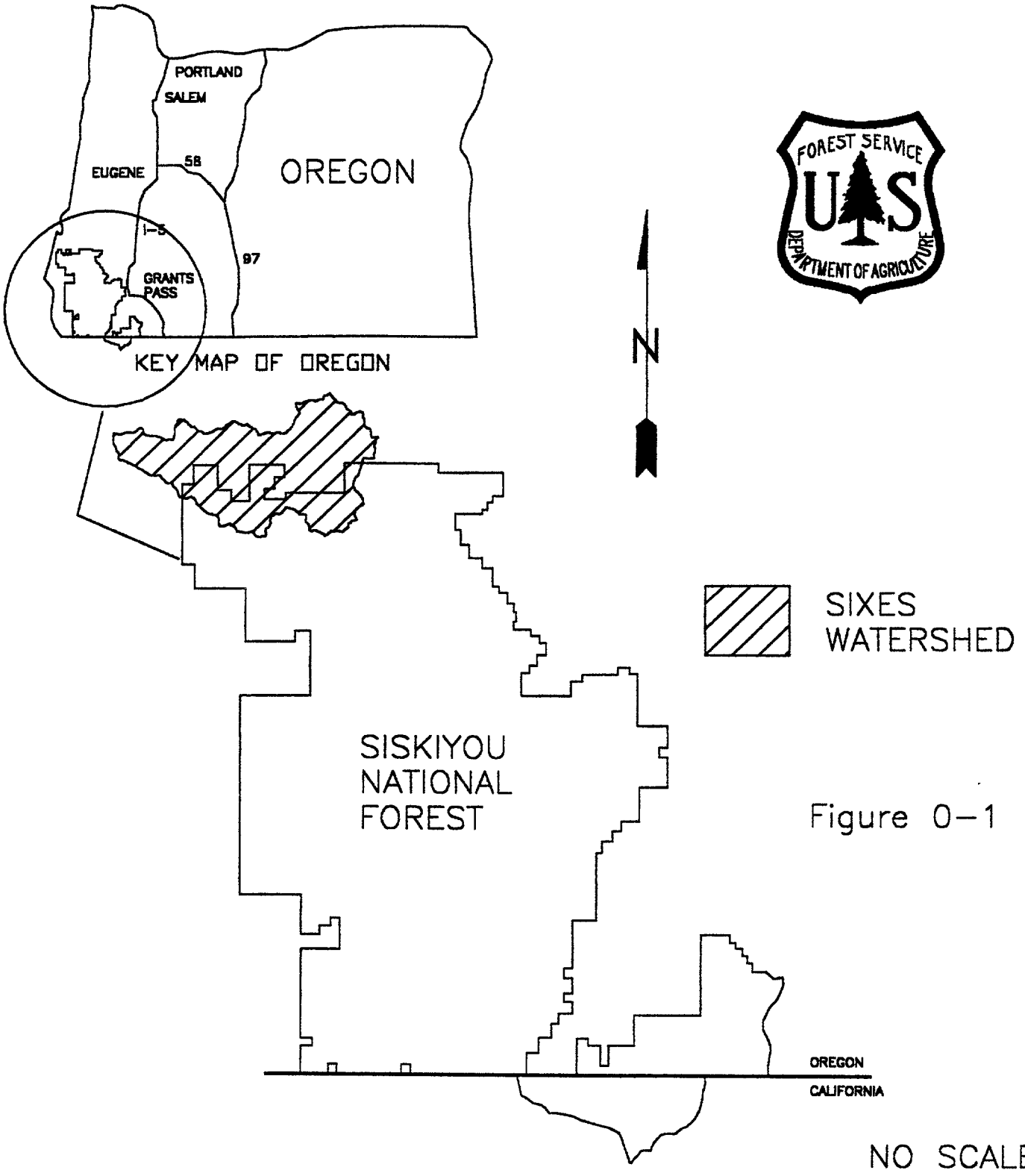


Figure 0-1

III. MANAGEMENT CONTEXT

The Sixes River is in Curry County, Oregon, between the Rogue and Coquille River watersheds. Floras Creek lies immediately north, and Elk River immediately south.

The Northwest Forest Plan (1994) identified 12 province planning and analysis areas within the range of the Northern spotted owl. The use of planning and analysis provinces allows differentiation between areas of common biological and physical processes at a larger scale than individual watersheds. The provinces, although not optimum for all management objectives, help stratify different scales of analysis.

Southwest Oregon Province

The Southwest Oregon Province contains approximately 12,678 square miles and is located in Southwest Oregon (Figure 0-2). The province is divided into four distinct sub-basins which include the Umpqua River, Coquille/Coos Rivers, Rogue River and the South Coast Basins.

The Southwest Oregon Province overlays distinctly different geologic provinces that have considerable implications for the diversity and migration of flora and fauna. This province includes the physiographic-based Cascade Province, the west Cascade sub-province and the Klamath Province. The Klamath Province links these areas to the Sierra Nevada of California to the south and the Oregon Coast Range to the west and north.

South Coast Basin

The South Coast Basins contain 1,093 square miles (699,634 acres). It contains all coastal rivers within the Southwest Oregon Province except the Rogue, Umpqua and Coquille/Coos watersheds (Figure 0-2). The South Coast Basins can further be divided into distinct sub-basins (watersheds). These sub-basins include numerous small coastal streams and larger coastal rivers such as the Winchuck, Chetco, Pistol, Elk and Sixes.

The various South Coast sub-basins generally have headwaters in the Siskiyou Mountains of the Klamath Province. The topography is characterized by a relatively narrow coastal plain and narrow alluvial valleys extending into the mountainous interior.

The South Coast streams have been altered by Europeans starting in the mid nineteenth century. The narrow coastal plain, vegetated by mature Sitka spruce and Douglas-fir forest, were settled and cleared where agriculture is possible. Agricultural draining and clearing has simplified the stream and riparian habitat in, and along, coastal streams.

The result of these activities has been a general lowering of the water table in the coastal and interior valleys and the confinement of the streams to a single channel. The interior hillslopes have been roaded for timber harvest. Parts of these headwater areas include unstable and potentially unstable sites, and the sediment transport characteristics of the streams have been altered. These activities have changed the lower stream sections and estuary habitat so important to juvenile salmonids migrating to the ocean.

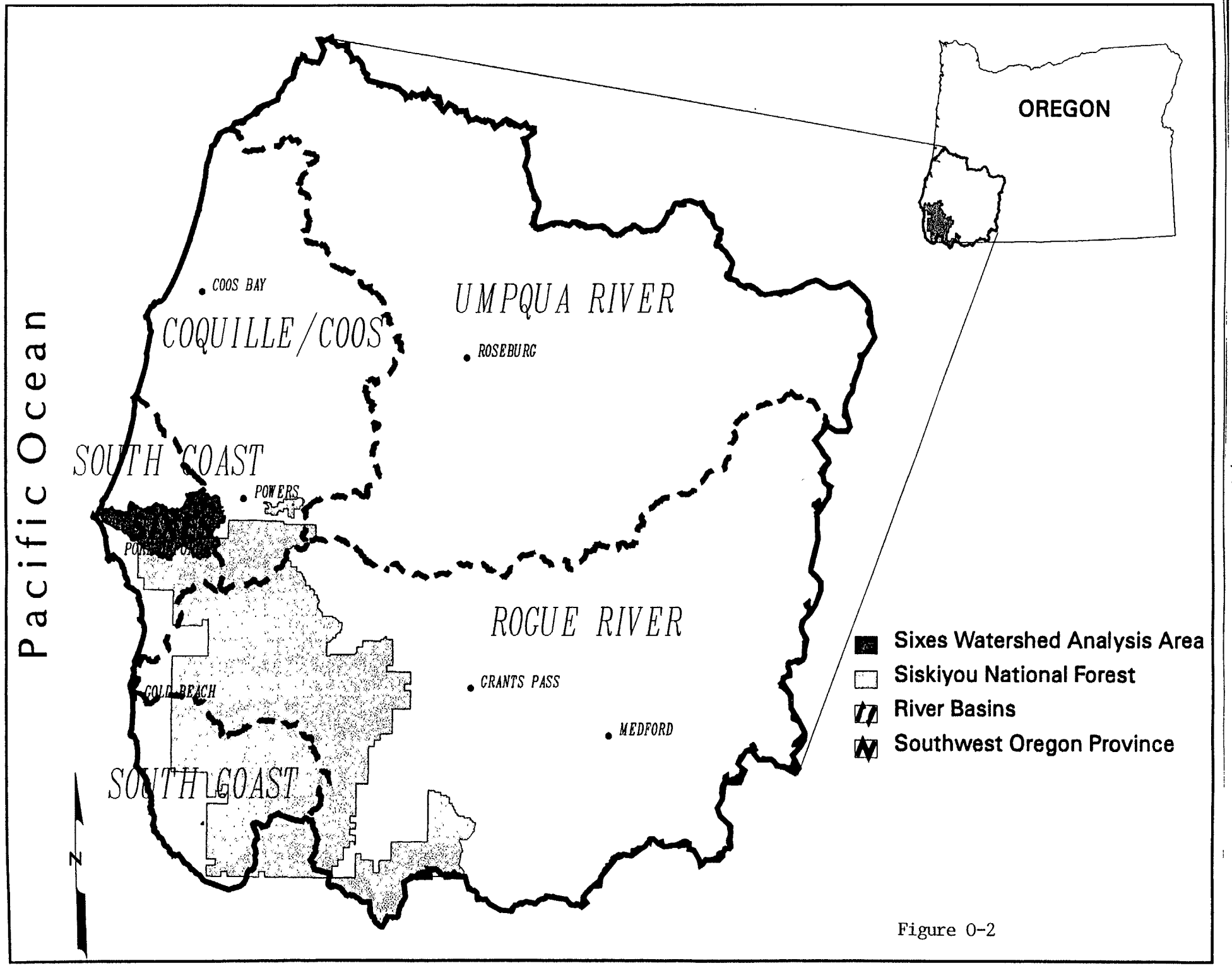

OREGON
Pacific Ocean
COOS BAY
COQUILLE/COOS
UMPQUA RIVER
ROSEBURG
SOUTH COAST
POWERS
ROGUE RIVER
GRANTS PASS
MEDFORD
SOUTH COAST
N
Sixes Watershed Analysis Area
Siskiyou National Forest
River Basins
Southwest Oregon Province

Figure 0-2

Sixes Sub-Basin

The Siskiyou National Forest Land and Resource Management Plan (LRMP), as amended by the ROD has created management allocations on Federal lands that define the type of management activities within the watershed. Current National Forest land designations (Figure O-3, Land Allocation Map) within the watershed are 449 acres of matrix, 11,184 acres of late successional reserves (LSR) and 111 acres of riparian reserves (based on site tree potential of 200'). An additional 10,250 acres are in other designations such as wilderness areas and special wildlife sites. Activities in these allocations cannot proceed prior to determining how proposed land management activities meet Aquatic Conservation Strategy objectives. The exception are those minor activities that would be categorically excluded under national Environmental Policy Act regulations (except timber harvest) may proceed if they are consistent with ACS objectives and Riparian Reserves and standards and guidelines are applied.

There are 2,072 acres of federal land managed by the BLM in the Sixes Watershed. These are designated Matrix lands with two sub-allocations; 1,627 acres of General Forest Management Areas (GFMA) and 444 acres of Connectivity/Diversity Blocks (CON). The objectives are to provide a sustainable timber supply, provide connectivity between LSR, provide early successional habitat, and provide important ecological functions.

IV. CHARACTERIZATION

A. Physical Setting

The Sixes River flows in westward direction to its mouth just north of Cape Blanco on the Pacific Ocean. The watershed is approximately 28 miles long and drains approximately 85,800 acres. Elevations in the Sixes River Watershed range from sea level to just over 3,280 feet on the ridge north of Barklow Mountain.

Climate

The climate is typical of coastal Oregon with a strong marine influence, high winter precipitation and moderate year-round temperatures. Average annual precipitation ranges from 70 inches in the lower elevations near the mouth to 110 inches in the higher elevations. Precipitation on any given year can vary by as much as 40 inches from the average. Most of this precipitation comes as frontal rainstorms during the months of October through April. Snowfall is generally light and of short duration because of the low elevations and the moderating marine influences. Stream discharge is rain-dominated with 95 percent of the basin below the transitory snow zone. A pronounced summer dry season exists, although this is moderated by maritime fog. Fog drip is an important contributor to annual water yield and particularly to dry season stream flows.

The proximity to the coast not only modifies the temperatures and humidities found in the watershed but also results in frequent high wind velocities, particularly during winter storms. These generally westerly winds commonly reach 40 miles per hour with 100 miles per hour winds occasionally recorded.

FOREST SERVICE MANAGEMENT AREAS

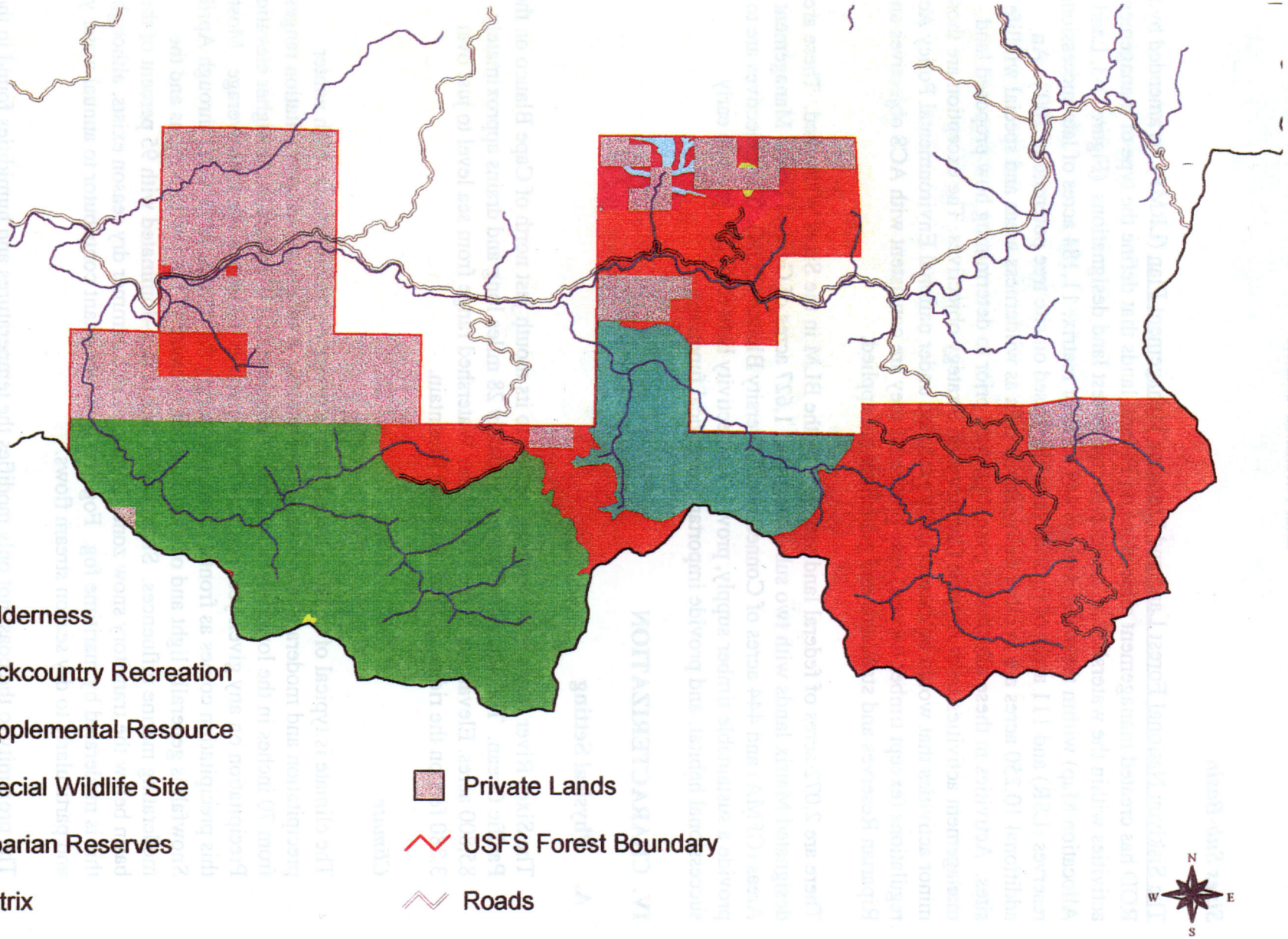


Figure 0-3

Geology, Soils and Landforms

The Sixes Watershed is located at the northern edge of the Klamath Mountains Geologic Province, but includes younger rocks of Cretaceous age, rocks from the California Coast Ranges Geologic Province and rocks from the Oregon Coast Range Geologic Province. Rocks from these provinces have been juxtaposed by a history of plate tectonics, faulting and deposition.

East-west trending faults divide the watershed into two halves. The south half consists of the older Klamath Mountains rocks and Cretaceous Formations (Figure O-4). The Klamath Mountains rocks include the metamorphosed sedimentary and volcanic rocks of the Galice Formation that have been intruded by diorites. This intrusion is the source of the gold mineralization in the watershed (Appendix A: Mineral Potential). These rocks underlie some of the steepest slopes in the headwaters of the South and Middle Forks (Figure O-5). The south half of the watershed is predominantly Cretaceous age Rocky Point Formation sandstones and siltstones, with Humbug Mountain Formation conglomerates and sandstones. The bluffy slopes in the lower South Fork and Bee Creek area are underlain by the well-cemented conglomerates. The terrain in the south half is thus similar in character to much of Elk River, with steep slopes, deeply incised channels, and shallower, rockier soils.

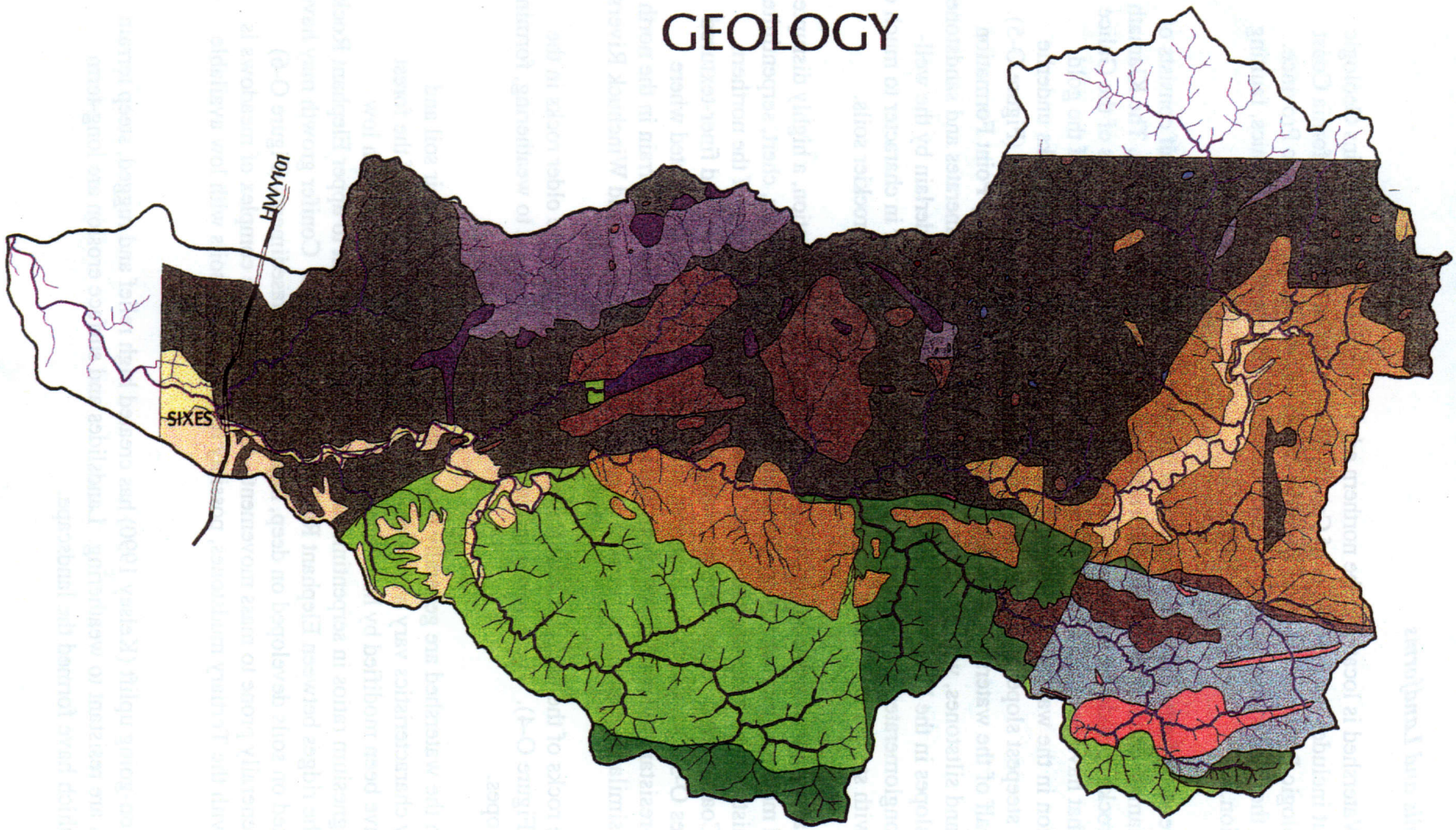
The north half of the watershed is underlain by the Otter Point Formation, a highly disrupted and sheared melange (mixture) of mudstone, sandstone, volcanic rocks, chert, serpentinite, and blueschist. These rocks are equivalent to the Franciscan Formation of the northern California Coast Range. Slopes are generally more gentle with deeper and finer-textured soils (Figures O-5, O-6 and O-7). Scattered buttes and steep ridges are located where weathering-resistant volcanic rocks, chert, and blueschist are exposed. Terrain in the north half is thus similar in character to coastal drainages such as the Pistol and Winchuck Rivers.

Tertiary age rocks of the Oregon Coast Range were deposited over the older rocks in the watershed (Figure O-4). These young sediments are weakly resistant to weathering, forming gentle hillslopes.

Meadows in the watershed are generally located on south aspects, but their soil and productivity characteristics vary with parent material. The current extent of the forest openings have been modified by human influence. Meadows associated with low calcium/magnesium ratios in serpentinite soils are limited in extent to upper Elephant Rock Creek and the ridges between Elephant Rock and Crystal Creeks. Conifer growth may have been inhibited on soils developed on deep, highly sheared metasediments (Figure O-6) which are generally prone to mass movement. A relatively large complex of meadows is associated with the Tertiary mudstones, possibly resulting from soils with low available moisture.

Recent and on-going uplift (Kelsey 1990) has created high relief and rugged, steep terrain where rocks are resistant to weathering. Landslides and surface erosion are long-term processes which have formed the landscape.

SIXES WATERSHED GEOLOGY



- *Quaternary alluvium*
- *Alluvial/marine terraces*
- *Tertiary Flournoy Fm*
- *Tertiary Lookingglass Fm*
- *Tertiary undifferentiated*
- *Cretaceous Rocky Point Fm*
- *Cretaceous Humbug Mtn Fm*
- *Cretaceous undifferentiated*
- *Otter Point metasediments*
- *Otter Point volcanics*
- *Otter Point chert*
- *blueschist*
- *diorite*
- *Galice metasediments*
- *Galice metavolcanics*
- *Colebrooke schist*
- *ultramafic rocks*
- *serpentinite*

N W E S

Figure 0-4

AUGUST 22, 1996

SIXES WATERSHED
SLOPE

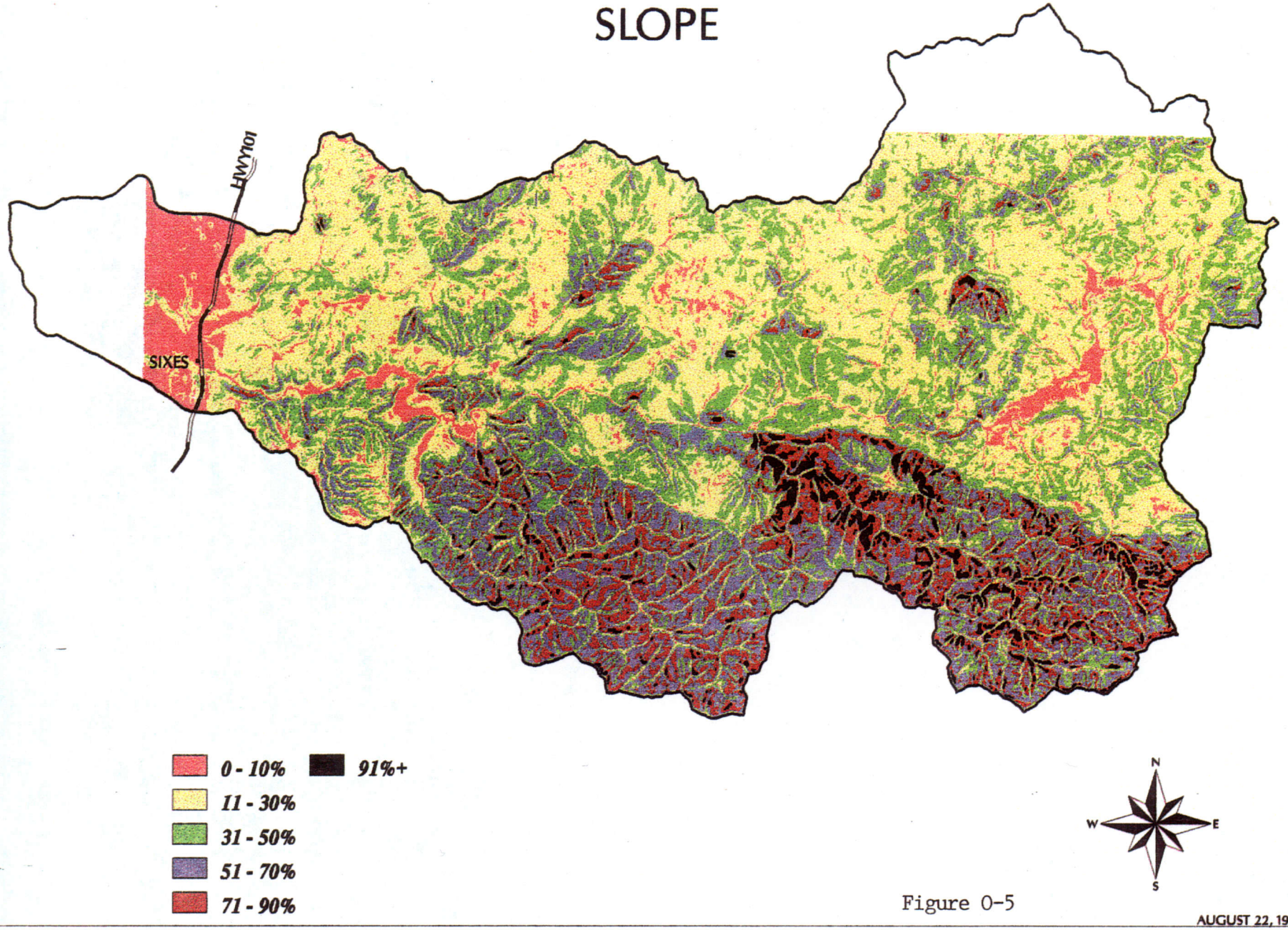


Figure 0-5

AUGUST 22, 1996

SIXES WATERSHED
SOIL DEPTH AND PARENT MATERIAL

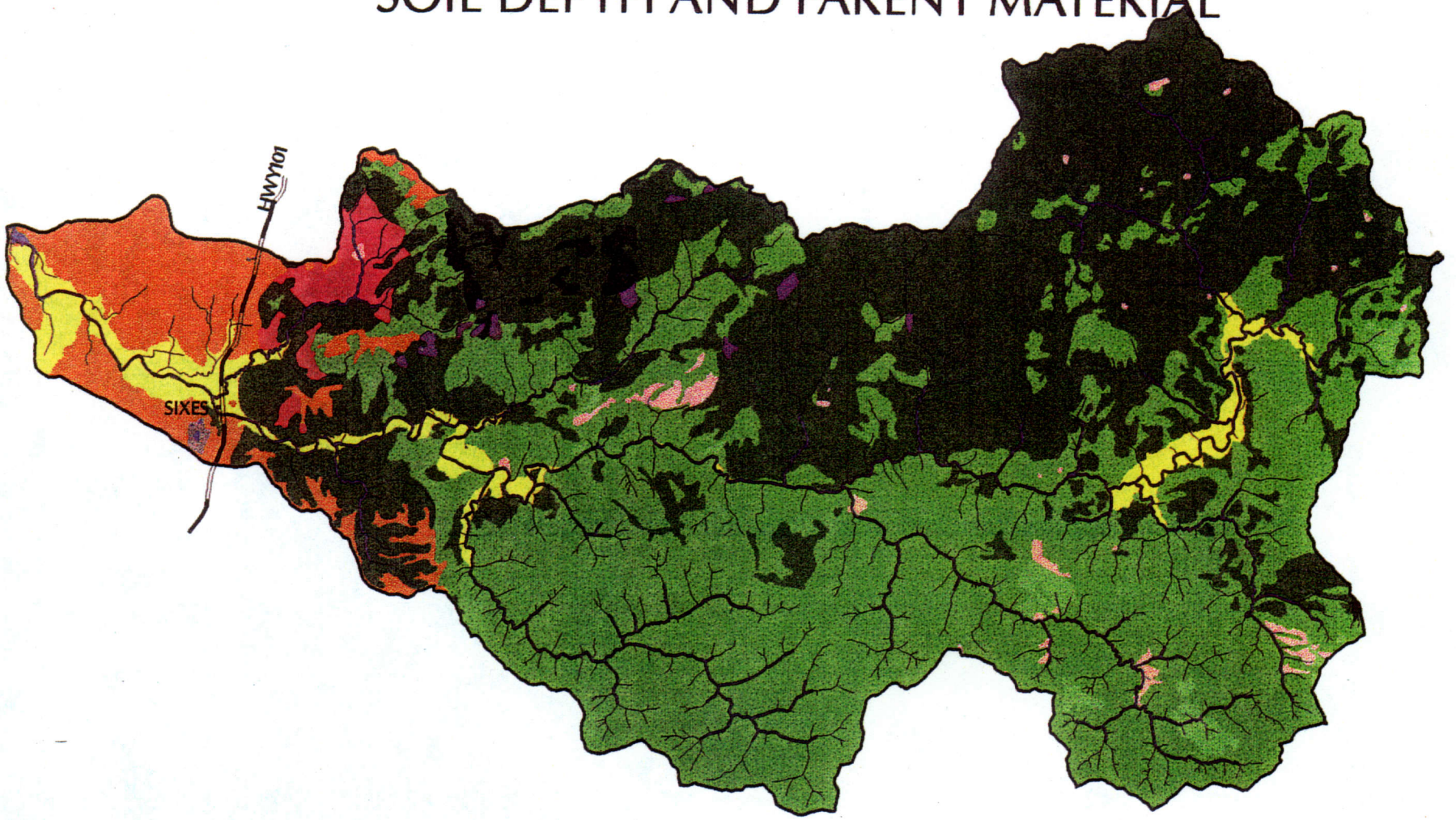
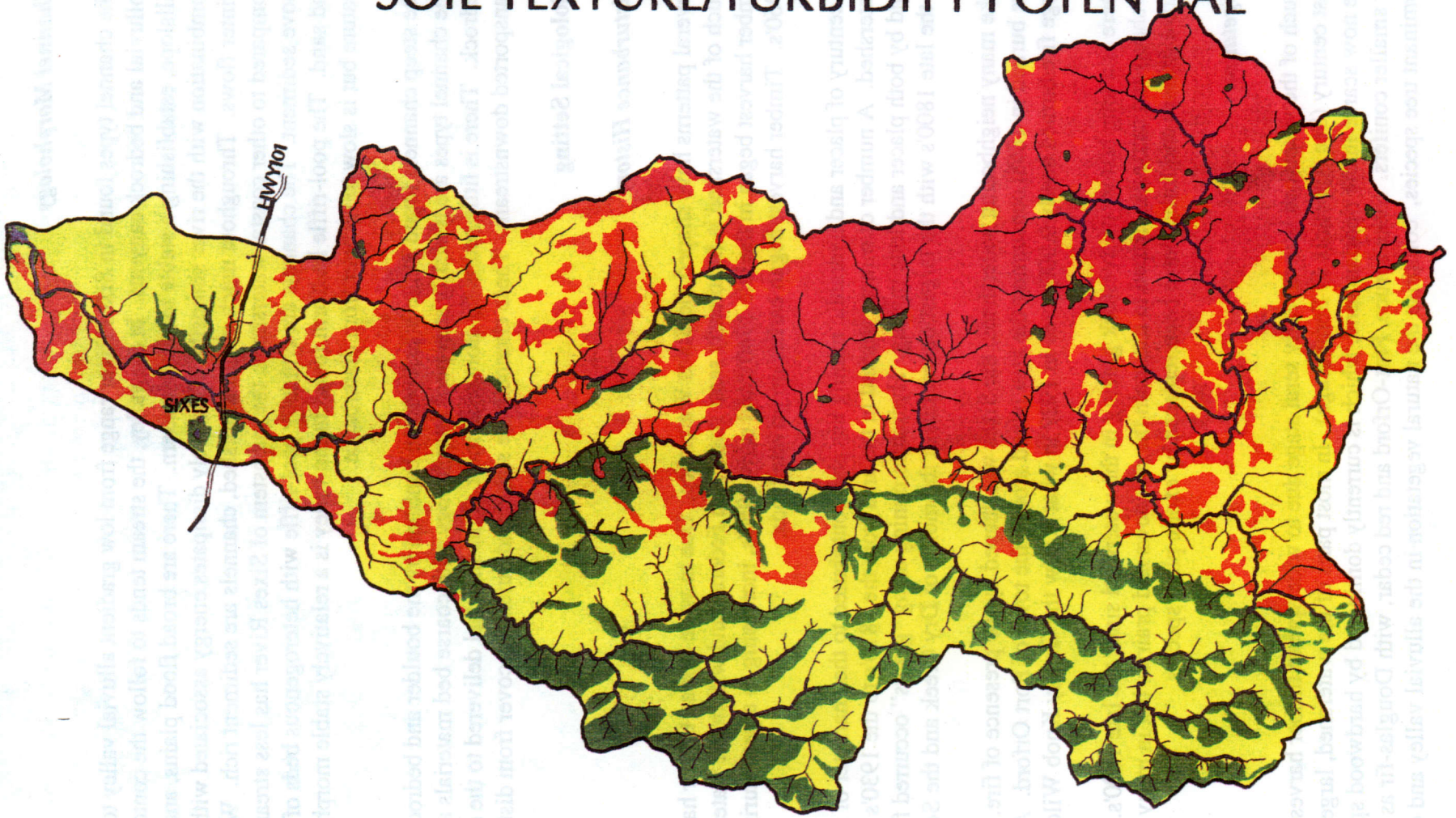


Figure 0-6

AUGUST 22, 1996

SIXES WATERSHED
SOIL TEXTURE/TURBIDITY POTENTIAL



Turbidity Potential	Percent Clay
High	40-55
Moderate	27-39
Low	10-26
Very Low	0-9

Footnote: Percent Clay is a weighted average for subsurface soil horizons of each series in a soil mapping unit. Mapping for Curry and Coos Counties by Natural Resources Conservation Service.

N
W E
S

Figure 0-7

SEPTEMBER 18, 1996

Channel Morphology

The channel types found in Sixes River range from low gradient alluvial valley to steep colluvial and bedrock canyons. In the valley, the stream tends to follow the contours of the hillslope, establishing a stable meander pattern. There are broad flood plains, and this in combination with the river sinuosity, effectively dissipates energy associated with higher winter flows. Throughout much of the watershed, channels are sediment rich. When compared to other coastal watersheds, the mainstem of Sixes River has less stream power to move sediment. The channels are typically pool-riffle with heterogenous beds of cobbles and sand. The pool-riffle bedform found in the valley is a relatively stable morphologic feature but is slow to recover from disturbance.

The steep channels found in the hillslopes are confined by the boulder and bedrock walls. The channel types are typically step-pool morphology with coarse bed materials and areas of bedrock. There is little sediment storage as most of the material delivered to the channel is transported downstream. These channels are stable and quickly recover from disturbance.

B. Biological Setting

Disturbance History

Several patterns have shaped the Sixes Watershed. Due to wide spread timber harvest, much of the watershed is in an early seral stage. On Federal land within the watershed, timber harvest began in the late 1940's and early 1950's, increasing to a peak during the late 1960's. Timber harvest began earlier on private lands.

A century of placer and hydraulic mining has also contributed to the character of the watershed. A number of miners worked in the area from the 1870's to the 1930's to recover gold by both placer and lode mining. Hydraulic mining using "giants" occurred for decades in the late 1800's with the largest operations at the mouth of Dry Creek and the South Fork.

Like many neighboring watersheds, the Sixes was shaped by the presence of fire. A large fire burned in 1868, consuming the area in and around the town of Port Orford. Another large fire burned nearly 9,000 acres in 1927 in what is now the Grassy Knob Wilderness.

There is a long history of livestock grazing in the watershed since the late 1800's. Heavy use by sheep and cattle has helped to maintain the meadows and prairies but in many cases native grasses and forbes have been replaced by exotic plant species.

Vegetation

Much of the watershed is in an early seral stage due to wide spread timber harvest over the past century (See Appendix F: Seral Stage). In most parts of the watershed, large conifers are now scarce in the riparian zone, which is currently dominated by hardwood species and by smaller conifers. Sitka spruce, Port-Orford and red cedar, with Douglas-fir as the dominant tree species, comprise the natural vegetation in the alluvial valley and coastal

wetlands. In the lower valley, the riparian forest is absent altogether, having been replaced by grass pasture or by exotic vegetation such as Himalayan blackberry and Scotch Broom. Parts of the watershed are currently maintained as oak-savanna vegetation and are used as cattle pasture. (Bakke, Shea)

Wildlife

A good variety of wildlife habitats exists in the watershed, including river bottom meadows and riparian zones, mixed hardwood and conifer forests, ridgetop prairies, rocky slopes and cliffs, and early seral habitat.

Many of the wildlife species commonly found along the South Coast are also found in the Sixes River watershed. Approximately 60 mammal, 155 bird, 13 amphibian, and 12 reptile species are found in the watershed. These include the Northern spotted owl which nests in late seral and climax forests, and marbled murrelets which use the drainages as flyways and nesting areas. Other federally listed threatened and/or endangered species, the peregrine falcon, bald eagle, and snowy plover are occasionally present in the watershed. Deer and elk are common, particularly in the river bottom meadows and ridgetop prairies. Carnivores such as black bear, mountain lions, bobcats, and coyotes are also common.

Fisheries

The Sixes River and tributary streams are home to anadromous and resident salmonids as well as other freshwater, estuarine and marine fishes. The watershed contains important freshwater spawning and rearing habitat for chinook salmon, coho salmon, chum salmon, winter steelhead, sea-run cutthroat and resident rainbow and cutthroat trout. Populations of salmonids within the watershed are depressed over historic levels. Coho salmon and winter steelhead have been proposed for a listing of "Threatened" under the Endangered Species Act (1973).

C. Social Setting

History

The history and economic development in and around the Sixes River follows a pattern similar to that seen along much of the Oregon coast, initially starting with fur trade and trapping and progressing to mining, homesteading and settlement with subsistence agriculture, commercial fishing, timber harvest and wood processing (Appendix B: Cultural History). The Sixes River area is considered important in the history of southwest Oregon mining.

Before the coming of the Europeans, this area was inhabited by the Quatomah band of the Tututni group of Athabascan speaking Indians. There were settlements in the Floras Lake, Sixes River, Eckley, Elk River, and Port Orford areas. The Sixes River was used more heavily than the Elk River.

The first Europeans in the area were fur trappers and traders in the 1820's. In 1828, Jedidiah Smith's party crossed the Elk and Sixes Rivers on a journey north from California. Much of the early fur trade was conducted over the inland California Trail, across Siskiyou Pass.

European settlers and miners started moving into the area in the early 1850's. The first European settlement in southwestern Oregon was at Port Orford, founded by Captain William Tichenor in 1851. After an attack by the Lower Coquille Indians on a party of explorers, the U.S. Army established Fort Orford.

With the discovery of gold in the black sands along the beaches in 1853, many prospectors poured into the region from California. The success of mining on the Sixes River also created a small gold rush around 1856. This led to the construction of a small mining community in the rugged canyon of the South Fork known as Summersville. Several other mines operated on the Sixes River and its forks.

In the mid-1870's a second mining boom occurred at the mouth of the South Fork Sixes River. Writing in 1898, Orvil O. Dodge noted "The placer mines on this stream have been worked continuously, to a limited extent, for more than thirty-five years past, and it is safe to say that more gold has been taken out of it than from any other stream in western Oregon, except the Rogue River." The Sixes was further developed by the Hydro Sixes Mining Company in 1914.

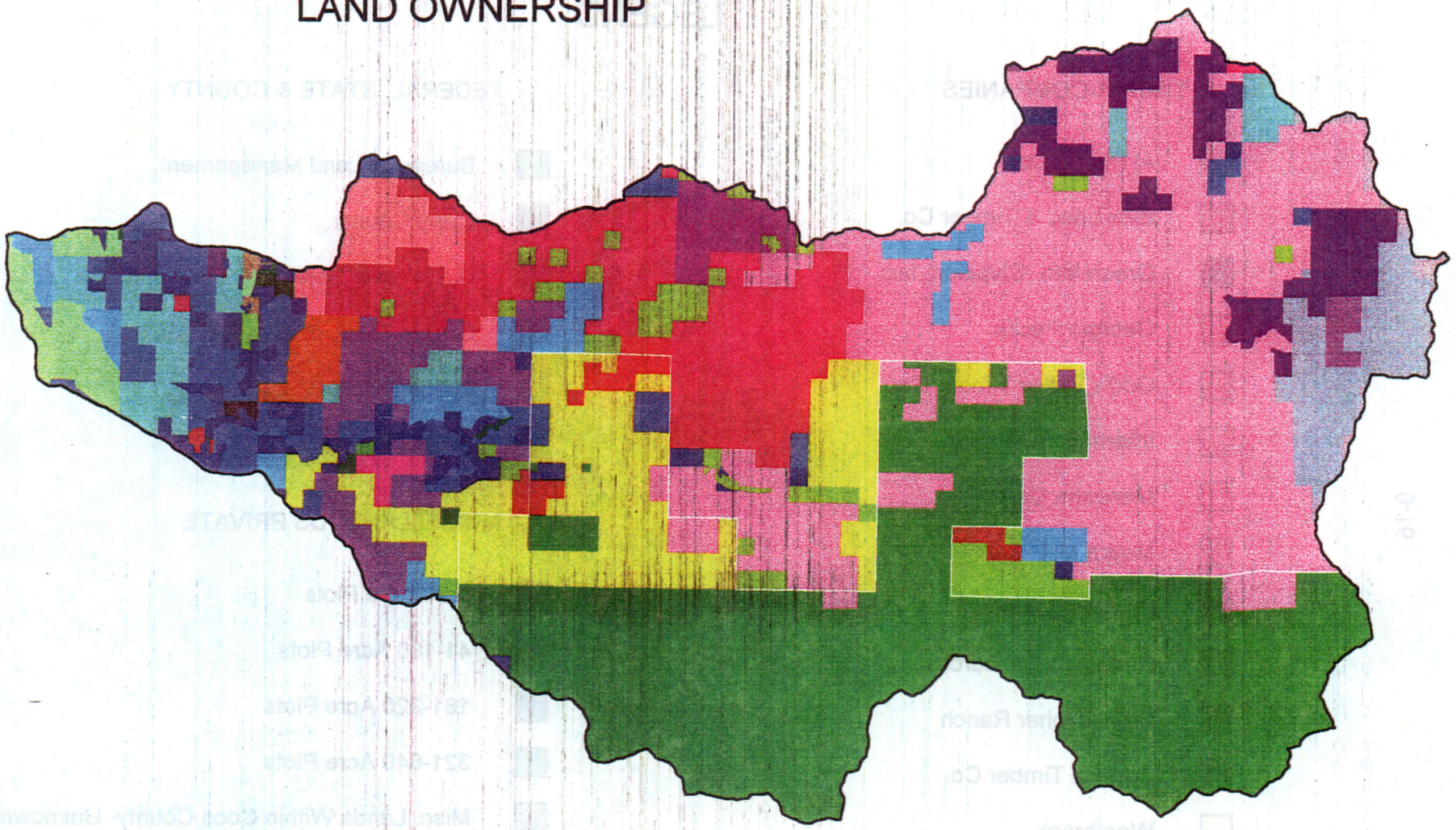
A settlement named Eckley was formed near the North Fork of Sixes River in 1860 and continued until the time of the first World War. At least three large families lived there: the Haines', Guerins', and Gibbs.' These families lived by subsistence farming and cattle ranching. Other settlers moved onto land in Otter and Big Creeks. Eckley became a stopping place for travelers from Port Orford going to the communities in the South Fork Coquille River and the mines on Johnson Creek. Ellis S. Dement leased the Haines property in 1913 and bought the ranch in 1927. Today it is a remote cattle ranch. The road connecting Sixes to Powers passes through private land and is closed to public travel.

In 1906, the Siskiyou National Forest was established. The Forest was organized into districts in 1909. Much of the early mission of the Forest Service was custodial and involved fire protection. After World War II, the Forest Service started intensively managing timber and building logging roads.

Land Ownership

The analysis area contains 24,415 acres of Federally managed land and 61,501 acres of privately owned land for an approximate total of 85,916 acres (Figure O-8). The watershed is divided into nine subwatersheds, ranging from 6,800 to 19,790 acres each (Figure O-9).

LAND OWNERSHIP



See next page
for map legend

Figure 0-8

LAND OWNERSHIP MAP
LEGEND

TIMBER COMPANIES

- Al Pierce Co.
- Elite Land & Timber Co.
- Green Mtn. Chipping, Inc.
- Georgia Pacific
- God's Valley Timber Co.
- International Paper
- Menasha Corp.
- Moore Mill
- Rogge Lumber
- Roseburg Resources
- Stonecypher Ranch
- Seneca Timber Co.
- Westbrook
- Wayne Kennedy Logging
- Wicklander Lmtd. Partnership
- Yosemite Pacific

FEDERAL, STATE & COUNTY

- Bureau of Land Management
- Curry County
- U.S. Forest Service
- Oregon Dept. of Fish & Wildlife
- Oregon State
- School District 2CJ

MISCELLANEOUS PRIVATE

- 1-40 Acre Plots
- 41-160 Acre Plots
- 161-320 Acre Plots
- 321-640 Acre Plots
- Misc. Lands Within Coos County- Unknown Ownership

RANCHES

- Powers Ranch
- Sam & Dorothy Dement

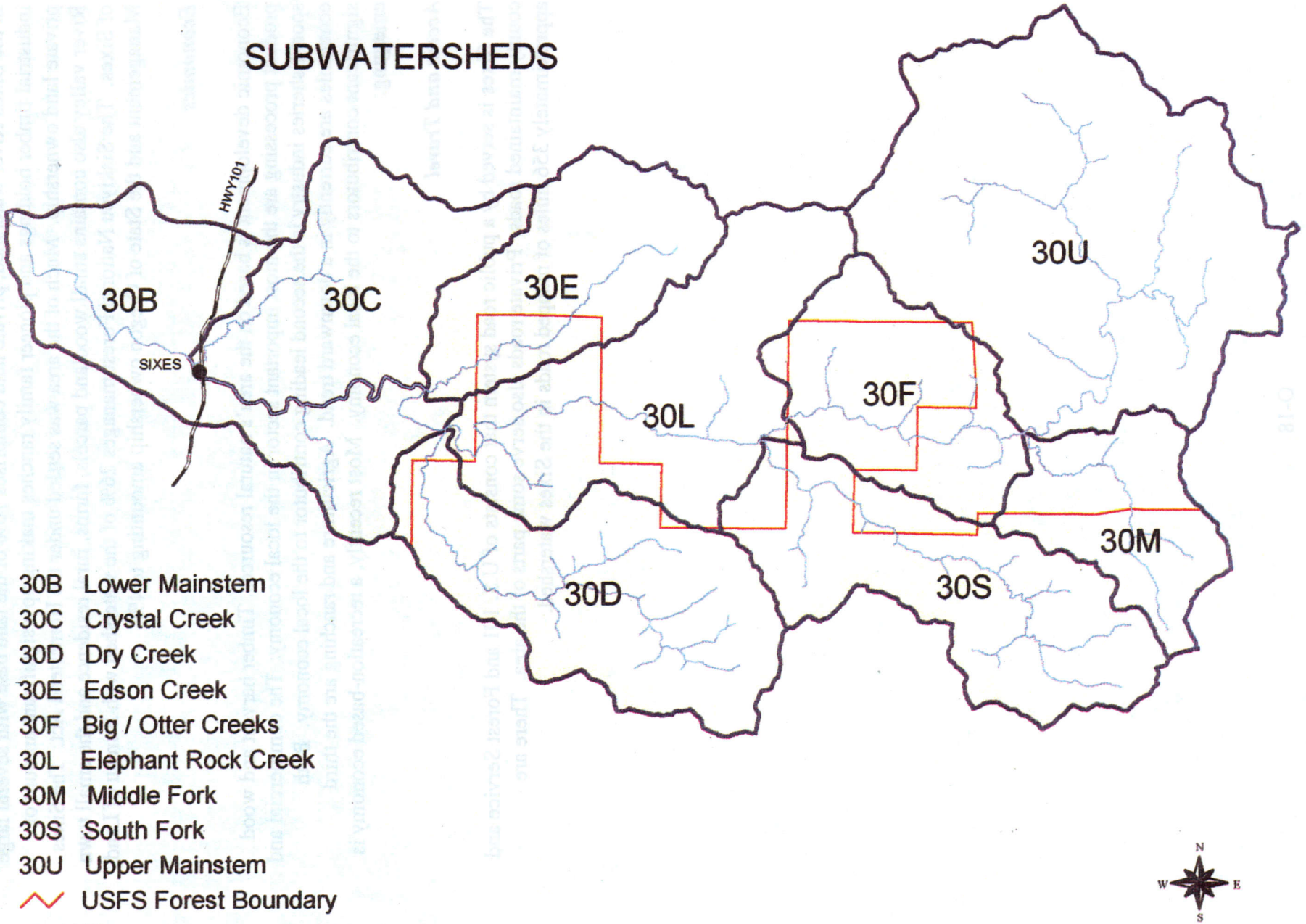

SUBWATERSHEDS
HWY101
SIXES
30B
30C
30E
30U
30F
30L
30M
30D
30S
30B Lower Mainstem
30C Crystal Creek
30D Dry Creek
30E Edson Creek
30F Big / Otter Creeks
30L Elephant Rock Creek
30M Middle Fork
30S South Fork
30U Upper Mainstem
USFS Forest Boundary
Streams
N
W
E
S

Figure 0-9

In the Sixes River watershed, private land comprises 70% of the land base with several large industrial timber holdings and pioneer family ranches making up a significant amount of private land ownership. Much of the area was settled under the Homestead Act. The Sixes River valley also contains small woodland parcels, farms, rural residence and the small town of Sixes. The Siskiyou National Forest manages 26% of the watershed with Bureau of Land Management and the State of Oregon ownership amounting to 4%.

Economics

Economic development is based on the area's natural resources. Timber harvest and wood product processing are the most important sector in the local economy. The commercial and sport fisheries industry is the second leading contributor to the local economy. Both economies are currently in a downward trend. Agriculture and ranching are the third significant contributors to the local economy. Most recently, a recreation-based economy is emerging.

Access and Travel

The Sixes is served by a public road system that consists of U.S. 101 and Forest Service and county maintained roads. Private roads also serve some parts of the area. There are approximately 356 miles of mapped roads in the Sixes watershed.

AQUATIC ECOSYSTEM

I. WATERSHED GEOLOGY AND GEOMORPHOLOGY

(See Overview: Physical Setting for Introduction to Geology and Geomorphology).

The Sixes flows from its headwaters into an alluvial valley that developed in weakly resistant Tertiary sedimentary rocks (Figure O-4). More resistant rocks along an east-west trending fault confine the channel until it reaches the alluvial terraces near little Dry Creek and the valley widens across a coastal plain.

The lower 2.5 miles of the river is subject to tidal influence, creating an estuarine area. During the summer, prevailing northwest winds form a sand bar or sill at the mouth of the river, creating an embayment with cold salt water beneath warmer fresh water. As the sill builds the embayment expands, trapping nutrients and enlarging the area available for rearing of juvenile fish (Reimers 1973).

The durability and size of sediment delivered to the channel varies considerably with the underlying bedrock. The Klamath Mountains rocks (Galice and diorite) generate more durable boulder and cobble-sized particles from parts of the South and Middle Fork Watersheds. Gravel and sand-sized particles dominate the bedload from the Cretaceous conglomerates and sandstones (Humbug Mountain and Rocky Point Formations). Boulders and cobbles may also be delivered to the channel, but are not as durable during transport downstream. Sheared Otter Point bedrock weathers to fine-textured soils that cause turbidity when transported as suspended sediment. Resistant rock types within the Otter Point melange are delivered at the toes of deep-seated landslides as durable boulder to gravel-sized particles.

Soil textures that include a higher percentage of clay produce sediment that is carried in suspension for long periods of time. The Sixes River Watershed has a higher proportion of clayey soils than the Elk River to the south (Figure O-7), and takes longer for the water to clear following storms.

II. AQUATIC ECOSYSTEM PROCESSES, CONDITIONS, AND TRENDS

A. Sediment Delivery

What processes deliver coarse and fine-grained sediment to the watershed?
~where are they delivered?
~in what magnitude?

How much sediment is delivered naturally and how much is derived from human activity?

Mechanisms of sediment transport and delivery vary with geologic and geomorphic setting, due to differences in rock structure, hillslope angle, soil strength and depth, moisture-holding capacity, and root anchoring types.

The layered sedimentary rocks of Cretaceous age are well-cemented, forming steep and even bluffy slopes (Figure O-5), that are subject to landslides or chronic rock ravel. Where soils are present, they may fail as shallow, rapid debris slides, debris avalanches or debris flows. Debris flows are triggered during heavy rainfall by soil saturation, scouring streams to bedrock and depositing sediment and large wood at tributary junctions or low gradient reaches.

In the north half of the watershed, deep slow-moving landslides, such as slump-earthflows, are the dominant failure process. Earthflows act like conveyor belts, chronically moving sediment into adjacent channels. Earthflows move more rapidly when the ground is saturated, and are accelerated by factors that increase soil moisture levels or the length of time the soil is saturated. Within sheared and serpentinized rocks of the Otter Point Formation, earthflows deliver fine-grained sediments by debris slides from their toes and by erosion of marginal gullies. These natural features range in size from small creeping areas with high groundwater levels to massive slump-earthflow complexes (Slope Stability Features Map in process records).

The magnitudes of sediment delivery from landslides were measured on lands within the National Forest Boundary (McHugh 1986), for natural, road and harvest-related slide volumes and trends (Appendix C: Methods). Figure A-1 illustrates the estimated volume of landslide sediment delivered to streams during aerial photo-bracketed time periods.

Naturally-occurring landslides were triggered by a number of storms throughout the time period, rather than concentrated in response to a single storm. The only exception is for 1952-1956, which includes a single landslide estimated at 62,000 cubic meters (described below). This time period includes the 1955 storm.

Approximately 1.5 river miles upstream of Dry Creek, a very large debris flow failed from an unnamed tributary in section 9 to the south between 1952 and 1956 (possibly during the 1955 storm). The debris flow "ran out" into the mainstem Sixes, creating a temporary dam and lake about a mile in length (Huritt 1996, personal communication). The debris flow failed from the deposit of a larger ancient deep-seated landslide. It is unknown whether the debris flow may have been triggered by a road constructed near the head scarp.

Rates of sediment delivery from ravel were not estimated for the landslide inventory. Natural openings that result from rock outcrops, debris chutes or ravelling slopes are common on steep Cretaceous and diorite slopes. Although the affected area is relatively extensive, the rate of ravel delivery to streams is unknown.

Road and Harvest-Related Sediment Delivery

Roads are associated with a variety of sediment delivery processes in the Sixes River Watershed. Cutbank and fillslope failures may lead to debris flows or smaller debris slides. Rock fall has been observed from steep road cuts. Old road designs with side-cast construction has caused numerous fill failures. Decomposition of wood buried in some

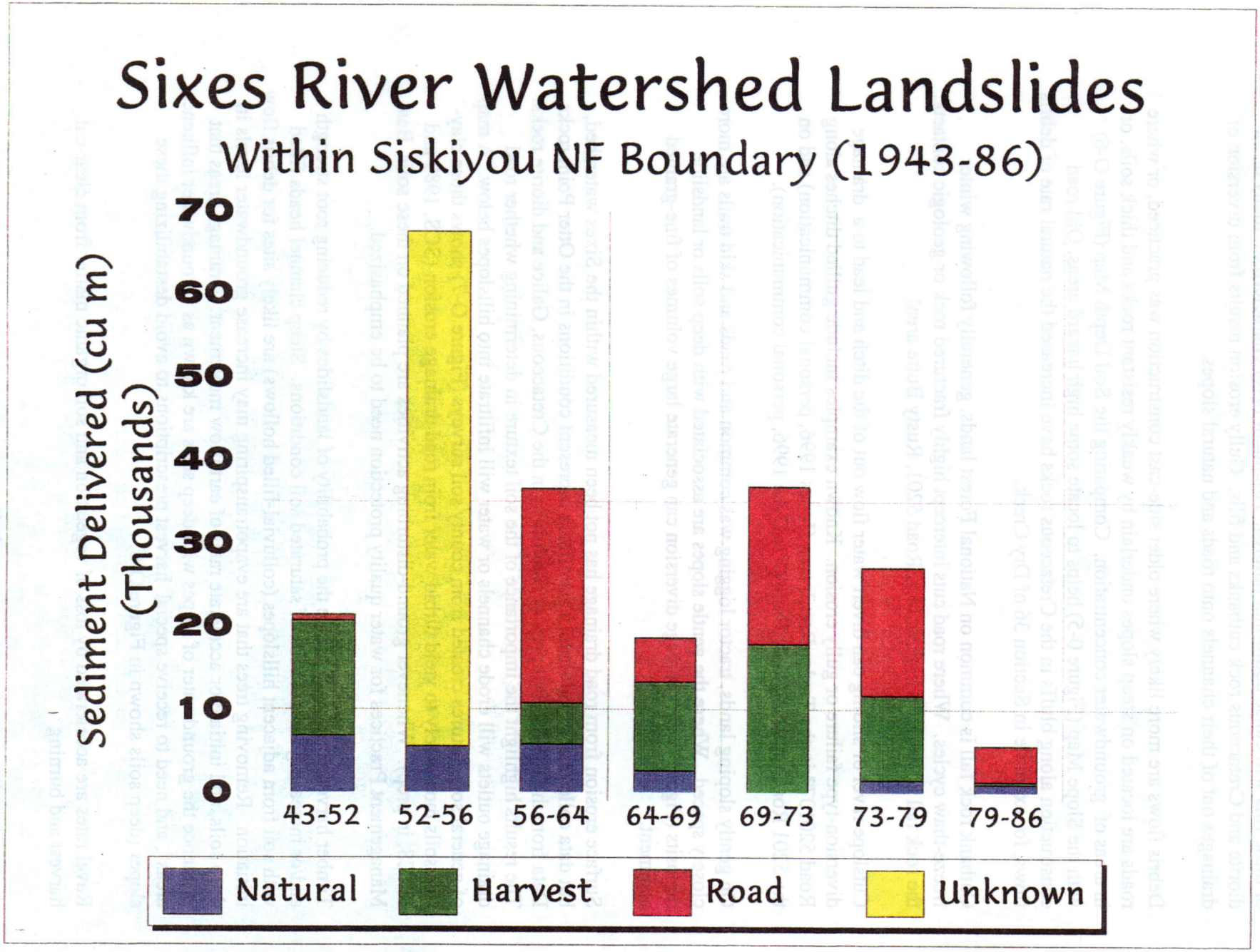

Sixes River Watershed Landslides
Within Siskiyou NF Boundary (1943-86)
Sediment Delivered (cu m)
(Thousands)
70
60
50
40
30
20
10
0
43-52
52-56
56-64
64-69
69-73
73-79
79-86
Natural
Harvest
Road
Unknown

Figure A-1

of these fills will cause additional failures. Abundant ravel characterizes many of the diorite and Cretaceous rock cutbanks and fills. Gully erosion results from diversion of drainages out of their channels onto roads and natural slopes.

Debris flows are more likely where older side-cast construction was practiced, or where roads are located on steep slopes underlain by weakly resistant rocks and thick soils, or in areas of groundwater concentration. Comparing the Soil Depth Map (Figure O-6) with the Slope Map (Figure 0-5) helps to locate some high hazard areas. Old road construction along bluffs in the Cretaceous rocks have increased the natural rate of debris flows, for example in Section 36 of Dry Creek.

Cutbank rock fall is common on National Forest lands, generally following winter freeze-thaw cycles. Where road cuts intercept highly fractured rock or geologic contacts, the rock fall potential is highest (e.g. Road 5201, Rusty Butte area).

Cutslope ravel or sliding can divert water flow out of the ditch and lead to a drainage diversion-type failure or gully erosion. Known examples include gullied ditches along Road 5201072 in the Taylor Ranch area (Jones 1996, personal communication) and on the 5201 Road north of Rusty Butte (VanDyke 1996, personal communication).

On gently sloping lands, tractor logging was common and roads and skid trails are more closely spaced. Where the gentle slopes are associated with deep soils or landslide deposits (Figure O-6), drainage diversion can generate large volumes of fine-grained sediment.

Surface erosion from road drainage has not been measured within the Sixes watershed, but data collected in the Pistol River likely represent conditions in the Otter Point rocks. Data from the Elk River represent conditions in the Cretaceous, Galice and diorite rocks. The results highlight the importance of the soil texture in determining whether road drainage outlets will erode channels or water will infiltrate into hillslopes below. A map of general soil textures created from county soil surveys (Figure O-7) shows those clay-rich soils most likely to yield turbid water from road drainage erosion (SCS, 1989 and NRCS, in prep). Whenever ground-disturbing activities are planned on these soils, Best Management Practices for water quality protection need to be emphasized.

Timber harvest also can increase the probability of landslides by reducing root strength and/or increasing the duration of saturated soil conditions. Steep channel heads filled with soil from adjacent hillslopes (colluvial-filled hollows) are likely sites for debris flow initiation. Removing trees that are evapotranspiring may increase groundwater levels in deep soils, and initiate or accelerate rates of earthflow movement. Drainage areas that influence the groundwater of slopes with deep soils are known as "groundwater influence areas", and need to receive special harvest prescriptions to avoid destabilizing these slopes (deep soils shown in Figure O-6) .

Ravel rates are accelerated by loss of vegetation and soil organic matter from clear-cut harvest and burning.

Landslide hazard maps are also not available for harvest on National Forest Lands. Maps of lands unsuitable due to irreversible soil loss are incomplete, particularly for the upper North Fork Dry Creek, Bee Creek watershed, and in section 20 east of Bee Creek that drains into the South Fork Sixes River.

Landslide causes, volumes, and timing were inventoried for lands within the National Forest Boundary (McHugh 1986). Figure A-1 shows estimated volumes delivered to stream channels for each air photo time period. Between 1943 and 1986, an estimated 5.6 times the natural landslide sediment volume was delivered to stream channels from National Forest lands (excluding the 1955 large debris flow in section 9, of unknown cause).

Landslides from roads and harvest generally followed the disturbance within a few years. The volumes thus reflect periods of intensive land use. The access road to section 36 of Dry Creek was constructed in 1961, and sediment delivery was high during the 56-64 time period as a result. Roads constructed in 1969-70 in Benson Creek had a high incidence of failure during the 69-73, 73-79, and 79-86 time periods (see Subwatershed section for more details on South Fork Sixes and Dry Creek landslides).

No historic landslide inventory was completed for privately-owned lands. On the gentle slopes (Figure O-5) sedimentation rates are difficult to measure on aerial photographs due to the slow creep processes that accumulate soil and the small size of the slides that deliver sediment to streams at the toe of deep-seated landslides. Gully erosion also requires field measurement. Locations of deep-seated landslides are mapped (Slope Stability Features Map in process records). On steeper lands, debris flows were observed from some roads crossing headwalls. Delivered sediment volumes would be useful to construct a watershed sediment budget for understanding sediment storage, routing, and rates of recovery of pool habitat. In some parts of the channel, morphology and sediment transport may be factors limiting fish habitat, as well as a concern for bank stability (see Channel Morphology section).

A Watershed Improvement Needs (WIN) Inventory identifies known sites where past failures and erosion are evident (Appendix D: Watershed Road-Related Restoration Opportunities). The list includes abundant raveling cutslopes and harvest units, rock and debris slides, and some unstable fills. On some older side-cast roads in mid-slope positions, fills may have already failed. Restoration needs have been assessed for roads in the Benson Creek watershed (USDA 1990) and roads accessing section 36 of Dry Creek (USDA 1992). Similar assessments would be useful for the road systems on Moon Mountain and on the southeast side of Mount Avery.

For National Forest Lands, a systematic inventory of ditch drainage distances, diversion potential, and high hazard road crossings is not available. Dates of road construction, to correlate with landslide timing, would also be useful in determining the role of older roads with sidecast fill or buried wood in potential future failures.

Streambank Erosion

Erosion of streambanks is most evident in those areas where the channel flows through alluvium (ie. channel deposits; see Valley Alluvium in Figure O-6). Stabilizing vegetation is absent, and channel aggradation and widening has occurred. Future recovery of the channel from past sediment delivery is discussed in the Channel Morphology section.

Mining

Prospecting and associated mining disturbance has been extensive in Dry Creek and South Fork (see Overview). Hydraulic mining of streambanks would have delivered considerable sediment to channels in the late 1800's to 1930's. Because the landslide inventory measured only landslide scars that were created after 1943, mining-related sediment is not included in the sediment volume estimates.

Grazing

Some rilling and gullying are evident in meadow areas. Although these types of channels may develop naturally in meadows, increased downcutting results from concentrated road drainage and compaction by grazing with reduced infiltration of water into the soil. "Terracettes" caused by grazing sheep is evidence of this effect. Where present, riparian vegetation, including willows, can stabilize banks and store sediment. Channel erosion from grazing on meadows and floodplains is likely a minor sediment source in the watershed, but no systematic observations are available.

The hillslope between Wilson Prairie and Elephant Rock Creek is sparsely vegetated and a likely source of sediment, due to the presence of a large active earthflow (mapped by McHugh, 1986). It is not known to what extent grazing or other disturbance of these lands may affect the rate of earthflow movement.

Future Trends

Future storms will cause natural landslides, and will interact with roads to concentrate flow and cause additional erosion. Deposits of road and harvest-related sediment currently stored in channels will be mobilized by high flows, creating a new sediment source for downstream channels. Sediment transport will especially affect the South Fork Sixes from bedload rich tributaries such as Benson, Dixie, and Rusty Creeks.

The probability of high intensity wildfires is low due to the marine climate in the Sixes Watershed. However, a high intensity wildfire would likely increase ravel rates by consuming surface organic matter on steep ravel prone slopes. The lower fire intensities associated with present day prescribed burning have a lower risk of causing ravel.

In 1989, the Siskiyou National Forest Plan established land allocations and standards and guidelines to protect streamside areas. The Northwest Forest Plan (1994) established new

land allocations that have further reduced timber harvest and road construction on Federal Lands in the Sixes River Watershed. New standards and guidelines provide added protection to streamside (riparian) zones, including unstable and potentially unstable lands. Harvest of timber stands on privately-owned lands is ongoing. Riparian guidelines from new Oregon Forest Practices regulations will apply to future harvest on private lands.

The timing of landslides following roading or harvest shows that older disturbances generally are less susceptible to failure, presumably because growing vegetation increases stability and because unstable sites have already failed. Data from National Forest lands show that between 1943 and 1992, approximately 80% of the landslides failed within the first five years of disturbance. After 10 years, more than 90% had already failed. However, existing harvest units and roads may cause new landslides, depending both on the age of the disturbance and on the intensity of future storms. On Federal Lands, relatively few roads have been constructed to access timber harvest units since the mid-1980's. On private lands, new roads and harvest units are more numerous and may be susceptible to storm-triggered landslides and erosion. Of the road-related slides that do occur in the future, most will result from inadequate maintenance, leading to drainage diversions, stream crossing failures, and debris flows.

Other future sources of sediment are deposits already in storage in Benson Creek, the headwaters of Dry Creek, and Dixie and Rusty Creeks. Movement of this material will be buffered by large wood dams in the channel, and future sources of large wood within riparian stands (see Large Wood section).

Large scale hillslope disturbance from gold mining is not a likely future scenario, due to difficult access and low values. Working of placers in stream beds is likely to continue, particularly on the South Fork Sixes River. Suction dredging generally rearranges channel sediment, and loosens fine-grained suspended sediment during low flow months, but is not a source of coarse-grained materials to the extent that would cause changes in channel form.

B. Large Wood

What processes deliver large wood?

Where have management activities reduced the large wood supply below natural levels?

"Large wood" is defined by USFS Region Six Stream Survey protocol as wood that is a minimum of 50 feet long and a diameter of 24 inches at the small end. Large wood influences channel form and sediment transport (see Channel Morphology section) as well as serving as habitat cover and nutrient storage (see Fish Habitat section). Large wood is delivered to stream channels by falling from adjacent riparian forests, by debris flows, stream side landslides, and by transport from upstream sites. Large wood has also been removed from the channel in association with placer mining, during some early

logging operations, and during post-storm salvage (see Channel Morphology section). Locally, within stream sources of large wood have been reduced by burial from sediment delivery (eg. Benson Creek and Dry Creek headwaters).

In the historic record, few riparian stands were replaced by natural disturbances such as wildfire, due to the marine climatic influence and less intense fire in moist riparian areas. The largest floods rearranged the existing large wood and converted some floodplain conifers to alder-dominated areas (see Channel Morphology section). Windthrow of trees into riparian areas and channels has been a natural process, although exacerbated by timber harvest especially prior to the 1962 Colombus Day windstorm.

Prior to settlement, the river most likely was bordered by a forest of mixed conifers and deciduous trees. In most parts of the watershed, large conifers are now scarce in the riparian zone, which is dominated by hardwood species and by smaller conifers (Figure A-2). The long-term supply of large wood has been reduced from riparian areas primarily by timber harvest and clearing for agriculture. Riparian vegetation and shade is lacking in agricultural valleys along the mainstem Sixes and lower Crystal Creek, having been replaced by grass pasture or by exotic vegetation. Riparian vegetation has also been lost from the streambank bordered by Cape Blanco State Park. Other processes include scouring by road and harvest-related debris flows (discussed in the Sediment Delivery section above), and root rot infection of Port-Orford-cedar wherever present and accessible by roads.

Late seral (structural) stage vegetation within Riparian Reserves is a measure of large wood supply for each subwatershed (Figure A-3). Riparian silvicultural treatments designed to accelerate late stage stand conditions would be beneficial in subwatersheds with high proportions of mid stage riparian vegetation.

Future Trends

Future silvicutural treatments will include more thinning of stands, leaving a windfirm canopy to protect adjacent riparian areas. Existing riparian areas adjacent to clearcuts may still be vulnerable to a large windstorm during saturated soil conditions.

Riparian protection under the State Forest Practices Act does not include all trees that might fall into stream channels and onto unstable banks. Thus, the large wood supply from non-Federal lands will be below the potential for these riparian areas well into the future. Port-Orford-cedar root disease will continue to cause mortality in riparian stands in infected drainages (see discussion in Terrestrial section).

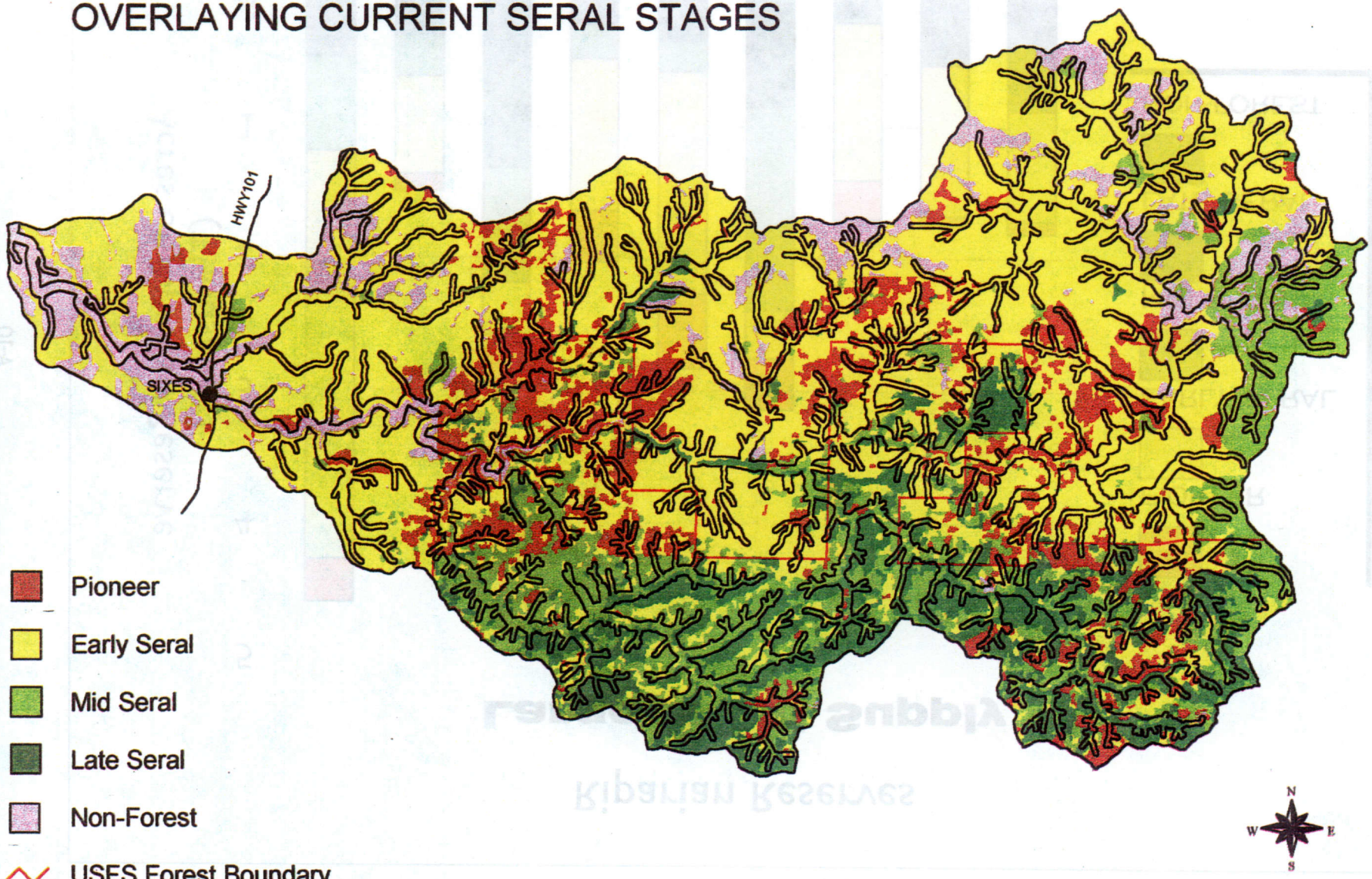

RIPARIAN BUFFER ZONES-
OVERLAYING CURRENT SERAL STAGES
HWY101
SIXES
Pioneer
Early Seral
Mid Seral
Late Seral
Non-Forest
USFS Forest Boundary
N
W
E
S

Figure A-2

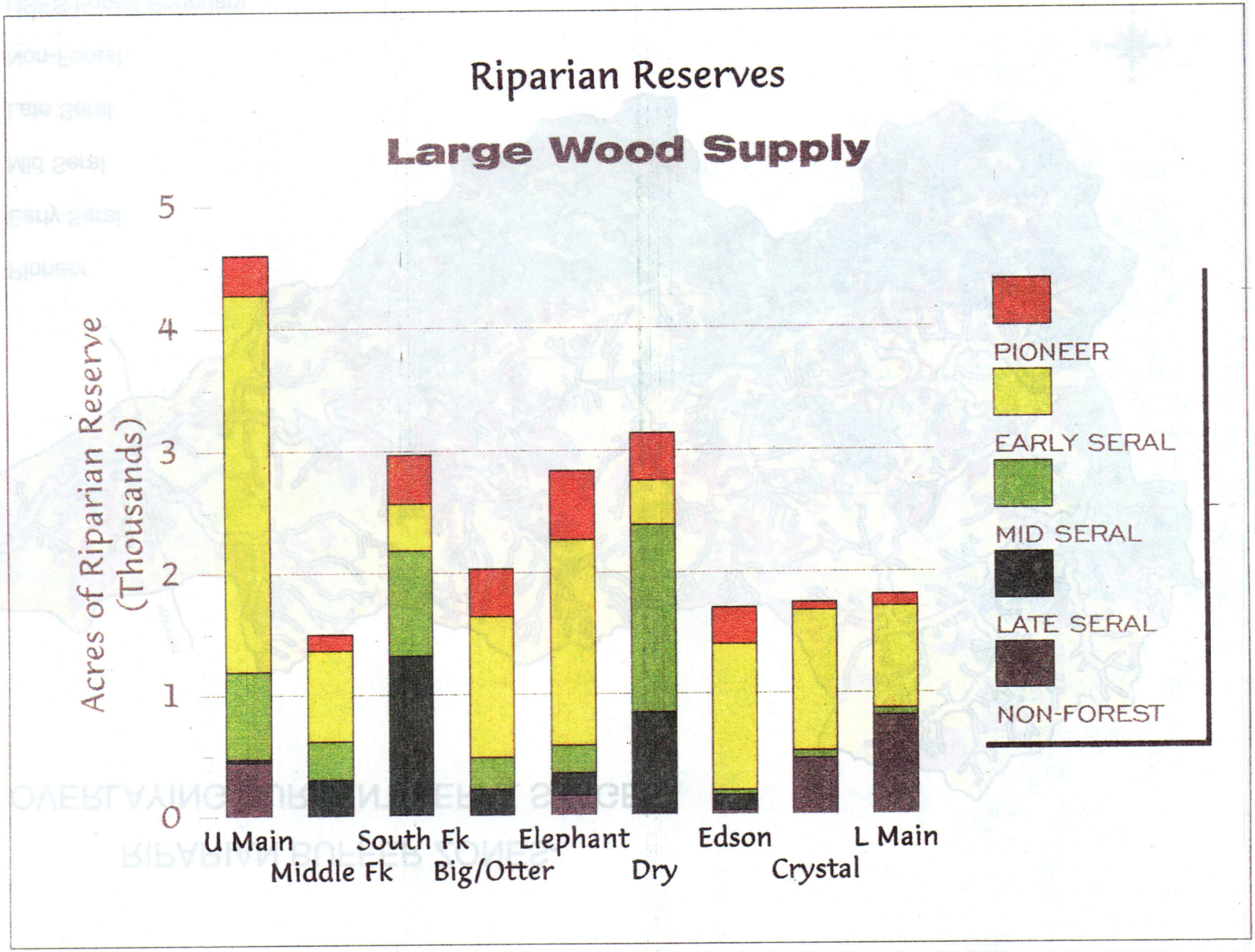

Riparian Reserves
Large Wood Supply
Acres of Riparian Reserve (Thousands)
0
1
2
3
4
5
U Main
Middle Fk
South Fk
Big/Otter
Elephant
Dry
Edson
Crystal
L Main
PIONEER
EARLY SERAL
MID SERAL
LATE SERAL
NON-FOREST

Figure A-3

C. Water Quality

Key Question:

What are the processes that reduce stream shade and increase water temperature?

Where have human activities increased solar exposure and stream water temperature over natural levels?

Stream Temperature

Factors that can contribute to increases in summer stream temperature are storm events that cause landslides, bank scour, removal of riparian vegetation and wider, shallower channels. Human activities in Sixes River that can increase stream temperature are harvest of riparian shade vegetation, river terraces developed for live stock and increased sediment delivery from roads and harvest units that can aggrade channels.

Stream temperature data has been collected on Sixes River at Highway 101 from 1965 to the present. The stream temperature data is not complete with some years missing. Stream temperature was recorded using a hand held thermometer at approximately the same time day each year. By not using a continuously recording thermograph, monthly peak temperatures may have been missed. Changes in stream temperature in the recent past can be evaluated by correlating stream temperature data with changes in riparian vegetation on historical aerial photographs and anecdotal accounts (See Appendix E: Clean Water Act).

In the lower and upper valley segments, where the active channel becomes very wide, channel shape is more important than riparian vegetation in maintaining lower temperatures. The shade from trees only covers a significant amount of the water surface in the early morning and late afternoon, when solar radiation values are low. If the channel becomes wider, the water surface area can double or triple, increasing the solar radiation absorbed. Temperature data collected by the Forest Service in other watersheds have shown mainstem temperatures to be as much as one degree F cooler below a cold water tributary. Loss of stream shade on the tributaries, which results in increasing temperatures, will eliminate the cooling effect allowing mainstem temperatures to climb.

Stream temperature on the mainstem increased 6 to 8 degrees Fahrenheit (F) shortly after the 1964 storm (Department of Environmental Quality, DEQ). The increase does not appear to be the result of a change in stream flow. The channel at this time had become wide and shallow when compared to earlier years and there was a significant loss of stream shade on the tributaries from timber harvest (refer to Channel Morphology and Large Wood sections).

Stream side vegetation lost from the 1964 storm and timber harvest has since grown back along most of the tributaries, and stream temperatures have been decreasing over the last two decades. The mainstem channel is down cutting in the valley sections, becoming

narrower and deeper. Temperature data collected by the DEQ over the last decade has shown a cooling trend where temperatures are 3 to 5 degrees F cooler than those collected in the late 1960's.

Turbidity

Sixes River has naturally high levels of turbidity (loss of water clarity) following storms when compared to other coastal watersheds such as Elk River. This is attributed to larger amounts of silts and clay in the watershed that enter the water through landslides and surface erosion. Road construction and timber harvest can cause landslides and surface erosion which can add to the natural rate, further reducing water clarity.

The amount of clay content in the soil can affect the potential for producing higher levels of turbidity in a stream. The higher the clay content the greater the potential for producing turbidity. Soil content varies in a watershed. Figure 0-7, Soil Texture/Turbidity potential, shows the areas in Sixes River with high clay content that can effect water clarity. Areas with the greatest potential include, Otter Creek, Big Creek, Sucker Creek, Sugar Creek, Haines Creek and the North Fork. Recent stream surveys of Otter and Big Creek revealed signs of fines in bedrock pools indicating recent elevated turbidity levels.

Without continuous historical turbidity monitoring data, what affects human activities have had on water clarity are not known. Long time residents have accounted that Sixes River is always dirtier than Elk River and that they haven't noticed any worsening of water clarity as the result of road construction or timber harvest.

Nitrogen

Water chemistry has been monitored by the DEQ in Sixes River since 1965. Dissolved nitrogen sampling was incorporated into the water chemistry monitoring in 1976. There is one period, from 1986 to 1991, that data was not collected. Results show that nitrogen levels are lowest during the summer and increase during the winter. In November of 1984, nitrogen levels increased to more than double the value of samples collected prior to that time to .64 mg/L. Winter nitrogen levels remained elevated until 1995 when they decreased to the levels recorded before 1984. Forest management activities can alter the nitrogen cycle by introducing organic material and sediment (EPA 1991). Results of studies that monitored water quality following applications of urea for forest fertilization have shown increases of nitrogen (Ice, *et al.* 1992). While these are two possible sources, it is unknown what has caused winter levels of nitrogen to increase. Current levels are not considered to be a health risk to aquatic species or human.

Mercury

Mercury can be introduced into a stream by either natural sources or from mining. Mercury was used to capture the finer gold flakes in the final processing of the placer materials. Decades of mining operations without environmental protection controls, has resulted in introducing mercury into many of the forests streams. It is common for

recreational suction dredges, operating in streams that were previously mined, to uncover puddles of liquid mercury that reside in the stream substrate.

Recreational miners have reported finding mercury in Sixes River (Park 1996). There are no natural sources of mercury in the watershed. It is assumed that the source was historic mining. Because of the extensive mining history of the Sixes River, there is a likelihood that it contains higher concentrations than other streams. The only associated health risk would be if the mercury is getting into the aquatic food chain and contaminating fish that are consumed by humans.

The Department of Environmental Quality was contacted about the potential concentrations of mercury in the Sixes River. In August of 1996, DEQ sampled fish in Sixes River and tested them for mercury contamination. Results of the tests show that the fish contained very small amounts of mercury, well below levels considered to be a health risk to humans (Drake 1996, personal communication).

Trends

Water quality has been improving in Sixes River since 1980. That trend is expected to continue into the future. Modification of the State Forestry Practices Act and Northwest Forest Plan has increased protection of streams which will continue to improve and protect water quality on private and federal land. Water quality will never reach the level of quality it was under natural conditions. Human development in the watershed has permanently altered many natural features. The watershed will continue to move toward a new level of optimum attainable water quality.

Future storms will cause increases in sediment delivery and produce high stream flows that create changes in the channel, and may again cause some set back in water quality. However, water quality should never reach the degraded level it did in the late 1960's and 1970's. Future restoration such as closing and stabilizing roads, removing culverts and planting of conifer trees in riparian areas will help to accelerate the recovery of water quality.

D. Stream Flow

Key Question:

> *What flood events are known to have occurred in the watershed and have human activities changed the natural magnitude and frequency of flow?*

A stream gage was located on Sixes River at Sixes from 1968 to 1970. There was also a gage station on Dry Creek for a short period. Neither gage has a sufficient period of record to look at flood flows or flow trends. The average annual water yield for the Sixes Watershed is estimated to be 480,600 acre feet. Low mean monthly flows of 36 - 180 cubic feet per second (cfs) occur between June and October, and high flows of 1800 - 10,500 cfs occur between November and April. Storms which caused flood flows can be

estimated from the USGS gauge on the South Fork of the Coquille River at Powers, Oregon. Flood flows of magnitude greater than 10-year return interval occurred in 1944, 1955, 1964 and 1971. The storms of 1955 and 1964 were estimated to have a return interval of 50+ and 100+ respectively.

Domestic and agricultural water supplies, timber harvest and roads can affect stream flow. Compacted areas in harvest units, road surfaces and cut slopes can intercept water, transporting it more rapidly than natural processes. Studies quantifying the effects have found varying results from no effect to highly significant effects, depending on the characteristics of the watershed and transport mechanisms. There is insufficient information and research to determine if human activities have affected stream flow in Sixes River.

Harvested areas can increase snow accumulation and a rain on snow event can result in rapid melting of the snow, increasing peak flows (Harr 1976). Less than 5 percent of the total watershed area is in the transient snow zone. Consequently, it is not likely that peak flows have been affected by existing harvest activities in areas that may be susceptible to rain on snow events.

E. Channel Morphology and Substrate

Key question:

How have floods and human activities affected channel morphology?

Sixes River flows 28 miles from its headwaters to the Pacific Ocean. The mainstem follows an east-west trending fault that divides the watershed into two halves. Sixes River can be characterized in four segments. A lower segment from the Pacific Ocean to river mile 12, that traverses a low gradient, wide valley rising less than 100 feet in elevation. The stream is wide and shallow with large gravel bar flood plains. The substrate is predominantly gravels and cobbles with some sands. In the middle segment from river mile 12 to 22, the gradient increases and the stream is confined by hillslopes. The channel consists of predominantly boulders with a mixture of sands gravels and cobbles. The large boulders create deep pools in this area. It then enters the upper low gradient, valley segment with a shallow, wide gravel channel and wide flood plains similar to the lower valley segment. The final segment is steep with gradients over 20 percent as the river climbs to its headwaters.

The two low gradient valley sections function as low energy deposition areas where sediments collect and the channel shape can change as the gravels get rearranged during higher storm flows. The segments are connected by a steep boulder transportation reach. This high energy section has the ability to transport large amounts of sediment. The large boulders make the channel stable and as a result there is very little change from increased sediment and storm flows.

The mainstem has gone through several changes in recent history from storms, mining, timber harvest, road construction, agriculture and home construction. Placer mining began in the latter part of the 1800's with five hydraulic mines in operation. The use of hydraulic giants concentrates powerful streams of water to wash material from stream banks. This type of operation can cause significant change to a stream. Without accurate historical documentation, it is unknown how the years of mining on Sixes affected the channel.

The earliest accurate documentation of the condition of Sixes River is a set of aerial photographs taken in the summer of 1940, which is the reference point in history used to compare channel changes. Up until this time period, mining remained the most significant human disturbance in the watershed. Some cedar was being harvested in the lower watershed. Midway into the decade, the Bay Timber Company harvested trees in the headwaters, taking the logs up over the top to Powers. The watershed was largely unroaded. Riparian areas were well vegetated on the tributaries with a mixture of hardwoods and conifers. Flat areas adjoining the river, old river terraces, had been cleared, planted with grass, and were being used for raising livestock. The remaining riparian area on the mainstem, for the most part, was well stocked with conifers and hardwoods.

The upper and lower valley segments had abundant sediment stored in the wide and flat flood plains. The channel meandered back and forth on these alluvial deposits with some down cutting creating pools connected by narrower riffles. The appearance would be associated with high natural sediment loading and low stream energy to move sediment. Deep pools were formed behind rock outcrops and down river of bends. Large wood was present in tributary streams and deposited on mainstem flood plains.

In 1954, timber harvest and road construction escalated for the next two and a half decades. At that time standards for road construction and harvest did not adequately protect resources. Road and harvest activity added to the destabilizing effect of storms. Increased sediment delivery aggraded flatter streams segments and caused down cutting in steeper segments. Large areas were clear cut to the stream on private ground from Edson Creek to the upper valley. Harvest on Federal ground occurred on the upper South Fork and Middle Fork.

A major storm event occurred in 1955 having approximately a 50 year return interval. For most streams on the coast, the flood event of 1955 had the greatest effect of any natural event within the photo record. Comparison of aerial photographs after the storm showed the mainstem to have experienced relatively minor damage when compared to neighboring Elk River. Local effects could be seen on tributaries from logging and road building that caused stream bank failures and aggraded areas below the activity. The most notable feature was the increase in large wood and debris jams in the tributaries. A large slide occurred on the mainstem between river mile 12 and 13 in the 1950's which dammed the river creating a lake to Plum Trees (Huritt 1996, personal communication). There is insufficient information to determine if it was the result of the 1955 storm. Bill accounts that a logger took his cat and pulled logs from the dam, so it would gradually

break down, which eased the concern of residents down river who feared that it would catastrophically fail.

The condition of the mainstem and many of the tributaries changed drastically in the late 1960's through the 1970's. A combination of the 1964 flood and associated increases in natural sediment delivered, exacerbated by increases in sediment from logging and roads, changed the channel shape and increased sediment stored in the upper and lower valley segments of the main channel. (see Sediment Delivery section). Aerial photographs taken subsequent to the storm show pools more shallow and riffles wide and flat Anecdotal accounts support this observation reporting that during this time period the normally swift water that flowed through the riffles in summer, was slow moving in the wide flat channel (Hofsess 1996, personal communication; Huritt 1996, personal communication). There was also major shifts in the channel location changing as much as 200 feet from one bank to the other. The old river terraces that were developed for agriculture and homes experienced bank failures. In some locations rock and car bodies were placed on the bank to help stabilize them.

The large wood that was abundant in the tributaries and mainstem in the latter part of the 1950's had all but disappeared by the mid 1960's. The most likely reason for the disappearance was salvage logging. Several tributaries had roads that paralleled the stream making access easy. In other areas cat roads can be seen on aerial photographs next to the stream. Anecdotal accounts of that time period reported it was common practice for the residents to salvage logs on the flood plains of the mainstem to earn extra income.

Comparison of current aerial photographs with ones taken two decades ago revealed, the upper and lower valley sections were showing signs of improvement. The channel had began to down cut in the deposited gravels creating more defined riffles and deeper pools. Without historical measurements of the channel to compare, it's difficult to determine how much the channel has recovered. The net amount of sediment stored in the valley sections has probably not changed much since 1980. Instead erosional processes have redistributed it. Resident time of stored sediment in the active channel width is in the order of a few decades and can persist in the flood plains for hundreds of years (Madje 1984).

Trends

As a result of the 1964 flood in Sixes River, channel shape and sediment storage in the main channel changed drastically. Since landslide and erosional sediment production has decreased in recent years, stored sediment in the active channel comprises the majority of the sediment transport budget. Recovery in Sixes River from a major aggradational event will continue into the future with a slow decrease of stored sediment through time. Only a small amount of sediment remains stored in the tributaries compared to the mainstem.

The timing of sediment production in Sixes River watershed is episodic due to storms. Most of the potential failures on old roads have occurred. Future road related sediment

will most likely occur from reduced road maintenance and new road constructed on private lands (see sediment delivery section). A large storm in the future will cause main channel changes from the distribution of stored sediment and to a much lesser degree than in the past from human sources.

Large woody debris in a stream can be an important determinant of channel form and process. Large wood can remain and interact within the channel for decades. The vast depletion of old conifer trees in the riparian areas of Sixes River will have an adverse affect on the stream channel for the next hundred years.

F. Fish Species, Distribution, and Trends

What fish species are present in the Sixes River?
~What habitats do they utilize?
~Where are the key spawning and rearing areas?
~What population trends have these species exhibited?
~What factors have caused declines?

Table A-1 lists the species that have been found in the Sixes Watershed and their habitats. Many of these species utilize the salt water and estuarine environment. Due to the lack of data on population trends of these salt water and estuarine species, analysis in this document will focus on the fresh water and anadromous salmonids. Species of concern include coho salmon, chinook salmon, steelhead trout, sea-run cutthroat, resident rainbow and cutthroat trout.

Salmonid production can be viewed as the end product of energy that is routed through the stream and ocean ecosystem. Over the last 20 years, several El Nino events have created unfavorable ocean conditions for salmonid survival. These frequent events have negatively impacted salmonid runs along the coast of Oregon. Since land managers have no control over ocean conditions, the physical, chemical and biological components of freshwater systems become critical for salmonid production. All salmonids need quality spawning and rearing habitats. Temperature, cover, barriers, stream velocities and flow can limit distribution in freshwater habitats. Quality habitat components include cool stream temperatures (< 64 degrees), oxygenated water, deep pools, intact riparian zones, cover elements, large woody material, suitable substrates for spawning and access to refuge areas during floods and escape from predators. Where these components are abundant, salmonid production will be high. When these components become limited or absent, salmonid production will decline.

Productive flats are low gradient unconfined reaches with high fish productivity. Spawning and rearing densities tend to be much higher where sediment is deposited in broad floodplains within the wide valley floor. Large wood is often deposited in these areas. Riparian vegetation develops and provides organic matter, nutrient storage and flood refuge areas. The main channel often splits around bars and wood jams creating a variety of habitats. The variety of habitat types support a diverse assemblage of aquatic organisms. These areas have been termed "biological hotspots" and typically support a

large percentage of salmonid production. Figure A-4 illustrates the 'productive flats' located within the Sixes Watershed. These areas are sensitive to increased sediment production, changes in temperature, stream cleanout activities and are often where past land use activities have been concentrated. Land managers should focus monitoring activities on the productive flats to determine whether management actions are consistent with Aquatic Conservation Strategy objectives and to determine long term aquatic habitat trends.

Many salmonid stocks within the Pacific Northwest are depressed over historic levels (Nehlsen, *et al.* 1991; Nickelson, *et al.* 1992). The Sixes River is no exception. The National Marine Fisheries Service is currently evaluating whether a listing of 'Threatened' or 'Endangered' for most Pacific salmonid stocks is warranted under guidance of the Endangered Species Act of 1973. It is estimated that salmon have become extinct from approximately 40% of their historical breeding ranges in Washington, Oregon, Idaho and California during the last century (NRC 1995). Remaining populations are severely depressed in areas where they were formerly abundant.

Recent changes in management direction such as the modification of the State Forestry Practices Act and Northwest Forest Plan will help accelerate recovery of salmonid species by keeping key structural riparian components intact. The Northwest Forest Plan designated Key Watersheds that provide critical habitat which serve as the anchor for wild salmonid preservation. Land Management activities within Key Watersheds must emphasize preservation and restoration of existing aquatic habitat. Dry Creek has been designated a Tier 1 Key Watershed in the Sixes Basin. Coordinated recovery efforts are being funded at Federal, State and Private levels. Local watershed associations (Elk/Sixes) are increasing public awareness and prioritizing restoration projects in the watershed by utilizing lottery dollars obtained from the State of Oregon. Increased awareness, landowner cooperation, recent legislation and monetary support for restoration will help to increase salmonid populations throughout the state of Oregon and within the Sixes River Watershed.

Historical escapement data for the Sixes River Watershed is limited at best. Anecdotal accounts have become essential in reconstructing baseline data. John Hodges (1947) reported on the banner year for escapement of fall chinook. He stated that, "excessive chinook runs were overpopulating the Elk and Sixes", yet one local stated, "It was roughly 1/10 of what they had been before he stopped commercial fishing". Another local was quoted to say, "Run sizes during 1947 were approximately 1/5 of what they were 20 years ago". Interviews conducted with people who lived in the Sixes watershed during the 1940's and 1950's have also relayed information indicating noticeable reductions in all species of salmonids (Hofsess 1996, personal communication; Huritt 1996, personal communication). The most noticeable change in fall chinook escapement was the lack of fish spawning in the mainstem (Reimers 1971). Verbal accounts can often be exaggerated or biased in nature and there is no way to quantify escapement, however one point is clear, salmonid populations in the Sixes River Watershed are below historical accounts.

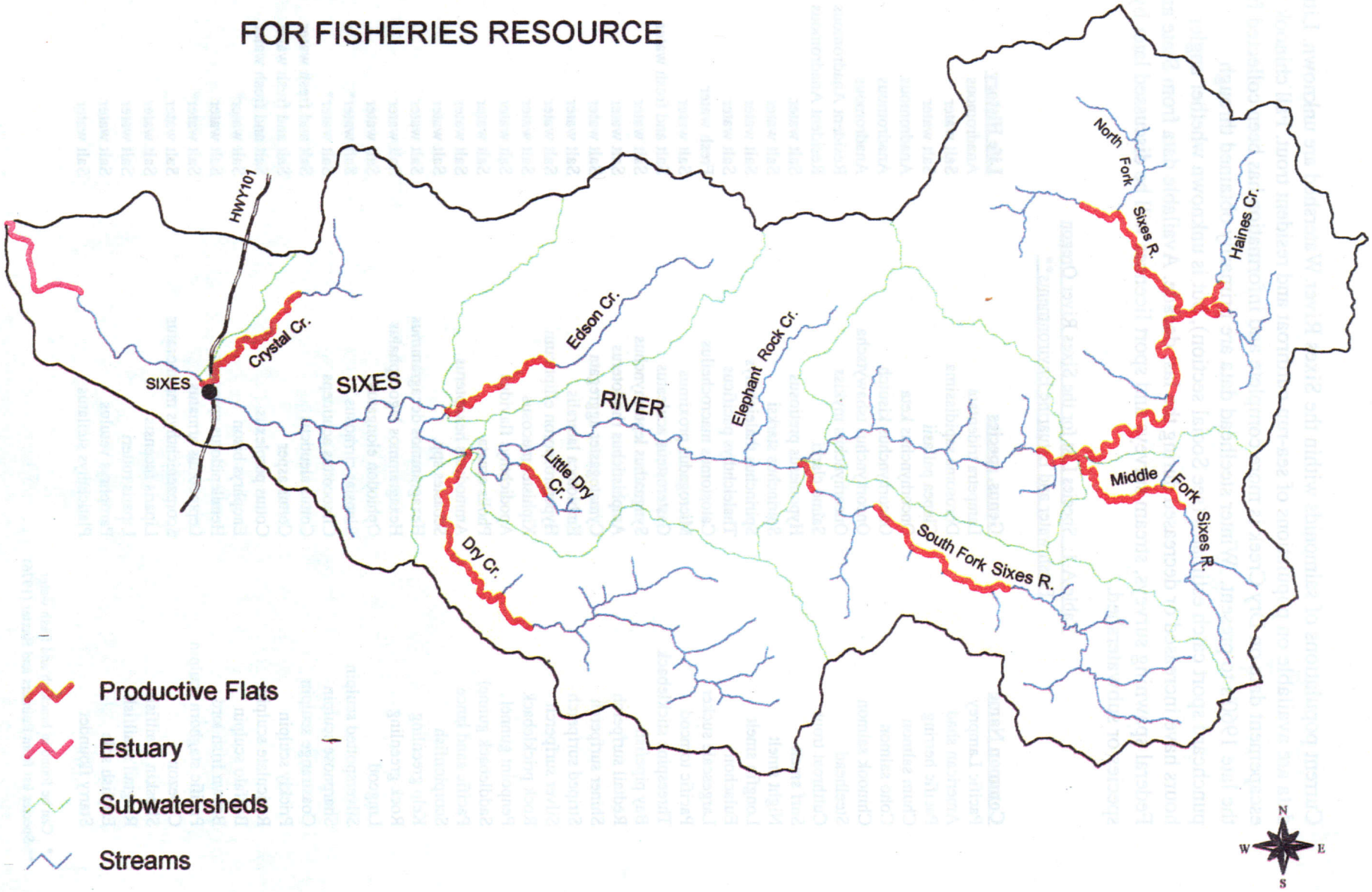

PRODUCTIVE FLATS
FOR FISHERIES RESOURCE
HWY101
SIXES
Crystal Cr.
SIXES
RIVER
Edson Cr.
Elephant Rock Cr.
Little Dry Cr.
Dry Cr.
North Fork Sixes R.
Haines Cr.
Middle Fork Sixes R.
South Fork Sixes R.
Productive Flats
Estuary
Subwatersheds
Streams
N
W
E
S

Figure A-4

Current populations of salmonids within the Sixes River Watershed are unknown. Little data are available on populations of sea-run cutthroat and resident trout. Fall chinook escapement data on Dry Creek is more complete and information has been collected from the late 1960's to present. Winter steelhead data are primarily obtained through punchcard sport catch estimates (see Social section), but is unknown whether angler hours have increased or decreased during the last decade. Available data from State and Federal spawning surveys, stream surveys and sport licences will be discussed later by species or subwatershed.

Table A-1: Species List for the Sixes River Oregon Fresh water and Estuarine Environments**

Common Name	Genus, species	Life History
Pacific Lamprey	Lampetra tridentata	Anadromous
American shad	Dorosoma sapidissima	Salt water
Pacific herring	Clupea pallasii	Salt water
Chum salmon	Oncorhynchus keta	Anadromous
Coho salmon	Oncorhynchus kisutch	Anadromous
Chinook salmon	Oncorhynchus tshawytscha	Anadromous
Steelhead	Oncorhynchus mykiss	Resident Anadromous
Cutthroat trout	Salmo clarki	Resident Anadromous
Surf smelt	Hypomesus pretiosus	Salt water
Night smelt	Spirinchus starksi	Salt water
Longfin smelt	Spirinchus thaleichthys	Salt water
Eulachon	Thaleichthys pacificus	Salt water
Largescale sucker	Catostomus macrocheilus	Fresh water
Pacific tomcod	Microgadus proximus	Salt water
Threespine stickleback	Gasterosteus aculeatus	Salt and fresh water
Bay pipefish	Syngnathus leptorhynchus	Salt water
Redtail surfperch	Amphistichus rhodoterus	Salt water
Shiner surfperch	Cymatogaster aggregata	Salt water
Striped surfperch	Embiotoca lateralis	Salt water
Silver surfperch	Hyperprosporon ellipticum	Salt water
Rock prickleback	Xiphister mucosus	Salt water
Penpoint gunnel	Apodichthys flavidus	Salt water
Saddleback gunnel	Pholis ornata	Salt water
Pacific sand lance	Ammodytes hexapterus	Salt water
Scorpionfish	Sebastes spp.	Salt water
Kelp greenling	Hexagrammos decagrammus	Salt water
Rock greenling	Hexagrammos lagocephalus	Salt water
Lingcod	Ophiodon elongatus	Salt water
Silverspotted sculpin	Blepsias cirrhosus	Salt water*
Sharpnose sculpin	Clinocottus acuticeps	Salt water*
Coastrange sculpin	Cottus aleuticus	Salt and fresh water
Prickly sculpin	Cottus asper	Salt and fresh water
Reticulate sculpin	Cottus perplexus	Salt and fresh water
Buffalo sculpin	Enophrys bison	Salt water*
Brown Irish lord	Hemilepidotus spinosus	Salt water
Pacific staghorn sculpin	Leptocottus armatus	Salt water*
Cabezon	Scorpaenichthys marmoratus	Salt water
Slipskin snailfish	Liparis fucensis	Salt water
Ringtail snailfish	Liparis rutteri	Salt water
English sole	Parophrys vetulus	Salt water
Starry flounder	Platichthys stellatus	Salt water

* Can be found in brackish and fresh water.
** Species list from Reimers and Baxter (1976).

Coho

Coho salmon within the Sixes River Watershed are part of the Mid/South Coast ESU (Ecologically Significant Unit). They have been proposed for a listing of 'Threatened' under the Endangered Species Act (1973). The National Marine Fisheries Service is expected to make a determination by November of 1996 to see if the listing is warranted. Populations within the Mid/South Coast ESU are roughly 10% of historic levels according to data obtained from ocean harvest rates and river catch from the 1920's to present (ODF&W 1995). Within this ESU, historic populations have been estimated to be from 1 million to 1.4 million (NMFS 1995). Current population estimates for this ESU are unknown, however, the majority are believed to be non-native hatchery fish with approximately 39,000 wild fish. Populations within the Sixes River Watershed were never as abundant as chinook or steelhead but have declined sharply since the 1950's (ODF&W 1995). Coho escapement for the Sixes River Watershed has been estimated to average 250 fish (Stein, *et al.* 1972). Important tributaries for coho spawning and rearing include Dry Creek, Crystal Creek, Edson Creek , Middle Fork, North Fork and upper mainstem (Frissell 1992).

Chinook

Chinook salmon escapement within the Sixes River Watershed have been estimated to range from 250 to 4,500 adults (ODF&W 1995; Reimers and Downey 1982). Recent data estimates current escapement to be from 250 to 1,500 adults, compared to 1,600 to 4,200 in 1978-1980 (ODF&W 1995). It is unknown what populations were during the early 1900's but, they are believed to be considerably higher. Dry Creek is an important tributary for chinook spawning. Approximately 60% to 70% of total spawning escapement for fall chinook within the Sixes Watershed, occur in Dry Creek (Reimers 1971; Susac 1996, personal communication). Other tributaries important to chinook escapement include Edson Creek, Crystal Creek, Middle Fork , North Fork and the upper mainstem (i.e near Dement Ranch).

Chum

Chum salmon are present within the Sixes River Watershed but are not very common. The watershed is near the southern extent of their present range (Meehan 1991). Approximately every other year some chum salmon will be seen during spawning surveys on Dry Creek (Susac 1996, personal communication). Estimates of population sizes within the Sixes River Watershed are unknown. Historical accounts have documented an occasional landing of chum salmon (Hofsess 1996, personal communication). Since most chum salmon spawn within the lower reaches of streams and frequently within the tidal zone (Meehan 1991), it is likely that many are missed during fall spawning surveys. Reimers (1976) seined juvenile chum salmon in the Sixes estuary.

Steelhead

Steelhead populations within the Sixes River Watershed have declined from historic levels. They have been proposed for a listing of 'Threatened' under the Endangered Species Act (1973). Urban and rural development adjacent to fresh water habitat have had the most impact on long term declines while low ocean productivity has been primarily responsible for recent steelhead declines (ODF&W 1995). Juvenile steelhead typically spend 2 years rearing in fresh water (Meehan 1991) and are therefore particularly dependent on quality fresh water habitats. Fresh water habitat alterations that lead to siltation, temperature increases, loss of structural complexity, loss of riparian cover and obstruction of habitats (culverts and logging debris jams) have accelerated declines of steelhead within the Sixes Watershed. Steelhead are often able to pass obstacles that are barriers to coho and chinook. They are able to spawn in steeper gradient streams that contain small pockets of suitable gravel.

Cutthroat

Little information is known about populations of cutthroat trout within the Sixes Watershed. Sea-run cutthroat have complex life histories that require freshwater, estuarine and marine habitats to complete their life cycles. Both resident and anadromous life histories are present within the basin. Resident cutthroat trout are the dominant salmonid above barriers in headwater tributaries. Recent work by Pete Bisson, of the U.S.F.S. Pacific Northwest Research Laboratory, indicate these headwater populations can significantly contribute to downstream anadromy. Cutthroat take readily to resident, potomadromous (individuals that migrate downriver and back upriver to spawn without residing in saltwater) and anadromous life histories. It is believed by 1980 much of the coastal cutthroat population had been heavily reduced due to habitat loss (ODF&W 1995). Cool water temperatures and woody debris that create quality pools, provide overhead cover and diversify habitat are some of the most important habitat requirements for cutthroat trout.

Resident trout

There are approximately 42 miles of known resident trout habitat within the Sixes River Watershed. Another 200 miles of perennial streams have not been surveyed or have not been documented as occupied resident trout habitat. It is suspected that much of the perennial stream habitat does support resident trout at least some time of the year. There is a limited fishery for resident trout and sizes are directly related to stream discharge. This represents a large data gap in this analysis.

Factors for Decline

Declines of salmonid populations are attributed to many factors. Four main factors include excessive past commercial and sport harvest rates, climatic factors resulting in poor ocean conditions, hatchery influences and alteration of fresh water habitats.

Early accounts from the turn of the century on the Columbia River portrayed tremendous exploitation rates from commercial gillnetters. Most experts agree that early catch rates along the Oregon coast were excessive. After ocean and river catch, adult escapement was not adequate to sustain run sizes. Commercial troll records of coho landed in Port Orford indicate a one third decrease in dressed harvest pounds from the 1960's through the 1980's (see social section). During the 1940's, parts of the lower Sixes were gill netted primarily for home consumption (ODF&W 1947).

Recent decades have not produced consistent upwelling off the Oregon coast that is essential to salmonid survival and growth (Pearcy 1992). This is especially critical for smolts during their first month at sea where accelerated growth correlates with increased ocean survival. Ocean upwelling mixes nutrient rich bottom water with surface waters allowing primary production to increase. When coastal upwellings are weak, primary production is low and the effect is felt throughout the food chain. However, ocean productivity is cyclic and conditions for strong upwellings appear to be improving. Recent short term salmonid declines have been attributed to climatic alterations and ocean productivity while long term declines have been attributed to changes in fresh water environment (ODF&W 1995).

Past hatchery practices and their adverse effects on wild salmonid populations are well documented (Waples 1991; Hindar, *et al.* 1991; White 1992). Large numbers of hatchery releases were especially prevalent during the 1960's. Genetic dilution of wild stocks and direct competition resulted in sharp declines of wild fish. The Sixes River Watershed has had no direct hatchery influences. However, some data suggests that stray rates from hatchery fish are considerably higher than normal stray rates (Ricker 1972). Fall chinook strays from the Elk River hatchery (averaging 10%) have been documented in Dry Creek indicating straying does occur and some degree of genetic transfer has diluted wild genomes.

Land uses such as agriculture, road building, logging, grazing and mining have had adverse impacts on fresh water habitats. Fresh water habitat is especially critical to anadromous species that spend one to several years rearing in fresh water environments (coho, steelhead and sea-run cutthroat). Changes in the physical environment within the Sixes River Watershed have been extensive (see Watershed Vegetation section). Road culverts that blocked access to spawning and rearing habitat resulted in immediate declines of salmonid populations. Replacing these culverts to allow passage of both juveniles and adults can be quite costly, but short and long term increases in available habitat are instantaneous. Riparian alterations from hydraulic mining in the Sixes watershed during the turn of the century are still evident today in Dry Creek and the South Fork Sixes (see Aquatic and Social Mining sections). Mining is currently limited to recreational dredging and has limited, localized increases in water turbidity. Logging has been the most dominant feature of land use in the Sixes River Watershed since the 1940's. Removal of forest canopies can cause increases in sedimentation, increase in water temperatures and increased diurnal temperature fluctuations. The removal of stream side vegetation can also decrease bank stability, decrease nutrient input, and deplete source areas of large woody material. Basin wide logging can cause changes in stream flow

regimes, resulting in potentially adverse water velocity and depth characteristics. Past stream clean out activities from 1950-1970 (see Channel Morphology and Substrate section) of large woody material depleted cover elements and nutrient storage capabilities. All of these alterations result in degradation of the aquatic environment and subsequently reduce salmonid populations. Current logging practices have dramatically improved over those of the past, decreasing the impact on the aquatic environment. Recent research, knowledge and education is helping to arrest degradation and ameliorate recovery of terrestrial, riparian and aquatic systems. The fresh water habitat in the Sixes River Watershed appears to be recovering from past land use practices (Frissell 1992; Nawa 1995).

III. SUBWATERSHEDS PROCESSES, CONDITIONS, AND TRENDS

A. Upper Mainstem

A relatively large percent of the riparian area is in early seral stage. Many of the stream channels drain meadows and pasturelands that are likely compacted.

The upper mainstem contains some productive spawning and rearing areas. Portions of the valley are low gradient unconfined segments that are accessible to anadromous salmonids (Figure A-2). Important areas include North Fork Sixes, Crafton Creek, Sugar Creek, Hayes Creek and Murphy Creek. Chinook, coho, steelhead and cutthroat have been documented in these areas. The area around the Dement Ranch has had a long history of land use (see social section). Much of the physical habitat has been altered due to land use activities (see seral discussion). Surveys (ODF&W 1994) indicate much of the upper mainstem could support greater number of coho than were observed. Since all of the upper mainstem is privately owned, much of the data on stream condition, spawning surveys and habitat surveys were not available.

B. Middle Fork

The Middle Fork enters the mainstem Sixes River within the lowermost part of the upper alluvial valley, at approximately river mile 23.7. Its drainage area is 7.7 square miles, primarily privately owned, with National Forest in the headwaters. The lower 3.5 miles of stream has a relatively low gradient of 2%. The riparian zone is primarily composed of early seral stage vegetation due to timber harvest near the stream.

The headwater channel is primarily composed of boulder and bedrock with areas of cobbles. Riparian areas are composed of mid and late seral stage vegetation, and are important for supplying large wood to the channel downstream. Although mostly unharvested, some steep slopes on National Forest lands were roaded and harvested and delivered landslide sediment to the west side of the watershed during 1967-1969.

The Middle Fork of the Sixes contains approximately 3.5 miles of anadromous habitat. Coho, chinook, steelhead and cutthroat are present (ODF&W 1963 and 1994). Spawning survey data has documented densities of adult chinook to be 39 and 55 and fish per mile

in 1994 and 1995 (ODF&W 1994 and 1995). Coho numbers during the surveys were 9 and 4 per mile, respectively. The lower 3.5 miles is an important spawning and rearing area for salmonids. The gradient (2%), substrates and temperatures are some of the best in the upper river system. Primarily resident cutthroat with some resident rainbow trout are present above the barriers on National Forest lands.

C. Otter and Big Creeks

Otter and Big Creek enter the mainstem at river miles 20.0 and 21.2 respectively. They have a combined drainage area of 10.7 square miles. These streams drain bedrock that is very weakly resistant to erosion, with scattered resistant knobs throughout. Evidence of continued road-caused debris flows from steep headwalls within the headwaters of both watersheds may be observed on the 1992 aerial photos.

Both streams are similar to Elephant Rock Creek being boulder and bedrock dominated channels, very stable and powerful to move sediment. Both channels are steep and confined by hillslopes. The channel substrate is primarily boulder and bedrock with areas of sand, gravel and cobbles. The boulders form plunge pools. Much of the stream banks are bedrock or armored with boulders. There is little sediment storage with most of the material being transported to Sixes River. Both channels drain areas that have a history of heavy logging and there is evidence that large amounts of sediment flushed down the channels in the 1960's and 1970's. Otter Creek has signs of bank instability with failures from the stream 200 feet up the slope. Both streams had fines in the boulder plunge pools suggesting recent upslope failures and high turbidity level.

Big Creek is primarily a steelhead tributary. Surveys in 1963 (Werner 1963) documented a few coho adults and one chinook carcass in the lower .5 miles of habitat. Gradients and substrate are not favorable for coho and chinook spawning.

Otter Creek contains approximately .25 miles of anadromous habitat. Surveys in 1963 and 1994 documented fall chinook and slight numbers of coho juveniles below the partial barrier. Steelhead juveniles were observed in 1994 indicating partial passage beyond .25 miles. Woody material is concentrated in jams that are composed primarily of logging debris.

Little Otter creek is inaccessible to salmonids due to a road culvert crossing on the 5201 road (M.P. 1.75). Approximately .8 miles of habitat suitable for winter steelhead and sea-run cutthroat exist above the culvert. Recommendations are to replace this culvert with a baffled pipe that would pass both juvenile and adult salmonids.

D. South Fork

The South Fork Sixes enters the mainstem at river mile 18.5, with a drainage area of 15 square miles. The channel is primarily boulder, bedrock, cobbles and gravels and is confined by bedrock and colluvial canyon walls.

Sediment delivery of landslides in the South Fork (Figure A-5) has been somewhat evenly distributed over time, and not triggered by any particular storm. However, the sediment load is concentrated in some parts of the watershed, as shown in the table below.

Table A-2: Landslide Sediment Delivery in South Fork Tributaries 1943-1986 in cubic meters (Reaches are as delineated by stream survey, Nawa, 1995)

	Natural	Harvest	Road
Reach 1&2 (below Butcher's Gulch	2400	0	0
Butcher's Gulch	0	0	0
Reach 3 (to Benson Creek)	1000	12500	6300
Benson Creek	0	13900	19000
Dixie Creek	1000	8800	7300

In the lower reaches (Butcher's Gulch, Reach 1&2), extremely steep slopes (Figure O-5) with unsuitable and unstable areas are present. For this reason, most of the lower watershed has not been roaded or harvested, and landslides are naturally-occurring. Boulder lag deposits at the mouth of Bee Creek are evidence of historic natural debris flows in this area (Nawa 1995). In contrast to the lower reaches, sediment delivery volumes per watershed area in Benson Creek are the highest in the Sixes River Watershed, estimated as 36 cubic meters/acre (see Appendix C: Methods).

Within the South Fork channel, stream surveys noted sites where road and harvest-related disturbance was evident (Nawa 1995). Near the mouth of Little Dixie Creek, a debris flow deposited a fan. This was likely caused by a road fill failure between 1979 and 1986 from road 5201393 (constructed in 1977). A natural debris flow also scoured the channel of Little Dixie Creek higher in the watershed prior to 1964.

The South Fork has the greatest abundance of late seral riparian vegetation in the watershed (Figure A-2). Pioneer and early seral stage vegetation are the result of timber harvest as well as streamside slides and debris flows (both natural and road-related). The riparian vegetation mostly consists of maple, alder and myrtle with some conifers. Stream surveyors found abundant wood in the stream, and noted that input of debris from logging and blowdown of riparian buffer strips increased large wood to levels judged to be above the range of historical variability (Nawa 1995). Sites with input of wood from logging or blowdown were located by the Natural Sequence Order (NSO) that identifies habitat units in a stream survey (Nawa 1995). Riparian buffers were blown down north of the 1986 Sixie Dixie Unit #1 (NSO 290), and east of the same unit (NSO 333).

Harvest of the 1968 Gold Bug Salvage Units #2 and #4 caused a landslide that delivered logging debris to the channel (NSO 370, 372) and removed riparian vegetation (NSO 371).

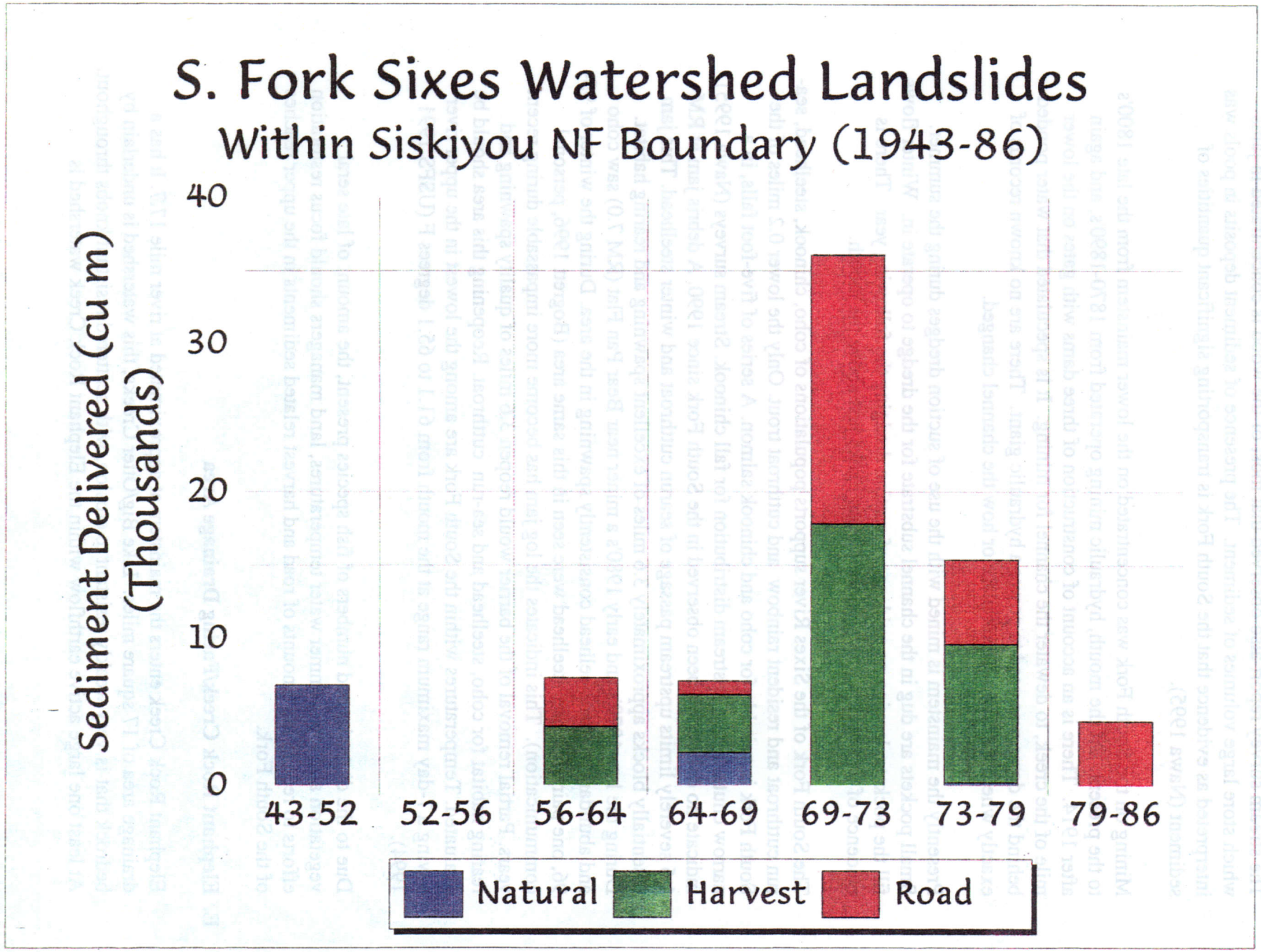

S. Fork Sixes Watershed Landslides
Within Siskiyou NF Boundary (1943-86)
Sediment Delivered (cu m)
(Thousands)
40
30
20
10
0
43-52
52-56
56-64
64-69
69-73
73-79
79-86
Natural
Harvest
Road

Figure A-5

The stream survey report also observed that most of the wood is concentrated in jams which store large volumes of sediment. The presence of sediment deposits in pools was interpreted as evidence that the South Fork is transporting significant quantities of sediment (Nawa 1995).

Mining on the South Fork was concentrated on the lower mainstem from the late 1800's to the present. At the mouth, hydraulic mining operated from 1870-1890's, and again after 1914. There is an account of construction of three dams with gates on the lower mile of the creek, to dewater the channel for mining. It is speculated that water ponded behind the dams was used to power a hydraulic giant. There are no known records of exactly where the mining took place or how the channel changed.

Presently the mainstem is mined with the use of suction dredges during the summer. Small pockets are dug in the channel substrate for the dredge to operate in. Winter flows fill the pockets, leaving no evidence of suction dredging the following year. There is evidence of hydraulic mining on the stream banks just above the mouth.

The South Fork of the Sixes River supports populations of coho, chinook, steelhead, sea-run cutthroat and resident rainbow and cutthroat trout. Only the lower 0.2 miles of the South Fork is suitable for coho and chinook salmon. A series of five-foot falls, in a narrow chute, limits upstream distribution for fall chinook. Stream surveys (Nawa 1995) indicate no coho have been observed in the South Fork since 1990. A debris jam at RM 1.5 severely limits upstream passage of searun cutthroat and winter steelhead. This jam essentially blocks approximately 3.6 miles of excellent spawning and rearing habitat. During the late 1970's and early 1980's a miner near Bear Pan Flat (RM 7.0) saw coho and abundant winter steelhead consistently spawning in the area. During the winter of 95-96, one pair of winter steelhead were seen in this same area (Bogrett 1996, personal communication). This indicates the log jam has become more impassable during recent years. Partial removal of the barrier would reopen 3.6 miles of quality spawning and rearing habitat for coho, steelhead and sea-run cutthroat. Reopening this area should be evaluated. Temperatures within the South Fork are among the lowest in the upper river having a 7-day maximum range at the mouth from 61.1 to 65.1 degrees F (USFS 1991 - 1994).

Due to the diversity and numbers of fish species present, the amount of late seral vegetation and low summer water temperatures, land managers should focus restoration efforts to reduce the amounts of road and harvest related sediments in the upper reaches of the South Fork.

E. Elephant Rock Creek/Facing Drainage Area

Elephant Rock Creek enters the mainstem at approximated at river mile 17.7. It has a drainage area of 17 square miles. Like Big/Otter Creeks, this watershed is underlain by bedrock that is very weakly resistant to erosion, with scattered resistant knobs throughout. At least one large active earthflow within the Elephant Rock Creek watershed is

delivering large boulders and fine-textured sediment to the channel. Numerous "jammer roads" from hi-lead logging systems cover the moderately steep slopes.

The channel is steep and confined by hillslopes. The channel substrate is primarily boulder and bedrock with areas of sands, gravels and cobbles. The boulders form plunge pools greater than 3 feet in depth. Much of the stream banks are bedrock or armored with boulders. There is very little sediment storage with most of the material being transported to the Sixes River. This type of channel is powerful and stable and not sensitive to disturbance, with quick recovery characteristics. Large boulders deposited in the channel from old landslides create deep pools and water falls. There is little large wood in the stream.

Most of the watershed was privately logged down to the stream. Thick alluvial deposits in flood prone depositional areas remain as indicators of the large amount of sediment that flushed through the creek during the past few decades. With the high stream energy and fast recovery rate, the channel is in good condition. The riparian area which was logged has revegetated with mature hardwood.

Little Dry Creek enters the mainstem at approximately river mile 12.9, upstream from Dry Creek. It is evident from deposits and stored sediment in the lowest reach that it transports an extremely high sediment load.

Elephant Rock Creek is a high gradient (8%) confined system. It contains 0.4 miles that are accessible to anadromous salmonids, downstream from a large waterfall that blocks passage. Steep gradient streams favor steelhead production and Elephant Rock Creek is no exception. Spawning and juvenile surveys from 1963, 1992 and 1995 have documented juvenile steelhead but no coho. In 1992, a few chinook juveniles were found near the mouth.

F. Dry Creek

Dry Creek has been designated a Tier 1 Key Watershed under the Northwest Forest Plan. Key Watersheds provide high quality habitats distributed across the landscape that are crucial for maintaining or recovering at-risk anadromous salmonids and resident fish species. Management actions should focus on restoration activities that are consistent with Aquatic Conservation Strategy Objectives.

Dry Creek enters the mainstem at approximately river mile 11.6 and has a drainage area of 15.8 square miles. A large ancient landslide form (mapped as valley alluvium on soils map, Figure 0-6) confines the lower reach near the mouth of Dry Creek, but it is unknown when the landslide last moved or how it affected the channel form. The pattern of alluvial deposits in lower Dry Creek and the area to the west indicates that the wide valley, low gradient in the lower mile has an older geologic origin. Dry Creek derives its name because the lower mile goes dry during the summer months. Dry Creek has naturally high sediment loading which aggraded the lower valley section. The excessive sediments

in the lower valley cause the summer flow to go subsurface. The bed composition is mostly gravel and cobbles with some small boulders.

The lower valley has the most extensive valley floor riparian stand within the Sixes watershed. The riparian vegetation in the valley section is mostly hardwoods. Upstream from the valley floor section, the high proportion of mid seral riparian vegetation (Figure A-2) reflects disturbance by wildfire in the Dry Creek watershed. Most of the riparian area is in the wilderness and consists of a mixture of conifers and hardwoods. Upstream the gradient gradually increases and the stream is confined by hillslopes to the headwaters. The confined sections of the channel are characterized by long pools, falls, chutes and riffles.

Dry Creek has a long history of mining which began back in the late 1800's. The Big Jewel mining operation constructed a dam on the North Fork of Dry Creek to pressurize a hydraulic giant near the mouth. Cedar was felled along Dry Creek to construct a flume to carry the water from the North Fork to the mouth. It is unknown what effects mining has had on the channel. A question that remains to be answered is if the hydraulic mining at the mouth widened the channel increasing the flood prone width. This would reduce the stream's energy during flood events causing aggradation to become more severe.

The headwaters of Dry Creek include the infamous "Section 36" that was roaded and harvested in the early 1960's. This section was acquired in 1972, and included the Oregon Wilderness Act of 1984, which established the Grassy Knob Wilderness. Poor land use practices resulted in soil compaction, water diversion, and removal of organics and surface soil horizons. It has been estimated that 70% of the area has impaired productivity with evidence of raveling soils and nonreforestation (Gross 1996). Approximately one mile of road was constructed in the Dry Creek channel and floodplain, placing large volumes of soils and rock in a perennial stream (USDA 1992). Figure A-6 illustrates the timing of landslide sediment delivery in the Dry Creek watershed. A single road-related slide along the access road to section 36 delivered an estimated 19,000 cubic meters of sediment. In 1992, it was estimated that storms transport 200 to 500 cubic yards of the sediment into the downstream reaches of Dry Creek each winter (USDA 1992). In the southwest quarter of section 36, about 75 acres drain into a closed basin where runoff is ponded, providing a sediment deposition site.

There is little doubt of the importance of Dry Creek as contributing a significant portion of spawning and rearing habitat for salmonids to the Sixes Watershed. It was estimated to support approximately 60% to 70% of total fall chinook escapement for the Sixes watershed (Reimers 1972; Susac 1996, personal communication). Stray rates of fall chinook from the Elk River hatchery from 1967 to present have averaged 10% (Susac 1995, personal communication). The lower 3.5 miles is critical spawning habitat for chinook, coho, cutthroat and steelhead. In addition, small numbers of chum salmon are occasionally counted in this section too. The upper portion of the watershed contains numerous miles of quality resident trout habitat. Summer juvenile densities upstream from the Westbrook bridge (RM 1.7 to RM 2.7) are among the highest found along Oregon's coastal rivers (USFS Stream Survey, 1990; Susac 1995, personal

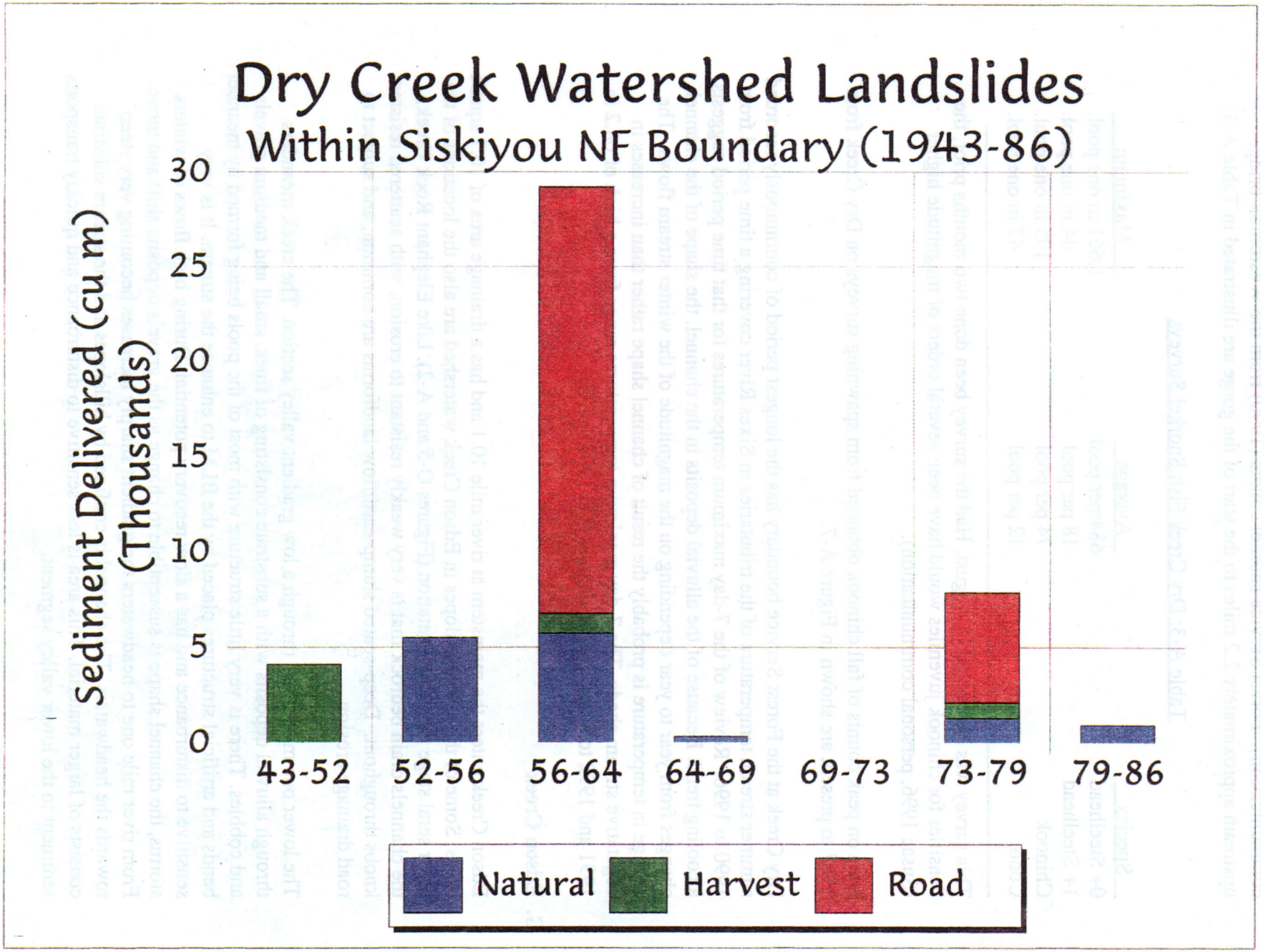

Dry Creek Watershed Landslides
Within Siskiyou NF Boundary (1943-86)
Sediment Delivered (cu m)
(Thousands)
30
25
20
15
10
5
0
43-52
52-56
56-64
64-69
69-73
73-79
79-86
Natural
Harvest
Road

Figure A-6

communication). Forest Service snorkel counts (1990) from the Westbrook bridge upstream approximately 2.2 miles to the start of the gorge are illustrated in Table A-3.

Table A-3: Dry Creek Fish Snorkel Surveys

Species	Average	Maximum
0+ Steelhead	684 per pool	1,661 in one pool.
1+ Steelhead	18 per pool	44 in one pool.
Chinook	74 per pool	195 in one pool.
Coho	12 per pool	47 in one pool.

This survey was conducted in August. Had the survey been done two months prior, the densities for chinook juveniles would have been several orders of magnitude higher (Susac 1996, personal communication).

Data on peak counts of fall chinook obtained from spawning surveys on Dry Creek from 1967 to present are shown in Figure A-7.

Dry Creek at the Forest Service boundary has the longest period of continuously recorded summer stream temperature of the tributaries in Sixes River covering a time period from 1990 to 1996. Review of the 7-day maximum temperatures for that time period suggests a cooling trend. Because of the alluvial deposits in the channel, the shape of the channel changes from year to year depending on the magnitude of the winter stream flows. The change in temperature is probably the result of channel shape rather than increases in vegetative stream shade. The 7-day maximum temperatures range from a high of 68.2 in 1991 and 1992 to a low of 65.3 degrees F in 1993 (USFS).

G. Edson Creek

Edson Creek enters the mainstem at river mile 10.1 and has a drainage area of 10.7 square miles. Some of the steepest slopes in Edson Creek watershed are also the locations of the older seral stage riparian vegetation (Figures O-5 and A-2). Like Elephant Rock Creek, the channels drain bedrock that is very weakly resistant to erosion, with scattered resistant knobs throughout. Deep-seated slump-earthflow landforms are common, and subject to road drainage erosion.

The lower one mile flows through a low gradient valley section. The creek meanders through alluvial deposits with a substrate consisting of fines, small and medium gravels and cobbles. There is very little structure with most of the pools being formed by meander bends and artificial structures placed by the BLM to enhance the stream. It is very sensitive to disturbance and has a slow recovery potential. During high flows of winters storms, the channel shape is susceptible to change as the gravels deposits shift and move. From river mile one to headwaters the gradient sharply increases becoming very steep towards the headwaters. The channel is confined by hillslopes and the stream substrate consists of larger material. This area is less sensitive to disturbance and quickly transports sediment to the lower valley segment.

Peak Counts of Fall Chinook

Dry Creek Spawning Data

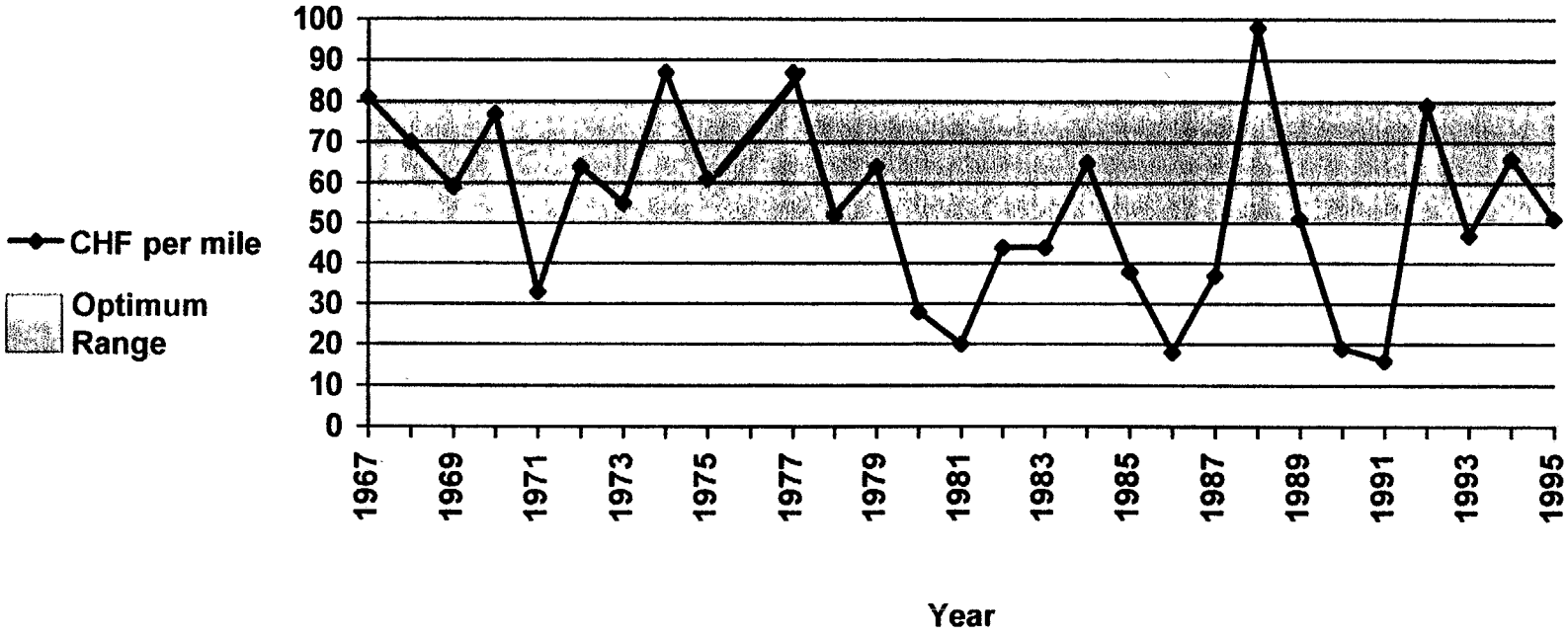


Figure A-7

Private logging began in Edson Creek in 1954. It has been heavily logged removing all vegetation down to the stream. As a result of the 1964 storm, natural failures and large amounts of sediment from logging and roads, the channel was heavily impacted in the late 1960's through the 1970's. The most heavily impacted area was the lower valley segments where sediment buried the stream, covering rocks and logs in the channels that previously formed the pools and provided structure. The stream was wide and flat with braided sections. There was little stream shade after logging removed the trees from the riparian area.

The stream has been recovering since 1980. The lower valley stream segment has established a stable meander pattern, down cutting through the gravel and cobble deposits. Shallow pools have formed. Large wood in the channel is spars consisting mostly of hardwoods. The riparian vegetation has regrown providing good stream shade but consists mostly of hardwoods.

Edson Creek supports fall chinook, coho, steelhead resident rainbow and cutthroat trout. During the late 1940's Edson Creek was being considered for a potential hatchery site. Approximately 2.5 miles of anadromous habitat is available up to the forks. The best quality spawning habitat is the low gradient segment from the mouth to approximately 1.0 mile upstream. Spawning surveys in this reach from 1994 and 1995 reflect chinook peak counts to be 40 and 33 adults per mile. Peak counts of coho were 4 adults in 1994 and no fish were spotted during the 1995 survey. There is very little woody structure on the lower gradient section (ODF&W, 1994). The 7-day maximum stream temperature at the mouth of Edson Creek was 67.3 degrees F in 1995 (Southcoast Watershed Council).

H. Crystal Creek

Crystal Creek flows into the mainstem at approximately river mile five. It has a drainage area of 12 square miles. Crystal Creek subwatershed is dominated by early seral conditions (75%). Crystal Creek enters the mainstem Sixes west of Highway 101. It flows across the agricultural valley, where the channel gradient is low, increasing the likelihood of sediment deposition and storage in terraces rather than transport to the mainstem. Riparian vegetation is lacking in the agricultural valley, so water flowing in this stream segment may be heating, but stream temperature data are lacking. Riparian vegetation in the headwaters has been removed for a mile by a debris flow below the road south of Grouslous Mountain. Much of the riparian area has been harvested, including some recent harvest along perennial streams.

There is a partial fish migration barrier located approximately 2.0 miles from the mouth. The falls appear to be passable for steelhead but not for coho and chinook. The best spawning area is a 3/4 mile stretch just downstream from the barrier. Downstream gradients are low, and land use is dominated by pastures and agriculture lands. Surveys conducted by ODF&W confirmed coho and chinook presence below the barrier and only steelhead and cutthroat above the barrier. Historical accounts indicate that coho and chinook have passed the falls on certain years (Werner 1963). The substrate is dominated by gravel, cobble and silt. There are moderate amounts of large wood. Peak counts of

chinook during 1994 and 1995 spawning surveys were 27 and 21 fish per mile respectively (ODFW, 1994, 1995 spawning surveys). The 7-day maximum stream temperature recorded three miles above the mouth was 62.2 degrees F (Southcoast Watershed Council).

I. Lower Mainstem

Beaver Creek enters the lower mainstem Sixes at river mile 7.7. The L.E. Smith Lumber Mill was located about one mile upstream during the 1950's and 1960's. Much of this basin was clear-cut logged during this period. Historical spawning surveys (ODF&W 1963) indicated winter steelhead presence for 0.75 miles up to a small falls below the mill site. One chinook carcass was found in the lower portion of the survey. However, surveys indicate 3.25 miles of anadromous habitat exist (ODF&W 1994). Coho, chinook, steelhead and cutthroat were found. Chinook distribution was limited to the lower 0.75 miles below the falls. Upper distribution of anadromy was hypothesized to be limited by flow. Seining indicated good numbers of coho and steelhead juveniles (ODF&W 1994). A road culvert blocked passage to a tributary where resident trout were found. These surveys indicate that Beaver Creek is in a state of recovery from past habitat degradation.

The Sixes River estuary extends inland for approximately 2.5 miles. During the winter, the intertidal or estuarine environment is much smaller due to high flows. On occasion, the estuary will be completely blocked by a sand bar during the summer months. The combined fresh water flow and tidal ebb current rapidly opens a new channel. The importance of quality estuarine habitats on salmonid survival for both adults and juveniles are well documented (Meehan 1991). In his work on the Sixes River, Reimers (1971) identified five life cycles traits for fall chinook. He found the most successful escapement returns came from juveniles that spent approximately 3 months rearing in fresh water and 3 months rearing in the estuary before entering the ocean. He concluded that freshwater and estuarine rearing were equally important to fall chinook salmon survival in the Sixes River. Physical habitat of the lower mainstem has changed dramatically. Timber once extended to the mouth of the river, as evidenced by the presence of stumps (Reimers 1971). The extensive cover, mainly Sitka Spruce, maintained cooler water temperatures and stabilized winter flows. To what extent these changes have had on salmonid populations are speculative.

IV. FINDINGS OF FACT

Sediment and Large Wood

- On lands within the National Forest Boundary, an estimated 5.6 times the natural landslide sediment volume was delivered to stream channels during 1943-1986 (excluding the 1955 large debris flow in section 9, caused by unknown factors).

- Most road and harvest-related landslides occurred within a few years following the land-disturbing activity, but older roads continue to cause road-related failures.

- The highest landslide volumes were delivered in Benson Creek (36 cu m/ac), the Dry Creek tributary containing the access road to section 36 (25 cu m/ac), and Dixie and Rusty Creeks (17 and 16 cu m/ac). The transport of these high volumes of sediment downstream in Dry Creek and South Fork Sixes River have affected channel widths and pool volumes, but the downstream extent is unknown.

- Rates of landslide sediment delivery from private lands have not been inventoried, however sediment sources include road-related debris flows, gullies and rills from concentrated road drainage or drainage from compacted grazing lands onto deep soils.

- Clay-rich soils are more extensive in the northern and eastern parts of the watershed, and more likely to produce turbidity.

- South Fork Sixes and Dry Creek contain the most late seral stage riparian vegetation that supplies large wood to channels within the watershed.

- The large wood supply in the watershed has been reduced from pre-historic levels due to timber harvest, salvage, and road-related debris flows.

Water Quality

- Summer stream temperatures increased during the 1960's due to, the 1964 storm, loss of stream shade from timber harvest, and increased sediment loading in the streams from human activities.

- Stream shade has grown back along much of the harvested tributaries, and it is estimated that summer temperatures have begun to reach pre-harvest levels.

- Continued monitoring by the Department of Environmental Quality at the Sixes River bridge on Highway 101 has shown a cooling trend where temperatures are 3oF to 5oF cooler than those collected in the late 1960's.

- The tributaries play a key role in providing cool water to the mainstem, helping to lower summer stream temperatures.

- Decades of historic mining, without environmental protection, introduced mercury into Sixes River. The Department of Environmental Quality tested fish in 1996 for mercury contamination finding the fish contained small amounts of mercury, below levels considered to be a health risk for human.

Channel Morphology

- The condition of the mainstem and many of the tributaries changed drastically in the late 1960's through the 1970's. A combination of the 1964 flood and associated increases in natural sediment delivered, exacerbated by increased in sediment from logging and roads,

changed the channel shape and increased sediment stored in the upper and lower valley segments of the mainstem.

- Comparison of current aerial photographs with ones taken two decades ago revealed, the upper and lower valley sections of the mainstem are showings signs of improvement.

Fisheries

- All salmonid populations within the Sixes watershed are depressed over historic levels.
- These reductions can be related to past land use activities and adverse ocean conditions.
- The Sixes watershed appears to be in a state of recovery from past habitat degradation.
- New State and Federal land management requirements will help keep key aquatic and terrestrial components in place and help accelerate recovery of depressed salmonid stocks.
- Dry Creek is the most important tributary for salmonid spawning and rearing within the Sixes watershed.
- The log jam on the South Fork of the Sixes has become a partial barrier for searun cutthroat and winter steelhead distribution.
- Physical characteristics within the Sixes watershed have changed considerably.
- Areas of historic habitat have been lost due to culverts blocking upstream passage, (e.g. Little Otter Creek and Beaver Creek.
- Land use impacts upon water quality, especially temperatures greater than 64 degree, have reduced available salmonid rearing capacities within the watershed.
- The Sixes estuary is an important component to salmonid survival.

V. SUMMARY OF DATA GAPS

Water Quality

- Stream temperature data is incomplete. The use of continuous recording thermographs at key locations on the mainstem would provide more consistent data for analysis.

Fisheries

- Upstream extent by species of fish bearing streams on public and private lands.
- Stream survey aquatic habitat information on private lands.

- Adult escapement by species for the watershed.
- Juvenile smolt production by species for the watershed.

Subwatersheds

- Since all of the upper mainstem is privately owned, much of the data on stream condition, spawning surveys and habitat surveys has not been gathered.
- For National Forest Lands, an inventory of ditch drainage distances, diversion potential, and high hazard road crossings is not available.
- Dates of road construction, to correlate with landslide timing, would also be useful in determining the role of older roads with sidecast fill or buried wood in potential future failures.

VI. MANAGEMENT RECOMMENDATIONS

Watershed restoration is an attempt to recover damaged ecosystems faster than they would actually do so themselves. While individual restoration projects are very specific, they must be part of a comprehensive approach that attempts to address the entire ecosystem and /or watershed. Practical restoration begins by identifying all restoration needs, then sifting through these for the most important processes of concern. Next, such factors as treatability, cost effectiveness, funding expectations, management constraints, and socio-political considerations are applied to arrive at the best implementable program.

Sediment and Large Wood

- Use Slope and Soil Depth Maps to identify areas of high debris flow hazard for additional field investigation when prioritizing road restoration projects or delineating Riparian Reserves at the project/site scale.
- Establish priorities for road restoration with focus on preventing diversions and debris flows (see known and suspected sites in Road-Related Restoration Appendix).
- When harvesting slopes underlain by deep soils, consider special harvest prescriptions within groundwater influence areas to avoid destabilizing slopes.
- Focus on Best Management Practices for Water Quality whenever conducting ground-disturbing activities on soils with high turbidity potential (clay-rich subsoils).
- In subwatersheds where the supply of large wood is low, survey riparian areas for silvicultural treatments such as planting conifers and thinning of hardwoods.

Water Quality

- Work with private landowners and the watershed council to develop a Water Quality Management Plan which would act as a Total Maximum Daily Load (TMDL) used by the Department of Environmental quality. The eventual goal would be removing Sixes River from the 303(d) list of Water Quality Limited Streams.

Fisheries

- Replace or fixculverts that block significnt habitat for both juvenile and adult salmonids.
- Work with private landowners and watershed councils to identify projects that restore the physical components that contribute to water quality.
- Dry Creek and the South Fork should be the focus for potential restoration and recovery projects on Federal Lands.
- Focus restoration activites by securing the highest quality habitats first, but do not forgo other opportunities.
- Focus restoration activities around and immediately upstream of productive flats, but do not forgo other opportunities..
- Restore riparian areas to more late seral conditions by riparian planting and silvicultural thinning of overstocked stands.
- Add large woody material to tributaries within the range of 20 to 80 pieces per mile depending upon flow.
- Evaluate modification of the log jam on the South Fork of the Sixes.
- Restore and stabilize floodplains by planting hardwood species such as alder and willow.

Past and proposed restoration activities on federal lands within the Sixes watershed are typically directed toward aquatic ecosystem health. The types of restoration treatments affecting the aquatic ecosystem generally fall into three categories: Hillslope restoration, riparian area restoration, and in-stream restoration. See Appendix D.

TERRESTRIAL ECOSYSTEM

I. WATERSHED DISTURBANCE AGENTS

Key Question:

What historic disturbance phenomena has occurred across the landscape?

There are a number of disturbance agents, including mining, wind, insect, disease, and grazing, affecting the make up of the Sixes River. However, in this watershed there are two primary agents: timber harvest and fire.

Generally wildfire occurrence in the watershed can be described as very low, which is typical of watersheds near the coast. The western hemlock plant series, which dominates this drainage, has low fire occurrence and a long fire return interval. It is possible to find evidence of past fires in natural stands throughout the watershed. However it has become more difficult to determine past fire disturbed areas by looking at the landscape today, as logging activity is now the dominant disturbance agent.

Logging activity in the Sixes Watershed began on private land holdings in the early part of the 20th Century, with harvest on publicly owned lands correlating with the end of World War II. Timber harvest, on publicly owned lands, peaked in the late 1960's and has declined to the present day (Figure T-1).

Historic Condition

There were reports of four large fires within the Sixes analysis area in the last 150 years. In 1868 much of the Southern Oregon coast, including the Sixes and Elk River drainages, burned. This fire spread as much as 30 miles inland, and burned the community of Port Orford. In 1898 a large fire burned on Salmon Mountain. During 1929 two large fires occurred in the Elk River. The Barklow Mountain Fire was a 9000 acre lightning fire. The Elk River Fire was a 9600 acre fire that burned much of the present day Grassy Knob Wilderness and into Dry Creek in the Sixes drainage. In 1966 there was a 655 acre fire in Otter Creek, as a direct result of timber harvesting operations, during an east wind event. However, these large, high intensity fires are uncommon in the western hemlock plant associations especially with the maritime influence common to the Sixes watershed (Figure T-2).

Prior to the turn of the century harvest disturbances were not a common practice. Typically the primary harvest-like disturbance was that of settlers clearing enough land to settle and begin a subsistence type life style. As the nation became more industrialized logging technology improved , increasing the ability to harvest the timber commodity of the Sixes watershed. Initial harvesting occurred near the mouth, lowlands and the extreme headwaters of the Sixes watershed. The headwaters of the Sixes River was harvested and hauled by train to Powers. The low lands of the Sixes River were harvested early in the century (1918), with Sitka spruce and Port-Orford-cedar utilized to support the military during World War I and II.

Current Conditions

The use of prescribed fire has been a common practice following logging as a method to accomplish site preparation or fire hazard reduction in this watershed. Most harvested lands were routinely burned and this practice continued for many years. This burning practice typically occurred in the fall months just prior to the onset of fall rains. However, the impacts to soil and water resources were often harsh from this practice. Stricter regulations, due to air quality requirements, have switched much of the fall burning to the spring months. This not only reduces smoke production, but lessens the prescribed fire impacts to soil and water resources. Today, human causes are the most common source of wildfires. The most damaging fires in the watershed are often associated with industrial operations such as timber harvest operations or escaped prescribed burns.

Timber harvest has been a common disturbance pattern in the watershed for nearly 100 years, and it remains so on private timber lands. Harvest levels have remained at a fairly constant level on privately owned lands across the watershed. However, timber harvest on publicly owned National Forest land began at the end of World War II and continued until it's peak in the late 1960's. Harvest levels have declined steadily since the late 60's reaching today's level of programmed timber harvest as directed through the Record of Decision for Amendments to Forest Service and Bureau of Land Management Planning Documents Within the Range of the Northern Spotted Owl (1994). This decline in harvested acres per decade for the lands managed by the United States Forest Service is listed as follows:

Table T-1 Harvested Acres per Half-Decade

Half-decade period	Acres (total)	Half-decade period	Acres (total)
1945-49	6	1970-74	489
1950-54	303	1975-79	407
1955-59	319	1980-84	221
1960-64	909	1985-89	61
1965-69	1288	1990-94	260

Information on harvested acres per decade for private lands is unavailable.

Current management direction for publicly owned lands is displayed on Figure O-3. The portion of the watershed within the National Forest boundary is subdivided into two primary land allocations. Within the Congressionally Reserved Areas there is no timber harvest. Within the Late-Successional Reserve there may be limited harvest, but only if it enhances late successional characteristics.

HARVESTED STANDS ON USFS LANDS

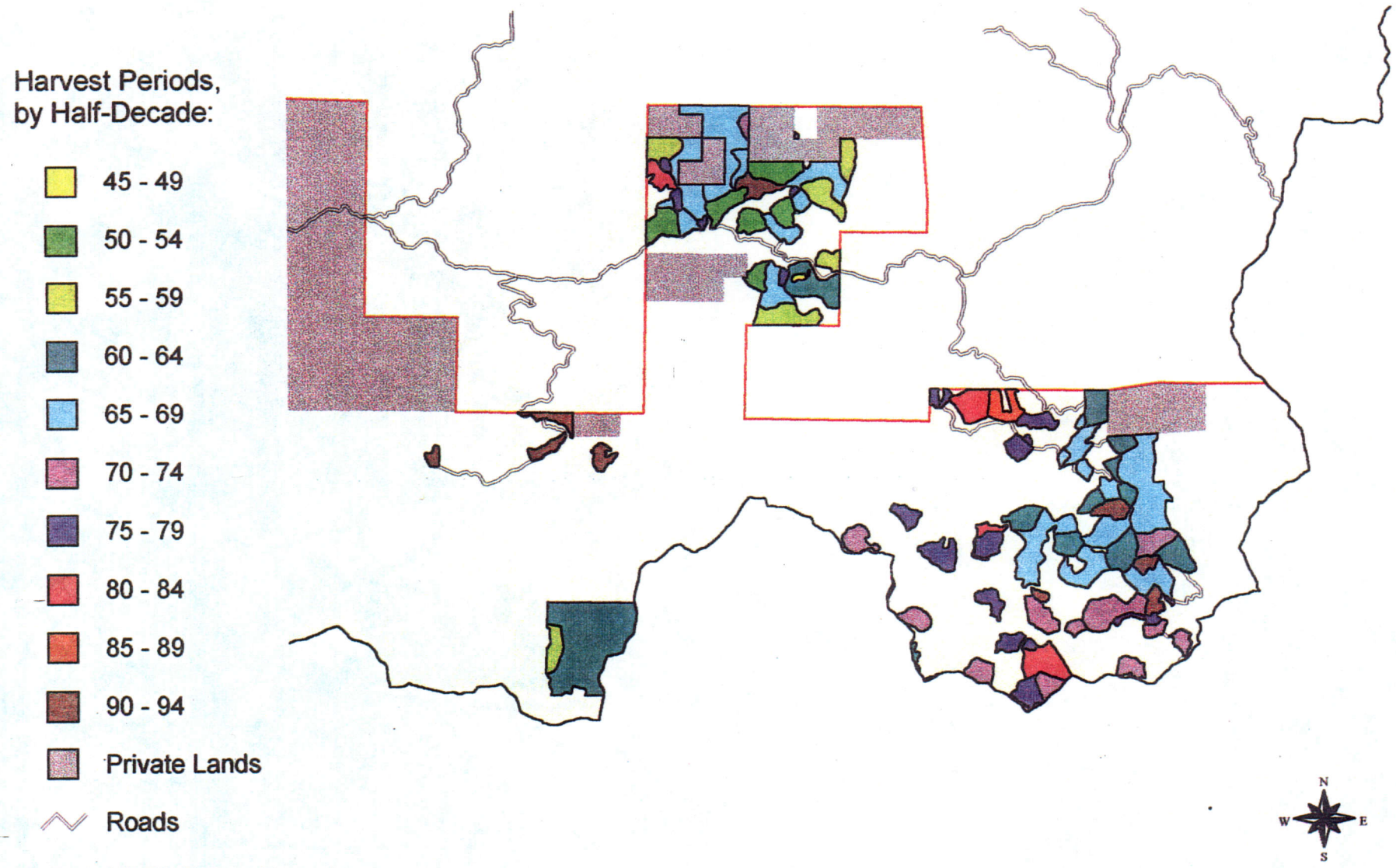


Figure T-1

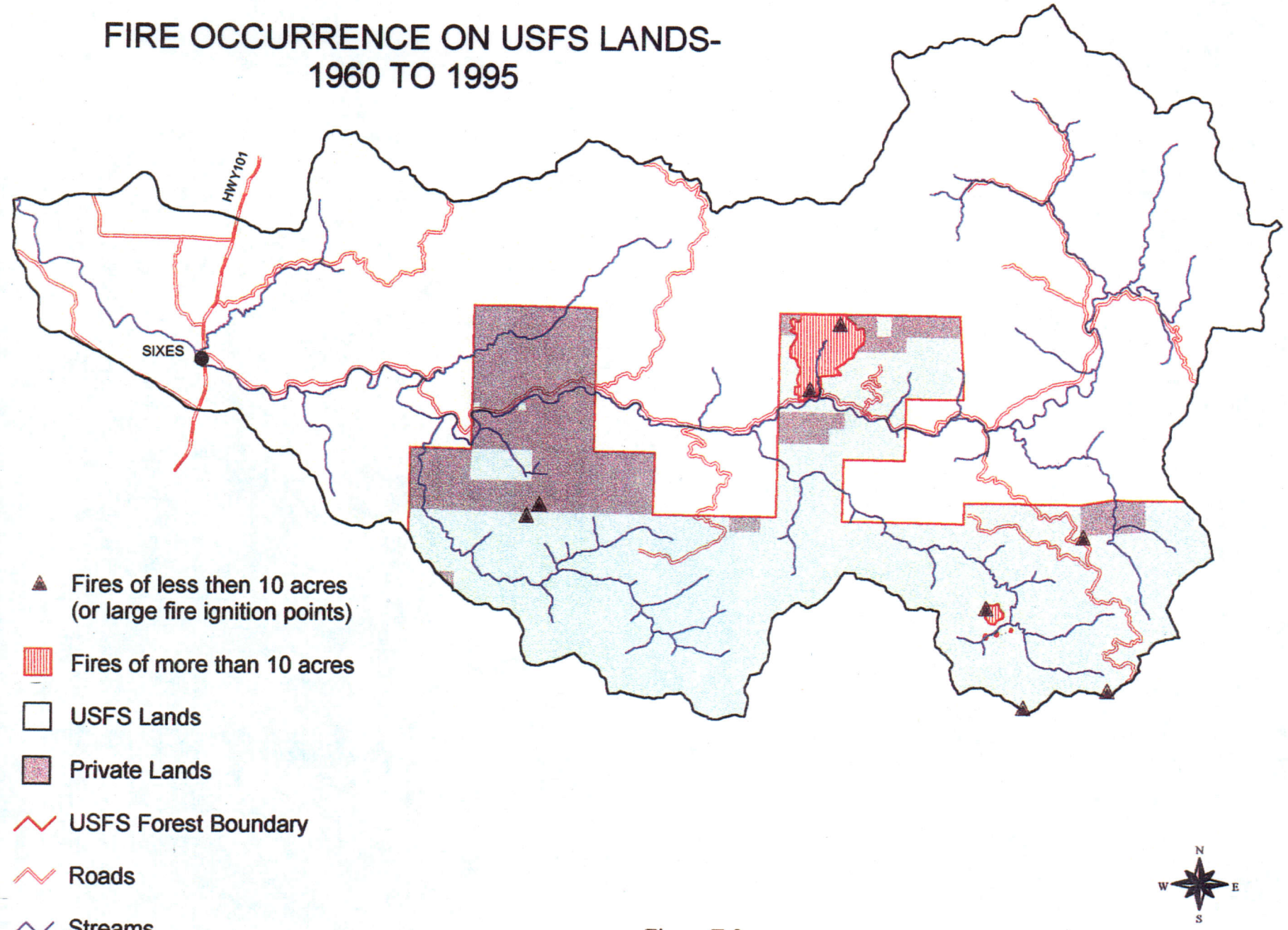

FIRE OCCURRENCE ON USFS LANDS-
1960 TO 1995
HWY101
SIXES
Fires of less then 10 acres
(or large fire ignition points)
Fires of more than 10 acres
USFS Lands
Private Lands
USFS Forest Boundary
Roads
Streams
N
W
E
S

Figure T-2

Synthesis and Interpretation

This trend of low timber harvest levels on publicly owned lands may continue as the management direction for lands within the Sixes tend to favor total or partial exclusion of timber harvest. As seen on Figure O-3, the vast majority of the publicly owned land is found in the Congressionally Reserved or Late Successional Reserve land allocation. This all but eliminates future planned timber harvest in these areas where the majority acreage of old growth in the Sixes Watershed exists. Opportunities still exist within LSR where treatments may enhance late successional characteristics, as displayed in Figure T-3.

The watershed does have approximately 450 acres allocated to the Matrix land allocation on National Forest which allows programmed timber harvest. However, at this time the entire Matrix allocation has been harvested and regenerated. Opportunities do exist within the Matrix land allocation as displayed in Figure T-3.

II. TERRESTRIAL ECOSYSTEM

Terrestrial Large Wood

Key Questions:

What areas are of concern for future wood supply?

Where have management activities reduced the large wood supply below natural levels?

Current Condition

Currently 65% of the Sixes watershed is in pioneer or early seral stage structure. The majority of the pioneer and early seral structures are located in the area outside the National Forest boundary. Timber harvest on these lands are on approximately 50 year rotations.

On National Forest lands within the watershed there are no rotation lengths, other than those lands designated in the Matrix land allocation. Management direction for these lands come from the Record of Decision for Forest Service and Bureau of Land Management Planning documents within the Range of the Northern Spotted Owl (4/94), where the areas designated as Late-Successional Reserves are left to natural processes with only minimal amounts of management opportunities occurring.

Historic Condition

At the end of the 19th century the seral stage structure across the watershed was nearly continuous, with most of the watershed consisting of mid to late seral stage structure. The portions near the mouth of the river were initially inhabited by early settlers setting up more permanent residence, and farming the area for subsistence, while slightly altering the seral

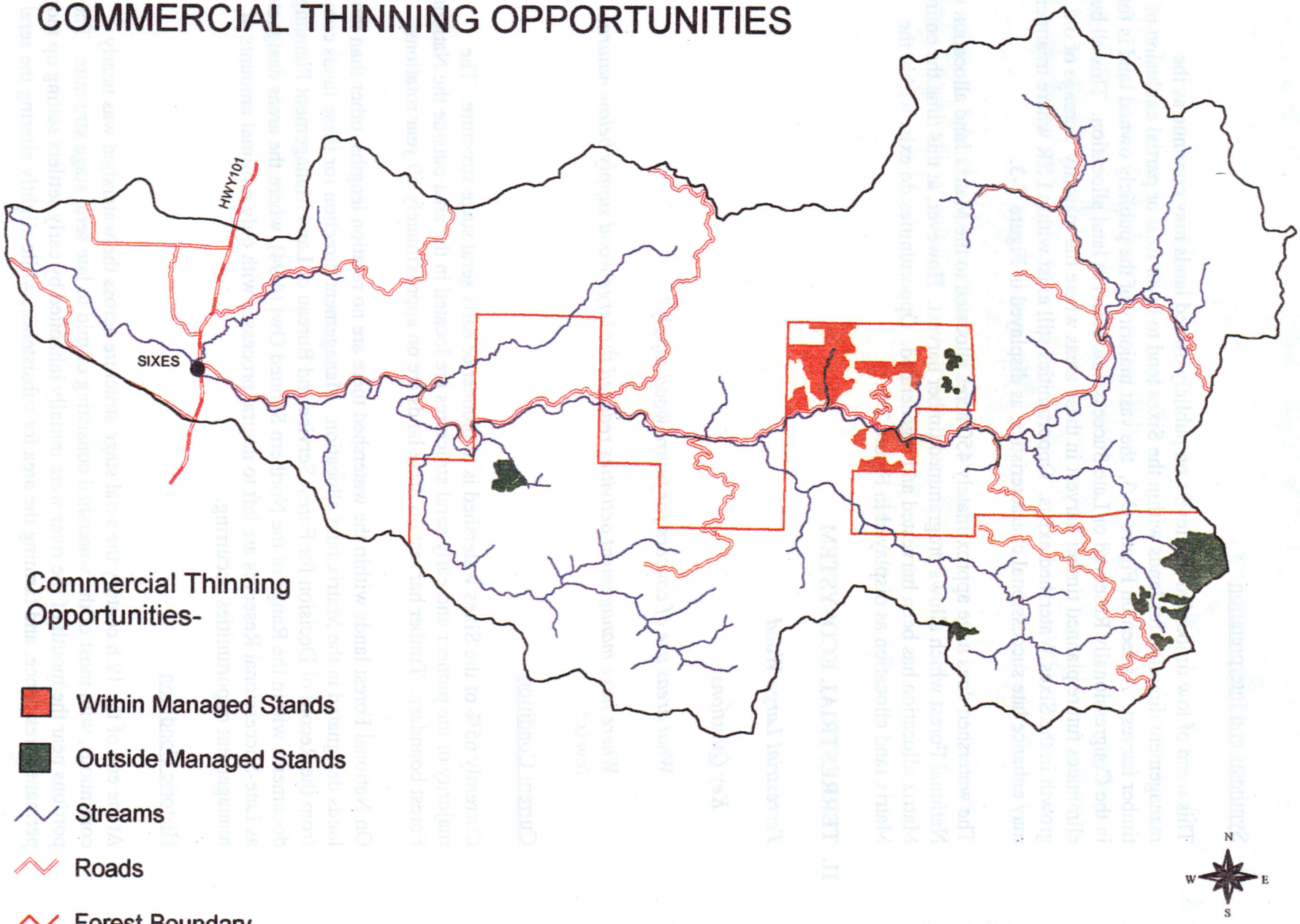

COMMERCIAL THINNING OPPORTUNITIES
HWY101
SIXES
Commercial Thinning Opportunities-
Within Managed Stands
Outside Managed Stands
Streams
Roads
Forest Boundary
N
W
E
S

Figure T-3

stage structure of that area. Other than natural (or human-caused) fires, altering the seral stage structure in a mosaic pattern, the watershed retained the mid to late seral structure until the early 20th century.

Synthesis and Interpretation

The lower portions of the watershed were initially harvested to meet the demand placed upon it by WWI and WWII to supply Port-Orford-cedar and Sitka spruce for the war effort. At the end of WWII, the demand for wood products switched from overseas to the home front in an effort to support the new housing boom across the nation. This housing boom greatly increased harvest in this watershed, and others.

The demand for wood products continued into the late 1960's until harvest, at least on publicly owned lands in the Sixes, tapered off. Currently, the portion of the watershed under Forest Service management (28%) is producing, for the most part, large acres within the mid to late seral stage structure (See Appendix F: Seral Stage). Currently these areas reside in the late-successional reserve land allocation where timber harvest is not a programmed treatment. These areas are able to provide potential large diameter material recruitment to the ecosystem in the terrestrial uplands and stream courses. This is not the case in the terrestrial uplands and stream courses of the lower portions where timber harvest has removed most of the larger diameter material. It appears these private acres will remain on harvest rotations of nearly 50 years. With these rotations there is little likelihood of future large material recruitment. Subwatersheds at the greatest risk for lack of large diameter material are: Lower Mainstem, Crystal Creek, Edson Creek, Elephant Rock Creek, and upper Mainstem (Figure A-3).

At this time the Sixes watershed does not show any sign of producing large diameter material available to take to the mills. Any material harvested within the watershed will be smaller diameter material.

Soil Quality

What factors and processes affect soil quality?

How have management and natural events changed soil quality?

Infiltration, storage and availability of water as well as soil organisms and plant growth are affected by soil properties such as particle size, depth, and volume of coarse fragments, and levels of nutrients and organic matter. Soil quality in parts of the watershed has been reduced by soil erosion and deposition, compaction, and consumption of organic matter by fire.

Severe erosion and soil loss resulted from construction of poorly-designed mid-slope roads in the 1960's and early 1970's (for example, roads accessing section 36 in Dry Creek, and roads in Benson and Rusty Creek watersheds). Tractor yarding on steep slopes and wet soils (Figure O-5) has resulted in compaction of soils, in addition to erosion and sediment delivery discussed under Aquatic Ecosystems.

Before skyline yarding towers became commonly used, roads for short-span hi-lead logging systems were densely spaced on steep slopes (known as "jammer roads"). On these slopes, surface soils and organic matter have been displaced and lost. Diversion of water that would have percolated into the soil may have caused additional erosion. Revegetation patterns reflect the loss of soil quality and reduced water in the soils of these slopes.

On steep slopes, particularly in the Cretaceous sedimentary rocks and diorite (Figures O-4 and O-5), timber harvest and prescribed burning have reduced organic matter and contributed to increased rates of ravel. Soil quality is retained by more recent timber harvest practices that leave higher volumes of large wood and burn slash under higher moisture conditions.

Downslope from meadows and pastures that have been extensively grazed, there is some evidence of rilling and gullying. These features and the "mini-terraces" created by sheep on hillslopes are caused by soil compaction.

Future Trends

Although fires have not been frequent or extensive in this watershed, a high intensity wildfire would increase ravel rates several-fold in the Dry Creek and South Fork Sixes subwatersheds, where Cretaceous sedimentary rocks and diorite underlie steep slopes. Reforestation and stabilization of older roads will continue to reduce erosion from roads (see Sediment Delivery section in Aquatic Ecosystems). Projects to restore roads, if implemented would further reduce soil losses from road fill failures and drainage diversions. Lack of maintenance on existing roads will cause continued drainage diversions during storms, with the most severe effects on deep, fine-textured soils (Figures O-6 and O-7) and earthflow deposits. Under the Northwest Forest Plan, reduced harvest and increased retention of large wood will maintain and improve soil quality on Federal Lands.

III. WATERSHED VEGETATION

A wide diversity of plant communities and habitats and several different plant associations occur within the watershed. This diversity is influenced by a number of factors including soil types, elevation, climate, and various disturbances. For plant species, there is one key question, subdivided into 10 parts. These come from social/legal obligations the Forest Service has for species management. These laws are incorporated within the USDA Forest Service Manual (2620, page 9) which requires that "management of habitat provides for the maintenance of viable populations of existing native and desired non-native wildlife, fish, (26 CFR 219.19) and plant species (USDA regulations 9400-4) generally well distributed throughout their current geographic range." The Sixes River watershed contributes to overall ecosystem sustainability through maintenance of its contributions to species viability and biological diversity.

Key Question:

How does the Sixes River Watershed contribute to plant species diversity and viability?
~What plant species are present?
~What plant associations are present?
~What important plant habitats exist in the watershed?
~What is the array of these plant habitats and seral stages across the landscape?
~How can these habitats be maintained or enhanced?
~What processes shaped the vegetation patterns?
~What are the influences of human activities?
~What sensitive and rare plant species are present?
~What exotic plant species are present, and what is their influence on native vegetation?
~What is the predicted future occurrence of plants?

Historic Conditions

Many factors contribute to plant diversity and distribution within the watershed. Much of the soil is derived from sedimentary sandstones, siltstones, and conglomerates. Soils such as these on steep terrain are highly unstable and erodible, and landslides and slumps are common. Mining, grazing, logging, and road building have all added to soil movement.

The wet coastal climate greatly influences local vegetation. Average annual precipitation ranges from about 70" to 110" in the headwaters, mostly during the months of October through April. The summer dry season is moderated by frequent heavy fog resulting in "fog drip". Very high westerly winter winds often occur and blowdown and wind damage is common. In higher elevations some winter ice and snow damage may also occur.

Much livestock grazing has occurred historically, particularly on the large meadows on the north edge of the watershed and on the Dement and Avery Ranches. Many cattle were pastured in these areas in the early days and still are at present. Large bands of sheep were run lower down the drainage and on the coastal headlands (Cuatt 1996, personal communication; Hofsess 1996, personal communication). This has resulted in the introduction of many non-native grasses and forbs (Appendix G: Exotic Plants).

Wide spread logging beginning in the late 1910's has put much of the drainage into early seral stages (Figure T-4, Current Seral Stages). Diseases and insects also affect the vegetation, especially the Port-Orford-cedar root rot disease *Phytophthora lateralis*.

Vegetation composition as shown on Figure T-5 (1890 Stages) shows that the watershed was dominated historically by late seral to old growth western hemlock, Douglas-fir, Port-Orford-cedar and western redcedars. Approximately 55,600 acres out of 85,833 total were probably in this condition. Early residents consistently commented on the extensive old growth forest with much less undergrowth than at present (Hofsess 1996, personal communication). The natural meadows on the north side, in the headwaters, on the floodplains, and on the coastal headlands have been present for thousands of years as a result of soil types, exposure,

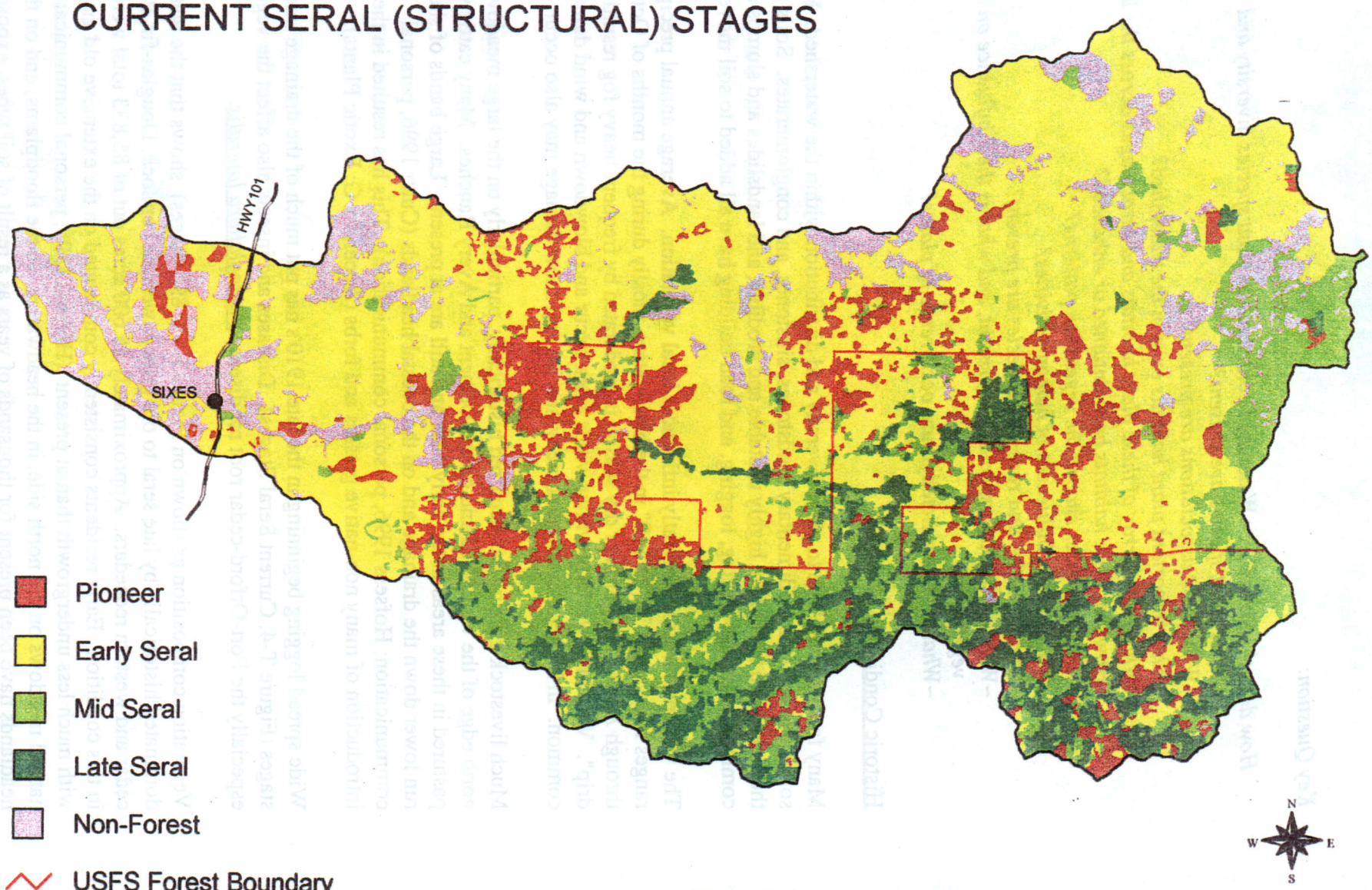

CURRENT SERAL (STRUCTURAL) STAGES
HWY-101
SIXES
Pioneer
Early Seral
Mid Seral
Late Seral
Non-Forest
USFS Forest Boundary
N
W
E
S

Figure T-4

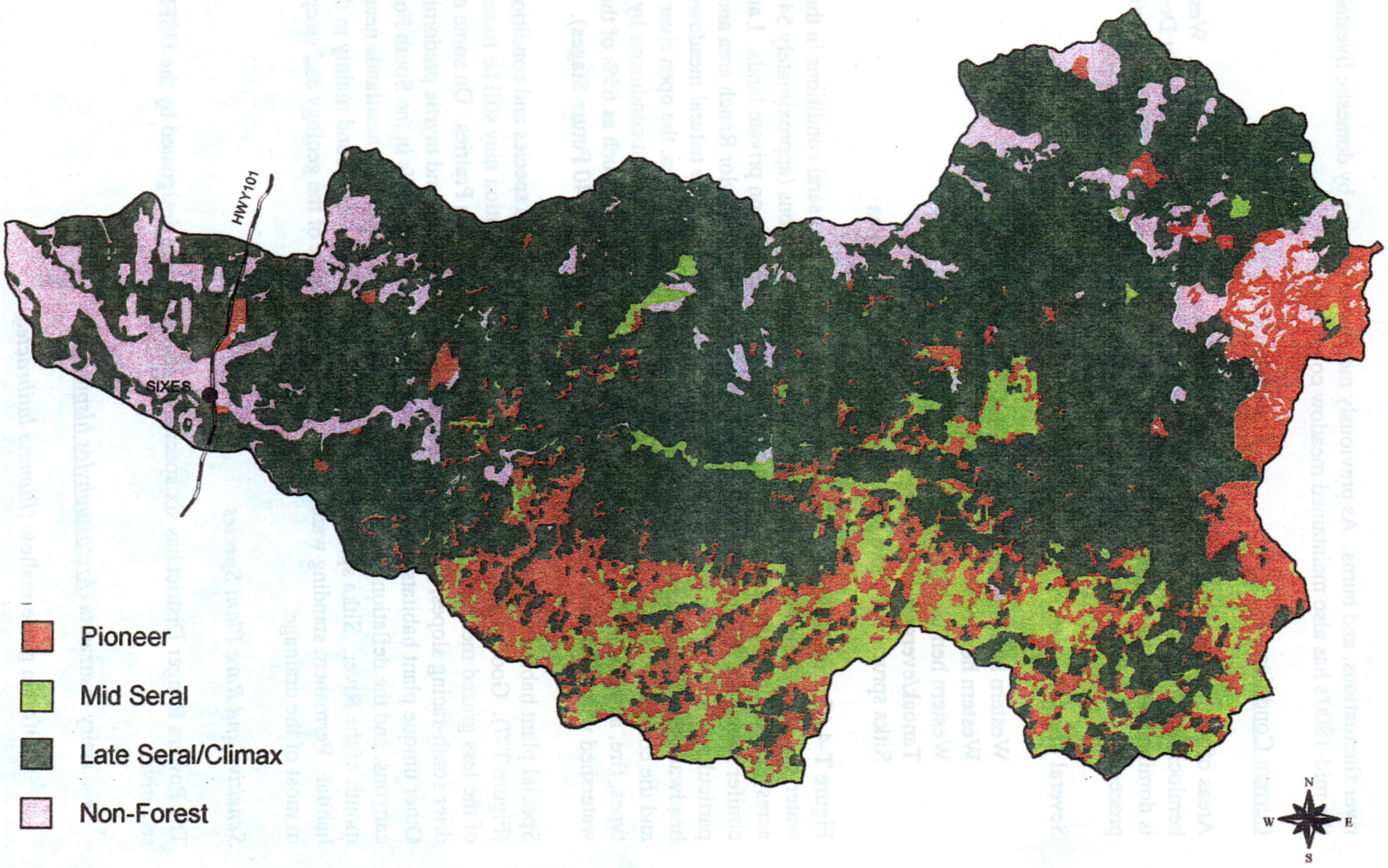

ESTIMATED 1890 SERAL STAGES
HWY101
SIXES
Pioneer
Mid Seral
Late Seral/Climax
Non-Forest
N
W
E
S

Figure T-5

river fluctuations, and burns. As previously mentioned grazing by domestic livestock since the mid-1800's has also maintained meadow conditions.

Current Condition

Areas of similar vegetative composition are classified into Plant Associations. Western hemlock is the climax conifer species in most of the drainage, though at present Douglas-fir is dominant as the mid-seral stage. Without disturbance these stands would theoretically proceed to a hemlock climax condition as the Douglas-fir overstory deteriorates.

Several plant associations are recognized in the Sixes watershed:

Western hemlock/Port-Orford-cedar
Western hemlock/western redcedar
Western hemlock/salal
Tanoak/evergreen huckleberry
Sitka spruce and shore pine - coastal plant communities

Figure T-4 (Current Stages) illustrates present vegetation and seral conditions in the watershed (See Appendix F: Seral Stage). Early seral conditions (approximately 54% of all acres) predominate because of logging operations, particularly on private lands. Late seral conifer stands are still present on National Forest lands in the Taylor Ranch area and particularly in the upper South Fork and Dry Creek drainages. The natural meadows in the headwaters on the Dement Ranch, the prairies along the north ridges, the open river terraces, and the coastal headland grasslands are all maintained in their present conditions by soil types, fire, and grazing. If current land use practices continue as much as 65% of the entire watershed will be in pioneer or early seral stages (Figure T-6, 2040 Future Stages).

Special plant habitats in the watershed include a diverse mix of species and conditions (Figure T-7). Good stands of native grasses and prairie vegetation may still be found in some of the less grazed meadows such as Salt Lick and Taylor Ranch Prairies. On some of the drier south-facing slopes, hardwoods such as tanoak, chinkapin, and myrtle predominate. Other unique plant habitats include the vernally wet sandstone cliffs in the South Fork canyons, and the deflation plains, wetlands, and coastal estuaries and headlands near the mouth of the River. Sitka spruce and shore pine, for example, are found mainly in this habitat. Permanent standing water habitats are rare because of the geology and steep terrain in most of the drainage.

Sensitive and Rare Plant Species

The Powers Ranger District has six species of plants that are designated by the USFS as sensitive:

- Hairy manzanita (*Arctostaphylos hispidula*)
- California globe-mallow *(Iliamna latibracteata)*

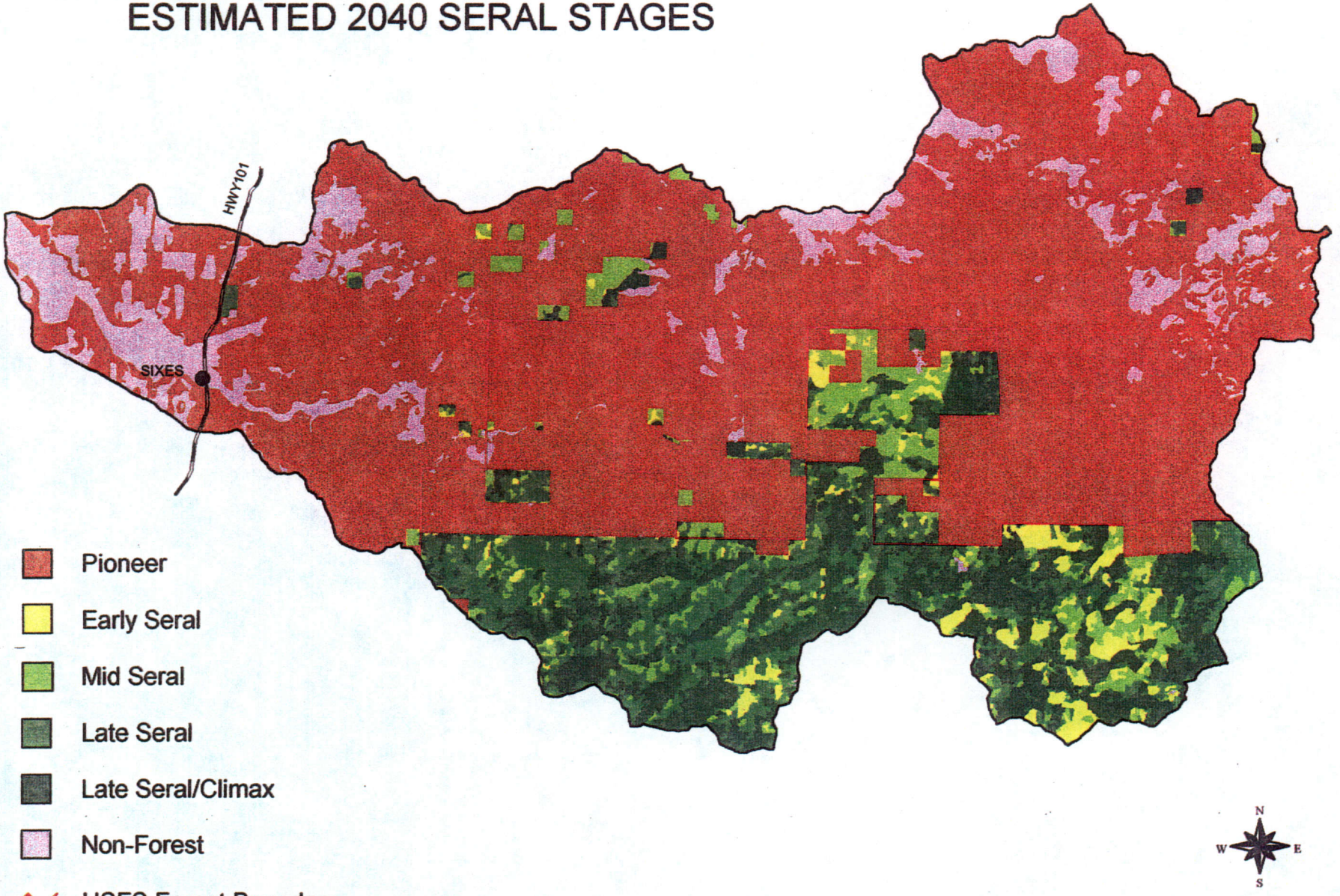

ESTIMATED 2040 SERAL STAGES
HWY101
SIXES
Pioneer
Early Seral
Mid Seral
Late Seral
Late Seral/Climax
Non-Forest
USFS Forest Boundary
N
W
E
S

Figure T-6

TREE SPECIES OCCURRENCE

FOR AREAS COVERED BY PMR SATELLITE DATA

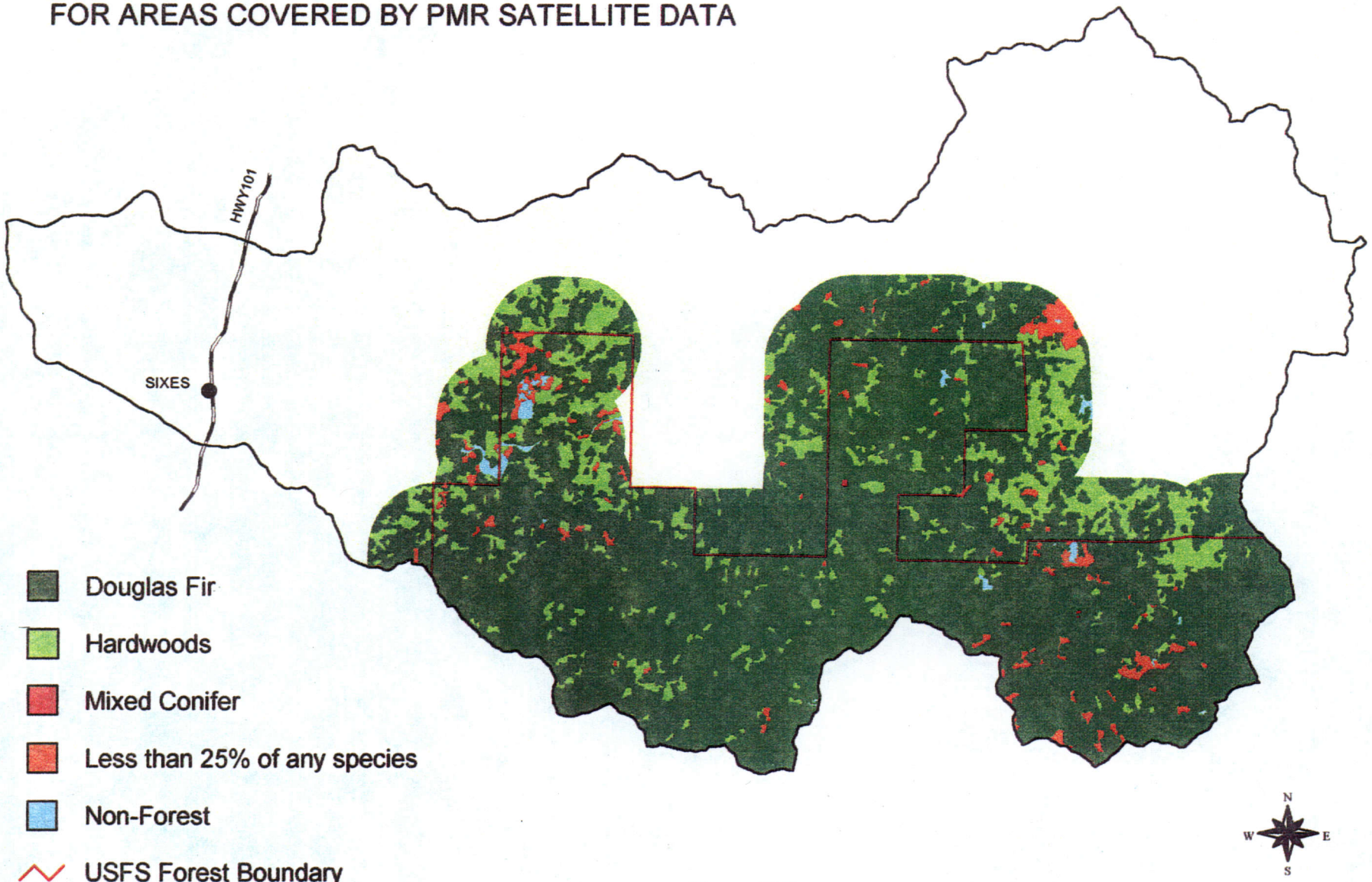


Figure T-7

- Bolander's hawkweed *(Hieracium bolanderi)*
- Leach's brodiaea *(Triteleia hendersonii var. leachiae)*
- Piper's bluegrass *(Poa piperi)*
- Bensonia *(Bensoniella oregana)*

Only one of these is found anywhere in the Sixes Watershed:

- Hairy manzanita (*Arctostaphylos hispidula*) is found in small numbers on the Mt. Butler summit in the headwaters of the South Fork.

One Oregon Natural Heritage "watch list" species, the coast fawn-lily (*Erythronium revolutum*) is present in good numbers on wet cliffs in the South Fork canyon. It is only found on Forest Service land.

The following species are not found on Forest Service land but are found in the watershed on BLM lands:

- Western lily (*Lilium occidentale*), listed as being federally endangered, occurs in the wet coastal deflation plains.
- Large-flowered goldfields (*Lasthenia macrantha prisca*), pink sand verbena (*Abronia umbellata*), and silvery phacelia (*Phacelia argentea*), are all 'species of concern' (Rittenhouse 1996, personal communication). These are also "seaside" species.

Exotic (Non-native) Vegetation

Approximately 80 species of exotic plants presently occur within the watershed (Shea 1993, Appendix G). The fertile soils and forgiving climate are very conducive to these fast-growing, non-native species. They consist mostly of grasses and forbs established by historic overgrazing, timber harvest, and other ground-disturbing activities. A seed mixture of several exotic species developed by the Oregon Department of Fish and Wildlife has been routinely broadcast-seeded for revegetation projects in the watershed for many years.

Sources of native seeds are now available and the broadcast seeding of exotics will discontinue.

Non-native grasses such as Dogtail (*Cynosurus echinatus*), Velvetgrass (*Holcus lanatus*), and Beachgrass (*Ammophila arenaria*); forbs such as Oxeye Daisy (*Chrysanthemum leucanthemum*), and Foxglove *(Digitalis purpurea)*; and shrubs like Himalayan Blackberry (Rubus discolor) and Scotch and French Brooms (*Cytisus sp.*) are especially common. Of particular concern are the aggressive Gorse (*Ulex europaeus*) and Tansy (*Senecio jacobaea*). Tansy is widespread along roadsides in the watershed and has been biologically treated for

several years with the tansy flea beetle (*Longitarsus jacobaeae*). Gorse is present on National Forest lands in nine different locations; and is a common and aggressive invader along Highway 101. Gorse was brought in accidentally from the Bandon area as seeds imbedded in dirt on vehicles. Recently the gorse spider mite *Tetranychus lintearius* has been used successfully on private lands. A National Forest gorse control program has been in operation for several years within the watershed; gorse plants and shoots are pulled out of the ground by hand or cable in the spring while the ground is loose and before the plants flower. Opportunities to use the gorse spider mite on National Forest should be evaluated. .

There are several large patches of Japanese Fleeceflower (*Polygonum cuspidatum*) in escaped hedgerows in the lower river valley. This is a very aggressive shrub capable of great proliferation and should be controlled.

Further information on Powers plant species may be found in the Powers Herbarium plant collection, and in a Checklist of Common Plants on the Powers Ranger District (Shea 1992).

Future Trends

Table C-3 in the 1994 Record of Decision, Standards and Guidelines, lists over 300 total species of fungi, lichens, bryophytes, mollusks, arthropods, amphibians, mammals, and vascular plants which are selected to be protected through survey and management standards and guidelines. Extensive surveys for these species will commence during 1996. Known sites (such as *Arctostaphylos hispidula*) will be monitored and managed accordingly.

Under current Forest Service policies there will be less creation of early seral stage vegetation on Federal lands. The present aggressive program of controlling certain exotic plants and of cultivating native grass seeds is designed to slow the spread of non-native species. Seeding projects will replace exotic mixtures with native seeds.

On private lands within the watershed it is expected that extensive logging and ground disturbance will continue and early seral stages will be maintained (Figure T-6, 2040 Future).

Port-Orford-cedar

How is Port-Orford-cedar root disease distributed across the watershed?

~How can the presence and spread of the disease be managed despite differing land ownership?

Historic condition

This disease first entered ornamentals in the state of Washington in 1923. By 1942, the disease was discovered in the Willamette Valley of Oregon. Transportation and planting of ornamental cedar throughout Oregon spread the disease into southwestern Oregon within 10 years (Roth, *et al.* 1987). This lethal fungus was not native to the range of POC and may explain why the cedar appears to have no resistance to attack, unlike the Asiatic species of *Chamaecyparis* that is somewhat resistant.

Management activities in the past have led to the introduction of *Phytophthora lateralis* into the watershed. The spread of the disease has the potential to alter the distribution and quantity of Port-Orford-cedar within the watershed.

Current condition

Port-Orford-cedar (*Chamaecyparis lawsoniana*) is a minor but valuable component of the Sixes Watershed. It is found on a variety of geologic and soil types, occurring as scattered individuals or small groups within a stand. It occurs primarily at low-to-mid elevations within its natural range of Southwestern Oregon and Northern California. Within the Sixes Watershed Port-Orford-cedar and *Phytophthora lateralis* are distributed in known locations as shown in Figure T-8. However, a complete inventory and documentation is not available for private lands.

Port-Orford-cedar provides an important component for stand diversity and structure. It can be a component of the understory and/or overstory. It can provide long-term woody material for fish and riparian area structure, as well as large woody material and coarse woody material for small mammals, herbivores, amphibians, mosses, lichens, etc. on the forest floor. It has a high value as a timber product, as well as for special forest products. Large Port-Orford-cedar may provide exceptional nesting and roosting habitat for woodpeckers and other bird species.

Port-Orford-cedar can be infected with a lethal root disease *Phytophthora lateralis*. Port-Orford-cedar root disease, *Phytophthora lateralis* is spread by way of infected soil, water, and to a smaller extent root grafting. The fungus produces spores during its life cycle that can enter the watershed through transport in water or dry soil. Transport of soil on vehicles, machinery, and animals is the common method of spread (Zobel, *et al.* 1985).

The fungus has four spore forms that have different functions in the survival and transport of the disease. The fungus is able to survive (in Chlamydospore form) without a host for many years, depending on soil moisture and temperature.

Zoospores contact actively growing root tips of POC and germinate. Mycelium of the fungus grows through the inner bark and cambium of the root system and up towards the root collar of the tree. The mycelium plugs the water transport system of the tree, and moisture stress due to transpiration eventually kills the tree.

Management activities have been responsible for the majority of the transport of the disease through the spread of organic matter over long distances between infected and uninfected areas. Once the fungus is in a new area, it can move in water downslope from the infected site as an active zoospore or resting chlamydospore. The spread of the disease requires precise conditions of cool soil temperatures and saturated, to near saturated soil moisture over a period of time. Infection is highly dependent on the presence of free water in the vicinity of susceptible tree roots. High risk areas are streams, drainages, low lying areas downslope from infected areas, and roadways.

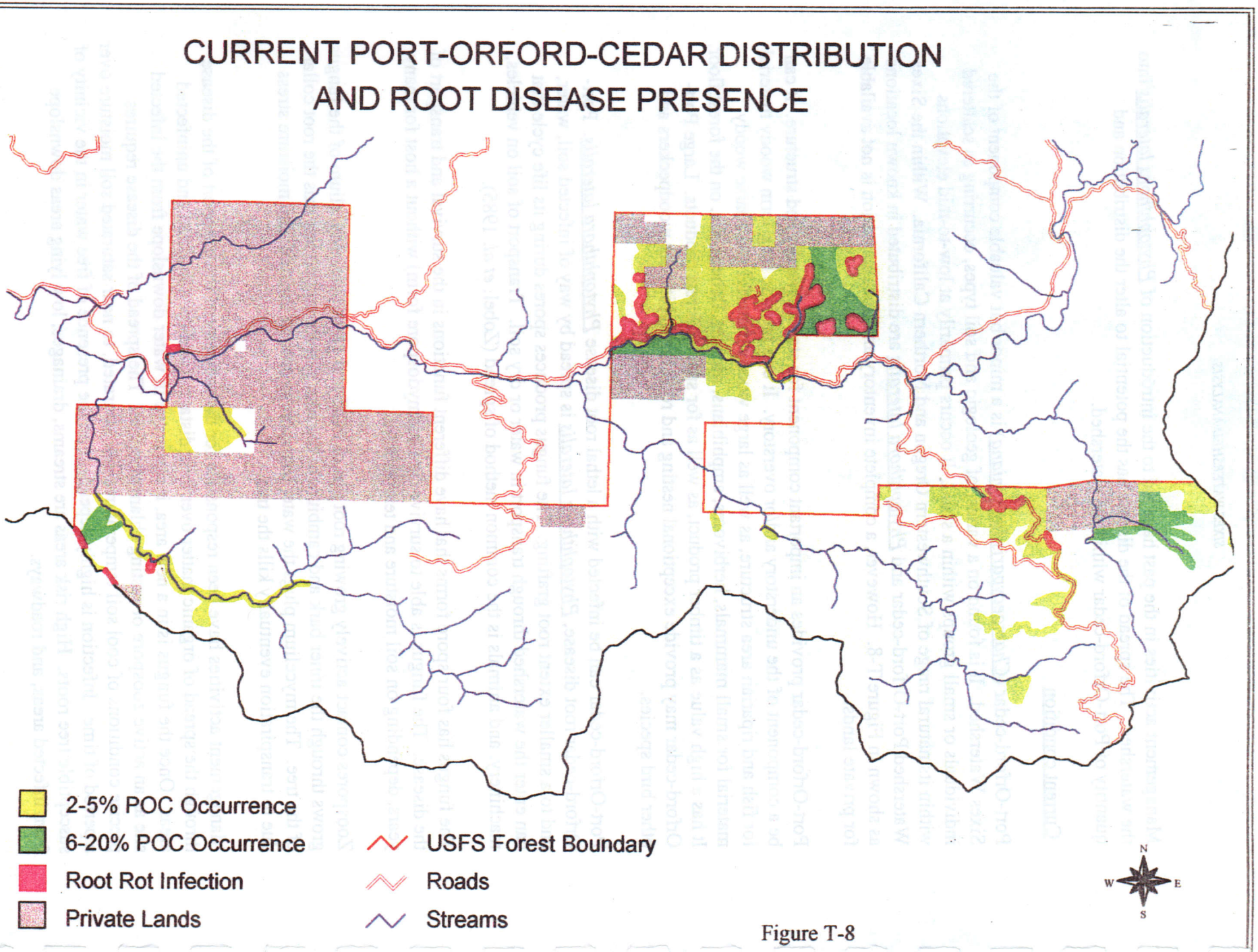

CURRENT PORT-ORFORD-CEDAR DISTRIBUTION
AND ROOT DISEASE PRESENCE
2-5% POC Occurrence
6-20% POC Occurrence
Root Rot Infection
Private Lands
USFS Forest Boundary
Roads
Streams
N
W
E
S

Figure T-8

Synthesis and Interpretation

It was not until the middle of the 20th century that *Phytophthora lateralis* entered into the Sixes watershed. Since that time the disease has migrated throughout "high risk" areas (along roadsides, and in creeks/streams below infected roadsides), as the conditions for its spread are ideal in the maritime climate that influences the Sixes watershed. Currently only about 28% of Federal lands within the watershed use some method of disease control strategies to manage the spread of *Phytophthora lateralis*. However, this percentage may be smaller as control measures implemented by the Forest Service and BLM are greatly hindered by the large percent of intermingled private ownerships. This may be the case especially where access to private land holdings must go through public lands.

Winter logging activities, and road accessibility during the wet season (October - April) may have contributed to the spread of the root disease throughout the watershed where control strategies, such as sanitization, road closure during wet season, limiting winter timber haul, and other strategies may not be instituted. It appears that only where there is large continuous public ownership is there an opportunity to manage the disease spread. At this time we can only assume that much, if not all of the private land is infected wherever Port-Orford-cedar is found along roads and streams.

IV. WATERSHED WILDLIFE

There are many diverse wildlife habitats in the watershed, all the way from the brackish estuary to high mountain ridges in the headwaters. Consequently, a wide variety of mammals, birds, reptiles, and amphibians are present.

Similar to the vegetation section, there is one key question which has been subdivided into eight parts. The same social and legal obligations previously explained also apply to wildlife management on National Forest lands.

Key Question:

How does the Sixes River Watershed contribute to wildlife species diversity and viability?

~What wildlife species are present?
~What important wildlife habitats are present?
~How are these habitats arranged across the landscape?
~How may the habitats be maintained and/or enhanced?
~What Proposed, Endangered, Threatened, Sensitive, or Rare species are present, and what is their status?
~What exotic species are present, and what is their influence on native species?
~What are the influences of human activities?
~What is the predicted future occurrence of wildlife in the watershed?

Historic Condition

Personal communication with local residents has helped to document past populations of wildlife species in the watershed analysis area and for use as a comparison with present day populations (Bogrett 1996, personal communication; Cuatt 1996, personal communication; Hofsess 1996, personal communication).

Historically, the Sixes River watershed had an abundance of western hemlock- Douglas-fir late seral habitats, with numerous non-forested meadows along the high ridges and low elevation river bottoms. Large stands dominated by hardwoods also occurred on drier, south facing slopes. At the landscape level these three habitats dominated; "special habitats" such as cliffs, talus slopes, hardwood stands, ponds, and lakes formed a relatively small component. Riparian areas along the main river and the numerous tributaries have always been present. Wildlife diversity, distribution, and abundance has varied since early times as these habitats underwent changes, natural and human caused.

Elk were present in large numbers historically, but were virtually exterminated by hide hunters in the 1860's and 1870's (Shea 1990). Numbers remained low until the 1960's when the Oregon Department of Fish & Wildlife transplanted elk from the Millicoma area back into the Sixes. There have always been good numbers of black-tailed deer present. Carnivores which were present historically and which are still common include black bear, raccoon, bobcat, mountain lion, coyote, mink, river otter, harbor seal, and California sea lion. Seals and sea lions would sometimes follow the salmon runs over a half mile up the river. Sea otters were common in the early 1800's (Morgan 1953) and were rare but present near the mouth early this century. Beaver, mink, and American marten were regularly taken by early trappers, and ringtails were present in small numbers. On one occasion during the 1940's a wolf was heard howling and tracks were found (Hofsess 1996, personal communication). Other mammals such as raccoons, brush rabbits, and mountain beavers were common. Porcupines were uncommon, and red and gray fox were absent. Undoubtedly, some of the rarer carnivores such as lynx, fisher, wolf, and grizzly bear were also present historically.

Birds found historically in the watershed include blue and ruffed grouse, California and mountain quail, great horned, screech, and spotted owls, Steller's jay, and many other species similar to what are present today. Bald eagles and ospreys were uncommonly observed, and no nesting of these two species was ever reported. Bald eagles would have congregated in the fall along the main river to feast on the spawning salmon. Golden eagles were historically more common, and nested along the high ridges as they still do today. Band-tailed pigeons were much more common in the past. There are accounts of great numbers of pigeons which used to congregate at the Blue Clay Slide mineral site on the North Fork of the Sixes River (Shorb 1996, personal communication). ODF&W surveys at this site show a significant decline in numbers in the last ten years. Peregrine falcons and marbled murrelets were also undoubtedly more numerous than at present.

Reptile and amphibian populations in the past are probably similar to the present. Alligator and fence lizards, garter and gopher snakes, and a variety of frogs have probably always been common. There are no historic records of western pond turtles or bullfrogs in the watershed.

Current Condition

Key Question:

What wildlife species are present?

The presence or absence of wildlife species in a given area is a direct result of habitat types available. All mammals, birds, and herptiles need certain types of ecosystems, and sometimes more than one type is necessary during the course of a normal life cycle. Wildlife distribution will change as a result of habitat changes.

Changes in seral communities is a natural process and not always negative. Intensive timber harvest in the Sixes watershed has reduced late successional habitat (Figure T-4). This has had a great impact on those species dependent on older forests such as spotted owls and marbled murrelets. In contrast, species such as deer, elk, bluebirds, and bobcats are dependent on early vegetative stages and thus benefit from those land management practices. A mixture of habitat types is important to maintain viability of all wildlife species.

Other unique habitats will affect distribution and breeding success of different species. Sites such as cliffs and scabrock slopes, ponds, meadows, and small openings, hardwood stands, and riparian zones provide habitat diversity that allow a variety of species to coexist (Appendix H: Amphibians, Reptiles and Mammals of the Sixes Watershed and their Associated Habitat; and Appendix I: Birds of the Sixes Watershed and their Associated Habitat). These constitute macro scale type habitats. Additionally, microsite conditions such as snags, downed wood, and patches of hardwoods provide necessary breeding, resting, and foraging habitat.

The behavior of wildlife species is also an important process in terms of where particular animals are found, which sites are more important and which areas receive little use. Seasonal migration patterns are significant and may be altitudinal such as deer and elk, north-south as with the neotropical songbirds, or east-west as with bald eagles or marbled murrelets.

Mammals

Approximately 60 species of mammals are presently found in the watershed (Webb and Shea 1990), including estuarine marine mammals such as harbor seals and sea lions. There are good populations of deer and elk at present. About 200 elk live in the upper drainage (Figure T-9) and deer are present throughout (ODFW 1996). The watershed is within the ODF&W Sixes Hunting Unit and they occasionally allow special damage hunts for elk such as occurred on the Powers Ranch in the 1980's. There are also many black bears (Shea 1995) in the drainage as they utilize the widespread early seral vegetation for feeding. Smaller mammals such as bats, mice and voles, tree and ground squirrels, mountain beaver, skunks, river otters, bobcats, raccoons, and coyotes are common. Cougars, American martens, gray

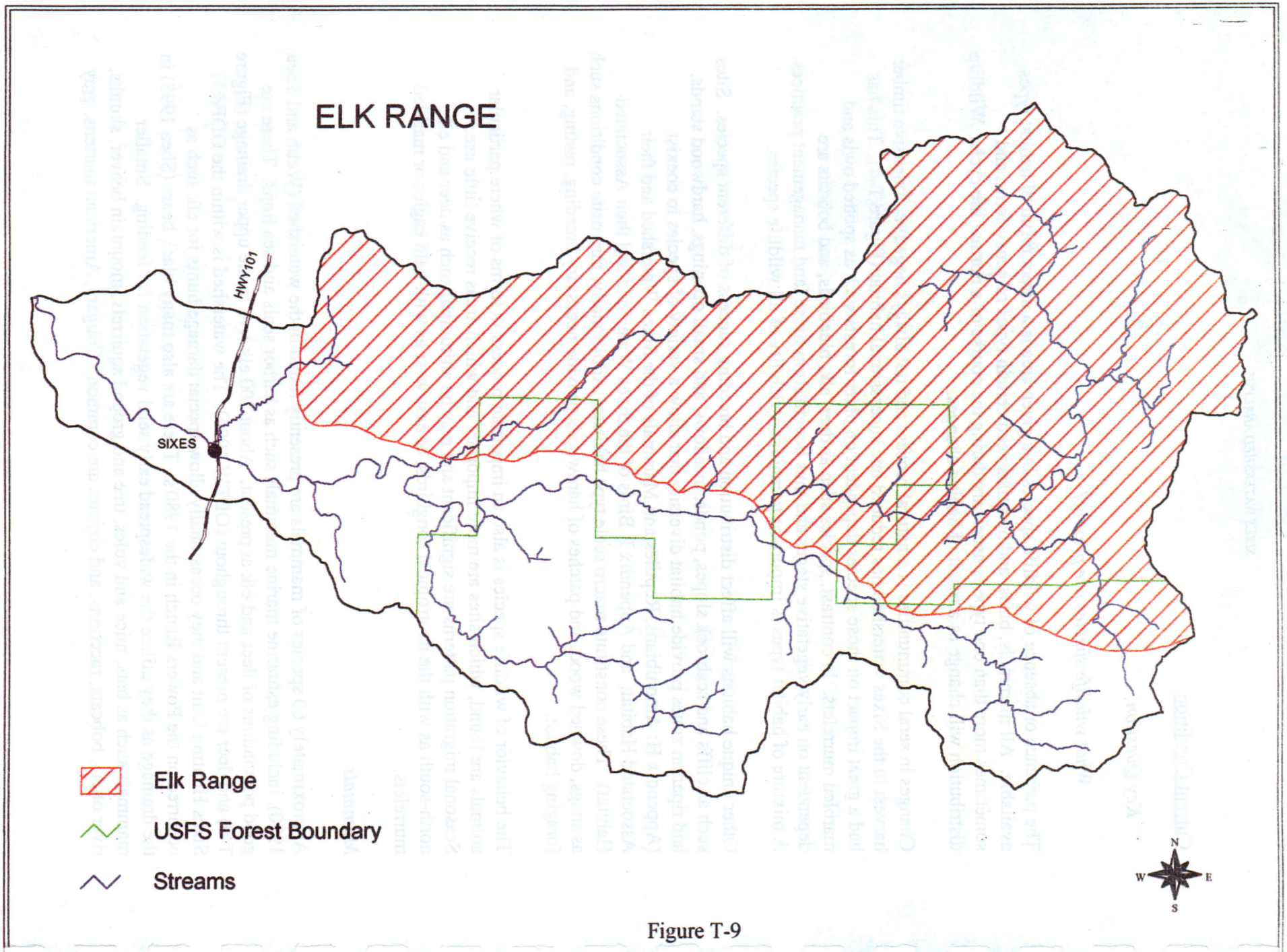

ELK RANGE
HWY101
SIXES
Elk Range
USFS Forest Boundary
Streams
N
W
E
S

Figure T-9

foxes, and ringtails are uncommon. There is a small population of ringtails in the South Fork of the Sixes (Bogrett 1996, personal communication), but Southwestern Oregon is on the extreme northwestern edge of it's range.

Non-native Mammals

The only exotic mammal known with certainty to be present in the watershed is the Virginia opossum. This mammal is a native of the eastern United States but was introduced into northwestern Oregon in the 1940's (Maser, *et al.* 1981). They have since spread south along the coast and are now a part of the Sixes River wildlife community.

Additionally, it is possible that house mice, black and/or Norway rats, and wild boars (Hofsess 1996, personal communication) also inhabit the watershed. These species occur primarily around human dwellings or structures and so would likely be found only around the Sixes community.

Birds

Approximately 154 bird species reside in the watershed (Webb and Shea 1991). Band-tailed pigeons do not exist in the numbers of previous years and appear to be decreasing (Shea, personal observation). Peregrine falcons are observed along the coast and slightly inland during the winter months but there is no documentation of breeding activity. Bald eagles also are seen occasionally but there is no recorded nesting activity in the Sixes watershed. There are no known osprey nests along the main Sixes river. A 15-mile Breeding Bird and Winter Bird Survey route was established the summer of 1995 that begins along the Rusty Buttes road and ends in the Elk River watershed.

Non-native Birds

Wild turkeys reside in the watershed and are not native to Oregon. The Oregon Department of Fish and Wildlife has been periodically stocking them in the area for years most recently in 1989 and 1993. Turkeys have been sighted in numerous parts of the watershed, particularly around the Powers and Dement ranches (District files). This stocking program will likely continue, and the birds often successfully propagate on their own. The impact of wild turkeys on native wildlife is probably slight though in some cases there may be competition for acorns.

Likely there are also starlings, pigeons, and house sparrows in the areas of human habitation (primarily the Sixes community). In some cases starlings establish wild populations and aggressively compete with native cavity nesters, particularly tree swallows, western bluebirds, and some woodpeckers.

Reptiles and Amphibians

There are 12 reptile species that occur in the watershed (Webb and Shea 1990) though the frequency of occurrence for three of these, western pond turtle, sharp-tailed snake, and

western terrestrial garter snakes, is unknown. Species such as the western skink, northern alligator lizard, gopher snake, and rubber boa are common. Southern alligator lizards are only occasionally found. Fence lizards and garter snakes are abundant.

There are 13 amphibian species in the Sixes watershed, three of which are classified as status unknown: the eastern bullfrog, western toad, and Del Norte salamander. The red-legged frog, foothill yellow-legged frog, and Pacific giant salamander are common. Olympic salamanders and tailed frogs are only occasional, and Pacific treefrogs and rough-skinned newts are abundant (Shea 1996).

Non-native Reptiles and Amphibians

The eastern bullfrog is possibly present in the watershed although it has not yet been documented. Bullfrogs are prolific breeders and provide a lot of food for predators such as kingfishers, mergansers, ospreys, raccoons, mink, river otters, etc. However, they are also a large aggressive species and will feed on native frogs. They severely limit the rare western pond turtle populations where they occur together because they eat the young turtles.

Key Question:

What important wildlife habitats are present?

Special and unique habitats do not exist in abundance within the watershed boundaries. Meadows, ponds, hardwood stands, and talus slopes do, however, provide some diversity to the predominant habitat type of temperate coniferous rainforest, and the large majority of these acres are on private, non-federal lands. Of a total of 85,800 acres for the watershed, approximately 3,660 acres are occupied by meadow habitat, of which less than 20% are on National Forest land; approximately 70 acres occur in talus slopes, all on private lands; and 10 acres are in ponds, also all on private lands (Figure T-10).

Most meadows exist in the northern half of the watershed and although they provide great benefit for those wildlife species that utilize open landscapes, the main focus of these areas is the grazing of domestic livestock. The management of the meadows solely for the benefits of wildlife is probably not occurring and activities such as repeated burning and the planting of native grasses and forbs also is not taking place. Only part of one meadow system is on National Forest land and that is the Taylor Ranch meadows just north of the Sixes River.

Talus slopes, conversely, completely lie within federal ownership interspersed among the South Fork of the Sixes River. These are not large, ranging in size from 1 to 15 acres. Approximately 100 acres of hardwood stands are located in the South Fork of the Sixes River drainage.

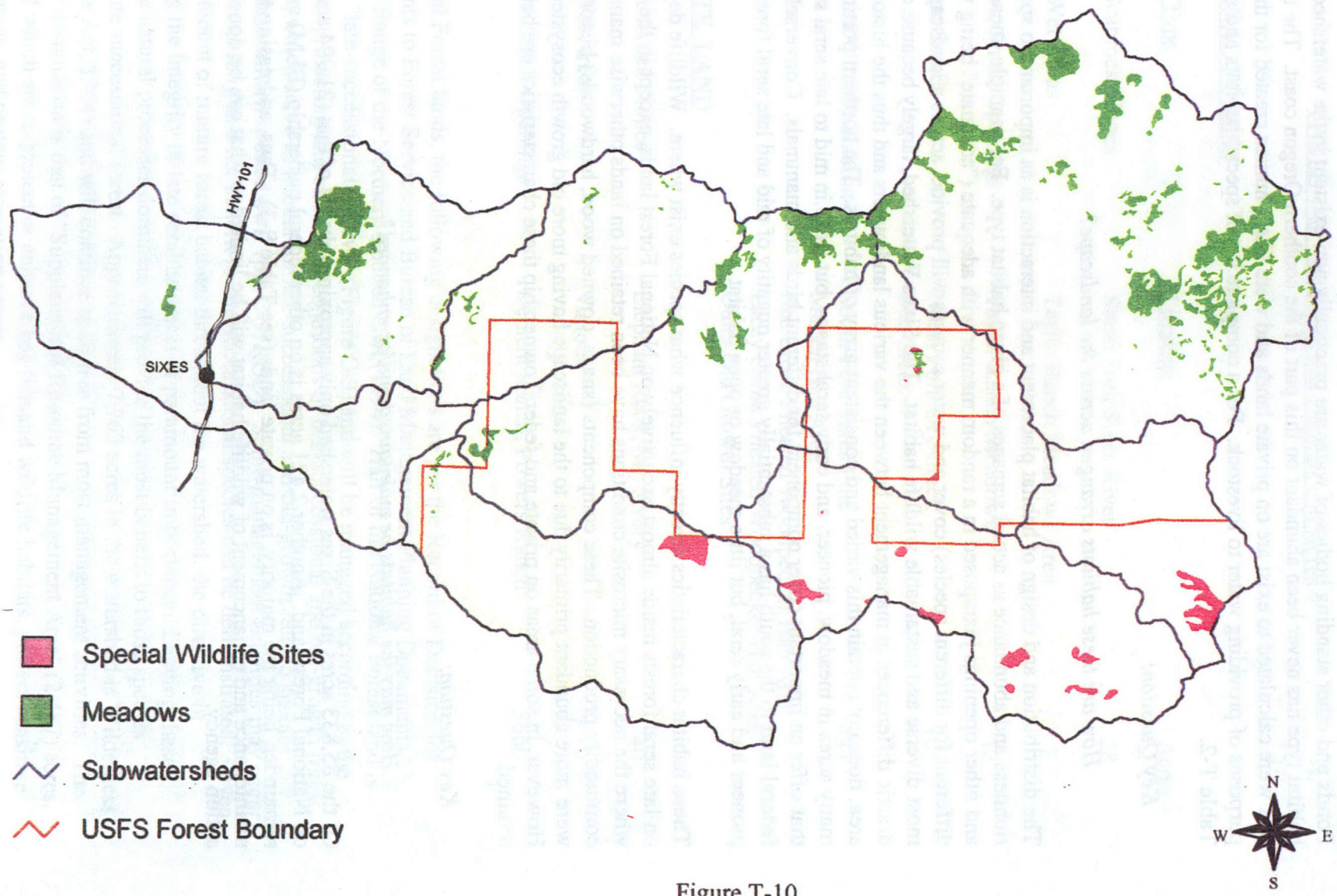

SPECIAL WILDLIFE SITES AND MEADOWS
HWY 101
SIXES
Special Wildlife Sites
Meadows
Subwatersheds
USFS Forest Boundary
N
W
E
S

Figure T-10

Ponds and other standing bodies of water are practically non-existent in the watershed. This habitat type has never been abundant on this part of the southern Oregon coast. The ten acres that were calculated to exist are on private lands and were likely human created for the purposes of providing water to livestock. For a complete list of special habitats and acres see Table T-2.

Key Question:

How are these habitats arranged across the landscape?

The distribution and design of habitat placement and interaction is as important to species richness and abundance as actual acreages of a given habitat type. For example, meadows and other openings juxtaposed in a random manner with adequate ("adequate" being very different for different species) cover and water sources will provide, across a landscape, the most diverse and sustainable wildlife habitat. The Sixes Watershed, largely because of the drastic differences in management between the various landowners and thus the history of the area, does not contain this varied and consistent array of habitats. The northern portion has many acres in meadow, pioneer, and early seral stages, but lacks in mid to late seral stages that offer an important cover component for different birds and mammals. Conversely, the federal land to the south has a substantially greater quantity of mid and late seral forest, some pioneer and early seral, but little meadow or open habitat.

These habitat characteristics directly influence what species exist where. Wildlife dependent on late seral forests reside almost exclusively on National Forest lands, except in the cases where the necessary microsite conditions have been retained on lands otherwise managed for commodity production. These components (snags, downed wood, hardwoods) historically were more abundant primarily due to the landscape having more old growth ecosystems. However, in some areas on private and federal ownership these characteristics are being retained.

Key Question:

How may the habitats be maintained and/or enhanced?

Of the 85,833 acres in the Sixes watershed only approximately 1/4 of that (21,994 acres) is on National Forest land. Another 2,421 acres is on other federal ownership (BLM) and the remainder, being the majority, is on private lands (see Table S-3). Thus, addressing the maintenance and enhancement of wildlife habitat will be limited to what can be done by this action agency.

TABLE T-2: List of Special Habitats and Acres

NATIONAL FOREST

Habitat Type	Location	Acres
Cliffs, Scabrock Slopes	South Fork Sixes River	28
Ponds, Wet Areas	Taylor Ranch Meadows Area	1
Meadows, Small Openings	Taylor Ranch Meadows	12
Hardwood Stands	North Fork Dry Creek Bee Creek	101
Designated Wildlife Habitat	South Fork Sixes Pine Marten Hab Area Bee Creek Pileated Woodpecker Hab Area Lacey Cabin Pileated Woodpecker Hab Area Other Old Growth Sites	487

PRIVATE LAND

Cliffs, Scabrock Slopes	Elephant Rock, Mt. Avery	40
Ponds, Wet Areas	Various	9
Meadows, Small Openings	Dement Ranch, Powers Ranch	3660

On National Forest lands, the following designations are per the Record of Decision for Amendments to Forest Service and Bureau of Land Management Planning Documents Within the Range of the Northern Spotted Owl (1994). Half of the National Forest land is designated "late-successional reserve" (Figure O-3) and will be managed according to the objective of "protecting and enhancing conditions of late-successional and old-growth forest ecosystems, which serve as habitat for late-successional and old-growth related species including the northern spotted owl" (pg. C-9, ROD). Some management activities may occur in LSR acres as long as a net benefit to late-successional species can be demonstrated. Given the small amount of mature forest habitat throughout the watershed, the directive of maintaining the integrity of late seral habitat is of paramount importance. Leaving these areas where natural processes dominate will provide the most benefit to those species requiring late successional forest. Approximately 7,763 acres in the watershed is Wilderness (Wilderness Act, 1964) and will continue to be free from most management activities. The third major designation is that of "Supplemental Resource Management Area" (2,487) acres, the goals of which are to protect or enhance key fish and wildlife habitats, protect sensitive watershed areas, and protect recreation values.

It can be assumed that the majority of the land in the northern portion of the watershed will continue to be maintained in an early seral habitat component. This will benefit some species but will also continue to exclude others that once occupied these lands. Likewise, it can also be assumed that watershed land to the south will remain in mature forest and will not benefit those species that rely heavily on open habitats. It would seem that across the landscape (in terms of macroscale habitat conditions) this dichotomy of ownerships and focus is not going to change much. However, a management option available to all landowners and one that may be very useful in the long term for maintaining sustainable populations of many wildlife species is that of retaining microsite habitat conditions (snags, downed wood, hardwoods) within managed areas.

Key Question:

What Proposed, Endangered, Threatened, Sensitive, or Rare species are present, and what is their status?

Five federally designated Endangered or Threatened species are known to spend at least a portion of their life cycle in the Sixes watershed: peregrine falcon (Endangered), bald eagle (Threatened), northern spotted owl (Threatened), marbled murrelet (Threatened), and snowy plover (Threatened). More information on these species is provided below. Additionally, several species are listed by the U.S. Forest Service as "sensitive" and include: Pacific western big-eared bat, white-footed vole, red-legged frog, western pond turtle, Del Norte salamander, and common kingsnake. The red-legged frog, Del Norte salamander, and western pond turtle have been surveyed in the watershed and the remaining species have not been extensively surveyed. Red-legged frogs are common in the Sixes drainage. No western pond turtles or Del Norte salamanders have been found.

Bald Eagle

The Sixes River drainage has been designated as a "key area" for bald eagle (Haliaeetus leucocephalus) recovery in the Pacific Bald Eagle Recovery Plan (1986). The Sixes drainage is included in Zone 23, the California/Oregon Coast portion of the plan and is one of twenty-two key areas identified. Critical to attaining recovery goals is the management of these key areas and land management agencies should "provide for eagle requirements in both key areas and potential nesting areas, and eagle habitat management must be a primary consideration in key occupied areas". Additionally, the Sixes, as well as the Elk River to the south, is listed in the Working Implementation Plan for Bald Eagle Recovery in Oregon and Washington (1989) as a "Potential Territory".

There are currently no known territories in the Sixes River drainage, nor is there a known wintering population. A single bird was most recently observed along the river during the spring of 1996 and a pair was seen at Floras Lake (north of the watershed) in 1996 (Heaney, 1996). Target recovery territories for the area is one (1). Tasks needed to achieve recovery of the species are outlined in the "step down" portion of the plan (see Appendix J: Pacific Bald Eagle Recovery Plan).

Additional direction for bald eagle management on the Siskiyou National Forest is found in the Land and Resource Management Plan (1989). Existing active and inactive nest sites and designated recovery sites will be protected, as well as feeding and roosting sites (pg. IV-28, LRMP).

There has never been a complete survey done for bald eagle use and distribution in the Sixes River drainage. The need for such a census, identification and documentation of eagle activity and behavior as well as delineation of suitable nesting, roosting, and perching habitat is critical and necessary to meet recovery plan tasks. Given that pairs of eagles have been observed at several nearby locations such as Floras Lake, Bandon Marsh, and the South Fork of the Coquille River, it is possible that there are nesting birds within the Sixes River drainage. Two recommendations for further bald eagle investigation in the Sixes area are to (1) compile all sighting data for the drainage with maps and written comments on birds observed, and (2) begin yearly winter route surveys to document bird activity. These routes are run during a two week period in January and must be done consistently year after year. They do not need to be a set length nor is there any specific protocol along the route. Surveyors watch for birds and may stop at any time for extended observation at a particular location. Additionally, it may prove justifiable in the future to do an aerial survey to look for nests.

Peregrine Falcon

The Sixes River drainage lies within one of the Pacific Peregrine Falcon Management Units for Southwest Oregon (Recovery Plan for Peregrine Falcon, 1982). These management units represent geographic areas either known to be occupied or that were historically occupied and are still suitable for peregrines. According to the Recovery Plan the ultimate goal for the unit including the Sixes, is to have ten active nest sites producing young over a five-year period. Recovery Plan objectives for peregrine falcon are outlined in Appendix K.

Interestingly, there have, over the past 20 years, been consistent sightings of peregrine falcons in the Sixes area and surroundings. These observations largely come during the winter so breeding status is undetermined for most areas where birds reside. The New River to the north of the Sixes watershed consistently has peregrine falcons present during the winter months (Mangan 1996, personal communication). It is unknown where, or if, these birds are nesting.

From 1989 to 1991 habitat managed by the Coos Bay District of the BLM, Siskiyou National Forest, and private land in Southwest Oregon was surveyed to document presence and/or potential occupation by breeding peregrine falcons (Pagel 1991). Many cliffs (> 70) were aerially and ground surveyed for falcon presence and overall habitat suitability. Elephant Rock is rated as "medium-high" quality habitat although no birds were located during the 1989, 1990, and 1991 surveys. Specific recommendations in the report include that:

1. Funds and personnel should be made available for surveys of medium-high potential cliffs every two to three years, and

2. Peregrine falcon sightings during the breeding season should be seriously examined. Medium-high potential (Mangan, *et al.* 1988) cliffs near reported sightings (within four to eight miles) should be examined to determine occupancy.

The Oregon Department of Fish and Wildlife was involved in a falcon rearing project at Cape Blanco in 1991. The four young were banded and all fledged but unfortunately, there has been little documentation since then regarding the fate of the birds (Collins 1996, personal communication).

Peregrine falcons are addressed in the Siskiyou LRMP on page IV-29, and specifically the objectives include that "sufficient existing nesting and feeding habitat shall be protected to meet the objectives of the Pacific Coast Recovery Plan", and that "all existing nest sites and any new nests shall be protected, and feeding areas may be enhanced."

Mt. Avery, managed by BLM, is also a site within the watershed that has the potential for peregrine falcon nesting habitat, though birds have not been documented there to date.

Northern Spotted Owl

Surveys for spotted owls on the Powers Ranger District have been done since the late 1970's. The information from these surveys was recently reviewed (March, 1996) and areas where pairs or single birds over a period of three years were located were designated as "spotted owl activity centers". Within the Sixes watershed there are four activity centers. It should be noted that most surveys done have been completed in response to proposed project work. Thus, there are gaps in the landscape where owls have not been surveyed and more owl information is needed to be collected. Additionally, since the adoption of the ROD and thus, LSR designation, the Forest Service has been doing no spotted owl surveys at all. It is assumed that Late-Successional Reserves will adequately provide for sustainable populations of owls over the long term.

Spotted owls have been surveyed on BLM land in the Crystal Creek drainage with no birds being detected. Owls have not been surveyed at the BLM recreation site. Additionally, owls have been inventoried on Georgia Pacific land with no new activity centers being detected.

Marbled Murrelet

Surveys for murrelets have been done on the Powers Ranger District since 1989. Initially, only general surveys were done which involved driving a transect with a set number of points and listening at each point for 10 minutes. Subsequently, it was determined that intensive surveys would yield much more information and they were implemented. The Sixes River is an important murrelet travel route and occupied behavior has been observed on National Forest and BLM land along the Sixes River. Most surveys have been done in response to project proposals and not with the objective of determining what habitat the birds are using.

Murrelet surveys conducted by the BLM include numerous detections (presence only) from near the mouth of the South Fork, and many occupied detections in Rowland Creek, including along the dividing ridgetop. Georgia Pacific has not found murrelets on their lands.

Work proposed on National Forest land is surveyed intensively for two years to determine marbled murrelet presence or occupancy. Areas determined to have "presence" of murrelets require that work activity only occur during set dates of the calendar year. A determination of "occupancy" entails that an area of protected habitat be designated around the location of observed murrelets. The draft recovery plan for the murrelet has been completed by the U.S. Fish & Wildlife Service and the final is pending.

Snowy Plover

The Southern Oregon coast has several areas designated as suitable plover habitat and these primarily include tracts of open, sandy beach. The North Spit of Coos Bay and the Dunes National Recreation Area, as well as Floras Lake and New River are prime examples. Within the bounds of the watershed, however, which has been deemed to be just north of Castle Rock and approximately one mile south of Cape Blanco, there is not an abundance of suitable habitat; plover status is unknown (Mangan 1996, personal communication). Most of this area is rocky and would not meet the needs of the bird; however, presence is possible, and they are included in this write-up.

Key Question:

What "species of special concern" exist in the watershed?

Small Forest Carnivores

One of the most sensitive measurements of the integrity of natural ecoysystems is the health of the small carnivore populations of the area. Carnivores represent this group of species and certain ones, such as the wolf, grizzly bear, and mountain lion have been studied extensively in the past. The smaller forest carnivores such as the American marten, fisher, lynx, and wolverine, have not been studied much and during this century the populations have shrunk considerably. Habitat loss, residential development, increased back country roading, trapping pressure, and sensitivity to humans have all contributed to the decline (Zielinski and Kucera 1995).

Several petitions have been submitted recently to the U.S. Fish & Wildlife Service to list three of these four (fisher, lynx, and wolverine) as endangered under the Federal Endangered Species Act. So far, all have been denied except for the wolverine, for which a decision is still pending. Different State and Federal agencies have designated them as "management indicator," "sensitive," and "species of special concern." In Oregon, at present, the wolverine is the only one listed under the Regional Forester's sensitive species list, and also is on the ODFW State T & E List as threatened, and the California State Threatened List. In Oregon, the lynx is considered extirpated and is designated as a "furbearer with a closed season". Neither lynx nor wolverine are considered residents of the Siskiyous presently though

interviews with local people and previous Forest Service employees indicate that at least historically, lynx were present in some areas on Galice District and at Powers (Ford 1993, personal communication and Hofsess 1996, personal communication). American marten and fisher are listed in Oregon on the ODFW Sensitive Species List and in California by the Department of Fish & Game as species of special concern. Interestingly, these species are also listed in the Oregon Furbearer Trapping and Hunting Regulations (July 1, 1996-June 30, 1998). The fisher has a closed season the entire year and the marten may be trapped west of highway 97 from November 1 through January 31. Furtakers are requested to submit date, location, sex, and carcass to the local ODFW office before March 1. This information is considered critical to successful future management of American marten.

In the past, it has been extremely difficult to survey for these species due to their secretive nature, their tendency to leave little visible sign of their presence, being nocturnal and naturally very shy of humans, and occurring at low densities. In recent years, however, with the use of remote camera stations, track plate devices, and snow tracking, data are being accumulated to learn more about their life histories.

Powers has been doing camera surveys since 1991, however, none have been done in the Sixes River Watershed. Sightings and suitable habitat are indicators of a need for such surveys.

Northern Goshawk

The Northern Goshawk, the largest accipiter in North America, has become a species of concern since the early 1990s. It is listed as a Category II species with the U.S. Fish & Wildlife Service, which means insufficient information is available to warrant a listing of threatened or endangered status at this time. In California, the species is listed as "sensitive", a species of special concern. In Oregon, it is listed as a management indicator species on some National Forests. The primary reason for concern is loss of the goshawk's preferred habitat, old-growth forest.

Key Question:

What exotic species are present, and their influence on native species?

In general, the presence of exotic wildlife species has negative impacts on native populations. Examples of this include the effect the European starling has had on certain species of songbirds, or the decline in western pond turtle numbers due to the voracious feeding habit of the eastern bullfrog. Occasionally, the effects may be minimal or difficult to discern as in the introduction of the wild turkey. The effect of increased "edge" habitat that results with the removal of forested land will continue to provide areas for many of these exotic species to dwell. Although the watershed is still relatively free of non-native animal species at present, number and kinds will increase in the future.

The exotic nutria is a mammal that will also need to be considered in the future. Although not present yet in the drainage, they were introduced into Northwestern Oregon in the 1930's on commercial fur farms. They have since steadily spread south into every major waterway, and are currently found in large numbers in the Umpqua River drainage 40 miles to the north. It is only a matter of time until they spread south and are also present in the Coos, Coquille, and Sixes River systems, where they may directly compete with native beavers and muskrats.

Key Question:

What are the influences of human activities?

The greatest influences to the drainage have occurred with timber removal and clearing land for the grazing of domestic stock. This has resulted in a landscape that is maintained primarily in an early seral stage, thus favoring those wildlife species preferring those habitat conditions. Constant soil and slope disturbance also favors the invasion of exotic plant species which often deteriorate wildlife habitats.

What is the predicted future occurrence of wildlife in the watershed?

If current land use practices continue (Figure T-6) those wildlife species dependent on early seral stage conditions will prosper. These will include deer and elk, and birds such as quail, woodpeckers, and bluebirds. This will primarily occur on private lands in the north portion of the watershed. Those species dependent on older seral stages, such as spotted owls and murrelets will not increase rapidly, however, they should have a slow recovery in areas designated as LSR or Riparian Reserves on Forest Service land in the south portion.

V. FINDINGS OF FACT

Watershed Disturbance Agents

- Historically fire has been one of the primary disturbance agents; but fire occurance is low in the Sixes Watershed and the western Hemlock plant series has a fire return interval of over 250 years.

- Timber harvest on National Forest lands peaked in the late 1960's; and timber harvest is the dominant disturbance agent today.

- Two percent of the National Forest within the watershed is in a land allocation (matrix) that allows scheduled timber harvest.

- 25% of the watershed, nearly all of the federal ownership, is unavailable for timber harvest due to Congressionally withdrawn designations. Late Successional Reserve lands have severe restrictions on harvest activity, and must meet objectives compatible with species dependent on older seral stages.

Watershed Vegetation

- A wide range of vegetation exists in the watershed due to the moderate climate, abundant rainfall, different soil types, range of elevations, disturbance agents, and diversity of habitats.

- Vegetative composition and seral stages have changed dramatically in the past 100 years, mostly due to human activities such as grazing of livestock, road construction, and logging. The trend has been from late seral/climax stages to pioneer and mid-seral stages.

- There are several rare, listed plant species present in the watershed, all of which currently have healthy populations and adequate safeguards for survival:

  Hairy manzanita (*Arctostaphylos hispidula*)
  Coast fawn-lily (*Erythronium revolutum*)
  Western lily (*Lilium occidentale*)
  Large-flowered goldfields (*Lasthenia macrantha*)
  Pink sand verbena (*Abronia umbellata*)
  Silvery phacelia (*Phacelia argentea*)

  Hairy manzanita and coast fawn-lily are in late-successional reserve on Forest Service land. The other four are on BLM land and state park land along the coast.

- There are approximately 80 species of exotic plants present in the watershed which tend primarily to establish in areas of extensive ground disturbance such as road building, logging, intense prescribed burning of logging slash, and overgrazing.

- Current gorse control on federal land has had some success. Use of gorse spider mites on private lands has been effective.

Port-Orford-cedar

- Port-Orford-cedar is of high commercial value.

- *Phytophthora lateralis* root disease exists in the watershed.

- *Phytophthora lateralis* moves in water via aquatic spores, as spores in mud transported by people, machinery, or animals, or by growing through root grafts between adjacent trees.

- Dry conditions reduce the danger of spread by spores but do not kill the fungus or its resting spores.

- Soil moisture is by far the greatest environmental influence on the spread of *Phytophthora lateralis*.

- Control strategies on federal land are implemented on all ground disturbing activities to control import and spread of *Phytophthora lateralis*.

Wildlife

- There has been a major increase in early seral stage habitats in the drainage in the last century.

- Wildlife species associated with late successional forests have declined in numbers and distribution, while early successional ones have increased. This finding is reached based on acres of seral habitat presently available.

- Beginning in the early 1990s, land management on federal land focused on the retention and maintenance of late-successional forest, with direction provided by the Northwest Forest Plan (1994).

- Surveys have documented spotted owls in several sites in the drainage. Owl activity centers and suitable habitat within the late-successional reserve and the Grassy Knob Wilderness should provide for stable populations within the watershed.

- Occupied behavior has been documented for marbled murrelets on National Forest.

- Roosevelt elk now occur in the watershed in higher numbers than a century ago.

- Exotic wildlife species present in the drainage include the opossum and wild turkey, and possibly a few other birds and mammals.

VI. SUMMARY OF DATA GAPS

Watershed Vegetation

- More general plant surveys are needed to make a complete inventory of plants in the watershed on all ownerships.

- More intensive plant surveys are needed on rare and sensitive species present on Federal lands, and on plants specifically listed in the 1994 Record of Decision.

- Areas of special interest for further plant surveys include; Mt. Butler, South Fork Sixes Canyon, Dry Creek, and Taylor Ranch Meadows, each of which represents a unique habitat for plants.

- Exotic plant surveys are needed to determine the extent of these species, and the possible need for treatment.

Wildlife

- More general wildlife surveys (presence/absence, numbers, habitat use) are needed for basic information on such species as ungulates, furbearers, neotropical songbirds, raptors, small mammals, reptiles, and amphibians.

- More intensive wildlife surveys are needed on rare and listed species such as murrelets, peregrines, spotted owls, eagles, goshawks, big-eared bats, red tree voles, red-legged frogs, white footed vole, and western pond turtles to comply with the Endangered Species Act.

VII. MANAGEMENT RECOMMENDATIONS

Disturbance Agents

- Propose programmed timber harvest on Federal lands (primarily Forest Service) in the Sixes Watershed as displayed in Figure T-3. These areas have been previously managed and the opportunity exists in the near future (revisit these opportunities after 2006) to commercially thin these young managed stands.

- Propose commercial thinning in LSR, where treatment may enhance late-successional characteristics while maintaining consistency with the ROD. The map displayed in Figure T-3 shows the proposed sites of commercial thinning in unmanaged stands. These opportunities currently exist, but are subject to site specific analysis for their validity in meeting the objectives of the LSR.

Large Woody Material

- Treat managed stands in LSR where opportunities exist to enhance the stands toward late-successional characteristics, including characteristics such as large diameter conifers, vertical structure, and species diversity.

- Locate high priority areas for riparian planting of conifers where future large conifer recruitment is low.

Soil

- Use broadcast burning on harvest units only when moisture is high enough to avoid complete, or near complete fuel consumption.

- Use logging systems that minimize soil disturbance/compaction.

- Identify restoration projects that will reduce soil quality losses from road fill failures.

Watershed Vegetation

- Maintain special plant habitats and species diversity by such methods as prescribed burns in meadows; selective thinning in older, mature stands; and by maintaining adequate and clean water flows to wetlands and riparian zones.

- The gorse and tansy control programs should be continued by monitoring, physical removal, and use of biological controls. Treat machinery which works in gorse-infected areas by washing and disinfecting before entering National Forest lands for other projects. Explore the use of the gorse spider mite for use in the control on federal land.

- Coordinate with other Federal and private organizations and landowners in an active noxious weed abatement program.

- Discontinue the use of exotic seed mixtures on National Forest. Native grass seed will be collected for use on ground disturbing activities such as road obliterations.

- Continue to survey and monitor rare plant populations. Protect or restore known sites by such methods as road closures or by removal of competing vegetation such as European beachgrass.

Port-Orford-cedar

- Continue control strategies for site-specific projects.

- Continue annual POC monitoring.

- Continue monitoring and mapping spread of *Phythophthora lateralis*.

- Identify and map low risk water sources for fire suppression and other management purposes.

- Develop partnerships with small landowners and private timber companies to develop strategies to help control the spread and import of *Phythophthora lateralis*.

Wildlife

- Maintain or enhance existing meadows (such as Taylor Ranch) through burning and cutting encroaching vegetation. (See "Unique Habitat Restorations", pg. 143, Southwest Oregon, LSR Assessment, 10/95).

- Continue intensive herptile surveys in cooperation with ODF&W. This information is useful for western pond turtle and red-legged frog, both sensitive species.

- Continue Neotropical Breeding Bird Survey and Winter Bird Survey routes that have been established in the drainage. These give excellent basic data on species presence and population trends.

SOCIAL DISCUSSION

I. CHARACTERIZATION

A. Social Setting

As the evolution of the watershed area is influenced by human activities, so too are the human lifestyles and activities influenced by management activities in this area.

Residents of the local area pursue a variety of lifestyles, but many share a common theme and orientation to the outdoors and to natural resources. This orientation is reflected in both vocational and leisure pursuits.

Commercial fishing, agricultural, timber, and tourism industries are economic mainstays of the local areas. An economic analysis of Oregon coastal communities reveals a heavy dependence on natural resources. Yet, despite the common concern for and dependence on natural resources, social attitudes differ sharply with respect to managing these resources. Local residents offer a broad spectrum of perspectives, ranging from preservation to maximum development and utilization of natural resources.

The public has identified a number of values with social implications. One commonly held value is that National Forest lands should contribute to the employment of local citizens. In rural areas that have developed with and are dependent on local natural resources, the question most commonly asked is how much timber will be cut. This question of how much federal timber will be cut has a direct effect on local employment.

A similar question could be asked for every commodity that has been or could potentially be produced within the watershed. Key questions have been developed asking what local employment opportunities are present for the commodities traditionally produced within the watershed.

A second commonly held value is the desire for access to public lands and uses of public lands for non-commodity uses. There is often interest in a variety of recreational uses, and the list gets longer every year. Access even without a recreational focus is often an issue.

There is an increasingly sharp division among individuals who favor commodity production and those who favor easy access to plentiful recreational opportunities and those individuals who favor protection or conservation of natural resources. We hope to identify where and when these conflicts between values and resources exist.

B. Commodity Values

What type and amount of employment has the Sixes River drainage contributed to the local economy?

From logging and wood processing?
~On Federally managed lands?
~On private ownerships?

From other products (special forest products) on timber lands?
~On federally managed lands?
~On private ownerships?

From agriculture and ranching?

From fish harvest and processing?

From mining and mineral extraction?

From recreational uses?

Economic development in and around the Sixes River follows a pattern similar to that seen along much of the Oregon coast; fur trade and trapping, mining, homesteading and settlement with subsistence agriculture, commercial fishing, and timber harvest and wood processing. Economic development was and is based on the area's natural resources. Most recently recreation has expanded as a source of employment.

Mining

Historic Conditions

White settlers and miners started moving into the area in the early 1850's. Jake Summers came to Port Orford with the Tichenor party in 1851. He acquired a Donation Land Claim of 160 acres at the junction of Crystal Creek and the Sixes River. The success of Jake Summers' mining on the Sixes River also created a small gold rush around 1856. This led to the construction of a small mining community in the rugged canyon of the South Fork, known as Summersville. Miners have worked the creek almost continually since that time. In the mid 1870's a second mining boom occurred at the mouth of the South Fork Sixes River. This area was further developed by the Hydro Sixes Mining Company in 1914.

Placer mining was common and profitable on the Sixes for about 30 years. Gold mining continued until the 1930's through the use of hydraulic giants at the mouth of Dry Creek and on the South Fork Sixes. These giants caused a change in the stream channel of the Sixes River, which has been previously discussed.

Current Conditions

Since the boom days of gold mining on the Sixes it has been an industry in decline. It has not been economical to mine the Sixes since about World War II. However, a number of mining claims still exist along the river. There is currently no placer mining, and suction dredging is the most common method of gold mining today. Many of these small dredges will be operating on the weekends during summer low water. The effects of suction dredging increase geometrically with the diameter of the intake hose. The magnitude and significance of the effects from small suction dredges seems minor when compared to larger suction dredges and other past methods of mining.

One center of suction dredging activity is at the Sixes River Campground managed by the BLM. There is no current limit on the number of dredges that can operate in this section; therefore a noticeable increase in turbidity occurs, to the detriment of aquatic processes.

The BLM has overall responsibility for mineral resources on federal lands and their 1994 records show approximately 63 placer claims and 67 lode claims in the watershed. The locatable minerals, in this case gold, have high potential; however, it is not currently economical to extract the minerals that are located. Only small quantities of gold have been extracted in recent years. The small amounts of gold recovered will not support additional capital investments. By comparison the Sixes River has a higher number of claims than Johnson Creek on the South Fork of the Coquille or Elk River (Fritz 1996, personal communication), this shows that there is a relatively high amount of interest in the gold resources of the Sixes River. See Appendix A for additional discussion of mineral potential.

None of the gold mining activity currently taking place produces significant employment. Curry county employment statistics show .01% employment in the mining industry. This can be attributed to the production of rock, sand and gravel. Labor and proprietor income from mining is 0% of Curry county's total. (McGinnis, *et al.* 1996)

In addition to locatable minerals (gold), there is also leasable and saleable mineral potential within the watershed. There is a low potential for leasable minerals, such as coal, oil, and gas. The saleable minerals, sand, gravel, rock, and stone have high potential and these resources are mined within the watershed.

Future Trends

It is expected that the current trend will continue and mining will not make any significant contribution to employment in the local area.

There will continue to be conflicts between suction dredging interests and resource protection, especially increased turbidity, the resorting of gravels, etc., that affect the reproduction and development of salmonids.

Agriculture

Historic Condition

A settlement named Eckley was formed near the North Fork of Sixes River in 1860. At least three large families lived there by subsistence farming and cattle ranching. Other settlers moved onto land in Otter and Big Creeks. Ellis S. Dement bought the Eckley Ranch in 1927. Today it is a remote cattle ranch.

The lower five miles of the river runs through a broad coastal plain now used for agriculture, mainly livestock production (cattle and sheep) and berry production (cranberries, blueberries, caneberries). Curry County including the Sixes area produce a majority of the world's Easter Lily bulbs. Most livestock operations also manage for timber production on small woodlots. The next five miles upriver are a narrow valley with continuous grassy river benches, now used for livestock pasture and home sites. Along the upper 18 miles, there are 2,000 acres of National Forest lands generally south of the main river channel. Most of the National Forest land is steep with narrow canyons, unfit for agriculture or settlement. A large valley exists along the upper portion of the Sixes River from the mouth of the Middle Fork, upriver about five miles, past the mouth of the North Fork. Most of this valley is now part of the Dement Ranch.

Current Condition

Agriculture is one of the basic industries of Oregon's south coast with about 74,000 acres under production in Curry county. 21% of agricultural production is in cropland, primarily berry production; 30% is in livestock pasture or rangeland. The remaining 44% is described as woodlands (timber production). It is typical in the farming sector that employment is highly seasonal, but the Curry county average is 140 jobs annually, with a range of 100 to 200 (Anderson 1995).

The question was asked about what contribution the cultivation of illegal crops had on the local economy. No attempt was made to answer that question.

Future Trends

The trend for agriculture is good. Specialty products (timber from private woodlands) have shown a dramatic increase since 1984. Likewise berry production, primarily cranberries, has doubled in ten years. Livestock and associated products have remained steady through the last decade. Gross farm sales have improved from approximately $30,000,000 in 1984 to $90,000,000 in 1994 (Anderson 1995).

Timber

Historic Conditions

Based on the geology of the watershed a pattern of timber harvest developed. The flat land near the coast was logged early in the 1900's and cleared for agricultural uses. Next the relatively gentle ground north of the main stem of the river was logged. This land is in private ownership today, and includes several large industrial owners (Georgia Pacific, Moore Mill Land and Timber, and Westbrook). The much steeper land south of the main river channel was unclaimed when the Siskiyou National Forest was established in 1906. After World War II, the Forest Service started intensively managing timber and building logging roads. Timber harvest on private lands, especially by Coos Bay Lumber Company, occurred before harvesting started on federal lands.

Current Conditions

Away from the grassy valleys, the vegetative cover is predominately conifer forests. There are numerous private landowners managing these lands for timber production. Timber harvest from these lands supports the wood processing industry throughout Southwest Oregon. Virtually all private land has been harvested, and is currently regenerating or is nearing second growth harvest age. See Figure O-8 for current land ownership patterns and Figure T-4 for current seral stage.

National Forest lands have both second growth and old growth forest. The National Forest lands within the watershed are significantly steeper and of a different rock type than the private lands. See Figure O-4 Geology Map and Figure O-5 Slope Map. Great care must be taken when logging these lands to avoid unacceptable impacts to the soil and water resources. Timber harvest has occurred in the past, but harvest is currently at a very low level.

Private timber lands are approximately 1/4 of the Curry county land base. Nearly 2/3 of the county land area is administered by the Forest Service or BLM. Historically, timber harvest came from both private and federal lands, however harvest form federal lands has declined dramatically. In 1988 Curry county ranked 13th amoung Oregon counties in timber harvest, but had dropped to 20th by 1993.

Timber-based employment has fallen by 50% since 1978, with a steep reduction from 1987 to 1991 and a more gradual reduction since 1991. In 1978, Curry County timber employment was at 1,200 jobs and is currently 600 jobs. "Losses in timber employment occurred in the past because firms either had cut their commercial timber or because their mills had become obsolete. In recent years, employment losses have been more directly related to the uncertainly surrounding the availability of federal timber, as well as the introduction of technological improvements" (Anderson 1995).

This drop in timber industry employment is in contrast to an overall population increase for Curry county. The county's population increased by 2,300 during the 1980's. This has been attributed to an in-migration of retirement age people. People over 65 make up 25% of the county population, which is well above the state and national percentages which are below 15%. This demographic helps explain the rapid increase in housing and property values since the mid 1980's and some of the increases in the service industries.

It should be noted that the only community in the county to lose population was Port Orford, the community closest to the Sixes River.

Future Trends

The trend for the lumber and wood products industry is toward a 17% reduction in jobs between 1995 and 2005 in Coos and Curry Counties. The two-county area is expected to add 2,500 jobs by 2005 for an overall increase in employment of 9.5% (Anderson 1995). Discussion of how much timber will be produced from federal lands in the Sixes Basin is in the terrestrial section.

There continues to be an expectation that timber harvest and timber industries employment from federal lands will go back up to the levels of the 1980's. This expectation is at odds with current federal land management policies. The flip side of this issue is the preservation of the resources on federal lands so that resources receive maximum protection and no commodities are produced at all.

Other Forest Products

There are a group of products collected from the forest that do generate employment opportunities; these products include firewood, ferns, boughs, mushrooms, burls, and other greenery. Compared to timber harvest and timber processing these products contribute very little to the local employment. There is considerable public interest in firewood and other forest products. The Powers Ranger District receives several hundred phone and personal contacts about these commodities each year.

Historic Conditions

Public interest in firewood may have peaked during the 1980's when many homes had converted to abundant and inexpensive fire wood as a home heating source. There were three main sources of firewood; large diameter snags or down logs, recently blown-down trees, and unmerchantable material left after logging. In the recent past, 1987 to 1990, the Powers Ranger District sold 680 cords of firewood per year. Very little of this total came from the Sixes drainage.

Other forest products are also referred to as non-convertible products because they can not be converted into board foot measurements. These products are sold by permit, and the permit system began about 1980. The level of collection before that time is unknown, but was probably slight due to the lack of commercial markets.

Current Conditions

In 1993 and 1994 the Ranger District sold 230 cords of personal use firewood per year, which is a significant reduction from previous levels. Availability has been reduced, because greater protection of large diameter snags for their wildlife value, less unmerchantable material from a reduction in logging, and the high value blown-down trees have as lumber. There have been no commercial firewood sales on the Powers District for many years. Little or no firewood is available from commercial timber lands (Matejka 1996, personal communication).

The whole class of special forest products are harvested in relatively small amounts and have a negligible effect on ecosystem processes, with two exceptions. The District has received damage from the collection of Port-Orford-cedar boughs and the collection of burls. In 1992, 236 permits were issued for special forest products; the value of the permits was $5,518. The permits are valued at approximately 10% of the market value.

Future Trends

Demand for firewood will remain constant for the next few years, but will probably decline in the long term, because of availability or increased cost. The supply of firewood from National Forest lands and commercial timber lands in the Sixes drainage will be quite low.

Potential conflicts exist between the public and the Forest Service over the availability of firewood. Users expect plentiful, easy to get firewood and view the restrictive policies used to protect LSR values and wildlife habitat (snags and down logs) as unjustified.

There is a great deal of market variability for special forest products. A different product has the greatest value each year, (1993 bough permits, 1994 beargrass, etc.) As a whole class of products the outlook is good; demand is far less than supply. Availability of permits should be good with the exception of Port-Orford-cedar boughs, which are not currently being sold because of past damage and the threat of spreading root rot disease.

Conflicts include collecting products during the wet season and trying to limit use of the roads to reduce the spread of POC root disease; competition between different forest product collectors, and over collection of products before proper administrative rules can be implemented and enforced.

Fisheries

Current Conditions

The commercial and sport fisheries industry is probably the second place contributor to the local economy. Salmon was a major share of the total fish catch until recently. The Sixes River makes a significant contribution in fish production, but in a relative comparison much less than the Elk

River. Commercial and sport salmon fishing has been severely restricted during the last three years in an attempt to increase the number of salmon returning to the area's rivers and streams to spawn.

The current commercial harvest of Coho and Chinook is summarized below. (Schindler 1996)

Table S-1: Troll Catch Landed in Port Orford in Pounds (dressed)

Species	Annual Catch 1952 to 1991	Annual Catch 82 to 91
Coho	92,967*	36,256
Chinook	135,224**	161,459

** Between 1963 and 1979 the annual catch was consistently over 100,000 pounds annually.*
*** Only 4 years since 1972 have fallen below 100,000 pounds annually.*

Now bottom fish (also called "ground fish") makes up the major share of the commercial catch. The trend for commercial fishing has been downward; Coos and Curry ports landed 55.9 million pounds in 1989 and only 37.9 million pounds in 1994. The total value of the fish and shellfish catch in Coos and Curry Counties was $23 million in 1994. (Anderson 1995).

Potential conflicts exist between commercial and sport fisherman; each wants more fish from what some believe is an already declining resource. A second issue is the effects timber harvest and road construction have had on anadromous fish habitat and, ultimately, fish populations.

Recreation

Current Conditions

There are several segments of the recreation industry that hope to develop businesses based on the natural resources of the area. The sport fishing segments has been steadily gaining in popularity. Some local fisherman have noted that it is increasingly difficult to gain access to the river for fishing since much of the riverside property is fenced and posted. (Hammerberg 1996, personal communication) River guides have increased over the past ten years, a positive effect on employment.

The current sport catch on the Sixes River is summarized in the chart below for the years 1982 to 1995. (ODF&W 1995.)

Table S-2: Current Sport Catch on Sixes River (1982 -1995)

Species	High Catch	Low Catch	Average Catch	% of Oregon Catch
Fall Chinook	1334 in 1988	183 in 1991	493	approx. 1%
Coho	50 in 1984	0 in 92-94	12	less than .1%
Steelhead	570 in 1984	20 in 1994	218	less than 1%

Big game hunting is one of the most visible activities in the watershed during the fall months, and both developed and dispersed camping areas are utilized.

The Forest Service manages no recreational sites in the Sixes River, and offers limited dispersed recreational opportunities. Most of the dispersed recreation takes place on or directly adjacent to the road system. The use of roads for scenic drives, hunting, exploration, and other mobile uses keeps impacts well dispersed and therefore no specific location is associated with these pastimes. There are few vistas or scenic overlooks on the main travel route (the Sixes River Road) through the watershed. Some off-road vehicle use occurs in the lower portion of Elephant Rock Creek which is private land.

Terrain and topography along with land management designation limit current and future developed recreation on national forest in the watershed. The Forest Service classifies much of the land adjacent to roads in recreation opportunity spectrum (ROS) as Roaded Natural. The remainder of the watershed is either Semi-Primitive Motorized or Semi-Primitive Non-Motorized (Grassy Knob Wilderness). These designations are meeting the desire for dispersed recreation opportunities.

A large portion of the Grassy Knob Wilderness is in Dry Creek Subwatershed, and available for semi-primitive recreation. The Wilderness has no trails so access is very limited. The lack of trails is one feature that distinguishes the Sixes River from other watersheds with a high percentage of federal ownership. A portion of two subwatersheds, the South Fork and the upper part of the Middle Fork, are essentially roadless and are currently MA-8 (Late Successional Reserve). There has been discussion about this roadless area and adjacent parts of the Elk River Watershed being designated as wilderness. No formal proposal has been submitted.

The BLM is managing two developed recreation sites within the watershed, Sixes Campground (22 campsites) and Edson Creek (25 campsites). The land management allocation on the BLM lands is "Special Recreation Management Area". This means that these lands get special emphasis in the BLM recreation program (Turowski 1996, personal communication).

The Sixes Hotel offers "bed and breakfast" and fishing guide service just off Highway 101. This local business hopes to expand by packaging recreational opportunities, including fishing and mountain biking. This is consistent with Curry County's plan for developing nature-based tourism (Turowski 1996, personal communication). The large industrial landowners do not encourage access to their lands for recreational uses (Matejka 1996, personal communication). Georgia Pacific unlocks their gates after the conclusion of fire season to allow access for hunting. Moore Mill allows hunting, but generally requires a permit to access their lands and keeps the gates locked so that access is on foot (Hammerberg 1996, personal communication).

Future Trends

Recreational uses are expected to increase in the Sixes basin. There is good access off Highway 101, a major transportation and recreational route. Developed and dispersed recreation such as camping and hunting are expected to remain constant. Interest in salmon and steelhead fishing has increased and can be expected to increase further, supporting more guided fishing trips. More non-traditional recreation such as biking, mountain biking, rafting and canoeing, hiking, natural walks, and nature interpretation, or packaged experiences combining several of these activities will likely increase. Several entrepreneurs are showing interest in these types of activity.

Recreation trends shown in the 1993 Oregon State Comprehensive Outdoor Recreation Plan indicate that demand for dispersed recreation use of various types is increasing (OP&RD, 1994). We have concluded that this board trend for the state of Oregon will also be true for the Sixes River.

C. Land Ownership

Key Question:

Who owns and manages the land in the watershed?
~What policies govern it's use?

Current Condition

The Sixes watershed currently consists of 85,833 acres of varied land ownership. The primary land owners include: Georgia Pacific (22,483 acres), the Federal Government with lands managed by the Forest Service (21,921 acres) and the Bureau of Land Management (2,421 acres). Other land ownership is as follows:

Table S-3 Land Ownership

Acres	Ownership	Acres	Ownership
22,483	Georgia Pacific	618	God's Valley Timber
21,921	National Forest	397	International Paper
7,455	Moore Mill	346	Coos County
6,921	Westbrook	287	Menasha Corp.
6,021	Individual: 1-160 ac.	193	Roseburg Resources
4,438	Individual: 161-640 ac.	114	Curry County
2,929	Al Pierce Co.	84	Wicklander LMTD Partnership
2,879	Sam & Dorothy Dement	70	School 2cJ District
2,421	Bureau of Land Management	63 / 63	Green Mtn Chipping/Wayne Kennedy Logging
2,369	Powers Ranch	51	Rogge Lumber
1,410	Stonecypher Ranch	37	Yosemite Pacific
1,228	Oregon State Lands	30	Oregon Department of Fish & Wildlife
1,005	Seneca Timber Co.	10	Elite Land & Timber

See Figure O-8 for spatial distribution of land ownership. Please note that acres of U.S. Forest Service may differ from the overview, as the information used to create this chart and map failed to note a recent land swap of approximately 75 acres to the benefit of the U.S.F.S.

The policies governing the use within the watershed revolve around lands managed by the Federal Government and major timber companies. Currently 28% (24,342 acres) of the land base is governed 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 (4/94). The primary emphasis for these publicly owned lands is to manage for late-successional species. As a result the emphasis is on natural processes with little, if any management intervention.

Approximately 51% of the land base is managed by small and large timber companies. The management strategy of these landowners is to maximize timber production utilizing harvest rotations of approximately 50 years. All private lands managed must comply with the Oregon Forest Practices Act.

Past timber harvest on these lands has created large tracts of forest in pioneer and early seral stage classes. With current direction, these lands will continue to be managed at the pioneer to early seral stage size structure. Little area outside the National Forest boundary is likely to attain mid to late seral size structure.

The remaining 21% of the watershed lies in ownership consisting of small ranches, private residences, agricultural operations (cranberry bogs, berry patches, farms), an airport, and a school district.

Historic Condition

At the end of the 19th century the population across the watershed was sparse with much of the population inhabiting the lower reaches of the Sixes River. The watershed at the time was in the late seral stages in the upper reaches, with an emphasis on agricultural uses in the lower reaches. At that time the only policies governing these inhabitants was to maintain subsistence living. This usually involved only utilizing from the land that which would feed and clothe their immediate family. This was the case for both Native Americans and the new settlers to the area.

Synthesis and Interpretation

Management direction for the watershed has changed drastically since the turn of the century. Most of the watershed at the turn of the century consisted of mid to late seral stages. As the social values for the watershed have evolved through the 20th century the demand for wood, and the ability to extract the commodity has increased to meet the demand for wood products. This demand was met from easily accessible private lands, and then progressed up river after World War II. By the early 90's, public sentiment had begun to change policies on public land. This change has swung from timber extraction to ecosystem / landscape management.

D. Public Use Values

Key Question:

How are public uses affected by land allocations on federally managed lands?

~How has access to the Sixes River developed through time to its present condition?
~How might access change in the future?
~What are the past and present recreational uses in the Sixes River?
~How might recreational uses change in the future?
~What conflicts exist between access and recreational values and resource protection values?

Historic Conditions

For many years, access into the drainage was by two east-west trails and two north-south trails. These early trails provided access to mining activities and the early homesteads. Gradually the trails were replaced by roads which provided access for the same purposes and made extraction of timber resources more economical. As timber harvest replaced mining as the dominant industry the road network expanded and improved. The early

roads would be narrow, windy, rough, tortuous travel by today's standards. One of the earliest travelways was the railroad from Powers up Salmon Creek and into the headwaters of the Sixes.

The majority of the roads were constructed during the 1960's and 1970's coinciding with a period of robust timber harvest. Roads during this period were often poorly located and sidecast excess material which caused some undesirable resource effects. (see the geology section).

As the road system developed, recreational uses also increased. Access to attractive camping spots, natural features, and new hunting and fishing areas all brought increased recreational users to the watershed.

Current Conditions

There are 50.6 miles of road on National Forest lands in this watershed. There is a road density of 2.3 miles per square mile, excluding the nearly 7000 acres of roadless wilderness. Private lands have 312 miles of mapped roads for a density of 3.2 miles of road per square mile. Road density is often used as a measure of potential resource impacts related to roads. Another relative measure of resource impacts is the number of times the roads cross streams. See Table S-4 for stream crossing per mile by sub-watershed.

Table S-4: Stream Crossing Per Mile by Sub-Watershed

Subwatershed	Area Sq Miles	Stream Crossings	Stream Crossing Density
Lower Mainstem 30b	14.13	9	.64
Crystal Creek 30c	11.98	27	2.25
Dry Creek 30d	15.92	8	.50
Edson Creek 30e	10.72	32	2.98
Big/Otter Creek 30f	10.70	42	3.93
Elephant Rock 30l	16.95	54	3.19
Middle Fork 30m	7.74	13	1.68
South Fork 30s	15.06	2	.13
Upper Mainstem 30u	30.92	67	2.17

Table S-5 shows the miles of National Forest road by maintenance level; Level 1 is a very low level of maintenance while Level 5 has the highest level of passenger comfort and safety. The highest maintenance level on National Forest roads in the watershed is Level 3. Curry County has 24 miles of Level 4 roads within the watershed.

Table S-5: National Forest Road Miles by Maintenance Level

Maint. Level	Miles N.F.
5	0
4	0
3	3.2
2	27.1 plus 3.6 shared w/ private
1	20.2
	(2.3 obliterated in 1994)

There is no formal trail system in the watershed today on either National Forest or private lands. Some abandoned roads are used for foot travel, such as the old road to Section 36 in the Grassy Knob Wilderness. The remnants of some former trails also exist, such as the trail to Mount Butler. Use of trails in the Sixes is projected to be low. Because of this low use, no investment in trail construction has been planned.

The watershed is currently providing both roaded and unroaded recreational opportunities. The Dry Creek drainage remains largely unroaded and is natural in appearance.

An asset of an unroaded area is the opportunity for solitude and semi-primitive recreational experiences. With highly broken topography and dense vegetation covering most of the unroaded area, the natural screening of sight and sound provides ample opportunity for these types of experiences.

The opportunity for dispersed recreation is good on National Forest lands and is only limited by the current size and condition of the road system. Big game hunting is an activity which often utilizes this dispersed recreation opportunity. Although there is extensive roading of much of the private lands within the watershed, access by the public is limited because of locked gate policies. Some off-road vehicle use does occur especially on the more gentle slopes on private lands.

The opportunities for developed recreation on National Forest lands are severely limited. There are two BLM campgrounds (Sixes and Edson Creek) in the drainage now. There is one bed-and-breakfast business on the lower river.

Future Trends

In 1994, a Transportation Network Analysis was completed Forest-wide to determine the future needs of the transportation system. Historically, timber management was an important emphasis on the Forest and the primary reason an extensive road system was developed. Today, the Forest is managed for a lower output of timber that will involve a less extensive road system. The road system will allow reasonable access to major points of interest, and areas where resource management is occurring.

The closure, abandoning, or decommissioning of some roads seems likely given the high cost of maintaining a road system in areas that are not producing commodities.

However, the public often desires low use roads to remain open for a variety of reasons. Often they are used for gathering forest products, hunting access, providing scenic views, and solitude, as well as other recreational needs.

Potential conflicts exist between road closure advocates and those who advocate an extensive and open transportation network on National Forest lands. Those favoring some road closure focus on the expense of maintaining an extensive road system when the road use is exclusively for low density recreation use. Those opposing road closures counter that the greatest expense is in construction and that road maintenance is a small expense for roads that the nation's-taxpayers have supported.

II. FINDINGS OF FACT

Mining

- Commercial mining for metallic minerals within the analysis area is unlikely.
- Small scale or recreational gold mining with suction dredges will continue. Short term affects to the aquatic system (such as increases in turbidity) during the summer low flows will be likely. Impacts on salmonids are generally limiting in both extent and intensity.
- Employment from gold mining will be negligible.
- Extraction of rock, sand, and gravel will continue to contribute some employment, but it will be minor.

Agriculture

- Agricultural production will continue to contribute to Curry county income and employment.
- Three primary agricultural sectors; (crops and berries, range and pasture (livestock), and woodlots)will maintain their relative importance to local employment. Berry production and specialty wood products show an increasing trend.

Timber

- Less than 2% of the National Forest lands (matrix) are available for commercial timber harvest. Prior to 1993 14% of the National Forest lands within the watershed was available for commercial timber harvest.
- Opportunities for some harvest from LSR does exsist where it will enhance late successional characteristics.
- Private lands will provide almost all of the timber and wood product raw materials within this watershed.

- Timber industry employment has dropped by almost one half from a peak in the early 1980's. Decreased harvest levels on federal lands were part of the decline, as well as increased production efficiencies.

- Timber harvest and wood products production will continue to decline. Despite this trend, the timber industry will remain an important employment sector, providing jobs and income.

Other Forest Products

- Demand for firewood will continue. Supply of firewood from National Forest lands has decreased and will remain low. Little firewood will be available from the larger commercial landowners. Therefore, some of the demand for firewood will go unmet.

- The total market value of special forest products, (ferns, boughs, and burls, etc.) will remain small and make only a small contribution to local employment and income.

Recreation

- The diversity of recreational experiences has been increasing, as new recreational pastimes such as mountain biking have become popular.

- The direct development of recreational facilities such as campgrounds within the watershed, especially on National Forest, is limited. Dispersed recreation utilizing special features and solitude of National Forest lands seems good.

- The total volume of recreational use has increased, specifically guided sport fishing. Therefore, employment related to the recreation has increased.

- Big game hunting in the fall will be popular, but does not have the potential to draw people into the county as sport fishing does.

Commercial Fishing

- This industry should continue its relative importance to south coast employment and income.

- There has been a shift from a salmon fishery to a ground fish dominated industry.

Access Management

- A portion of the population desires a continuation of the current road system on National Forest lands. An equally vocal populace is in favor of decreasing road system mileage. This has the potential to become a highly polarized issue.

- The long-term prognosis for maintaining an extensive road system on National Forest is not good, since road mantenance funding has decreased significantly.

Land Ownership

- The largest land holders in the watershed are Georgia Pacific and National Forest System with each managing about 1/4 of the watershed. Moore Mill and Westbrook each have approximately 8% of the watershed.

- Twenty-eight percent of the watershed is federal land governed by the policies identified in the Northwest Forest Plan.

- Approximately 51% of the land base is managed by small and large timber companies.

III. MANAGEMENT RECOMMENDATIONS

Ownership

- Federal agencies should continue to look for partnership opportunities to assist communities in developing economically, such as our participation with Port Orford's Community Response Team (CRT).

Access

- Continue road closures to protect Port Orford cedar from the spread of root rot disease.

- Continue site specific analysis to manage roads where analysis shows high risk of damage to water quality or anadromous fish habitat, recognizing the tradeoffs with recreational use.

Recreation

- Continue to look for partnerships in recreation, such as projects that would link to the Powers - Glendale Bike Route or the Rogue-Coquille Scenic Byway.

Mining

- Maintain or increase mineral administration of mining activity to protect resource values.

IV. SUMMARY OF DATA GAPS

- No significant data gaps were identified during the analysis. Although site specific information on employment and income for the Sixes River drainage is not available, the data specific to Curry County is adequate for watershed analysis. Likewise, recreation use specific to the Sixes River is not available.

Appendix A: Sixes Watershed Minerals And Mining Potential

Several geologic formations in the Sixes watershed are mineral-bearing or have mineral-bearing potential. Though lode mining and placer mining occurred from the 1850s through the 1940s, there has been no commercial mining in the area in the recent past. Geologically, there is the potential for economically exploitable mineralization in Sixes watershed geologic formations. (See Watershed Overview for brief history of mining in the Sixes area.)

Metallic mineral-bearing potential resides in some of the rock groups of the Sixes. The Galice Formation contains sulfide minerals in quartz veins and mineralized shear zones, in which gold has been found. Volcanogenic sulfide deposits in the Colebrook Schist have the potential for gold and copper mineralization. Ultramafic rocks (peridotite and serpentinite) are potential source rocks for nickel, chromite, and copper. The dacitic and rhyolitic dikes of the Sixes have potential to contain gold, zinc, or molybdenum deposits (Ramp 1977). Plutons of the Middle and South Forks may also be potential sources of mineralization (Lund, 1969).

Of these rock groups in the Sixes watershed, historic gold lode prospects were located at Big Ben mine near Rusty Butte, at the Combination prospect [unknown location], both in quartz veins, and the Bear Cat prospect [unknown location], in quartz vein with pyrite.

Economic gold placer deposits were panned and dredged in the Cape Blanco beach area, in the South Fork of the Sixes River, and in the Sixes River mainstem below the confluence of the South Fork (Ramp, 1977).

The sand-sized fraction of the Sixes River bedload is 1 - 6% heavy minerals, which include metallic and non-metallic minerals. Chromite mineralization is evidenced by the black sand deposits of the Sixes. The Sixes Beach placer, Butler Mine, Madden placer and Cape Blanco placer were all prospected for chromium.

Manganese oxide of a low grade is found in Dothan and Otter Point Formations in conjunction with chert. Varicolored jasper is abundant in the Otter Point metasediments in the North Fork of the Sixes. Occasional jade has been found where serpentinite and amphibolites are closely associated.

Thinly-bedded coal, of limited extent, is found in the Middle Fork of the Sixes in Umpqua Group sediments. These beds were prospected and found to be not economically exploitable (Ramp, 1977).

Appendix B: Sixes River Cultural Resource Summary

Description

The Sixes River flows westerly into the Pacific Ocean approximately 7 miles north of Port Orford on the southern Oregon coast. The River is approximately 28 miles long and drains a watershed of about 86 thousand acres, in Curry County, between the Rogue River and the Coquille River watersheds. The Floras Creek drainage lies immediately north, and the Elk River immediately south, both are also coastal streams.

The Sixes River takes its name from the Chinook jargon word for friend. The original pronunciation may have been Sihks, but was soon anglicized to Sixes. Chinook jargon was the trade language of Indian tribes of the Pacific Northwest coast, and was used by the French, English, and American fur traders also.

The lower 5 miles of the river are through the broad coastal plain now used for agriculture, mainly sheep raising & cranberry bogs. The community of Sixes is loosely centered around the general store/gas station/post office at the junction of highway 101 and the Sixes River. The river reaches the ocean just north of Cape Blanco. The next 5 miles upriver are a narrow valley with continuous grassy river benches, now used for pasture and home sites. These lands are privately owned, outside the Siskiyou National Forest boundary. Along the upper 18 miles, almost 29 thousand acres are within the Siskiyou National Forest. Most of the National Forest land is steep with narrow canyons, unfit for cultivation or settlement. A large valley exists along the upper portion of the Sixes River from the mouth of the Middle Fork, upriver about 5 miles, past the mouth of the North Fork. Most of this valley is now part of the Dement Ranch. Away from the grassy valleys, vegetative cover is mostly Douglas-fir trees, second growth with some old growth timber on the National Forest. The understory is abundant heavy brush. Private land has been previously logged. The area is covered by the Langlois, and Powers 15' quadrangle maps of the U.S. Geological Survey.

Before the coming of the white man, this area was inhabited by the Quatomah band of the Tututni group of Athabascan speaking Indians. There were settlements in the Floras Lake, Sixes River, Eckley (Dement Ranch), Elk River, and Port Orford areas. The Sixes River was used more heavily than the Elk. Villages of other Indian groups were in the Powers, Agness, and Illahe areas; and near the mouths of the Rogue and Coquille Rivers.

Archeological sites are documented with the State of Oregon. Village site 35CU93 and fishing sites CU 121 and CU 128 are located along the Sixes River. Another village site is the Strain site near Floras Lake, ten miles north of Port Orford, (35CU47). Archaeologists excavated 3 of 5 house pits located on a knoll overlooking the lake back in 1958-59.

A local Powers collector has artifacts reported taken from private land on the Avery, Powers, and Dement ranches that span the last 9,000 years. Many are of local cryptocrystalline distinctive to sources on the Dement ranch. Ground stone adzes, milling stones, and numerous other items indicative of village activities are present in the collection.

Three main trails ran east-west through the present Powers Ranger District:

1) Up the Sixes River and over the prairies to Baker, Rowland, & Dement Creeks, or down Salmon Creek to the Powers area, all tributaries on the South Fork Coquille River;

2) Up the Elk River to the only easy ridge north, onto the Sixes/Elk divide, east over Barklow Mtn. onto Johnson Mtn, thence to the Powers area;

3) From Port Orford over Bald Mountain & Rocky Peak, then along the Elk/Rogue divide to Iron Mountain, then to either Illahe or Agness.

Three trails ran north-south connecting these trail systems:

1) A trail 4 miles west of the Forest boundary joined the lower Elk River with the Sixes River;

2) A trail north from Iron Mountain along the ridgeline over Barklow Mountain joined the 3 main trails.

3) A trail from Illahe, over Agness Pass, followed the South Fork Coquille River downstream to what are now Powers & Myrtle Point.

White settlers & miners started moving into the area in the early 1850's. With the discovery of gold in the black sands along the beaches in 1853, many prospectors poured into the region from California. In July, 1854, Thomas Johnson found placer gold near the headwaters of the South Fork Coquille River. His discovery created a minor gold rush. Ralph E. ("Jake") Summers, from Pennsylvania, came to Port Orford with the Tichenor party in 1851. He acquired a Donation Land Claim of 160 acres at the junction of Crystal Creek and the Sixe's River. The success of Jake Summers' mining on the Sixes River also created a small gold rush around 1856. This led to the construction of a small mining community in the rugged canyon of the South Fork, known as Summersville. Miners have worked the creek almost continually since that time. In the mid 1870's a second mining boom occurred at the mouth of the South Fork Sixes River. This area was further developed by the Hydro Sixes Mining Company in 1914. A BLM campground at the forks is named after superintendent Charles Inman.

Conflicts erupted between the Indians and the settlers & miners. Almost all the Indians in southwest Oregon were removed north to reservations at Siletz and Grand Rhonde, after the Rogue River War of 1855-56.

Several mines operated on the Sixes River and its forks. Some are shown on the early General Land Office survey maps dating from 1857 to 1924. The Saint Patrick's, Elgin Consolidated Placer, and Devilbiss holdings were three of the larger mines. The miners and settlers used the early Indian trails and built some of their own.

A settlement named Eckley was formed near the North Fork of Sixes River in 1860 and continued until the time of the first World War. At least three large families lived there, the Haines, Guerin's, and Gibbs. These families lived by subsistance farming and cattle ranching. Other settlers moved onto land in Otter and Big Creeks. Eckley became a stopping place for travelers from Port Orford going to the communities in the South Fork Coquille River, and the mines on Johnson Creek. A post office operated there from 1883 to 1916. Ellis S. Dement leased the Haines property in 1913, and bought the ranch in 1927. Today it is a remote cattle ranch, the road connecting Sixes to Powers passes through private land and is closed to public travel.

The 1915 Siskiyou National Forest map shows a road reaching up the Sixes River to the bend 1 mile above Edson Creek; and a road from Myrtle Point south to Eckley at the North Fork Sixes.

The Siskiyou National Forest was established in 1906. In 1909 when the Siskiyou National Forest was organized into districts, Bill Milbury, the first ranger, established a Ranger Station at a place that became known as McGribble in the middle Elk River area, 3 miles northeast of Humbug Mountain. The Forest Service maintained some of the old trails, did some selective logging in the early years, and started building some roads. Much of the early mission of the Forest Service was custodial and involved fire protection. Five fire lookouts were built on mountains surrounding the Sixes River: Edson Butte (1941), Sugarloaf Mtn. (1926), Barklow Mountain (1933), Mt. Butler (1929), and Grassy Knob (1935). Of these, only Edson Butte survives as a state lookout. After World War II, the Forest Service started intensively managing timber and building logging roads.

(For more details, see "Sixes River History" and "Sixes River Mining").

Potential

The Siskiyou National Forest, Cultural Resource Sample Survey Design predicts the likelihood of finding cultural resources.

Three categories of probability are identified: high, medium, and low.
The eight factors used to predict probability are: slope, aspect, elevation, soil, fisheries, stream classification, minerals, and vegetation.

The high potential areas are terraces along the Sixes River and the lower ends of major tributaries. Medium areas are interspersed along non terrace areas of Sixes River, corridors along major tributaries, gently sloping ground, broad ridges, and open or semi-open high peaks. All remaining area is low probability.

Approximate distribution of probability categories:

High probability 2% Medium probability 8% Low probability 90%

Actual finding of sites, both historic and prehistoric, has corresponded fairly well to the predictive model.

Inventory of Existing Sites

In 1977 & '78 the Forest Service contracted with Steven D. Beckham, Archaeologist and Historian, to do cultural resource overviews of the Sixes River, Otter Creek Tract and the Siskiyou National Forest. He documented research about the original American Indian inhabitants and the later settlement by whites. In 1980, the Bureau of Land Management also contracted with Beckham for a cultural resource overview of the Coos Bay District which reaches from Florence to Brookings, approximately 30 miles inland.

Since the time of the overviews and the development of a cultural resource program on the Forest, 14 cultural resource surveys for individual projects within the Sixes River basin have been done. An additional 3 surveys border the Sixes River area. These surveys located and documented 20 cultural resource sites, four of these being prehistoric.

Approximately one third (35%) of the Sixes River watershed has been surveyed for cultural resources. An estimated 63% of the remaining unsurveyed area is in the Grassy Knob Wilderness. (Dry Creek, in the wilderness, is tributary to the Sixes River).

List of sites by category:

4 Prehistoric - (2 lithic scatters and 2 meeting places)
2 USFS fire lookout sites (none now exist)
1 USFS trail camp (structure in disrepair)
5 Cabin sites from early settlers & miners
5 Trails (all fragmented, none used or maintained)
3 Mining sites along the South Fork Sixes River

Significance

None of the historic sites are eligible for the National Register of Historic Places (NRHP). The prehistoric sites have not been excavated or analyzed, nor been nominated to the NRHP.

We may yet find significant cultural resource sites in the Siskiyou National Forest part of the Sixes River watershed. Two recorded Indian meeting places have not yet been re-discovered. At least four standing historic structures (mining cabins) exist on National Forest land in the Sixes River area, but these are in disrepair and highly unlikely to be eligible for the National Register of Historic Places.

Tribal Rights - Current Use

The Quatomah Indians are not a recognized tribe. It is unknown if there are any survivors of the group. Decendents of the group might be found among the Confederated Tribes of the Siletz Reservation.

The area is not used by American Indian groups for any tribal or group purposes.

Community concern for cultural resource values in Sixes River has been low. It has not been raised as an issue by the public in any timber sale Environmental Assessment scoping process.

No law enforcement problems related to cultural resources have occurred yet and none are anticipated.

Joe Hallett
Cultural Resource Coordinator
Powers Ranger District
Siskiyou National Forest 2/27/96

Sixes River History

The first whites in the area were fur trappers and traders in the 1820's.
In 1826 Alexander McLeod, of the Hudson's Bay Company, traveled south from Fort Vancouver and explored the Umpqua, Coos, and Coquille River systems. He reached the mouth of the Rogue River. In 1828 Jedidiah Smith's American party, before they were robbed, crossed the Elk and Sixes Rivers on a journey north from California. Much of the early fur trade was conducted over the inland California Trail, across Siskiyou Pass.

For about 40 years the Hudson's Bay Company nearly monopolized the fur trade and exploration of the Pacific Northwest. By 1826 the company had established its most southern post, Fort Umpqua, near the present town of Elkton.

The first white settlement in southwestern Oregon was at Port Orford, founded by Capt. William Tichenor in 1851. Early explorers also named these places: Cape Blanco, Floras Creek, Sixes River, Humbug Mountain, Brushes Creek, and the Siskiyou Mountains.

In August of 1851 a party led by W.G. T'Vault left Port Orford to find a route to the mines of Jackson County. They proceeded over to the Rogue River, then up to Big Bend where most of the party turned back. A small group continued but were forced by the topography northward to the South Fork Coquille River which they followed to the ocean where they were attacked and scattered by the Lower Coquille Indians.

The U.S. Army established a post, Fort Orford, this same year as a result of the hostilities. The army attempted to open a trail to Fort Lane in the upper Rogue River Valley. In October 1855, Lt. August V. Kautz took a detachment of soldiers through the Coast Range. The expeditions map, drafted the following year by Thomas J. Cram shows they travelled up the Elk River watershed to Iron Mtn. then to the Rogue River and up the Mule Creek drainage then down the main ridge to Grave Creek. This and another 1856 map of the Port Orford vicinity are the areas' first detailed maps.

Charles Foster came to the west coast in 1849. Before settling on the Big Bend of the Rogue River in 1853, he ran a pack train from Crescent City, California to the Randolph mines north of the Coquille River near the coast. He was employed to guide Captain Smith and a company of soldiers over the trail from Port Orford to the Big Bend during the Indian war of 1856.

After the Indian war of 1855-56 almost all the Indians were removed from southwestern Oregon to reservations, north, at Siletz and Grand Rhonde.

In July of 1856, Dr. John Evans completed the last of his geologic expeditions in the Oregon Territory. He and his party left from Port Orford, traveled across the Elk and Sixes Rivers, up a ridge crest to the divide between Floras Creek and the Sixes River and camped near the present Edson Butte. The next day they proceeded to the vicinity of what is now Powers Ranch. Later the party ascended Johnson Mountain, then visited the mines on Johnson Creek.

After camping on Johnson Mtn., they traveled to present day Powers before moving down the South Fork Coquille River and then ascending the Middle Fork. Sometime during his travels he aquired a piece of a meteorite which was later analysed and identified. This is the famous Port Orford Meteorite which has become quite a folklore legend, as it has not yet been rediscovered.

With the discovery of gold in the black sands along the beaches in 1853, many prospectors poured into the region from California. In July, 1854, Thomas Johnson found placer gold near the headwaters of the South Fork Coquille River. His discovery created a minor gold rush. Ralph E. ("Jake") Summers, from Pennsylvania, came to Port Orford with the Tichenor party in 1851. He acquired a Donation Land Claim of 160 acres at the junction of Crystal Creek and the Sixe's River. The success of Jake Summers' mining on the Sixes River also created a small gold rush around 1856. This led to the construction of a small mining community in the rugged canyon of the South Fork, known as Summersville. Miners have worked the creek almost continually since that time. In the mid 1870's a second mining boom occurred at the mouth of the South Fork Sixes. This area was further developed by the Hydro Sixes Mining Company in 1914. A BLM campground at the forks is named after superintendent Charles Inman.

Several mines operated on the Sixes River and its forks. Some are shown on the early General Land Office survey maps dating from 1857 to 1924. The Saint Patrick's, Elgin Consolidated Placer, and Devilbiss holdings were three of the larger mines. Miners & settlers used Indian trails and built new ones.

A settlement named Eckley was formed near the North Fork of Sixes River in 1860 and continued until the time of the first World War. At least three large families lived there, the Haines, Guerin's, and Gibbs. These families lived by subsistance farming and cattle ranching. Eckley became a stopping place for travelers from Port Orford going to the communities in the South Fork Coquille River, and the mines on Johnson Creek. A post office operated there from 1883 to 1916. Other settlers moved onto land in Otter and Big Creeks. Ellis S. Dement leased the Haines property in 1913, and bought the ranch in 1927. Today it is a remote cattle ranch, the road connecting Sixes to Powers passes through private land and is closed to public travel.

In 1868 there was a large fire on the southern Oregon coast. The fire spread from Yachats to the Klamath River in California and burned inland up to 30 miles. Much of the Elk and Sixes drainages were burned. The skipper of a small sailing vessel said the fire was in view for seven days.

Land Office surveying began around Port Orford in 1857. Early GLO plat maps of the Sixes area from 1857-1910 show a trail up Sixes River and a trail between the lower Elk & Sixes west of the Forest Boundary. Also shown are settlers names & buildings, slashings, orchards, mining ditches, mines, and trails.

The 1915 Siskiyou National Forest map shows a road reaching up the Sixes River to the bend 1 mile above Edson Creek; and a road from Myrtle Point south to Eckley at North Fork Sixes.

The Siskiyou National Forest was established in 1906. In 1909 when the Siskiyou National Forest was organized into districts, Bill Milbury, the first ranger, established a Ranger Station at a place that became known as McGribble in the middle Elk River area, 3 miles northeast of

Humbug Mountain. The Forest Service maintained some of the old trails, did some selective logging in the early years, and started building some roads. Much of the early mission of the Forest Service was custodial and involved fire protection. Five fire lookouts were built on mountains surrounding the Sixes River: Edson Butte (1941), Sugarloaf Mtn. (1926), Barklow Mountain (1933), Mt. Butler (1929), and Grassy Knob (1935). Of these, only Edson Butte survives as a state lookout.

In September, 1929 bad fires started south of Elk River and burned to the edge of Port Orford. In November a series of several hundred incendiary fires
were set on the North Fork of Elk River which succeeded in burning Barklow and Salmon Mountains. The Barklow Mtn. fire, as it was named, burned 9,000 acres and had a perimeter of 26 miles.

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Siskiyou National Forest Road and Trail Log 1936 Powers Ranger District

Vance Carlson, Umpqua NF. Archaeologist, 4/86 conversation with Reg Pullen, Coos Bay BLM Archaeologist concerning sites on Sixes River.

Vance Carlson, Umpqua N.F. Archaeologist, conversation with local collector concerning sites along Sixes River. 4/86

Joe Hallett, Cultural Resource Technician, conversation with Curt Townsend, Forest Service retiree, 1942-1980, Powers and Gold Beach Ranger Districts.

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Sixes River Mining

The Sixes River area is important in the history of southwest Oregon mining. While placer mining provided more rapid and larger returns, a number of miners worked in the area from the 1870's to the 1930's to recover gold by both placer and lode mining. Several worked lode claims in the South Fork of the Sixes. (Peterson and Powers 1952: 384-90) (Beckham & Minor 1980:159).

Placer mining removes valuable minerals from rivers and streams, from simple gold panning of river sands to means as elaborate as ditches, flumes, dredges, and hydraulic scouring of river bars and banks. Lode mining includes the recovery of gold from quartz outcroppings by tunneling, shoring of shafts, quartz pulverizing and processing.

Mines of the Sixes River 1916 (Parks and Swartely 1916)

Name	Location
Byers and Hollenbeck Claims	South side of South Fork
Corbin Property	So. side Sixes, 1 mi above Dry Cr
Crawford and Fay Claims	South Fork of Sixes
Guerin Claim	Mouth of Butcher Gulch
Harrison Claims	South Slopes of Rusty Butte
Hydro-Sixes Mine Company Claim	Forks of Sixes River, (mouth SF)
Sixes Mining Company Claim	Two miles above Edson Creek;
(Divelbliss Family Claims)	3/4 mile above Edson Creek.
Smith and Robinson Claims	Mouth of Rusty Creek
Wagner Claim	T32S, R13W, Sec 20
Wall (P. L.) Claim	T32S. R13W, Sec 21
Wallace and Hadley Claims	South Fork of Sixes River
Way Claims	South Fork of Sixes River

Placer mining was important on the South Fork of the Sixes. Writing in 1898, Orvil O. Dodge noted: "The placer mines on this stream have been worked continuously, to a limited extent, for more than thirty-five years past, and it is safe to say that more gold has been taken out of it than from any other stream in Western Oregon, except Rogue River & tributaries (Dodge 1898: 422)." The Sixes Mining Company with C. Inman as superintendent made extensive developments at the forks of the river, while working the former Divelbliss placers between 1916 and the mid-1930's. (Parks and Swartley 1916:205-06; Butler and Mitchell 1916: 115-20).

The South Sixes cultural resource reconnaissance survey, (June 1988), conducted by Kathy Minor, Powers Ranger District employee, and Vance Carlson, archaeologist, located ample evidence of current and past mining along the South Fork of Sixes River. Although no claims are patented, at least four cabins are currently used by miners. Most appear to have been constructed in a period from 1915-1940, and have visqueen covered roofs with decaying floors. An occupant of one of the mining sites, Lisa Bogret showed us the site of an early saw mill and a number of the lode mines. A wooden sign designates a Huckleberry Knoll burial site where a headboard indicates the burial of Thomas Jenkins. As many as 14 persons are said to be buried

there according to Mrs. Bogret. The entire mountainside near the river shows hydraulic mining activity with outcrops of broken quartz that contain tunnel mouths in various degrees of collapse. A Thompson Flat near the present Bogret cabin may have contained as many as 13 small cabins for employees of the mines.

No evidence of any aboriginal activity in the steep canyon was found. The nearest known sites are in the basin that forms the Avery, Powers, and Dement Ranches near the mouth of the Middle Fork of the Sixes River.

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Appendix C: Elk-Sixes River Landslide Inventory Methods

McHugh (1986) identified and measured landslides and other slope features from seven sets of historical aerial photographs covering 1943 through 1979, using a binocular mirror stereoscope (magnification not given). The inventoried area included all lands within the National Forest Boundary, which includes some private inholdings. McHugh updated these data for 1979 through 1986 using the same inventory methods (McHugh, 1988, pers. comm.). Debris slides, debris avalanches, failing toes of slumps and earthflows, and debris flows that were active during this period were inventoried. Landslides with areas less than 100 square meters were excluded. Information collected included area, slope, aspect, elevation, rock type, percentage delivery to streams, and photo-bracketed date of initiation. In addition, the relation of the slides to harvest units or road construction was noted, and the date of such disturbance was recorded. Volume was measured from the first photo on which the slide appeared, and because few slides increased in size over time, slide growth was not analyzed.

McHugh identified landslides in managed areas as either harvest or road-related. Landslides were only attributed to roads where the initiation site could be clearly photo-identified as road-related. It may be argued that landslides within harvest units were naturally-occurring and not caused by harvest. However, the landslide frequency in harvest units is clearly greater even when the natural slide frequency outside of harvest units is subtracted. These findings agree with a number of other studies published prior to 1986.

Twenty-five percent of the landslides were randomly selected for field measurement within each of the three major geologic types. Area, depth and percent delivery to stream channels were measured in the field with tape, rangefinder, and clinometer. We developed a relation between photo-interpreted area and field-measured volume to estimate volumes for slides that were not field-verified. Several forested tributaries were traversed to determine that 60% of streambank landslides with areas less than 200 square meters were undetected by the aerial photo interpretation.

1992 aerial photographs from BLM were examined for this watershed analysis by Cindy Ricks and Patty Jones. Lands within the National Forest Boundary were examined carefully for evidence of any new road and harvest-related landslides that occurred between 1986 and 1992. Only one road-related landslide was found, a debris flow from road 5201 into Rusty Creek, that occurred prior to harvest of Dixie Knot Unit #2 in 1991. This section of road 5201 was constructed prior to 1961. Because some possibly new naturally-occurring landslides in upper Dry Creek have not yet been compared with previously inventoried slides or measured, these new data are not included on the bar graphs.

Appendix D: Sixes Watershed Road-Related Restoration

Past and proposed restoration activities on federal lands within the Sixes watershed are typically directed toward aquatic ecosystem health. The types of restoration treatments affecting the aquatic ecosystem generally fall into three categories: Hillslope restoration, riparian area restoration, and in-stream restoration.

Hillslope Restoration

Hillslope restoration is intended to reduce the risk of mass wasting and accelerated road and harvest related sediment delivery to water courses. Typical treatments include upgrading roads to control and prevent erosion, decommissioning or obliteration of unneeded or unstable roads, and controlling erosion on bare slopes or areas where soils have become impoverished. The majority of historic and proposed restoration activities on federal lands in the Sixes basin focuses on hillslope restoration. The geology of the Sixes basin makes it prone to mass wasting events and chronic ravel while the stream channel gradient favors deposition and storage of sediment, particularly in the upper and lower flat valley reaches. See Appendix D for details on past and future road-related restoration opportunities.

Riparian Area Restoration

Past management practices throughout the basin have reduced the number of large conifers both within the stream channel and along the riparian corridor. Planting and releasing trees (particularly native conifers) in the riparian zone can provide shading, reduce stream temperatures, stabilize stream banks, and eventually provide a source of large woody material. Planting, thinning and other vegetation management in degraded riparian areas to restore the natural succession of riparian plant communities is necessary for restoring aquatic health within the watershed. Typical prescriptions throughout the Sixes watershed include fencing livestock, interplanting multiple species of native conifers among even-aged riparian hardwoods such as alder, thinning to promote growth and vigor of desirable riparian species, and planting on disturbed areas such as stream side landslides, grazed stream banks, skid trails, landings, etc. A comprehensive fencing and planting program on private lands was initiated in 1994 on the entire Southcoast as part of the Oregon Watershed Health Program and the federal Hire-the-Fishermen programs, a portion of which has occurred on the lower Sixes River. Little in the way of riparian restoration has occurred on federal lands in the basin. Future restoration opportunities on federal land include riparian silviculture prescriptions on previously harvested tributaries of the South Fork Sixes.

In-Stream Restoration

In-stream restoration activities typically focus on either enhancing fish passage, providing habitat enhancement for any of several life stages of fish or stabilizing eroding stream banks. The addition of large woody material to enhance habitat complexity and placement of boulder deflectors to protect eroding banks are the most prevalent in-stream activities currently used in the Sixes watershed. Both private landowners and industrial timber companies have recently done stream channel restoration activities, primarily focused on increasing habitat complexity through the addition of woody material. Habitat improvements of this type are likely to continue

in the future. In-stream restoration on federal lands is limited to the recent replacement of the road/stream crossing on the unnamed tributary to the Sixes on Road 5201 (MP 6.26) in order to facilitate passage of steelhead and cutthroat. Future in-stream restoration activities on federal lands will primarily focus on fish passage. The 1995 stream habitat survey identified a log jam barrier on the South Fork Sixes. The jam is partially composed of past logging debris and serves as a partial barrier to approximately 3.6 miles of steelhead habitat. Potential treatments include hand removal of small pieces of the jam over several years to allow the stored bed material to gradually pulse downstream. The second restoration opportunity involves restoring anadromous fish passage to "Little Otter" Creek, which crosses road 5201 at milepost 1.73. The crossing currently consists of a 140 foot long 48-inch diameter culvert with an excessive drop at the outlet. The pipe is proposed to be replaced with a shorter, baffled pipe with step pools at the outlet.

Road-Related Restoration

Contracts on Forest Service administered lands to pull back unstable fill from roads and landings on the 5201 road system were completed in 1987, 1988, 1992, and 1994. All totaled, approximately 30 sites were treated with excavated fill material removed and placed in stable locations. Additionally, a program to decommission unstable or unnecessary roads was initiated in earnest in 1991 with all or part of 18 spurs of the 5201 road system being treated.

South Fork Sixes River Road Decommissioning (miles per year)

Year	1991	1992	1993
Miles	2.93	1.12	2.39

Road segments to be decommissioned were selected for treatment based on the May 1992 ***Environmental Assessment for Road Obliteration and Road Closure*** for the Powers Ranger District. The objectives of the prioritization and eventual treatment include protection of fishery resources by reducing future sedimentation, enhancement of wildlife forage and habitat, reduction of the spread of Port-Orford-cedar root disease, and reduction of road maintenance costs.

Other South Fork Sixes River road segments preliminarily identified in the EA for obliteration and still require treatment include:

Road Segment	5201.080	5201.081	5201.201	5201.270
Miles to Treat	1.30	1.90	0.44	1.27

Additional site specific hillslope restoration opportunities currently in the Watershed Improvement Needs (WIN) database for the South Fork are as follows:

Road No./Mile Post	Problem Description	Proposed Rehabilitation
5201 MP 0 to 8.3	Road related cutbank ravel and gullies	Hydromulching and cordoning
5201 MP 14.8	Road related quarry erosion	Seed, fertilize and plant with trees and shrubs
5201 MP 20.5	Erosion from shotgun culvert	Install culvert downspout
5201 General	Harvest related ravel and slides	Aerial hydromulching (100 acres) and hay bales in gullies
5201.200	Road related cutbank and fillslope ravel	Hydromulching (21 acres)
5201.201	Harvest related ravel	Aerial hydroseeding, shrub planting
5201.218 MP 0.1	Eroding road cut and fill slope	Hydromulch (0.8 acre)
5201.220	Road and harvest related debris slide (1000 feet long)	Aerial hydromulch (4.2 acres), fertilize and plant trees
5201.221 MP 0 to 1.1	Road related ravel, slumping of roadbed	Hydromulching (1.7 acres), conifer and shrub planting, and cordoning
5201.221	Harvest related ravel	Plant trees and shrubs in ravel, hay bales in chutes
5201.270 MP 0.35	Road related ravel and rockslide, roadbed erosion	Hydromulch cutslopes (5.2 acres), waterbars
5201.390	Road and harvest related ravel	Hydromulch cutslopes (10.3 acres), Aerial hydroseeding (13 acres), check dams, tree and shrub planting, cordoning
5201.390	Road related slump (140'x200')	Geotechnical investigation
5201.393	Harvest related debris slide from unstable road/landing fill	Plant trees and shrubs, seed and fertilize, pull back landing fill
5201.393	Road and harvest related debris slide	Aerial Hydromulch (40 acres)
5201.393	Road related fill failure adjacent to failing cribwork and eroding cutbank	Maintain/remove cribwork, plant trees and shrubs on cutbank
5201.393 MP 0.2 to 0.8	Road related surface erosion	Clean ditch, crown road, maintain cribwork

One road fill on the Road 5105 (China Peak area) appears to be located on a pre-existing landslide form (from aerial photographs) and should be checked for stability and diversion potential. The 5201010 road access to section 36 in Dry Creek should be evaluated to determine if the road fills have the potential to cause additional debris flows, and whether restoration is feasible or allowable within the Grassy Knob Wilderness.

Appendix E: Clean Water Act Section 303(d)

The 1972 Clean Water Act requires each state to identify streams, rivers, lakes and estuaries (waterbodies) that do not meet water quality standards. Stream segments where data show standards are not met are referred to as "water quality limited" and placed on the 303 (d) list. The 1994/1996 Clean Water Act Section 303 (d) list found the following segments water quality limited:

Name	Segment	Parameter
Sixes River	Mouth to Headwaters	Temperature - Summer

Habitat Modification: Documented habitat conditions that are a significant limitation to fish or other aquatic life. Habitat conditions considered are represented by data that relate to channel morphology or in-stream habitat such as large woody material.

Temperature - Summer: The seven (7) day moving average of daily maximum temperature shall not exceed 64 degrees Fahrenheit.

Appendix F: Classification to Seral Stages Using ISAT Vegetation Mapping Data

Pat Martinez and John McCullough - Siskiyou National Forest

Our objective is to classify the the vegetation information available from the ISAT Vegetation Mapping process into the seral stages defined below. In addition areas of water, rock and sparsely vegetated, snow, grass, and shrub will be identified and mapped. The source used is the Size/Structure Pixel Map layer in the Geographic Infomation System for the Siskiyou N.F. (header listing for the GIS file is SISKSZ.gis).

This is the only source used for this classification. It is expected to provide acceptable results for watershed scale analysis purposes. Although refinement of the results may be possible through merging information from the Canopy Cover and Species Classification or Species Groups Pixel Map layers, this was not considered because merging layers in MOSS has not been possible. Likewise, refinement of the results using the Vegetation Polygon layer and Database may also be possible, but was not considered.

No other aggregation, such as limiting the minimum size of resultant polygons was used; the minimum polygon may be as small as 1 pixel (25m X 25m). This is to avoid loss of seral stages which may follow linear features such as streams.

DEFINITIONS OF SERAL STAGES

VERY EARLY, PIONEER - Consists of species capable of coming in in open, disturbed areas. Clear dominance of seral species. PNC (see definition below) species absent or in very low numbers. Change may be slow if seed sources for PNC species are distant.(1) Generally less than 50 years old.

EARLY SERAL - Usually rapidly changing plant community. Some PNC species present but seral species dominate. Rate of PNC species colonization of the site may be slow.(1) Stage in forest development that includes seedling, sapling, and pole-sized trees.(2) Average age is 100 years old, with a range from 50 to 150 years old.

MID SERAL - Climax species dominates regeneration and understory layer and some are starting to make it into the overstory layer. Rather rapidly changing plant community. PNC species are increasing and colonizing the site. They are at about equal proportions with seral species.(1) Average age is 150 years old, with a range from 100 to 200 years.

LATE SERAL - Often slowly changing plant community. PNC species are dominant but some seral species still persist.(1) Greater than 200 year old.

CLIMAX - End point of succession (same as potential natural vegetation) where neither plant composition nor stand structure changes. The potential natural plant community that appears to be self-perpetuating in the absence of disturbance and there is no concrete evidence it is followed by a different subsequent community. It usually is not completely stable but fluctuates around a modal composition and dominance of species.(3) Greater than 300 years old.

PNC - Potential Natural Community. The biotic community that one presumes would be established if all successional sequences of its ecosystem were completed without additional human-caused disturbance under present environmental conditions. The potential natural community under exisiting environment.(1)

SIZE/STRUCTURE DEFINITIONS

The following are the size/structure classes potentially found in the Size/Structure Pixel Map layer on West-side Forests. Extended descriptions of each of these classes can be found in Classification Scheme for Western Oregon and Washington, Pacific Meridian Resources, Rev. 2/2/93. Classes identified as being present in the Siskiyou's map are highlighted.

SIZESTRUCTURE_CODE	SIZESTRUCTURE_DESCRIPTION
01	**Water**
02	**Rock, Sparsely Vegetated**
03	**Snow**
04	**Grass**
05	**Shrub**
06	Developed and Agriculture
~~	
09	Non-Tree
10	**Seed-Sap-Pole (Single-Size)**
11	**Pole (Single-Size)**
12	**Pole-Small (Single-Size)**
13	**Small (Single-Size)**
14	**Small-Medium (Single-Size)**
15	**Medium (Single-Size)**
16	**Medium-Large (Single-Size)**
17	Large (Single-Size)
18	**Large-Giant (Single-Size)**
19	Giant (Single-Size)
20	**Pole/MSLD (Multi-Size Low Density)**
21	**Pole/MS+ (Multi-Size)**
22	**Pole/MS++ (Multi-Size)**
23	**Small/MSLD (Multi-Size Low Density)**
24	**Small/MS- (Multi-Size)**
25	**Small/MS+ (Multi-Size)**
26	**Small/MS++ (Multi-Size)**
27	**Medium/MSLD (Multi-Size Low Density)**
28	**Medium/MS- (Multi-Size)**
29	**Medium/MS+ (Multi-Size)**
30	**Large/MSLD (Multi-Size Low Density)**
31	**Large/MS- (Multi-Size)**
32	**Large/MS+ (Multi-Size)**
33	Giant/MSLD (Multi-Size Low Density)
34	**Giant/MS- (Multi-Size)**
35	Small/Seed (Two-Size)
36	**Medium/Seed-Sap (Two-Size)**
37	Large/Seed-Sap-Pole (Two-Size)
38	Giant/Seed-Sap-Pole (Two-Size)
39	Giant/Small (Two-Size)

Note 1: Definitions of terms used:

MS	=	Multi-size.
LD	=	Low density less than 40 percent total canopy cover.
MSLD	=	Multi-size, Low density (<40% total canopy cover)
-	=	There is more canopy cover in small trees within this class then in larger trees within this class.
+	=	There is more canopy cover in larger trees within this class than in smaller trees within this class.
++	=	Provides additional information about old growth as defined by Region 6 for production of the regional old growth maps. Small/MS++ will meet the old growth definition at all elevations, while Small/MS+ will meet the old growth definition for the true fir zone. Pole/MS++ will meet the old growth definition at only the true fir zone.

DBH RANGE FOR EACH SIZE CLASS BY AREA

EAST and WEST SIDE Forest Groups B, C, D, E and F		EASTERN WASHINGTON Forest Group A	
Seedling (SD)	≤ 0.9" dbh	Seedling (SD)	≤ 0.9" dbh
Sapling (SP)	1.0-4.9" dbh	Sapling (SP)	1.0-4.9" dbh
Pole (PL)	5.0-8.9" dbh	Pole (PL)	5.0-8.9" dbh
~~		Small (SM)	9.0-15.9" dbh
Small (SM)	9.0-20.9" dbh	~~	
~~		Medium (MD)	16.0-24.0" dbh
Medium (MD)	21.0-31.9" dbh	~~	
~~		Large (LG)	>24.0" dbh
Large (LG)	32.0-47.9" dbh		
Giant (GT)	≥ 48.0" dbh		

Note 2: This is the complete set for the west side contract, or Forest group B, C and D, made up of Forests GPW, MBS, MHW, OLY, ROR, SIS, SIU, UMP and WIL.

AGGREGATION SCHEME - Size/Structure to Seral Stage

Seral Stage	Included Size Structure Classes	
VERY EARLY, PIONEER		
	10	**Seed-Sap-Pole (Single-Size)**
	11	**Pole (Single-Size)**
	note (1) 27	**Medium/MSLD (Multi-Size Low Density)**
	note (1) 30	**Large/MSLD (Multi-Size Low Density)**
	note (1) 33	Giant/MSLD (Multi-Size Low Density)
	35	Small/Seed (Two-Size)
	36	**Medium/Seed-Sap (Two-Size)**
EARLY SERAL		
	12	**Pole-Small (Single-Size)**
	13	**Small (Single-Size)**
	14	**Small-Medium (Single-Size)**
	note (1) 20	**Pole/MSLD (Multi-Size Low Density)**
	24	**Small/MS- (Multi-Size)**
	37	Large/Seed-Sap-Pole (Two-Size)
	38	Giant/Seed-Sap-Pole (Two-Size)
MID SERAL		
	15	**Medium (Single-Size)**
	16	**Medium-Large (Single-Size)**
	21	**Pole/MS+ (Multi-Size)**
	22	**Pole/MS++ (Multi-Size)**
	note (1) 23	**Small/MSLD (Multi-Size Low Density)**
	25	**Small/MS+ (Multi-Size)**
	28	**Medium/MS- (Multi-Size)**
	39	Giant/Small (Two-Size)
LATE SERAL		
	17	Large (Single-Size)
	18	**Large-Giant (Single-Size)**
	19	Giant (Single-Size)
	26	**Small/MS++ (Multi-Size)**
	29	**Medium/MS+ (Multi-Size)**
	31	**Large/MS- (Multi-Size)**
CLIMAX		
	32	**Large/MS+ (Multi-Size)**
	34	**Giant/MS- (Multi-Size)**

Notes:

(1) The Multi-sized Low Density - MSLD (crown closure <40%) designation may indicate ultrabasic soil conditions on the Siskiyou, rather than a developing stand on normal soils. Under ultrabasic soil conditions the seral stage is probably late seral or climax for all of the indicated Size/Structure classes. **Pixels with the MSLD designation should ideally be flagged in some way that will permit their identification separately, both in mapping and data resulting from aggregation.**

References (Seral Stage):

(1) "Definitions and codes for seral vegetation" (DRAFT). Greater Pacific Northwest Seral Status Team: Fred Hall, chair, Senior Plant Ecologist, Pacific Northwest Region.

(2) "Viability assessments and management considerations for species associated with late-successional and old-growth forests of the Pacific Northwest". The report of the scientific analysis team. March 1993.

(3) From the same draft paper of number 1 but the definition was cited in the paper as being from: (Daubenmire 1952, 1968, 1976, Greig-Smith 1964, Kormandy 1969, Mueller-Dumbois and Eleenberg 1974, Oosting 1956, Whittaker 1953., Cain 1939.)

Appendix G: Exotic Plant Species Present In the Sixes River Watershed

GRASSES, SEDGES, RUSHES

Silver Hairgrass	AICA
Meadow Foxtail	ALPR
European Beachgrass	AMAR
Sweet Vernalgrass	ANOD
Slender Oat	AVBA
Quaking Grass	BRMI
Soft Brome	BRMO
Ripgut Brome	BRRI
Cheatgrass	BRTE
Crested Dogtail	CYCR
Dogtail Grass	CYEC
Orchardgrass	DAGL
Crabgrass	DISA
Alta Tall Fescue	FEAR3
Foxtail Fescue	FEME
Nitgrass	GAVE2
Velvetgrass	HOLA
Toadrush	JUBU
Annual Rye	LOMU
Perennial Rye	LOPE2
Timothy	PHPR
Annual Beardgrass	POMO
Kentucky Bluegrass	POPR

SHRUBS

French Broom	CYMO3
Scotch Broom	CYSC
Fleeceflower	POCU
Sweetbriar Rose	ROEG
Himalayan Blackberry	RUDI
Evergreen Blackberry	RULA2
Gorse	ULEU

FORBS

Scarlet Pimpernel	ANAR3
Chamomile	ANCO
English Daisy	BEPE
Oxeye Daisy	CHLE2
Canada Thistle	CICA
Chicory	CIIN
Poison Hemlock	COMA2
Queen Anne's Lace	DACA4
Foxglove	DIPU
Teasel	DISY
Crane's Bill	ERCI
Coast Fireweed	ERPR
Dovefoot Geranium	GEMO
English Ivy	HEHE
Klamathweed	HYPE
Cat's Ear	HYRA
Everlasting Pea	LALA3
Bird's Foot Trefoil	LOCO3
White Sweet Clover	MEAL
Yellow Sweet Clover	MEOF
Pennyroyal	MEPU
Parentucellia	PAVI
English Plantain	PLLA
Common Plantain	PLMA
Curled Pondweed	POCR
Creeping Buttercup	RARE
Sheep Sorrel	RUAC
Curley Dock	RUCR
Burnet	SAMI2
Soapwort	SAOF2
Tansy	SEJA
Common Groundsel	SEVU
Sowthistle	SOAR
Chickweed	STME
Red Clover	TRPR
Hop Clover	TRPR2
Salsify	TRPR4
White Clover	TRRE
Moth Mullein	VEBL
Common Mullein	VETH

		SPECIAL AND UNIQUE HABITATS				TEMPERATE CONIFEROUS FOREST			
Species	Frequency of Occurrence	Meadows/ Small Openings	Marshes Ponds/Small Lakes	Riparian Zones	Rocky Areas Cliffs/Scabrock Slopes	Early Seral[1]	Mid Seral[2]	Late Seral[3]	Hardwoods
AMPHIBIANS:									
Red-legged frog	Common		X	X		X			
Foothill yellow-legged frog	Common			X		X			
Bullfrog	Status Unknown		X						
Pacific treefrog	Abundant		X	X		X			
Tailed frog	Occasional			X		X	X	X	
Western toad	Status Unknown	X	X	X					
Pacific giant salamander	Common		X	X		X	X	X	
Northwestern Salamander	Common	X	X	X		X	X	X	
Olympic Salamander	Occasional		X	X		X	X	X	
Oregon Salamander	Common		X	X		X	X	X	X
Dunn's Salamander	Occasional		X	X		X	X	X	
Del Norte Salamander	Status Unknown				X				
Western red-backed Salamander	Occasional	X		X		X			
Clouded Salamander	Occasional	X				X	X	X	X

1 = to 100 years old
2 = 100 to 200 years old
3 = 200+ years old

		SPECIAL AND UNIQUE HABITATS				TEMPERATE CONIFEROUS FOREST			
Species	Frequency of Occurrence	Meadows/ Small Openings	Marshes Ponds/Small Lakes	Riparian Zones	Rocky Areas Cliffs/Scabrock Slopes	Early Seral[1]	Mid Seral[2]	Late Seral[3]	Hardwoods
Rough-skinned newt	Abundant	X	X	X		X	X	x	X
REPTILES:									
Western pond turtle	Status Unknown		X						
Western skink	Common	X				X	X		X
Northern alligator lizard	Common	X			X	X	X	X	X
Southern alligator lizard	Occasional	X			X		X	X	X
Western fence lizard	Abundant	X			X	X			
Rubber boa	Common	X			X	X	X		X
Ringneck snake	Occasional	X				X	X		X
Sharp-tailed snake	Status Unknown	X				X	X		X
Gopher snake	Common	X			X	X	X		X
Western yellow-bellied racer	Common	X			X	X	X		X
Northwestern garter snake	Common	X			X	X			X
Common garter snake	Common	X			X	X			X
Western terrestrial garter snake	Status Unknown	X		X	X	X			X

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		SPECIAL AND UNIQUE HABITATS				TEMPERATE CONIFEROUS FOREST			
Species	Frequency of Occurrence	Meadows/ Small Openings	Marshes Ponds/Small Lakes	Riparian Zones	Rocky Areas Cliffs/Scabrock Slopes	Early Seral[1]	Mid Seral[2]	Late Seral[3]	Hardwoods
Aquatic garter snake	Common		X	X					
MAMMALS:									
Opossum	Occasional	X		X		X	X		X
Vagrant shrew	Status Unknown	X		X		X	X	X	X
Pacific shrew	Status Unknown	X	X			X	X		
Trowbridge shrew	Common	X				X	X		X
Dusky shrew	Status Unknown	X		X			X		X
Shrew mole	Common	X		X		X			X
Townsend mole	Common	X							
Coast mole	Common	X				X			
Little brown myotis	Common	X	X				X		X
Yuma myotis	Status Unknown	X				X			X
Long-eared myotis	Status Unknown	X				X			X
Long-legged myotis	Status Unknown	X				X			X
California myotis	Common	X					X	X	X
Fringed myotis	Status Unknown	X				X			X
Silver-haired bat	Common	X				X	X		X

1 = to 100 years old
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		SPECIAL AND UNIQUE HABITATS				TEMPERATE CONIFEROUS FOREST			
Species	Frequency of Occurrence	Meadows/ Small Openings	Marshes Ponds/Small Lakes	Riparian Zones	Rocky Areas Cliffs/Scabrock Slopes	Early Seral[1]	Mid Seral[2]	Late Seral[3]	Hardwoods
Big brown bat	Status Unknown	X				X	X	X	X
Hoary bat	Status Unknown	X				X	X	X	X
Townsend's big-eared bat	Status Unknown	X				X			X
Pallid bat	Status Unknown	X				X	X		X
Bobcat	Common	X			X	X			X
Mountain lion	Occasional	X			X	X	X		X
Coyote	Common	X				X			
Grey fox	Rare	X				X			X
Raccoon	Common	X	X	X		X	X		X
Ringtail	Occasional	X		X	X		X	X	
Black bear	Common	X		X	X	X	X	X	X
Short-tailed weasel	Common	X				X	X		X
Long-tailed weasel	Occasional	X				X	X		X
Mink	Common		X	X					
Marten	Rare						X	X	
Fisher	Rare						X	X	X
Spotted skunk	Common	X				X	X		X

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		SPECIAL AND UNIQUE HABITATS				TEMPERATE CONIFEROUS FOREST			
Species	Frequency of Occurrence	Meadows/ Small Openings	Marshes Ponds/Small Lakes	Riparian Zones	Rocky Areas Cliffs/Scabrock Slopes	Early Seral[1]	Mid Seral[2]	Late Seral[3]	Hardwoods
Striped skunk	Common	X				X	X		X
River otter	Common		X	X		X			
Brush rabbit	Common	X				X			
Mountain beaver	Common	X		X		X	X	X	
Porcupine	Occasional					X	X	X	X
Beaver	Common		X	X		X			
Townsend chipmunk	Abundant	X				X	X		X
California ground squirrel	Common	X			X	X			X
Western gray squirrel	Common					X	X		X
Douglas squirrel	Common					X	X	X	X
Northern flying squirrel	Common					X	X	X	X
Dusky-footed woodrat	Common	X				X	X		
Bushy-tailed woodrat	Common				X	X			X
Muskrat	Rare		X	X					
Deer mouse	Abundant	X				X	X	X	X
Western red-backed vole	Status Unknown			X		X	X	X	

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		SPECIAL AND UNIQUE HABITATS				TEMPERATE CONIFEROUS FOREST			
Species	Frequency of Occurrence	Meadows/ Small Openings	Marshes Ponds/Small Lakes	Riparian Zones	Rocky Areas Cliffs/Scabrock Slopes	Early Seral[1]	Mid Seral[2]	Late Seral[3]	Hardwoods
White-footed vole	Status Unknown						X	X	
Red tree vole	Status Unknown					X	X	X	
Townsend vole	Status Unknown	X		X					
Long-tailed vole	Status Unknown	X		X		X			X
Oregon vole	Status Unknown	X		X		X	X	X	
California vole	Status Unknown	X							
Pacific jumping mouse	Occasional	X				X			X
Black-tailed deer	Common	X				X	X	X	X
Roosevelt elk	Common	X				X	X	X	X
Harbor seal	Common			X					

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Appendix I: Birds of the Sixes Watershed and their Associated Habitat

		SPECIAL AND UNIQUE HABITATS				TEMPERATE CONIFEROUS FOREST			
Species	Frequency of Occurrence	Meadows/ Small Openings	Marshes Ponds/Small Lakes	Riparian Zones	Rocky Areas Cliffs/Scabrock Slopes	Early Seral[1]	Mid Seral[2]	Late Seral[3]	Hardwoods
Common Loon	Rare		X						
Horned Grebe	Rare		X						
Western Grebe	Occasional		X						
Brown Pelican	Occasional		X						
Double-crested Cormorant	Occasional		X						
Great Blue Heron	Common		X	X					
Green-backed Heron	Occasional		X	X					
Great Egret	Common		X	X					
Tundra Swan	Rare		X	X					
Canada Goose	Occasional		X	X					
Mallard*	Common		X	X					
Green-winged Teal	Occasional		X	X					
Cinnamon Teal	Rare		X	X					
Wood Duck*	Occasional		X	X					
Ring-necked Duck	Occasional		X	X					
Bufflehead	Occasional		X	X					

***Known or believed to nest on district**

1 = to 100 years old
2 = 100 to 200 years old
3 = 200+ years old

		SPECIAL AND UNIQUE HABITATS				TEMPERATE CONIFEROUS FOREST			
Species	Frequency of Occurrence	Meadows/ Small Openings	Marshes Ponds/Small Lakes	Riparian Zones	Rocky Areas Cliffs/Scabrock Slopes	Early Seral[1]	Mid Seral[2]	Late Seral[3]	Hardwoods
Spotted Owl*	Occasional						X	X	X
Barred Owl*	Rare						X	X	X
Great Gray Owl	Rare						X	X	
Northern Saw-whet Owl*	Occasional					X	X	X	X
Common Nighthawk	Occasional	X				X	X	X	X
Vaux's Swift*	Common						X	X	
Rufous Hummingbird*	Common	X				X			X
Calliope Hummingbird*	Occasional	X				X			X
Allen's Hummingbird*	Occasional	X				X			X
Anna's Hummingbird*	Rare	X				X			
Belted Kingfisher*	Common		X	X		X			
Northern Flicker*	Common					X	X		X
Pileated Woodpecker*	Common					X	X	X	X
Hairy Woodpecker*	Common					X	X	X	X
Downy Woodpecker*	Occasional					X	X	X	X
Red-breasted Sapsucker*	Common					X	X		X
Western Kingbird	Occasional	X				X			

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3 = 200+ years old

		SPECIAL AND UNIQUE HABITATS				TEMPERATE CONIFEROUS FOREST			
Species	Frequency of Occurrence	Meadows/ Small Openings	Marshes Ponds/Small Lakes	Riparian Zones	Rocky Areas Cliffs/Scabrock Slopes	Early Seral[1]	Mid Seral[2]	Late Seral[3]	Hardwoods
Olive-sided Flycatcher*	Common	X				X	X		X
Western Wood Pewee*	Common	X				X	X		X
Willow Flycatcher*	Occasional	X	X	X		X			X
Hammond's Flycatcher*	Occasional	X				X	X	X	X
Dusky Flycatcher*	Occasional						X	X	X
Western Flycatcher*	Common						X	X	X
Black Pheobe	Occasional	X				X			
Violet-green Swallow*	Common								
Tree Swallow*	Common	X		X		X			X
Barn Swallow*	Common	X		X		X			
No. Rough-winged Swallow*	Common	X	X	X		X			
Cliff Swallow*	Common		X		X	X			
Purple Martin*	Rare	X				X			
Gray Jay*	Rare						X	X	X
Steller's Jay*	Common					X	X	X	X
Scrub Jay*	Common	X				X			X
American Crow*	Common	X				X			X

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		SPECIAL AND UNIQUE HABITATS				TEMPERATE CONIFEROUS FOREST			
Species	Frequency of Occurrence	Meadows/ Small Openings	Marshes Ponds/Small Lakes	Riparian Zones	Rocky Areas Cliffs/Scabrock Slopes	Early Seral[1]	Mid Seral[2]	Late Seral[3]	Hardwoods
Common Raven*	Common					X	X	X	
Black-capped Chickadee*	Common	X				X	X		X
Mountain Chickadee*	Rare	X				X	X		X
Chestnut-backed Chickadee*	Common	X				X	X		X
Bushtit*	Common	X				X	X		X
Red-breasted Nuthatch*	Common					X	X		X
White-breasted Nuthatch	Rare					X	X		X
Brown Creeper*	Occasional						X		X
House Wren*	Occasional	X				X			X
Winter Wren*	Common	X				X	X	X	X
Rock Wren*	Rare				X				
Bewick's Wren*	Occasional	X				X			X
Marsh Wren*	Occasional		X	X					
Wrentit*	Common	X				X			
Dipper*	Common			X		X			

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		SPECIAL AND UNIQUE HABITATS				TEMPERATE CONIFEROUS FOREST			
Species	Frequency of Occurrence	Meadows/ Small Openings	Marshes Ponds/Small Lakes	Riparian Zones	Rocky Areas Cliffs/Scabrock Slopes	Early Seral[1]	Mid Seral[2]	Late Seral[3]	Hardwoods
Golden-crowned Kinglet*	Common					X	X	X	X
Ruby-crowned Kinglet*	Common					X	X	X	X
American Robin*	Common	X				X	X	X	X
Varied Thrush*	Common					X	X	X	X
Hermit Thrush*	Common	X				X	X	X	X
Swainson's Thrush*	Common					X	X	X	X
Western Bluebird*	Common	X				X			X
Townsend's Solitaire*	Occasional					X	X		X
Water Pipit	Rare	X				X			
Cedar Waxwing*	Common					X	X		X
Northern Shrike	Rare	X				X			
European Starling*	Occasional	X				X			
Solitary Vireo*	Common	X				X	X		X
Hutton's Vireo*	Common					X	X		X
Warbling Vireo*	Common	X				X	X		X
Orange-crowned Warbler*	Common	X				X	X		X
Nashville Warbler*	Rare					X	X		X

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		SPECIAL AND UNIQUE HABITATS				TEMPERATE CONIFEROUS FOREST			
Species	Frequency of Occurrence	Meadows/ Small Openings	Marshes Ponds/Small Lakes	Riparian Zones	Rocky Areas Cliffs/Scabrock Slopes	Early Seral[1]	Mid Seral[2]	Late Seral[3]	Hardwoods
Yellow Warbler*	Occasional		X	X		X			
Black-throated Gray Warbler*	Common					X	X	X	X
Townsend's Warbler	Occasional					X	X	X	X
Hermit Warbler*	Common						X	X	X
Yellow-rumped Warbler*	Common			X		X	X		X
MacGillivray's Warbler*	Common		X	X		X			
Common Yellowthroat*	Occasional		X	X		X			
Wilson's Warbler*	Common	X				X	X		X
Yellow-breasted Chat*	Rare	X		X		X			
Western Tanager*	Common					X	X	X	X
Black-headed Grosbeak*	Common					X	X		X
Evening Grosbeak*	Common					X	X		X
Red-winged Blackbird*	Common		X	X					
Brewer's Blackbird*	Common	X				X			
Brown-headed Cowbird*	Occasional	X				X			
Western Meadowlark	Common	X							

***Known or believed to nest on district**

1 = to 100 years old
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3 = 200+ years old

		SPECIAL AND UNIQUE HABITATS				TEMPERATE CONIFEROUS FOREST			
Species	Frequency of Occurrence	Meadows/ Small Openings	Marshes Ponds/Small Lakes	Riparian Zones	Rocky Areas Cliffs/Scabrock Slopes	Early Seral[1]	Mid Seral[2]	Late Seral[3]	Hardwoods
Northern Oriole	Rare								X
Lazuli Bunting*	Occasional	X		X		X			
Rufous-sided Towhee*	Common					X			X
Chipping Sparrow*	Occasional	X				X	X		X
Savannah Sparrow*	Common	X				X			
Fox Sparrow*	Occasional	X				X			X
Song Sparrow*	Common	X		X		X			
Lincoln's Sparrow	Occasional					X			X
White-throated Sparrow	Rare	X				X			X
White-crowned Sparrow*	Common	X		X		X			X
Golden-crowned Sparrow	Common	X		X		X			X
Dark-eyed Junco*	Common	X				X	X		X
Purple Finch*	Common	X				X			X
Cassin's Finch	Rare						X	X	
House Finch	Common	X				X			
Pine Siskin	Common	X				X	X		X
Red Crossbill	Common						X	X	

***Known or believed to nest on district**

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		SPECIAL AND UNIQUE HABITATS				TEMPERATE CONIFEROUS FOREST			
Species	Frequency of Occurrence	Meadows/ Small Openings	Marshes Ponds/Small Lakes	Riparian Zones	Rocky Areas Cliffs/Scabrock Slopes	Early Seral[1]	Mid Seral[2]	Late Seral[3]	Hardwoods
Lesser Goldfinch	Occasional	X				X			X
American Goldfinch	Common	X				X			
House sparrow	Rare	X							

***Known or believed to nest on district**

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Appendix J: Pacific Bald Eagle Recovery Plan
Site-Specific Tasks for Zone 23. California/Oregon Coast

The following are listed as the "most urgent" site specific tasks for bald eagle recovery in Zone 23: (pg. 133, Pacific Bald Eagle Recovery Plan)

1.32 MAINTAIN AND IMPROVE FORESTED HABITAT IN BOTH THE BREEDING AND WINTERING RANGE

Timber stands should be managed to promote habitat characteristics required by eagles for long-term nesting and roosting. In most cases, this requires management for old-growth stands. Silvicultural techniques, such as thinning or selective harvest, can help to create proper tree species composition and stand structure. The important element of any silvicultural plan should be to maintain an old growth overstory in the vicinity of nest sites and communal roosts. Development and maintenance of potential eagle habitat is as important as protection and maintenance of habitat currently used by eagles.

1.3211-- PROHIBIT LOGGING OF KNOWN NEST TREES, PERCH TREES, AND WINTER ROOST TREES

Trees used by eagles should be clearly identified and protected from logging. In addition, trees that provide wind breaks, that visually shield eagles from disturbances, or that are needed for long-term viability of eagle use areas must be maintained. Trees with unoccupied nests in suitable habitat and trees which formerly had nests should also be protected because these sites are sometimes used after several years of abandonment and will be important in providing habitat for expanding populations.

1.3215-- PRESERVE SNAGS IN EAGLE USE AREAS

All snags that are potential eagle perches within 500 m (1650 ft) of nests or roosts should be preserved. In addition, all snags utilized for roosting or foraging within nesting territories or communal roosts should be protected.

1.331-- ESTABLISH BUFFER ZONES AROUND NEST SITES

Buffer zones should be established for individual nest territories based on the location of nest trees, perch trees, and flight paths, as well as stand characteristics, known individual tolerances, and weather patterns.

Until site specific plans are available or until guidelines can be developed by local groups or agencies, guidelines prepared by the U.S. Fish and Wildlife Service Region I should serve as minimum protective measures.

1.332 EXCLUDE LOGGING, CONSTRUCTION, HABITAT IMPROVEMENT, AND OTHER ACTIVITIES DURING CRITICAL PERIODS OF EAGLE USE

Picnicking, camping, blasting, firearm use, timber harvest, and low level aircraft operations should not be allowed within 400 m of nests and roosts during periods of eagle use. These activities should also be regulated up to 800 m from nests and roosts where eagles have line-of-sight vision. Critical nesting periods vary throughout the recovery area but generally fall between 1 January and 31 August. Key wintering areas need protection from disturbance from approximately 15 November to 15 March.

1.333 PROHIBIT BUILDING CONSTRUCTION NEAR KEY BALD EAGLE NESTING AND WINTERING HABITATS.

Permanent structures that are occupied during periods of eagle use should not be constructed near nesting or winter use areas. Buildings should be no closer than 400 m from the shorelines of feeding waters. Wooded summer campgrounds and small farming operations are probably compatible with winter eagle use, but campgrounds in most wintering areas should be closed from November to March.

1.334 PROHIBIT VEHICLE TRAFFIC AT SENSITIVE KEY AREAS DURING PERIODS OF EAGLE USE

Snowmobile, boat, and automobile traffic can disturb eagles in some areas. Roads should be closed to protect nesting areas, when appropriate, and snowmobiles should be prohibited from traveling near nesting and wintering habitat during periods of eagle use.

Land use plans should guide human activity away from important feeding perches and prevent human disturbance in nesting and roosting areas.

Buoys and booms can be used to channel boat traffic away from sensitive eagle use areas. At Shasta Lake, California, this approach, in combination with shoreline signing and recreational maps, has reduced conflicts between eagles and recreationists (Detric pers. comm.).

The impacts of automobile traffic can be lessened if people remain in their vehicles. In addition, eagles may grow accustomed to the presence of humans at certain locations. Appropriate signs at these viewing points could educate the viewing public about bald eagle ecology and management.

3.2 PROVIDE FOR ADEQUATE STATE AND FEDERAL EAGLE PROTECTION EFFORTS

Eagles are now protected by a variety of state and federal laws including the Migratory Bird Treaty Act of 1918, the Lacey Act, and 1940 Bald and Golden Eagle Protection Act, and the Endangered Species Act of 1973, as amended. Law enforcement agents and agency lawyers must have latitude to prosecute specific cases under the most appropriate law. The Division of Law Enforcement, U.S. Fish and Wildlife Service, and individual state enforcement agencies should work in close cooperation while investigating and prosecuting illegal activity involving bald eagles.

3.3 PROVIDE SEASONAL SURVEILLANCE AT SELECTED HABITATS WHERE EAGLES ARE VULNERABLE TO HUMAN DISTURBANCE OR HARASSMENT

At some nest sites, roosting areas and other use areas, bald eagles may be vulnerable to detrimental distrubances by people walking, in land vehicles, or in boats. Assigning guards to nest or roost areas at critical times of the year may be necessary to avert disturbances that could result in birds being killed or abandoning a nest or roost site. Responsiblities of site attendants might include: identifying sources of disturbance, providing local public relations, discouraging people from entering especially sensitive areas, summoning law enforcement aid in emergencies, and collecting biological data.

4.11 REDUCE BALD EAGLE MORTALITY ASSOCIATED WITH SHOOTING AND TRAPPING

Shooting continues to be the most common cause of bald eagle mortality. Uncontrolled shooting could easily lead to the decimation of nesting and/or wintering populations in local areas. Aggressive law enforcement and public information and education programs (see Sec. 3.2) will be the most effective way to reduce shooting and trapping mortality. It also may be necessary to control or regulate public access in areas where shooting or trapping problems have been identified. Roads should be closed in some areas during critical periods of eagle use. Nest wardens may be required at nests near human population or recreation centers (see 3.3). Habitat management techniques (see 1.32) should also be used in these cases to keep eagles away from hazardous situations.

4.121 RESTRICT USE OF POISONS DETRIMENTAL TO EAGLES IN PREDATOR AND RODENT CONTROL PROGRAMS WITHIN IMPORTANT BALD EAGLE NESTING AND WINTERING HABITAT

Rodent and jack rabbit control with strychnine has been identified as a recurring cause of bald eagle mortality, and compound 1080 has been responsible for at least one bald eagle death in the West (National Wildlife Health Laboratory 1985). Extreme caution should be taken whenever control programs are initiated in traditional eagle use areas. If it is determined that bald eagles feed in the area, the control program should be disallowed or structured in such a way as to have no effect on eagles. Safer, alternative chemicals should be considered. If existing regulations are inadequate to protect the bald eagle, new legislation or regulations should be encouraged.

Appendix K: Peregrine Falcon Recovery Plan Objectives

The proposals that follow are believed to be necessary to restore the Pacific Coast population of the American peregrine falcon to a secure, self-sustaining status. A "self-sustaining" population is one whose natural productivity is equal to or greater than its mortality, without human management. Based on available data the minimum number of known self-sustaining wild pairs required for consideration of delistin the peregrine are: California, 120 pairs; Oregon, 30 pairs; Washington, 30 pairs; and Nevada, 5 pairs. This totals 185 active pairs for the Pacific States region. The minimum productivity for this number of pairs should be an average of 1.5 fledged young per active territory per year over at least a five year peiod. This productivity level is a Recovery Team best estimate based on review of other population reproductive rates (Hickey and Anderson 1969, Nelson 1977, Newton 1979a, Rattcliffe 1980) and estimates of rates required to maintain a stable population (Enderson 1969b, Young 1969). A variety of recovery indicators will be determined (e.g. DDE residue levels, coastal population productivity). Distribution within the Pacific States must be as widespread as possible within the historical range. Figure 1 is a map showing peregrine breeding management units and minimum number of active pairs as a recovery goal for each unit. These units represent geographic areas either known to be occupied or that were historically occupied and are still suitable for peregrines. Nest sites within each of these zones are physiographically and ecologically similar, and hence provide convenient management units. These minimum active nest site numbers do not equal the recovery goal. At such time that all minimum numbers are reached (totaling 122), then the Pacific Coast population may be considered for reclassification to threatened status. Once all minimum numbers are met, a fledging success average of 1.5 per active pair is achieved, and the total number of known pairs reached 185 for the Pacific States, then the species may be considered for total delisting. The minimum numbers of pairs per management unit, the total known numbers of pairs, and the appropriate average fleding success must be met prior to delisting. These numbers may be revised up or down as the species recovers, and its population ecology is better understood.

Basic needs to meet the objective of the Recovery Plan are to maintain sufficient habitat for a breeding population of 185 pairs, increase and maintain the productivity of individual pairs, decrease mortality at all age levels as much as possible, preserve migratory and winter habitat, and artificially supplement the number of birds entering the population until the breeding population of 185 pairs is achieved. In addition, an ongoing monitoring program is desirable to identify changes in the population and to measure the success of various protection and management programs. Peregrine young introduced into the wild should be the progeny of Pacific anatum stock to the greatest extent possible. Peregrines of uncertain or nonresident lineage should be avoided in this reintroduction program. Also, hacking efforts of anatum peregrines should be made in natural nesting habitat unless such habitats are shown to be unavailable or unsuitable. Natural nesting habitat is any historically known type of habitat (e.g. cliffs, islands, buildings, cavities of large trees). Urban release sites can add to the recovery of the wild population. Survival of young from urban hack sites is greater than at wild hack sites, and the urban-released young probably recruit into the wild as well as establish in urban environments (Cade, T. J. and P. R. Dague 1981). Our goal, however, is to establish wild nest sites to the greatest extent possible.

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