North Fork Eel River Watershed Analysis

Version 1.0

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Acronym Definitions

AWC - Available Water Capacity

BLM - USDI-Bureau of Land Management

CDF - California Department of Forestry

CDFG - California Department of Fish and Game

CFF - Cartographic Feature Files - map components taken from 7.5 quad maps

CFI - Continuous Forest Inventory

CHU - Critical Habitat Unit

CRMP - Coordinated Resource Management Plan

CWD - Coarse Woody Debris

EUI - Ecological Unit Inventory

FLPMA - Federal Land and Policy Management Act

FSEIS - Final Supplemental Environmental Impact Statement

HRV - Historical Range of Variability

LOP - Limited Operating Periods

LRMP -Land and Resources Management Plan

LSR - Late-Successional Reserve as defined in the Northwest Forest Plan

LWD - Large Woody Debris

NEPA - National Environmental Policy Act

NRF - Nesting, Roosting, and Foraging habitat

NSO - Northern spotted owl

OHV - Off-highway Vehicle

RMR - Recommended Management Range

ROD - Record of Decision

South Zone - Public lands within the Mad River Ranger District, Six Rivers National Forest.

SRNF - Six Rivers National Forest

TE or T&E - Federally-listed as threatened or endangered

TES - Federally-listed threatened or endangered, or a FOREST SERVICE Sensitive species

TTF - Timberland Task Force - vegetation data compiled from satellite images

USFWS - U.S. Fish and Wildlife Service

USGS - United States Geological Service

WHR - Wildlife Habitat Relationships

Appendices are available for review at the following locations:

Mad River Ranger District
Star Route Box 300
Bridgeville, CA 95573
(707)574-6233

Six Rivers National Forest
1330 Bayshore Way
Eureka, CA 95501
(707)442-1721

Bureau of Land Management
Arcata Resource Area
1695 Heindon Road
Arcata, CA 95521
(707) 825-2300

PREFACE

This Watershed Analysis covers all lands (both public and private) in the North Fork Eel River watershed. It is intended to be one component of a more extensive document that will also contain watershed analyses for the South Fork Eel River, the Van Duzen River, and an overview of the entire Eel River Basin. Our purpose is to put the Federal lands in perspective within the watershed as a whole. Recommendations are made only for Federal lands or for actions that Federal agencies should consider. Data available to conduct this Watershed Analysis varied by ownership. Data were far more abundant for lands managed by Six Rivers National Forest (which comprise the majority of land in the watershed), hence most of the analysis and subsequent recommendations are focused on those lands.

Due to time constraints, the North Fork Eel River Watershed Analysis does not presently meet the requirements of the Forest Service Environmental Impact Statement Record of Decision (FSEIS ROD) in a few specific areas. The team feels it is important to note these specific deficiencies. In order for the analysis to meet ROD standards, these deficiencies must be resolved.

- ROD Page C-32, RF-3: "Determine the influence of each road on the Aquatic Conservation Strategy objectives through watershed analysis."

Presently, we do not have a map of all roads on Forest Service and private lands. Once all roads have been mapped, an analysis of their "influence" can be undertaken.

- ROD Page C-48, "Fire and Fuels Management: For areas in the Matrix that are located in the rural interface, fire management activities should be coordinated with local governments, agencies, and landowners during watershed analysis to identify additional factors which may affect hazard reduction goals."

At this time, Lucy Salazar has spoken with the California Department of Forestry (CDF) in regard to the Eel River, but specific concerns have not been formally identified. Coordination with Bureau of Land Management (BLM) fire personnel has not occurred. Landowners have not been contacted. See the recommendations section concerned with this subject for further needs.

- ROD Page E-4: "Specific to monitoring and evaluation, the results and findings from watershed analysis are used to reveal the most useful indicators for monitoring environmental change, detect magnitude and duration of changes in conditions, formulate and test hypotheses about the causes of the changes, understand these causes and predict impacts, and manage the ecosystem for desired outcomes. Watershed analysis may result in additional monitoring questions. Watershed analysis will provide information about patterns and processes within a watershed and provide information for monitoring at that scale."

At this time, although this watershed analysis will provide some information useful to monitoring as well as some recommendations for future monitoring needs, it does not come close to revealing the most useful indicators (or even identification of all of the key processes) for monitoring as described in the ROD. Forest Service Ecological Unit Inventory (EUI) data will be helpful for monitoring Forest Service lands but are not available at this time. Even with these data, much information will need to be collected in order to begin the process of monitoring needs to meet the ROD.

Riparian Reserves are important land allocations in the ROD and are discussed both in relation to terrestrial species and aquatic species. Given the channel density in the North Fork Eel River watershed, Riparian Reserves could contain extensive acreage on Federal lands. The ROD requires watershed analysis prior to changing interim Riparian Reserve widths.

- ROD Page B-13: "Watershed analysis should take into account all species that were intended to be benefited by the prescribed Riparian Reserve widths. Those species include fish, mollusks, amphibians, lichens, fungi, bryophytes, vascular plants, American marten, red tree voles, bats, marbled murrelets, and northern spotted owls."

As of yet, Riparian Reserves are not yet mapped. Although channels have been mapped for Six Rivers National Forest land, the channels are not mapped on BLM lands. Inner gorge, unstable lands, and potentially unstable lands have not been mapped. Little or no data exist on fungi, bryophytes, and lichens that may occur in the watershed. Amphibian species in northwestern California are known to use even infrequently-flowing channels for

nursery areas and dispersal. Monitoring in Pilot Creek may provide some important information to species use of intermittent channels but data collection is just beginning and the results will not be available for some time.

CHAPTER 1: WATERSHED CHARACTERIZATION

PHYSICAL ENVIRONMENT

The North Fork of the Eel River watershed covers 180,020 acres, of which 89,570 are Federal (73,230 Forest Service and 16,340 BLM); 86,970 are State or privately owned; and 3,480 acres are tribal lands.

Elevations range from 600 feet at the mouth of the river to 5,900 feet in the Yolla Bolly Wilderness. There are 171 miles of "blue-line" streams (streams mapped on a USGS quadrangle map), and probably three to four times that amount in smaller ephemeral and intermittent streams.

Geology, Soils and Landscape

The North Fork Eel River watershed is underlain by three main types of Franciscan rocks. They are described as follows:

- Competent greywacke typically forms sharp ridges and steep, eroding hillslopes with shallow to moderately deep, poorly developed soils;
- Less competent greywacke includes deeply weathered saprolites and inter-bedded sandstone/shale that typically form moderately-steep, forested slopes and deep, gravelly loam to clay loam soils with good drainage and good water-holding capacity; and,
- Mélange areas typically have hummocky topography related to chronic instability; soils are mostly deep with somewhat restricted drainage.

Minor bedrock types include: chert and metavolcanic rocks that generally form small, elongate, resistant outcrops; and ultramafic rocks and associated soils that occur principally around Red Mountain, which support distinctive vegetation and form slopes that are commonly subject to mass wasting.

Units are generally separated by faults where the resulting weakened rocks are prone to slope failure. Physical properties of different geologic substrates vary greatly and abruptly at these contacts. Bedrock contrasts also may control groundwater movement, which in turn can affect slope stability and terrestrial habitats.

Soils are typically medium-to-moderately fine textured. Because of the Mediterranean climate, they are relatively dry from July through October.

The landscape consists of an older, subdued upland terrain that has been well-dissected by steep river canyons. Inner gorges are moderately well-developed in the middle and lower canyon sections. Large deep-seated slides are less common in the North Fork Eel River watershed than other parts of the Basin or Forest. Shallow slides are more common and tend to be on south-facing slopes, perhaps because of the sparser vegetation. Most recent landslides appear to be in canyons away from roads and cutblocks.

Hydrology and Sedimentation

Large amounts of sediment are currently stored in channels throughout the watershed, especially in the mainstem and major tributaries. There is evidence of recent downcutting through this material in many places, but the channel network is slightly transport-dominated overall.

Geologically rapid stream incision in much of the watershed has resulted in relatively narrow riparian zones. There is also very little perennial flow in most headwater streams, which limits the extent of riparian vegetation.

BIOLOGICAL ENVIRONMENT

Fisheries

The native fish assemblage is comprised of steelhead (both summer and winter runs), chinook salmon, rainbow trout, and Pacific lamprey. California roach (an introduced species) is quite common in the mainstem.

Water temperatures exceeding 80 degrees F have been recorded in the mainstem of the North Fork Eel River during summer seasons (Six Rivers National Forest Fisheries Department data, unpublished). Such temperatures are lethal to salmonids. These temperature conditions are not in compliance with the goals of the Federal Water Pollution Act of 1972 (otherwise known as the Clean water Act). This watershed is listed by the US Environmental protection Agency as an "impaired water body" because of the excessively high water temperatures and excessive sediment levels.

Split Rock, located downstream of Hull's Creek, is a partial barrier to anadromous fish, depending on the flow and the species of fish. Moreover, 1995 surveys in the mainstem upstream of Red Mountain Creek and within Hull's Creek suggest that squawfish are absent from the North Fork above this barrier. (Note: Native Americans often perceive the term "squawfish" to be an offensive designation. Hereafter, squawfish will be referred to by the scientific name, *Ptychocheilus grandis*). Unlike other Eel River sub-basins, anadromous fish in the North Fork are not subject to *Ptychocheilus grandis* predation.

Relation to Eel Basin: The North Fork Eel River is designated a Tier 1 Key Watershed in the Northwest Forest Plan. As such, it is expected to help anchor the recovery of anadromous fish over the next several decades. Federal lands within the North Fork Eel River watershed are expected to be managed in ways that will maintain habitat conditions while receiving priority for restoration. These Federal lands contain much of the best remaining fish habitat and the lowest water temperatures found anywhere in the Eel Basin. Maintaining and restoring these watersheds is probably crucial to sustain anadromous fish populations within the Eel River Basin (Figure 1).

Vegetation

Vegetation analysis in the North Fork Eel River watershed was based on two data sets: timberland task force (TTF) data from the California Department of Fish and Game (CDFG) and the California Department of Forestry (CDF), and vegetation mapping by the ecology group of Six Rivers National Forest. A detailed comparison of these two data sets is presented in Appendix C. There is good correspondence between the plant community data, but poor correspondence between the structural attributes in the TTF data set (i.e., canopy closure and size class) and the seral stage data in the Forest Service data set. These data sets cover different areas of the watershed at different levels of detail. The TTF data covers the entire watershed whereas the Forest Service data only covers the northern half. The TTF data are also more generalized than the Forest Service data. For example, where the TTF data identify an area as mixed hardwood, the Forest Service data identify it as white oak series. Finally, the Forest Service data can be directly related to geology and soil characteristics because of the recent Ecological Unit Inventory (EUI) conducted in this watershed. The TTF data do not provide these types of relationships. Because of these differences, the two data sets are presented separately. Vegetation descriptions (based on a modified Wildlife Habitat Relationship classification) of BLM lands in the watershed are also presented.

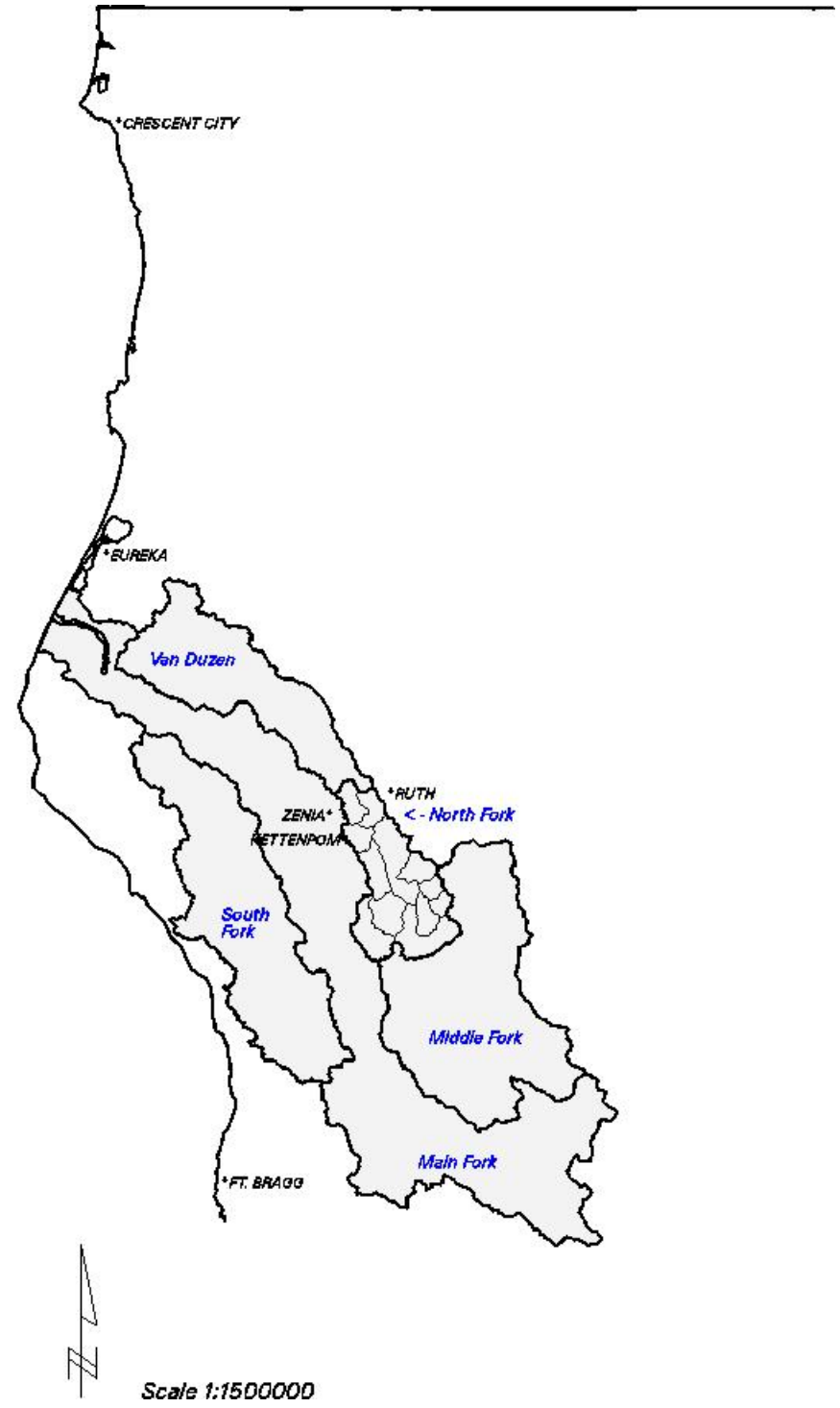

Figure 1. North Fork Eel River watershed located in northwestern California.

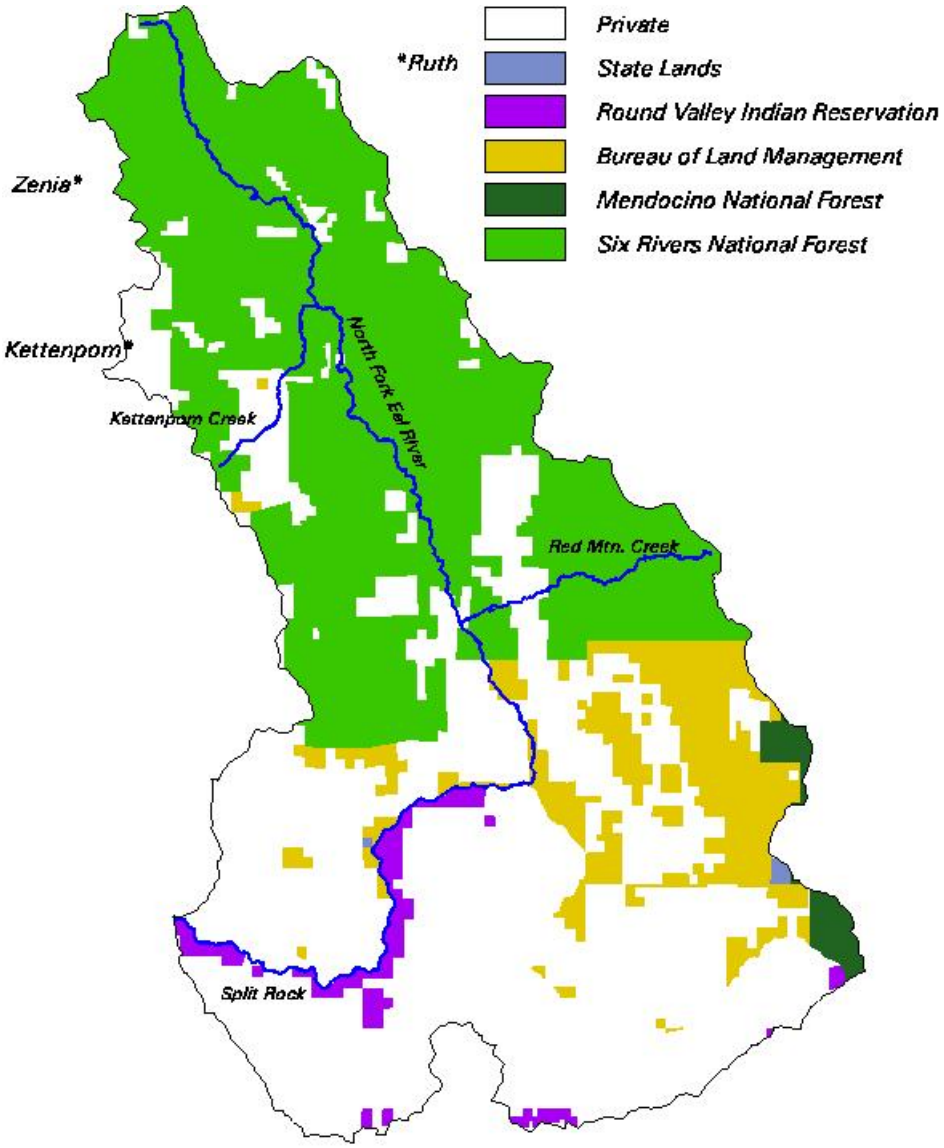

Figure 2. Public and private land ownership in North Fork Eel River watershed

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TTF Data for Entire Watershed:
According to the TTF data, the North Fork Eel River watershed contains primarily conifer and hardwood forests (Table 2, Figure 3). The dominant conifer types in this watershed are mixed hardwood conifer, Douglas-fir, and Klamath mixed conifer. The mixed hardwood type also dominates in this watershed. Herbaceous types, which include annual grasslands, make up three percent of the watershed according to this data set.

The conifer stands in this watershed are dominated by size classes 3 and 4 trees (Figure 4) with a dense canopy cover (Figure 5). Most of the stands with less than 40 percent canopy closure are in the southern third of the watershed (Figure 6). It also appears that most of the stands with dense canopy closure are within the National Forest boundary.

The BLM land outside of Wilderness areas (8,527 acres) is primarily mixed conifer with hardwood stands (Table 1, Figure 2). Douglas-fir and ponderosa pine make up a small component of this land. Most conifer stands are dominated by size classes 4 (11-24 inches) and 5 (greater than 24 inches) (Table 4) with medium (40-59 percent) canopy closure (Table 5).

Plant communities in the North Fork Eel River watershed show a high degree of natural fragmentation and diversity, primarily due to disturbance by fire and the influences of geomorphology, bedrock geology, and soils. Topographic position and aspect have a primary influence on the distribution of oak woodlands and grasslands in this watershed.

Conifer and oak woodland plant communities dominate the landscape in the North Fork Eel River watershed. Douglas-fir is the principal conifer vegetation series, while both white oak and black oak dominate in oak woodlands (Table 3, Figure 7). Other conifer communities include Jeffrey pine (on serpentine soils), white fir (at elevations above 3,800 feet), and ponderosa pine. Other plant communities in this watershed include grasslands, chaparral, live oak, gray pine, and western juniper.

Both bedrock geology and geomorphology influence vegetation in this area. Areas dominated by brush and live oak are generally found on steep slopes of metavolcanic rock and competent sandstone. Grasslands and oak woodlands are commonly associated with finer-grained substrates in mélange units. Some small patches of conifers within the watershed are found on ancient alluvial surfaces.

The primary soil characteristics affecting vegetation within this watershed are: available water holding capacity (AWC), parent material, and drainage. The tanoak and Douglas-fir vegetation series are primarily found on sites with high AWC. Live oak, gray pine, and chaparral plant communities are commonly found on sites with low AWC, while many grassland communities occur on sites with poor drainage.

Both natural and human-caused fires have created a mosaic of seral stages across the landscape (Figure 8). Early-mature and mid-mature stands for all vegetation series dominate this watershed (Table 4). Most of the old-growth Douglas-fir stands are in the Late-Successional Reserve (LSR) (Table 5, Figure 9), while most of the early-mature and mid-mature stands are in the Matrix, as are most of the white oak woodlands (Table 5). Some of the stands in those series related to commercial timber production have been harvested (Table 6).

Table 1. The distribution of Wildlife Habitat Relationship (WHR) vegetation types in the North Fork Eel River watershed. [BAR = barren, CPC = closed cone pine, cypress, DFR = Douglas-fir, HRB = herbaceous, JPN = Jeffrey pine, KMC = Klamath mixed conifer, MHC = montane hardwood conifer, MHW = montane hardwood, PPN = ponderosa pine, SHR = shrub, UND = undefined, WAT = water, WFR = white fir.]

WHR Type	Acres	Percent
BAR	190	0.11
CPC	30	0.02
DFR	40,801	23.00
HRB	5,570	3.00
JPN	4,902	3.00
KMC	25,263	14.00
MHC	53,725	30.00
MHW	30,103	17.00
PPN	13,477	8.00
SHR	5,199	3.00
UND	451	0.25
WAT	5	0.00
WFR	295	0.16

Source: Six Rivers National Forest Data for Northern Part.

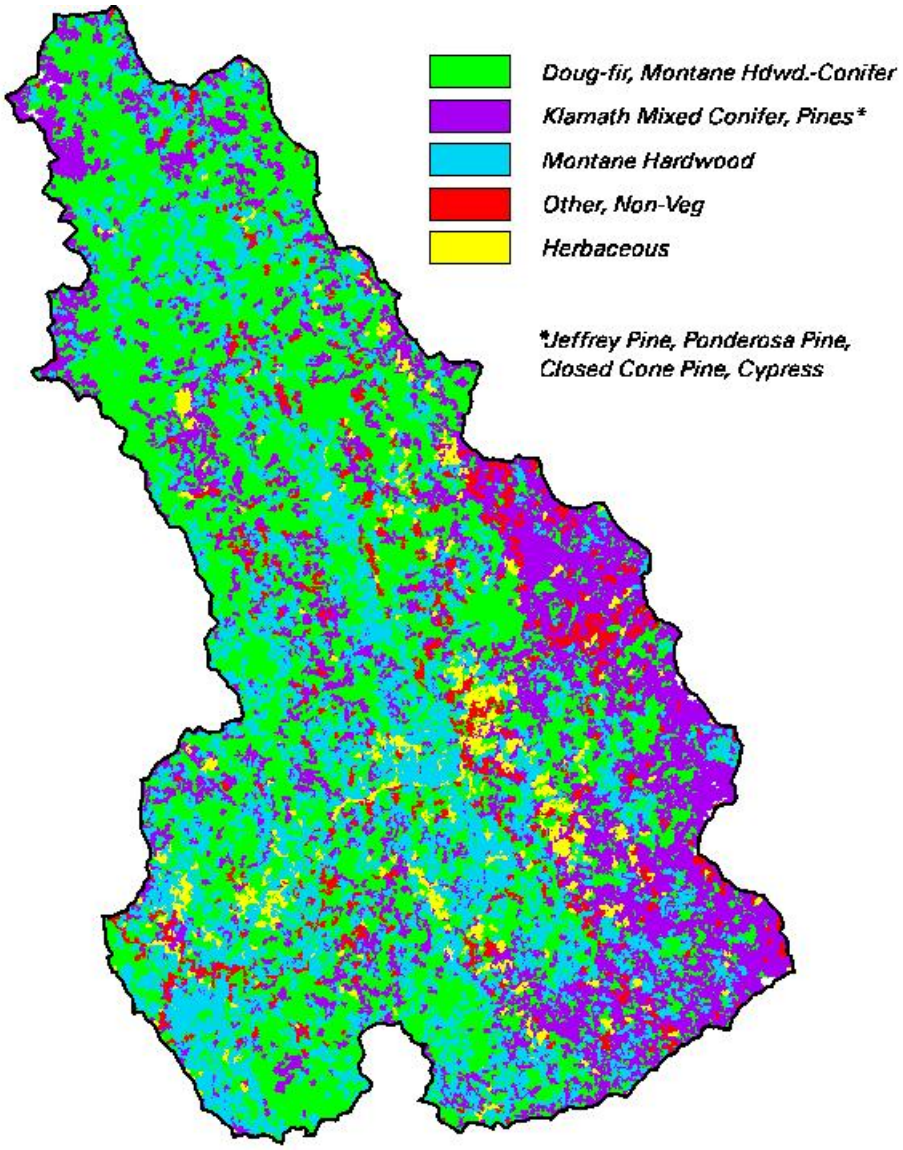

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Figure 3. Wildlife Habitat Relationships (WHR) classification Of land within North Fork Eel River watershed. Source: Timberland Task Force

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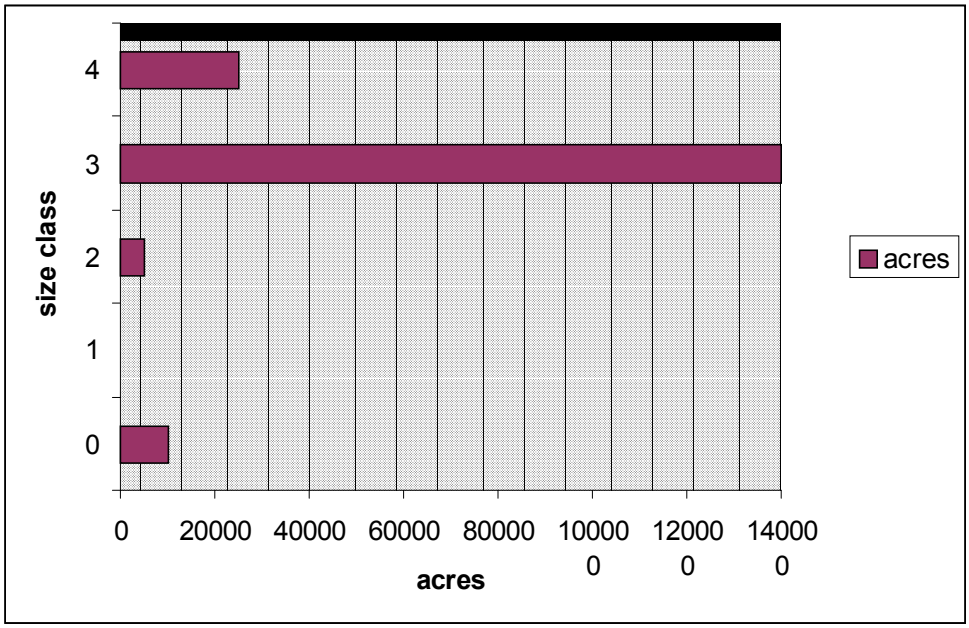

Size class distribution for commercial tree species within the North Fork Eel watershed. Source: Timberland Task Force.

Table 2. The distribution of vegetation types on BLM land in the North Fork Eel River watershed.

Vegetation type	Acres	Percent of watershed
Douglas-fir	**826**	**10**
Mixed conifer	**1,923**	**23**
Hardwoods	**2,593**	**30**
Ponderosa pine	**371**	**4**
Brush	**1,980**	**23**
Grass	**569**	**7**
River	**244**	**3**
Unknown	**21**	**0**

Table 3. The distribution of the vegetation series within the National Forest boundary in the North Fork Eel River watershed.

Series	Acres	Percent
Black oak	65	0.10
Canyon live oak	1,607	1.80
Chaparral	955	1.10
Douglas-fir	47,402	54.20
Grasslands	6,458	7.40
Gray pine	110	0.10
Jeffrey pine	1,071	1.20
Non-vegetation code	487	0.60
Ponderosa pine	349	0.40
Riparian	41	0.00
Tanoak	6,589	7.50
Western juniper	77	0.10
White fir	2,350	2.70
White oak	19,898	22.80

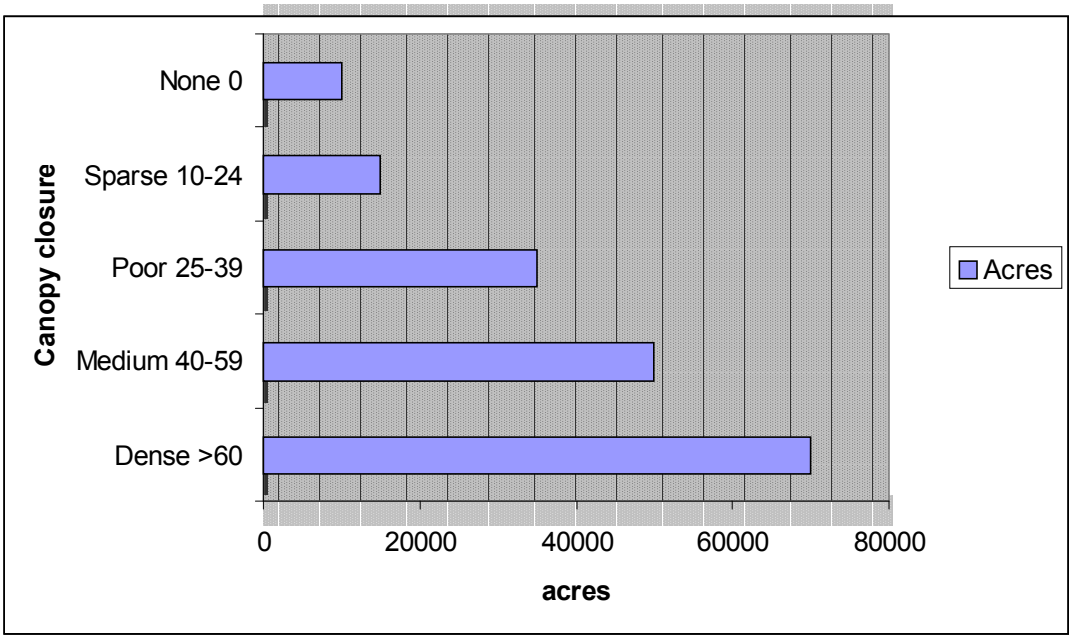

Figure 5. Canopy closure of commercial tree species within the North Fork Eel River watershed. Source: Timberland Task Force.

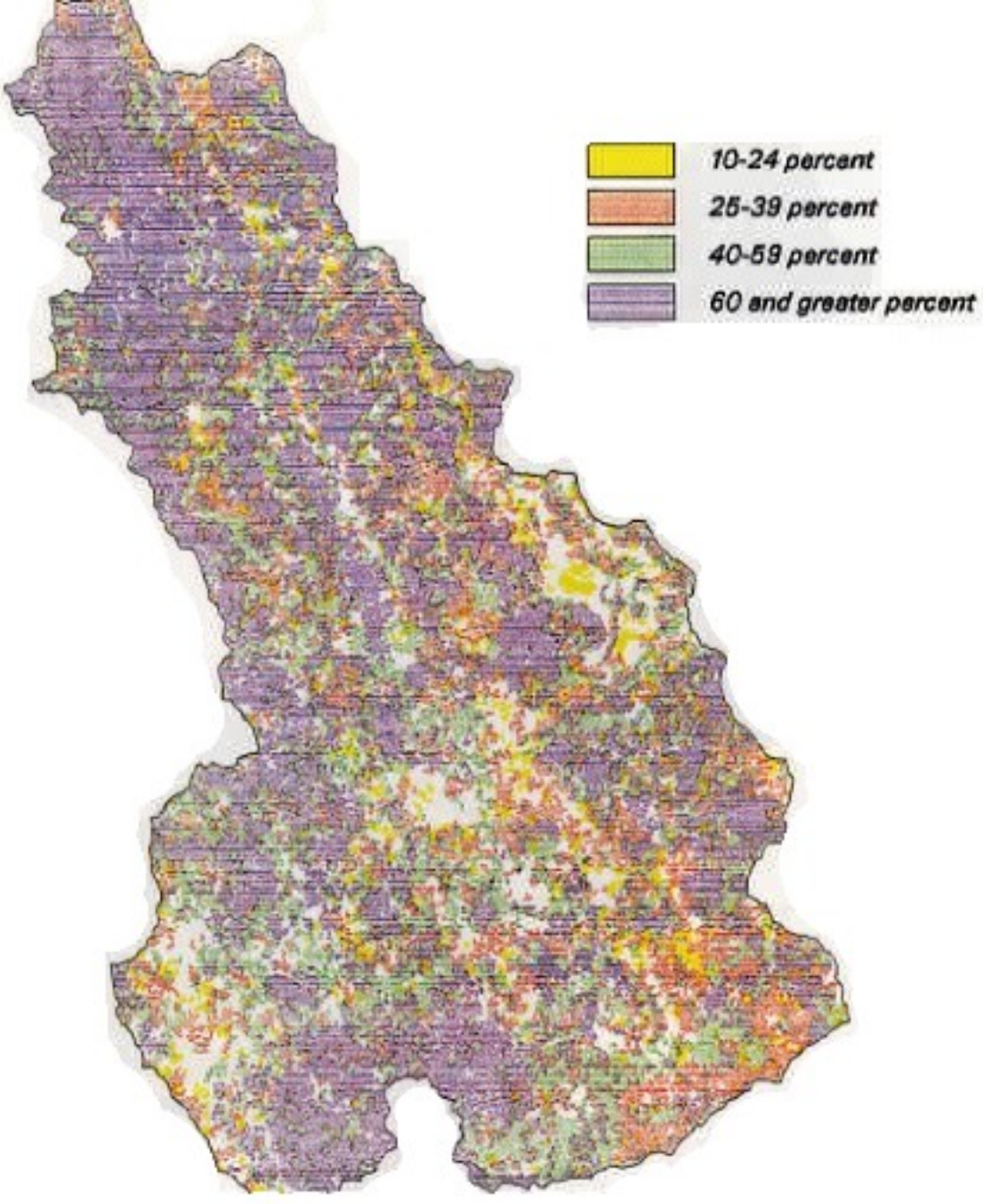

Figure 6. Closure class of commercial tree species within the North Fork Eel River watershed. Source: Timberland Task Force.

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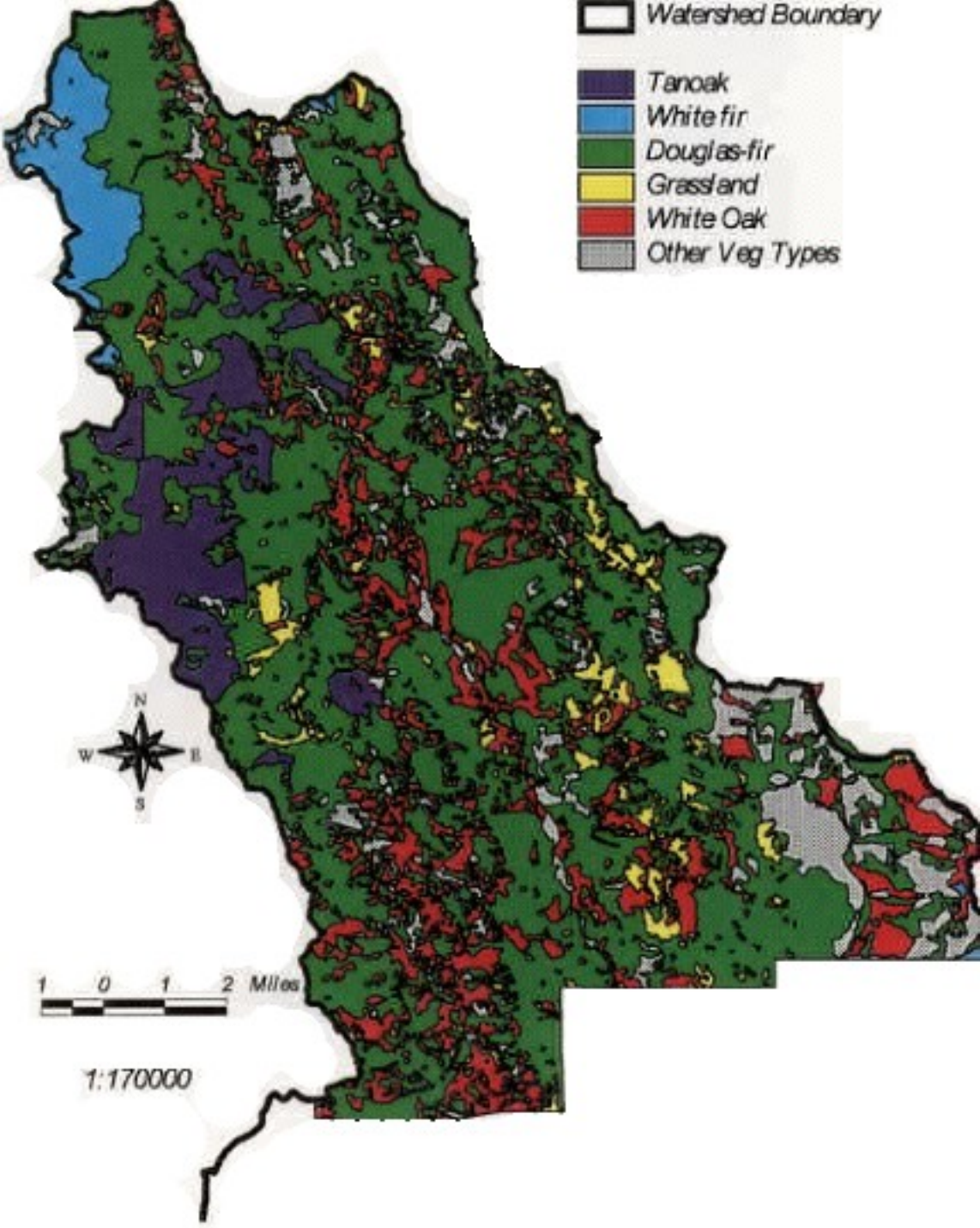

Figure 7. Vegetation series map of Six Rivers National Forest land within the North Fork Eel Watershed.

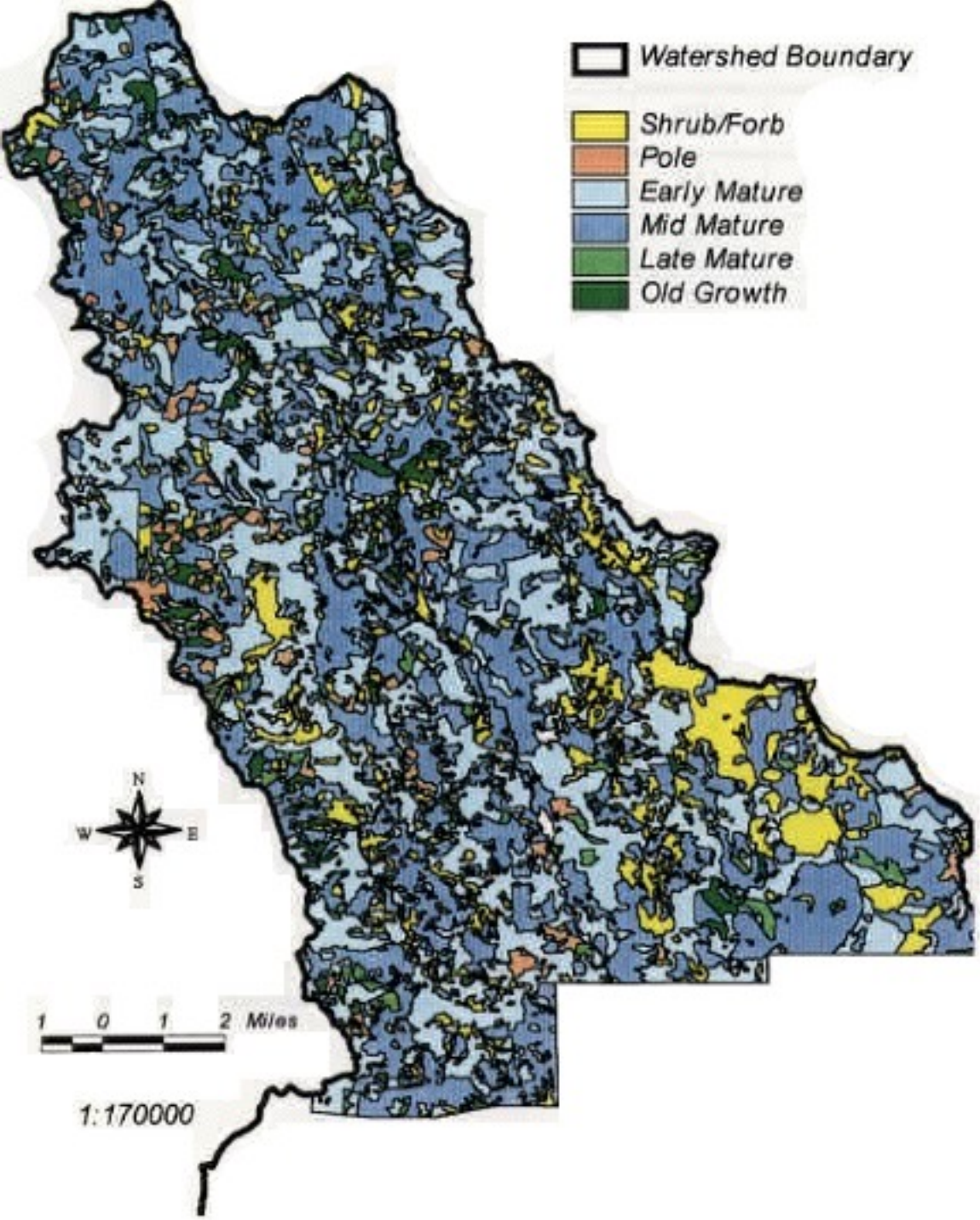

Figure 8. Map of seral stage distribution of all vegetation types for Six Rivers National Forest land within the North Fork Eel River watershed

Table 4. The allocation of seral stages for all vegetation types within the National Forest boundary in the North Fork Eel River watershed. [ADM = Administratively withdrawn, CON = Congressionally withdrawn, LSR = Late-Successional Reserve, MAT = Matrix, PVT = Private.]

Seral Stage		ADM	CON	LSR	MAT	PVT
Shrub/forb	acres	452	2,794	1,039	5,304	2,866
		7 %	16 %	8 %	16 %	18 %
Pole	acres	70	235	498	940	748
		1%	1 %	4 %	3 %	5 %
Early-mature	acres	3,055	6,808	2,363	15,063	8,256
		45 %	38 %	18 %	44 %	53 %
Mid-mature	acres	2,595	5,858	4,724	9,548	3,492
		38 %	33 %	36 %	28 %	22 %
Late-mature	acres	237	1,788	2,230	2,147	189
		3 %	10 %	17 %	6 %	1 %
Old-growth	acres	262	328	2,153	863	66
		4 %	2 %	17 %	3 %	0 %
Non-vegetation	acres	137	192	38	44	76
		2 %	1 %	0 %	0 %	0 %

Table 5. The seral stages and allocations of the dominant vegetation series within the National Forest boundary in the North Fork Eel River watershed. [ADM = Administratively withdrawn, CON = Congressionally withdrawn, LSR = Late-Successional Reserve, MAT = Matrix, PVT = Private.]

Series	Seral stage		ADM	CON	LSR	MAT	PVT
Douglas-fir	Shrub/forb	acres	141	389	235	1,506	127
			6 %	16 %	10 %	63 %	5 %
	Pole	acres	60	136	253	611	154
			5 %	11 %	21 %	50 %	13 %
	Early-mature	acres	1,200	1,604	597	6,483	5,922
			8 %	10 %	4 %	41 %	38 %
	Mid-mature	acres	2,391	4,663	2,699	8,277	2,493
			12 %	23 %	13 %	40 %	12 %
	Late-mature	acres	237	1,743	1,122	2,048	181
			4 %	33 %	21 %	38 %	3 %
	Old-growth	acres	212	328	1,036	496	59
			10 %	15 %	49 %	23 %	3 %
White oak	Shrub/forb	acres	12	744	0	230	45
			1 %	72 %	0 %	22 %	4 %
	Pole	acres	10	92	0	141	560
			1 %	12 %	0 %	18 %	70 %
	Early-mature	acres	1,712	4,067	456	8,063	1,559
			11 %	26 %	3 %	51 %	10 %
	Mid-mature	acres	170	652	0	887	500
			8 %	30 %	0 %	40 %	23 %

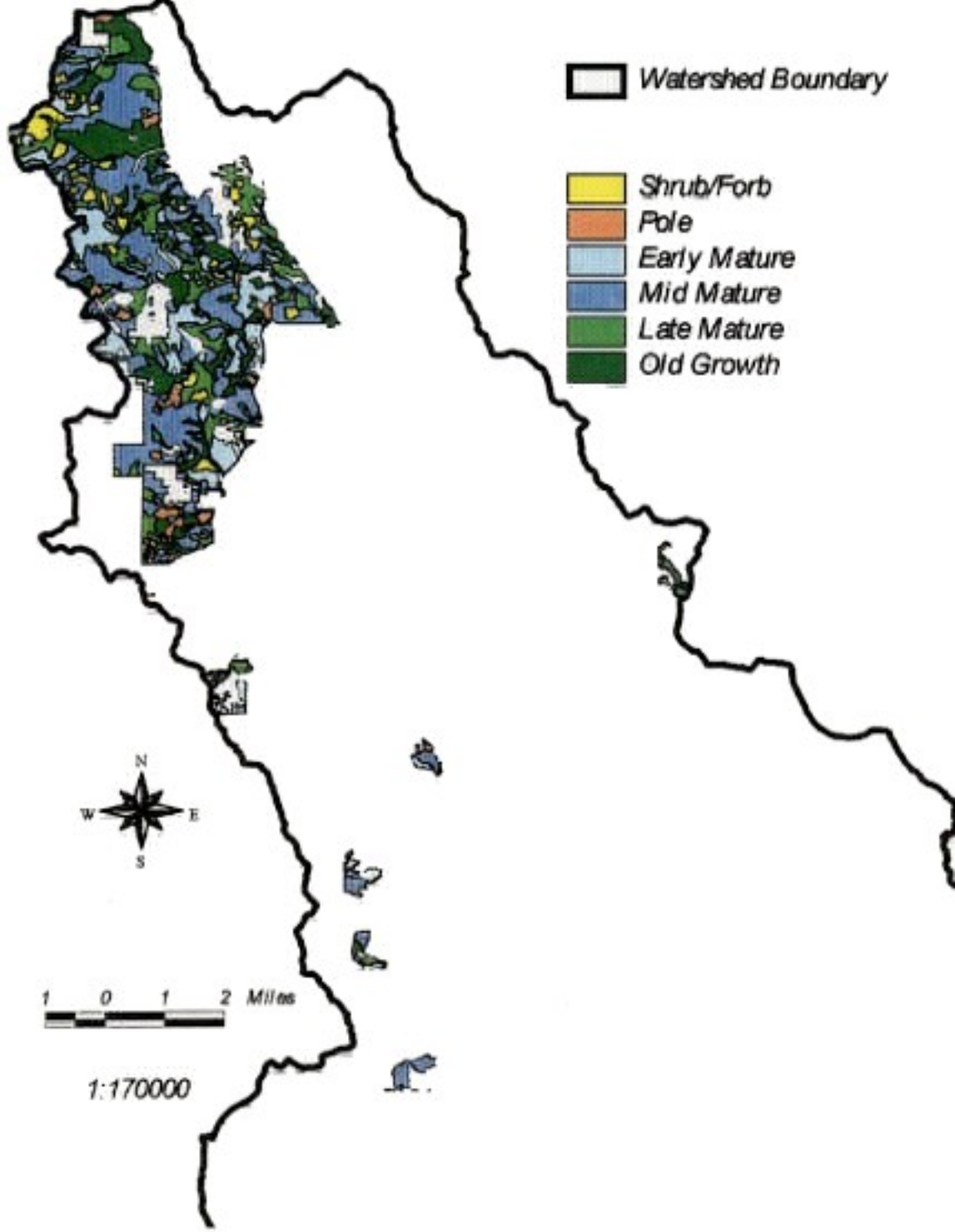

Figure 9. Map of seral stage distribution of commercial tree species for Late-Successional Reserves in Six Rivers National Forest within the North Fork Eel River watershed.

Riparian plant communities appear to be a small component of this watershed. Upland vegetation types often dominate small-order streams in the North Fork Eel River. True riparian plant communities include red alder (*Alnus rubra*), bigleaf male (*Acer macrophyllum*), California bay (*Umbellularia californica*), ash (*Fraxinus latifolia*), rush (*Juncus* sp.), and sedge (*Carex* sp). Many of the riparian communities are influenced primarily by natural disturbance rates. Most riparian communities show active regeneration and recovery from the 1964 flood.

The North Fork Eel River watershed supports two sensitive plant species, Tracy's sanicle (*Sanicula tracyi*) and pale yellow stonecrop (*Sedum laxum* ssp. *flavidum*). There also are approximately eight rare plant species.

The oak woodlands, specifically the white oak and black oak series, are potential habitat for Tracy's sanicle. Other habitat is also found in black oak patches nested in conifer forest and ecotonal areas where Douglas-fir and oak woodlands interface. Pale yellow stonecrop is typically found on outcrops of ultramafic, sandstone, and metabasaltic origin.

Relation to Eel Basin : The vegetation in the North Fork Eel River watershed is an expression of the drier climate and more xeric soil conditions in this eastern part of the Eel Basin. The dominance of tanoak throughout the Main and South Forks is an indicator of the comparatively more humid conditions found there. One isolated patch of tanoak occurs in the North Fork section where a moist air pocket exists. The drier conditions of the watershed also occur in the headwaters of the Van Duzen River and are even more pronounced in some parts of the Middle Fork Eel River watershed.

According to the TTF data, most of the vegetation types found in the North Fork area are also found in the Van Duzen River watershed and parts of the Middle Fork Eel River watershed. The Middle Fork watershed has more high elevation forest and therefore more red fir than the North Fork Eel River watershed. The Middle Fork watershed is also much drier in the southern part where blue oak and more chaparral communities are found.

Wildlife

Late-successional habitat is naturally limited by fragmentation in the North Fork Eel River watershed due to geology and fire regime. Fragmentation has been further increased by management practices on both private and public lands.

Threatened and endangered (T & E) species include the northern spotted owl (NSO) and the peregrine falcon. (See Table 7 for other Special Status species known or suspected).

Approximately 31,000 acres of suitable habitat for northern spotted owls and other late-successional species occur on Federal lands. The natural extent of mature, late-mature and old-growth forest habitat is about 40 percent as a result of the fire cycle. Spotted owls (pairs and territorial singles) are known to occur at 11 activity centers on Federal land, but most assessment circles are below current "take threshold."

Numerous cliffs in the North Fork Eel River watershed are likely to support several pairs of peregrine falcons, which currently are present at several locations.

Current Range and Distribution Surveys for marbled murrelet produced no detections in 1995. A second year of surveys has not yet been funded.

Table 6. The harvested and naturally occurring acres of each seral stage in the commercial series (tanoak, white fir, Douglas-fir) within the National Forest boundary in the North Fork Eel River watershed. [Note: "Harvested" implies clearcut as well as selectively harvested units.]

Seral stage		Harvested	Natural
Shrub/forb	acres	2,150	9,272
	percent	19	81
Pole	acres	1,050	639
	percent	62	38
Early-mature	acres	6,484	13,214
	percent	33	67
Mid-mature	acres	2,651	21,347
	percent	11	89
Late-mature/Old-growth	acres	234	10,028
	percent	2	98

Table 7. Threatened (FT), Endangered (FE), Proposed (PFT) and Special Status wildlife species in the Eel River Basin.

Special Status Species include USFWS Candidate species and Species of Concern (SC)formerly USFWS Category 2 Candidates FS Sensitive Species (FSS); and Protection Buffer, Survey & Manage and Bat species listed in the Record of Decision (ROD)

K=known occurrence S=suspected occurrence *=nesting/breeding E=believed extirpated ?=surveys needed

Common Name	Scientific Name	Status	Delta	Main	V.Duz	S.Fork	N.Fork	M.Fork
Marbled Murrelet	Brachyramphus mamoratus	FT		K*	K*	K*		
Northern Spotted Owl	Stirx occidentalis caurina	FT		K*	K*	K*	K*	K*
Aleutian Canada Goose	Branta canadensis leucopareia	FT	K					
Western Snowy Plover	Charadrius alexandrinus nivosus	FT	K*					
American Peregrine Falcon	Falco peregrinus anaturn	FE	K	K*	K*	K	K	K*
Bald Eagle	Haliaeetus leucocephalus	FT	K	K	K	K	K	K
Calif. Brown Pelican	Pelecanus occidentalis californicus	FE	K					
Tidewater Goby	Eucyclogobius newbarryi	FE	?					
West Coast Coho Salmon	Oncorhysnchus kisutch	PFT	K	K	K	K		E
Lotis Blue Butterfly	Lycaeides argyrognomon lotis	FE		?		?		?
Great Gray Owl	Stirx nebulosa	FSS,ROD						?
Northern Goshawk	Accipiter gentiles	SC,FSS			K	K*	K	K*
Ferruginous Hawk	Buteo regalis	SC	K			K		K
Little Willow Flycatcher	Empidonax trailli brewsteri	SC,FSS	K	K		K		K
Tricolored Blackbird	Agelaius tricolor	SC	K					
Western Burrowing Owl	Athene cunicularia hypugea	SC	S		K			K*
White-Headed Woodpecker	Picoides albolarvatus	ROD		K	K			K
Flammulated Owl	Otus flammeolus	ROD		K			K	K
Pygmy Nuthatch	Sitta pygmaea	ROD		S				
White-Footed Vole	Arborimus albipes	SC		S	S	S		
Calif. Red Tree Vole	Arborimus pomo	SC		S	K	K	K*	K
Calif. Wolverine	Gulo luteus	SC						?
Pacific Fisher	Martes pennanti pacifica	SC,FSS		S	K			K

American Marten	Martes americana	FSS		S	K			K
Long-eared Myotis Bat	Myotis evotis	SC,ROD	S	K	K	S	S	S
Fringed Myotis Bat	Myotis thysanodes	SC,ROD	S	S	K	S	S	S
Long-legged Myotis Bat	Myotis volans	SC,ROD	S	S	K	S	S	S
Yuma Myotis Bat	Myotis yumanensis	SC	S	K	K	K	S	S
Silver-haired Bat	Lasionycteris noctivagans	ROD	S	S	K	S	S	S
Pallid Bat	Antrozous pallidus	ROD		K	K	K		
Pacific Western Big-eared Bat	Plecotus townsendii townsendii	SC,ROD	S	S	K	S	S	S
Hoary Bat	Lasiurus cinereus	ROD	S	S	K	S	S	S
Summer Steelhead	Oncorhynchus mykiss	FSS	K	K	K	K	K	K
Chinook Salmon	Oncorhynchus tchawytscha	SC	K	K	K	K	K	K
Green Sturgeon	Acipenser medirostris	SC	E	E				
River Lamprey	Lampetra ayresi	SC		K				
Pacific Lamprey	Lampertra tridnetata	SC	K	K	K	K	K	
Longfin Smelt	Spirinchus thaleichthys	SC	K					
				K	K	K	K	K
Northwestern Pond Turtle	Clemmys marmorata marmorata	SC,FSS			K		K*	S
Tailed Frog	Ascaphus truei	SC		K	K		K*	K
Red-legged Frog	Rana aurora aurora	SC			K		K	S
Foothill yellow-legged Frog	Rana boylei	SC		K	K		K*	
Del Norte Salamander	Plethodon elongates	SC,ROD		K	?		?	
Southern Torrent Salamander	Rhyacotriton vaiegatus	SC			K		?	

Bald Eagle, great gray owl, American marten, and Del Norte salamander are not likely to occur on Federal lands in the watershed. Portions of the Ruth and Mendocino deer herds do occur here, and several key areas support densities ranging from 30 to 60 deer per square mile.

Relation to Eel River Basin : The North Fork Eel River watershed has the second largest percentage of Federal land of any Eel River subbasin. These Federal lands are expected to contribute to the recovery and preservation of numerous animal and plant species. Because of the great differences between past and present land management, the current conditions of Federal lands in the North Fork Eel River watershed are exceptional, compared with other parts of the Eel River Basin that have higher percentages of private land. Even though these Federal lands are expected to contribute only a small amount to local and regional economies, and much of it has been allocated to Late-Successional Reserves (LSRs), Wilderness, Research Natural Areas, Wild River corridors, and Riparian Reserves.

Provincial Context : In terms of wildlife habitat, the North Fork Eel River watershed lies in a "transition zone" between conifer-dominated landscapes to the northwest and hardwood-dominated landscapes to the southeast. The zone includes the coastal oak woodland hardwood habitat type which consists of both deciduous and evergreen oak species interspersed with conifers. This configuration results in a mosaic of habitat patches. Census data indicate a change in bird species composition along a northwest-southeast gradient between the Redwood Creek estuary and the interior Sacramento Valley foothills. Breeding neotropical migrant species such as black-chinned hummingbird, black-chinned sparrow, and sage sparrow are found almost exclusively in this watershed, which is probably the northern extent of their breeding range in the area (USDA, 1995). The oak woodland-dominated landscape provides important resources for specific bird assemblages during their migration, many of which are neotropical migrant species.

Grazing

Large numbers of sheep grazed in the watershed between 1860 and 1900. This activity was accompanied by a shift from perennial bunch grasslands to exotic annual grasslands.

Cattle have been utilizing the watershed since the 1900s but current numbers much decreased from past decades. All or portions of eight federal grazing allotments occur in the watershed on both National Forest and BLM lands. A total of 4,942 acres of BLM land support 732 Animal Unit Months (AUMs), while 21,000 acres of the National Forest

support approximately 300 AUMs.

SOCIOECONOMIC ENVIRONMENT

The North Fork Eel River watershed lies within southern Trinity and northern Mendocino Counties. The principal communities within the watershed are Kettenpom, Hoaglin Valley, and Lake Mountain. Nearby communities include Zenia and the Round Valley Indian Reservation. The combined population is approximately 950 people.

Many of the residents are artists and crafters who maintain small home-based businesses. There is also some ranching and agriculture, as well as a growing number of independent professionals. Most residents in part attribute their quality of life to the large surrounding area of public lands, but this leaves little room for the development or expansion of private businesses.

The Round Valley Indian Reservation is comprised of 30,500 acres within Round Valley and approximately 11,300 acres along the North Fork of the Eel River. The Round Valley Tribal Council is a Federally Recognized Tribe toward which the Federal government has Trust responsibilities. Round Valley is home to the Wailaki (whose aboriginal territory is within the watershed), Concow, Pomo, Nomelaki, Pitt River, Achomawi, Wintun, and Yuki.

There are numerous business enterprises in Round Valley, including ranching, small service businesses, and Tribal Government offices. The Tribe's Natural Resource Staff employs about 52 of its members.

The Bear River Tribe is located on the Rohnerville Rancheria, which is home to the Wiyot and Mattole tribal members. The Rancheria is a considerable distance from the watershed, but tribal members indicated that they do use the lands within the North Fork Eel River watershed during the present times. Ethnographic and historical data do not indicate their use of the isolated North Fork Eel River country in the past. There are eight enrolled members of this Federally Recognized Tribe toward whom the Federal Government also has Trust responsibilities.

Federal agencies represented in the area include the following:

Forest Service, with 24 permanent employees at the Mad River Ranger District (Six Rivers National Forest), and 12 at the Covelo Ranger District (Mendocino National Forest); they also employ about 68 temporary/seasonal employees;

Bureau of Land Management, with generally 20 permanent employees at the Arcata office and three-to-four people at the Whitethorn office;

U.S. Postal Service with three-to-four employees in Mad River, Zenia and Covelo; and

Round Valley Indian Reservation which employs approximately 50 people.

The Southern Trinity Joint Unified School District employs eight full-time, 31 part-time employees during the school year, and six full-time employees during the summer. There is a public works division and school employment in Covelo. Other county employment includes the Trinity County Road Department's Ruth Station and one Trinity County deputy sheriff, as well as the County Road Department yard and a courthouse in Mendocino County.

Covelo and Round Valley are rural communities that depend on agriculture and forest products from the local area. There are some retail and service-oriented businesses, but most employment is seasonal. There exists a large and diverse American Indian population within these communities.

Relation to Eel River Basin: Most of the Eel Basin is privately owned, offers no public access, and is moderately populated. In contrast, the North Fork subbasin is relatively remote and contains a designated Wilderness. Hence, the later offers a variety of recreational opportunities that depend on relative solitude; for instance, hiking, hunting, fishing, camping, and bird-watching. In addition, adequate public access allows for the collection of forest products such as beargrass, mushrooms, and wild herbs.

CHAPTER 2: ISSUES AND KEY QUESTIONS

This chapter presents a series of key questions organized under five main issues related to management of public lands in the North Fork Eel River watershed. These key questions will serve to focus this watershed analysis process. This is the first step in implementing the Six Rivers Land and Resources Management Plan (LRMP). As such, an overshadowing focus of this analysis is the concern for the preservation and enhancement the biodiversity of forest ecosystems where it can be appropriately applied. Two other major concerns addressed by the LRMP will also be addressed as they apply to the North Fork Eel River watershed: reversal of the apparent decline of anadromous fisheries through protection of aquatic/riparian areas, and providing a predictable level of commodity outputs to sustain local economies.

ISSUE 1: In what ways does or can the North Fork Eel River watershed contribute to the economy of local communities?

Key Questions:

What types of economic activities has the watershed supported in the past and can it support in the future?

What opportunities do the Federal lands in the watershed have to support local and regional economics, cultural values, and goals?

What management strategies will support the needs and values associated with American Indian uses within the watershed?

How can the consolidation of National Forest and BLM inholdings contribute to social and economic values?

ISSUE 2: What are the potential vegetative products (timber and other plants) that could be produced on a sustained basis in the watershed? What conditions (composition, structure, distribution) of vegetation would be desirable in this watershed to sustain the various human and wildlife uses of the landscape?

Key Questions:

How does the current distribution of seral stages and vegetation types in the watershed compare to the Historical Range of Variability (HRV) and Recommended Management Range (RMR)?

To what extent has livestock grazing altered the distribution and composition of plant communities within the watershed as compared with historical conditions?

How does the current fire regime compare to the historic range of fire conditions in the North Fork Eel River watershed? How have the past and current fire regimes been altered by vegetation management and fire suppression?

How has fire suppression affected vegetation characteristics, thereby influencing the diversity, abundance, and distribution of wildlife species? Can fire be introduced into this area through prescribed burning to offset these effects?

What are the susceptibilities of upslope areas to mass wasting and accelerated erosion when disturbed by management (roads, logging, grazing)?

To what extent does mass wasting and erosion affect plant community productivity and "health" in this watershed?

What areas or allotments have been most impacted from grazing; and what are the opportunities and priorities to stabilize and restore critical habitat altered by grazing?

What changes in habitat have promoted the establishment of exotics within the Eel River Basin? What are the

dispersal agents for exotics?

What considerations should Federal land managers follow to reduce the impact of private land management on forest fragmentation? How can we integrate private land management into federal planning and ecosystem management?

ISSUE 3: In what ways can the North Fork Eel River watershed contribute to the recovery of Threatened, Endangered and Special Status Species?

Key Questions:

Does adequate habitat exist to maintain viable populations of Threatened, Endangered (TE) and Special Status species in the watershed? What are the current limiting factors for species of concern?

What is the significance of the North Fork Eel River watershed in sustaining TE and Special Status species and their habitats, as well as contributing to recovery of previously more abundant species? What is the role of Federal lands in this recovery?

What management actions, if any, are needed in the North Fork Eel River watershed to facilitate the recovery of, or mimic natural processes essential for, TE and Special Status species?

What considerations should be included in prescriptions for vegetation management to reduce risks to TE and Special Status species? What prescriptions can be developed to sustain habitats within their Recommended Management Range of Variability?

What factors contribute to the introduction and dispersal of exotic species that are detrimental to TE and Special Status species within the watershed? What control measures or changes in land management are needed to reduce or eliminate the impact and the dispersal of exotics within the watershed? Which of these exotics are control priorities?

What are the effects of grazing on TE and Special Status species? How well do current federal allotment plans meet Land and Resources Management Plan objectives for these species?

Where and in what ways do water levels (lowered groundwater tables, diminished low stream flows) adversely affect TE and Special Status species?

What cooperative restoration is needed to reduce risks to habitat for TE and Special Status species? Where do connectivity/dispersal corridors need to be maintained or restored?

What are present or potential opportunities for cooperation between economic uses and needs of TE and Special Status species?

ISSUE 4: In what ways can the North Fork Eel River contribute to retaining and ultimately restoring anadromous fish stocks in the Eel River Basin?

Key Questions:

What is the relative importance of the North Fork Eel River for fish stocks in the Eel River Basin?

What conditions have contributed to the decline of native fish populations in the North Fork Eel River?

How has grazing influenced watershed conditions, particularly aquatic and riparian habitats?

What is the extent of *Ptychocheilus grandis* in the North Fork Eel River and do they influence the migration of salmonids into the upper drainage?

What are the important physical factors (e.g., mass wasting, aggradation) limiting aquatic habitat quality in the watershed, and how much can they be influenced by human intervention?

To what extent has vegetative management altered hillslope hydrologic and stream channel processes?

How and to what extent have logging, and road construction and maintenance affected "natural" mass wasting and sediment regimes (gullies, small impacted streams) in the watershed?

ISSUE 5: What strategy(ies) should the Federal agencies follow in managing access to this watershed?

Key Questions:

What are the principal concerns in this watershed for managing access to public lands?

What are the key physical conditions or processes that influence road management decisions in the North Fork Eel River watershed?

How should the transportation system on Federal lands be maintained? Specifically, how should the Forest Service and BLM address increasing requests from the private sector for residential and commercial access, given the potential for cumulative impacts to the landscape and its dependent resources?

What parts of the watershed have the greatest transportation needs in order to manage the public lands adequately?

What are the highest priority areas for restoration with respect to adverse impacts on riparian/aquatic habitats? What roads have the highest priority for decommissioning or upgrading to prevent resource damage?

What factors should be considered in constructing and decommissioning roads and stream crossings to benefit aquatic species?

How can recreation on public lands be developed with little or no impacts to adjacent private landowners?

CHAPTER 3 - REFERENCE CONDITIONS, CURRENT CONDITIONS; SYNTHESIS AND INTERPRETATION

This chapter consolidates the three steps from the Revised Watershed Analysis Guide (August, 1995) under the five main Issue headings from Chapter Two. It is the opinion of this watershed analysis team that this approach provides for better continuity among topics and allows for interdisciplinary connections to be exhibited in a clearer manner than could be achieved by the three chapter method.

ISSUE 1: NORTH FORK EEL RIVER CONTRIBUTION TO LOCAL ECONOMIES

REFERENCE CONDITIONS

A. Prehistory

Very little data exists specifically about the past climate and environment of the Eel River Basin; nor does much prehistorical or ethnographic data exist for the aboriginal peoples who inhabited the basin prior to the historic era. For these reasons, the following data are presented at the basin-level rather than at the watershed-level. However, pollen analyses have been conducted in adjacent regions of northwestern California. Some research that incorporates these regional studies with watershed-level historical environmental studies have been undertaken specifically for the North Fork Eel River watershed and is presented in Appendix A (Keter, 1995).

Regional pollen studies and paleoclimatic research suggest the following theories:

- The interior regions of the North Coast Ranges have experienced significant shifts in climate during the last 10,000 years.
- Species of plants, as well as their distribution across the landscape, have varied over time.
- During the mid-Holocene (8,500 B.P. to 3,000 B.P., referred to as the Xerothermic Period) the mean annual temperature was approximately 1.2 to 2.1 degrees centigrade warmer than at present.
- The dry season was somewhat longer and there was likely less annual precipitation.
- During the Xerothermic Period, open oak woodlands and grasslands dominated many of the interior portions of the basin and Douglas-fir was probably less widespread than today.
- Around 3,000 years ago, the climate began to moderate with mean annual temperature averages and precipitation totals beginning to more closely resemble those of today.
- Native Americans arrived sometime between 5,000 and 10,000 years ago and it is probable that human land use activities, including anthropogenic fire, hunting, gathering activities, and the establishment of villages and camps, would have begun to influence the dynamics of the area's ecosystem.
- Due to the lack of archaeological investigations, the prehistory of the region remains to be discovered.

- Regional studies suggest that the Athabascans arrived in the basin about 1,100 years ago, increasing the population density within the basin.
- Athabascan-speaking Wailaki (including the Lassik, Pitch Wailaki, and North Fork Wailaki), occupied the North Fork Eel River watershed.
- During the ethnographic period, northwestern California was rich with: game, large runs of salmon and steelhead trout, and plant resources (including bulbs, oak acorns, and seeds). The abundance of the area caused the population density to equal, and in some cases surpass, the population density of agricultural societies in other portions of aboriginal North America.
- The Athabascans lived in semi-sedentary villages along the major stream courses, following a "seasonal round subsistence strategy" of movement throughout their territory to procure resources as they were needed.

B. Historic uses

Historical data are fairly substantial for the North Fork Eel River watershed. The following is a summary of the contextual historical overview (Keter, 1995) and Appendix A.

- Euro-Americans first entered the North Fork Eel River area in 1854.
- By 1856, Nome Cult, later called Round Valley, was established as a permanent Indian Reservation as an annex to Nome Lackee; it was on the annex Reservation that most of the Indians living along the North Fork were placed. Round Valley Reservation is within the aboriginal territory of the Yuki.
- Despite the fact that Round Valley was declared a Reservation, settlers took up land, bringing in cattle, homes, and farms, thus usurping the southern part of the valley.
- During the first decade that the settlers occupied the land, there was much indiscriminate killing of Indians by settlers to punish them for "depredations." Later, killings were committed by the military in an effort to remove Indians from prime aboriginal lands and village homes. These incidents were referred to as the "Indian Wars of Northwestern California" and the "Mendocino Wars" between 1860 and 1865.
- Many Tribes were placed on the Round Valley Reservation during that era. There were two "Indian drives" — one across the northern San Joaquin Valley and the other across northern Sacramento Valley into Round Valley. Many died during these marches.
- By early 1865, large numbers of the native peoples had been killed in military actions, murdered, sold into slavery, or placed on Indian Reservations.
- With the end of the "Wars," settlement increased and the livestock industry expanded from Round Valley into the North Fork Eel River watershed to take advantage of the rich grazing lands.
- President Grant signed an order in 1870 declaring all of Round Valley to be Reservation land which extended its northern boundary to the North Fork Eel River. A few years later, this land was no longer under the control of the Indians.
- In the beginning cattle were introduced to the area, but by 1870, sheep dominated the rangelands. By 1890, there was a trend away from sheep ranching back to cattle grazing.
- Until the turn of the century, Round Valley settlers had a direct effect on the environmental and social conditions of the North Fork Eel River area. One rancher in particular dominated the North Fork Eel River watershed by his control of much of the Yolly Bolly country (southeastern Humboldt, northeastern Mendocino, and southwestern Trinity Counties) from the George White ranch in Round Valley.

- White and his "buckaroos" prevented homesteaders from settling in the watershed, often through intimidation or violence.
- During the 1870s, it has been estimated that at least 60,000 sheep spent part of the year within the North Fork. Well into the 1890s, a few settlers homesteaded with sheep ranching being the primary land use activity.
- The large sheep ranches were located in the west along the Main Eel River. Each summer, bands of 2,000 to 3,000 sheep were slowly driven through the watershed on trail ways leading to the high pastures of the Yolla Bolly/South Fork Mountain region.
- By 1900, the number of settlers moving into the area was increasing.
- In 1905, the Trinity and Mendocino National Forests were created and the Forest Homestead Acts (and later the Indian Homestead Act) were enacted, which increased the influx of homesteaders to the area.
- Present-day Bureau of Land Management lands were public domain lands that had been opened to homesteading. Much of the land was considered rough, rugged, isolated, and undesirable for homesteading. The land was administered by the Federal Lands Commission and in 1948 it was transferred to the BLM for administration.
- A small community existed within the upper reaches of the North Fork Eel River watershed; it included a post office (located on a local ranch), two schools, and at Seven Cedars there was a general store.
- By the time of the Depression, many of the homesteads in the upper reaches of the North Fork Eel River watershed (which were accessible only by trail) were abandoned.
- Round Valley and the town of Covelo continued to maintain large populations and influenced the North Fork Eel River watershed. For those settlers in the more isolated upper headwaters, Covelo was their place to shop, congregate, drive herds of stock, and earn supplemental wages.
- In 1947, Six Rivers National Forest was created out of several adjoining forests with the upper North Fork Eel River included within the new administrative boundary.
- Logging of private lands in the watershed was practiced in the 1950s and 1960s, carried out by numerous small logging companies and mills. On Federal lands, timber harvesting peaked during the 1970s and 1980s.

CURRENT CONDITIONS

A. Community priorities and needs

The following is a summary of data gathered from interviews conducted in 1995. The format, techniques, and a complete summarization can be found in Appendix B.

The Southern Trinity Area Plan (1995) identified the priorities and needs of the communities of Zenia, Kettenpom, Lake Mountain, and Hoaglin Valley through town meetings. The results are as

follows: (1) medical services; (2) road repairs and painting of the lines on roads; (3) repair and expansion of the Community Hall; (4) develop a local community refuse site; (5) increase communications by installing additional telephone lines into the area; and (6) zoning for controlled growth as opposed to unrestricted subdividing of large portions of land. The residents wish to preserve the independent lifestyles they presently enjoy and consider Federal land as a contributor to their goals.

Covelo and Round Valley have high unemployment rates and a larger population than that found around the headwaters of the North Fork Eel River. The economy is seasonal in nature, and is primarily associated with logging, fishing, and agricultural resources. One of Covelo's largest employers for many years was the Louisiana Pacific sawmill that ceased operations in 1992 and relocated in Ukiah. The Middle Fork Eel River watershed analysis (Mendocino National Forest, 1994) estimates that general unemployment in the Covelo-Round Valley area is about 40 percent; among the American Indian population it ranges from 60 to 80 percent. The Round Valley Indian Reservation regained the old Reservation lands up to the North Fork Eel River by purchasing the Big Bend Ranch in the 1980s. Approximately 11,300 acres were put into Trust and added to the Reservation.

B. Major human uses, including tribal uses

Subsistence

Hunting, fishing, fuelwood gathering, acorns, wild onions, wild celery, berries, apples, other fruits, water and mushrooms.

Botanical

For a list of specific plants see the Human Dimension Matrix in Appendix B. Most plants identified were used by American Indians for basketweaving, medicinal purposes, and crafts. Other botanical aspects identified were seed cones and wild flowers.

Special landscape features associated with recreation

Most do not perceive the upper areas of the North Fork Eel River as providing a viable pull for recreation. However, the Round Valley Council views the lower reaches as a very viable recreation landscape. Other locations identified were the North Fork gorge below Salt Creek and the North Fork Eel Wilderness, having values associated with anadromous fish and isolation.

Current recreation activities

It was determined that the primary recreational use of the watershed is by locals, which includes "North State" in the definition of local. Activities are camping, fishing, backpacking, rafting, kayaking, canoeing, hiking, and hunting. Poor river access was identified. Six Rivers National Forest currently administers the only reasonable public access to the river.

Recreation facilities and services

There are hunting guide services that operate out of Willits. The guiding is primarily for deer hunting, mainly in the Salt Creek area utilizing the Forest Service Salt Creek Campground. The only facilities that could be identified are operated by the Forest Service and are along the upper portions of the North Fork Eel River watershed; these are limited in number and quality. Most camping takes place in dispersed camps and wilderness camps. A few trails were identified as were some trailheads in the Wilderness.

Cultural gathering uses/preferences and special places

During the summer months, a number of American Indians from Round Valley gather and camp along the lower reaches of the North Fork Eel River. People identified the annual Blackberry Festival held in Covelo as a time for gathering together. In the upper reaches, Grizzly Mountain, the grange at Zenia, and the Kettenpom Store were the only locations identified as cultural sites.

Spiritual and religious uses

The Round Valley Tribes identified the Wailaki villages along the North Fork Eel River as extremely important to them in a spiritual sense. They also identified the significance that petroglyphs hold for them. Currently known locations of petroglyphs are along the Main Eel River.

Scenic resources

The viewshed along the high country on the ridge is very scenic and "a nice drive." The North Fork Eel River has a Wild and Scenic Designation and a few people expressed this to be a special consideration.

Wildlife, fish, and related uses

For a list of the specific species identified in the watershed see Appendix B. Hunting for deer, some bear hunting, and fishing for salmon, steelhead, and trout are the primary wildlife-associated activities occurring. The information in the appendix identifies the current condition or changes in the situations of species that the interviewees have seen over the years. As a note, many of those interviewed have lived locally their entire lives, spanning from ages in the 30's to 70's, with the older end of the scale being more numerous. There is great concern for the condition of the fisheries along the North Fork Eel River from the mouth to the headwaters. Concern was also conveyed in regard to the deer herds and the condition of their forage — there are too many shrubs is the general notion.

Commodity product uses

The following list is composed of many of the commodity practices in the North Fork Eel River watershed: timber harvesting (on private and public lands); gravel mining; grazing beef cattle (on private and public lands); burls; commercial firewood; wild seed collecting; plants and other resources for various cottage industries (such as wild herb collection) are being gathered primarily from public lands. Marijuana cultivation is occurring on public lands and possibly private lands. The latter cultivation is considered by some people to be a significant underground economy.

Individual lifestyle preferences and expectations

The general sentiment throughout the watershed was that most people want it to stay generally as it is at the present time. Those living in the upper portion of the watershed tend toward not wanting additional development; those along the lower portion would like some development but only without affecting the quality of the environment or life style. The primary value for people living within the watershed is that they do not want a lot of people moving in. They all want to maintain their individualist, rugged, subsistence-based culture. They appreciate living off of the land, rural isolation, hard-working ethics, and daily interaction with the natural resource environment around them. Newer residents, who were identified as an "alternate lifestyle community," have strong agrarian ties and link their actions to their views of natural resources; they prefer a low technology lifestyle and the isolation. American Indians want to be able to interact with their historical and cultural roots in this watershed, maintain their cultural lifestyle where fish and deer contribute a significant part. They also value the area because the various plants used in subsistence, health, art, and spiritualism are numerous and accessible.

Stability and sustainability of local rural and tribal communities' lifestyle and values

The same statement was heard over and over again, "It's the same as it always been; no jobs; not much going on; there's survival." It became clear that those living along the North Fork Eel River live there for reasons other than a career or a job. Individuals and families have existed since historic times on a multiple-income strategy — devising the needs of the family throughout the year through several different economic means. The residents on the lower reaches have larger ranches and a more diverse economic mix than the those in the upper reaches, although the difference is not extensive. Included are the careers and jobs associated with State and Federal employment within the town of Covelo. There are also large tracts of private, primarily commercial, timber lands in the lower reaches. The communities in the upper reaches are scattered throughout the country-side where there is extremely limited local employment. Most residents are now trying to, or have established, small businesses from their homes. The economics of this watershed has not changed dramatically since settlement began. Employment only peaks here and there.

Needs for rural economic livelihood

Most people expressed the belief that all agencies in the area need to be much more supportive and knowledgeable of small business operation. They believe that more wood needs to be taken out in timber sales, but also that the sales need to be small so that local small businesses can be competitive as they historically were before agencies started to conduct large sales. Safe, paved roads are deemed a necessity. Communities are split over recreation development in the upper reaches; most do not view recreation as providing any economic future for them. Others see it as their future and expect the Forest Service and BLM to develop the contributing facilities, including trails and campgrounds with toilets, and would like these agencies to promote recreational opportunities on Federal lands. The people in the lower reaches, primarily the Round Valley Tribes, have long-range plans to develop the recreational potential of their lands. Parts of the upper reaches of North Fork Eel River watershed have no electricity. Some feel that it is necessary to extend power lines in order to met the needs of people retiring in the area and for those residents who hope to establish businesses.

Legacy and options for the future

The following are expressed needs for the watershed: controlled burns in order to establish better browse for deer; removal of more dead and diseased trees; resolution of issues around the *Ptychocheilus grandis* fish which are adversely affecting traditional fisheries; creation of opportunities for the North Fork Eel River to have greater water flows as existed historically; desire for good water and spawning beds for fish; put fire back on the landscape; maintain and enhance the oak woodlands; and maintain the clean air.

Significant social trends

Some significant trends emerged from interview and questionnaire data that should be considered when planning or "futuring" for the North Fork Eel River watershed. They are as follows:

Private landowners

- Currently most owners do not reside on their property as a primary residence. Many have never visited the area or had done so only briefly. Non-resident owners seem to have the property as an investment and do not visit the area;
- Most owners use the watershed for camping, hiking, fishing, and hunting;
- Most intend to develop the natural resources on their property, primarily timber;
- The majority identified that they would prefer no clearcutting or slash burning after logging is completed; most supported the sustained yield forestry practices with the above stipulation of no clearcuts or slash burning;
- Most are concerned about public use of their property as a result of an increased use of public land due to management by the Forest Service and BLM, primarily the agencies activities associated with logging, road building, firewood gathering, hunting, and the lack of agency signing of land ownership;
- Most indicated they would need to use Forest Service or BLM lands for access to their property in the future or to haul commercial logs over agency roads;
- Most felt that federal management activities affected their quality of life very little;
- Most people love the peace, quiet, and beauty of the area; and
- There was a small (but developing) trend toward seeing their property as a possible lace for a retirement home.

Resource value/use trends

- American Indian culture includes the gathering of subsistence products for medicine, food, crafts, and the hunting of deer and other game is an upward trend;
- Other subsistence uses which are practiced include: limited gathering for food, such as berries; hunting; poles for fencing; and fuelwood. These are not an increasing trends but appears to remain steady;

- Individual or small group recreational use is a slightly upward trend;
- Hunting on private ranches (or fee hunting) is a slightly upward trend;
- There are cultural and social upward trends (both locally and State-wide) toward the need to restore and maintain oak communities or woodlands;
- Upward trends in private landowners' need to use Federal lands for access their land for residential and/or commercial development, primarily timber extraction; and
- There is an emotional upward trend of Round Valley Tribes regarding access to, and protection of, archaeological sites, particularly villages along the North Fork Eel River, and petroglyphs.

Economic value trends

- A slight upward trend in self-sufficient economic endeavors, such as home-based businesses;
- An upward trend in "virtual" offices, known as "Lone Eagles" or "computer commuters";
- A consistent trend whereby people are committed and determined to stay in the North Fork River watershed area despite the poor economic situation and lack of opportunities;
- A consistent trend toward maintaining the belief that the economy is about the same as it has always been with few jobs and not "much going on";
- An upward trend in the cultivation of small marijuana plantations which are considered to be a significant underground economy;
- There is a rising trend in the number of families receiving public assistance; and
- A consistent trend in the belief that timber contributes some factors into the economic multi-income strategy of the citizens.

SYNTHESIS AND INTERPRETATION

Key Question 1 : What types of economic activities has the watershed supported in the past and what can it support in the future?

The business communities within Kettenpom, Zenia, and their dispersed neighbors relate economically to the upper region of the North Fork Eel River while the residents of the Round Valley Indian Reservation relate economically to the lower reaches of the North Fork of the river due to the land that they own along that segment of the river.

Economic activities during the 1860s to the 1900s were primarily small entrepreneurial ventures such as hide and meat hunting and trapping; illegal moonshining; small farming for subsistence and local trade; and local selling and trading of crafts or special skills. As well, there were the larger ranching operations with large herds of sheep and cattle. Since around the 1950s, logging began on private lands operated by many small private companies. These activities created large and fairly steady incomes for the local communities. The many small private companies were mainly replaced in the 1970s when Federal agencies began offering large timber sales which primarily were purchased by larger timber outfits. In the 1990s, the agencies returned to offering much smaller sales in the watershed which resulted in the re-logging of private land. There have been three federal timber sales in the watershed during the 1990s. Currently there is a small amount of hide and meat hunting/trapping, along with guide services to direct them. There is also the illegal activity of marijuana cultivation; crafts are still being made but are marketed externally to the local area; services or special skills are now also marketed externally, in areas that have electricity, by being "computer commuters" which are locally are termed "lone eagles." Larger ranching operations still occur but with fewer numbers of larger ranches and with less numbers of cattle. There is an increase in these entrepreneurial ventures including such enterprises as: catalog sales, professional engineering services, authors, editors, crafts, home-made canned goods, and more. As done historically, men will leave the area for parts of the year to work elsewhere.

The economic trend in the past decade in the upper drainage has been away from a primarily timber-dependent

economy to a more diverse economy based on entrepreneurial ventures. There is a very limited economic industrial mix with two forces emerging as dominant today — ranching and product-oriented businesses. The natural resource-dependent industries are small farming, small mills, a very small industry of plant procurement through the Special Forest Products Program, crafts, and, grazing. There is some recreational use of the area, but it is very low.

Hunting is the primary use, with some dispersed camping, but these activities brings very little economic stimulus to the area. The community members expresses that the rural lifestyle is very important to them and they want to retain it; but they state that it is important for these small businesses to be supported by the various agencies that conduct business within their area of influence. There is a small segment of the community that expects the agencies to develop a recreational tourism base. The majority of the community believes that there is no recreational draw in the upper reaches of the North Fork Eel River that could entice recreationists to go there. There is really nothing to spend money on; currently there is only one store. Business owners in Southern Trinity County have previously stated that those people who currently come to recreate spend very little money there. The area, they believe, is too isolated to attract people. The Round Valley Tribal Government believes there is a draw on the lower river and are seeking to eventually develop that area for ecotourism.

Key Question 2 : What opportunities are there to support local and regional economics, cultural values, and goals?

There are short-term, seasonal employment opportunities associated with timber harvesting, road building, restoration, and emergency firefighting.

Programs and projects can be designed to provide optimal contracting opportunities for local entrepreneurial enterprises. Such enterprises can be developed to provide services to visitor users — such as recreationists — for example, guide services for hunting in the North Fork Eel River watershed.

There are opportunities for designing and developing with the local communities/Tribal Government some recreation experience that may be unique to the area in order to draw tourists. For example, entering into partnerships with concessionaires of facilities such as renting a lookout for camping. The greatest opportunity is to develop recreation for the entire watershed, including interested communities, agencies, and Tribal Governments, and designing a total watershed experience distributing recreational uses where appropriate. This may include such activities as guide services.

There are opportunities to support the ranching business by providing grazing areas and access to other non-timber products utilized by local ranchers such as poles and fencing materials.

There are opportunities for non-timber product users of the various cottage industries by developing a management strategy that does not adversely affect needed natural resources (e.g., cones, mushrooms, bear grass, wild herbs). The Special Forest Products Program can work with these users in order to understand their needs and to direct them to areas that are easily accessible for quality materials. This assistance would cut the costs of doing business.

Key Question 3 : What management strategies will support the needs and values associated with American Indian uses within the watershed?

The primary uses found in the North Fork Eel River watershed are fishing and the gathering of native plants to sustain the cultural lifeways of the Indian people residing within the watershed and in the Round Valley Indian Reservation. Aboriginal use of the watershed pre-dates Euro-American uses and their management of lands. Wailaki people were the predominate group on North Fork of the Eel River.

Native people managed these lands by fire to increase the range and frequency of useful plants, control plant diseases and insect infestations, and to stimulate new plant growth. Native people developed burning with low-intensity fires into a fine art in order to promote the growth of oaks without endangering other vital resources. Managing these oak groves enhanced not only acorn gathering but also mushrooms and other similar species. Fire was used to manage open areas or prairies, to generate the growth of grasses from which seeds were the first foods to be gathered in the spring, and to attract large game.

Fish procurement was a major element of these North Fork people. There is a data gap on the management techniques they used to secure the fish which return yearly. Fishing today in parts of the North Fork Eel River is

extremely limited and severely less than in historic times. Fish, however, is still a significant cultural food and plays a major role in the beliefs of the local people.

The North Fork Eel River watershed has numerous Wailaki village locations, most of which are still intact, primarily due to their being situated in rugged and isolated terrain. The Indian community and Tribal Government have extreme interest and concern in the protection of and their own access to these sites. They hope to secure, for present and future generations, the knowledges obtained within these series of village sites.

Key Question 4 : How can consolidation of National Forest and BLM inholdings contribute to social and economic values?

The fragmentation and isolation of BLM lands and the large private land inholdings within National Forest boundaries have resulted in high costs for administering the lands; thus, agency presence is often limited in the area. The situation also adds to the economic costs of projects within the watershed. Recreation facilities have been affected by, for example, the removal of toilets from campgrounds because of the high costs for maintenance, and recreation development in some areas has been limited or constrained by lack of key access.

ISSUE 2: POTENTIAL VEGETATIVE PRODUCTS AND DESIRABLE VEGETATION CONDITIONS

REFERENCE CONDITIONS

Products and uses

Native American uses: Prior to European settlement until the late-1850s, several plant species in the North Fork Eel River watershed were a primary food source for the aboriginal population. These included acorns from black oaks and white oaks, bulbous plants such as large camus (Camissia leichtlini), and nutritious seeds from perennial bunch grasses. The introduction of livestock into this area in the 1850s led to the depletion of many of these plant resources (See Appendix A).

Ranching: Grasslands in the watershed have been used extensively as forage for livestock. The most intensive period of use was 1865 to 1905. During this time, ranchers moved large herds of both sheep and cattle through the area during the spring months.

Logging: Intensive timber harvesting did not begin in the watershed until the 1950s on private land and the 1970s on public lands. Some selective logging occurred prior to this time, but at a much smaller scale.

Wildlife uses: Deer were historically more abundant in the North Fork Eel River watershed, especially before European settlement in 1854. Deer foraged on the extensive open grasslands and oak woodlands that once dominated the landscape. Although these native ungulates probably had some impact on the land, they tended to form smaller herds and were more migratory than livestock.

Some wildlife species were probably more abundant in this area before European settlement. In particular, small mammals, insects, and birds associated with open woodlands were probably more prolific prior to encroachment of Douglas-fir into these areas caused by fire suppression (Keter, 1995).

Plant community distribution, structure, and composition

Observational and anecdotal information suggests that the watershed was much more open in the past (Keter, 1995). Frequent natural fires, as well as burning by Native Americans and ranchers, probably kept the area free from understory vegetation. Black oak and white oak stands may have been more extensive in the past because frequent burning in these woodlands would have prevented the establishment of conifers. Data indicates that extensive ground fires recurred at approximately 13-year intervals in Douglas-fir/mixed evergreen forests (Adams and Sawyer, 1980). These fires would have prevented the development of an understory in tanoak stands in the watershed. The past fire regime may also have included a high frequency of stand-replacing fires. This fire regime probably resulted in more young conifer stands and lower amounts of old-growth in the North Fork Eel River watershed (Wright et al., 1995).

Eighty percent of the white oak stands in the North Fork Eel River watershed are in the early-mature seral stage. This suggests that many of these stands are all-age or have very little structural variability. There are indications that these stands would have been more structurally diverse under the past fire regime. A study of white oak stands on Bald Hills in Redwood National Park showed three types of stand structure: (1) young dense, even-aged stands, (2) clustered even-aged stands, and (3) stands composed of all size and age classes (Sugihara and Reed, 1987). They suggest that all-sized stands resulted from regular burning, whereas fire suppression results in dense, young, even-aged stands. With the regular burning of the past, there may have been more mid-mature and late-mature white oak stands.

The composition of grasslands has been altered permanently by overgrazing and the introduction of non-native plants. Non-native annual grasses were able to become established because of the disturbance caused by overgrazing and their pre-adaptation to the mediterranean climate (Jackson, 1985). Introduced annual grasses were able to out-compete perennial species for water and nutrients in open, disturbed areas. Once established, these annual grasses prevented the native perennial grasses from attaining their previous dominance (Barbour and Major, 1977; Burcham, 1982; Keter, 1995).

Disturbance factors

Fire : As in other parts of the West, fire has been a primary player in the North Fork Eel River area for thousands of years. Lightning-caused fires probably dominated the landscape in the prehistoric era, given the dry climate that then prevailed. Also, burning by Native Americans to increase forage production and clear areas for wildlife and human travel was extensive prior to 1865 (Keter, 1995). These fires probably included frequent, extensive ground fires as well as small (less than 1,000 acres), high-intensity fires.

Fire suppression by the Forest Service and other agencies did not begin in earnest in this area until the 1940s. Prior to that time, suppression was limited to modest efforts by ranchers and other residents of the watershed.

Other disturbance factors: Other past natural and human-caused disturbances have influenced the vegetation in the North Fork Eel River watershed. Overgrazing has altered the composition of grasslands and may also have affected riparian areas. By trampling vegetation in wet areas, intensive livestock grazing probably has increased erosion in riparian zones and retarded the establishment of vegetation. Past major flooding in riparian areas may also have changed the growth pattern of riparian vegetation. Natural erosion processes have also affected the distribution of plant communities; some parts of the watershed are currently without vegetation as a result of high rates of mass wasting. These erosion processes are addressed in more detail under key questions seven and eight in the Interpretation and Synthesis section.

CURRENT CONDITIONS

Products and uses

Trends related to current products and uses of the North Fork Eel River watershed are addressed in the Social Issues section. Those aspects related primarily to vegetation are summarized here.

Native American uses : There is increased interest in this watershed for the collection of acorns and plants by Native Americans.

Ranching : Ranching is still a primary activity on rangelands in the watershed. There are five allotments on Forest Service lands in the northern part of the watershed, and three allotments on BLM land in the southern part. The current use of these allotments is shown in Table 8. Some sources indicate that there is a decreasing trend in ranching because of a lack of interest among the younger generations in ranching families.

Table 8. National Forest range/grazing allotments on National Forest and Bureau of Land Management lands in the North Fork Eel River watershed.

NATIONAL FOREST				
Allotment/Unit	**Permittee**	**Total acres**	**NF acres**	**# of head**
Van Horn/Red Mtn.	Brown Investment	23,470	19,290	220
Van Horn/Rock Creek	Brown Investment	7,866	4,089	100
Long Ridge*	Donald Parker	16,940	15,124	83
Hoaglin	Donald Parker	7,548	7,058	35
Soldier Creek**	Vacant	10,493	9,135	0
Zenia***	Ross Burgess	15,502	14,201	50
Zenia	Marceline Stillwell			62
BLM				
Allotment/Unit	**Permittee**	**Total acres**	**NF acres**	**# of head**
Big Butte	Richard Wilson		5,015	Unknown
Travis Ranch	Brown Investment		4,607	Unknown
Scheubeck	Andre Scheubeck		335	Unknown

*Long Ridge is 95 percent in the North Fork Eel River watershed.

**Soldier Creek is 90 percent in the North Fork Eel River watershed.

***Zenia is 80 percent in the North Fork Eel River watershed and 20 percent in the Main Eel River watershed.

Logging : A cursory review of aerial photographs covering the southern part of the watershed reveals that considerable logging has taken place on private lands. Present information also indicates one timber sale planned within the jurisdiction of the Round Valley Indian Reservation in the southern end of the North Fork Eel River watershed. Currently about 1,200 acres have been clearcut on National Forest land, but the amount of timber harvesting on public land has decreased and will probably remain below past production levels. No logging is expected on BLM land because most of it has been designated as Late-Successional Reserve.

Plant community distribution and condition

Preliminary analysis of data collected over a 30-year interval on Continuous Forest Inventory (CFI) plots in areas of the Mad River Ranger District indicates some of the effects of fire suppression. There has been a significant increase in the Stand Density Index (SDI) for both Douglas-fir and white fir and a significant decrease in the SDI for black oak in the vicinity of the North Fork Eel River watershed (Talbert, personal communication). Although preliminary, these results confirm observations made by several researchers in this area which point toward increased growth and development of Douglas-fir stands. Observations by silviculturists indicate that competition-induced mortality has occurred in several early-mature and mid-mature Douglas-fir stands in this watershed.

The abundance of oak woodlands or savannahs in the watershed may be decreasing slightly due to Douglas-fir encroachment in these stands. At present, 23 percent of the area within the Forest Service boundary is mapped as white oak series (Table 9 and Figure 10). The abundance of Douglas-fir in white oak stands is edaphically controlled. Some white oak stands are growing on poorly-drained and shallow soils. Conifers are not able to thrive under these soil conditions and therefore do not have the potential to dominate these sites. Sites that do have the potential for conifer production may be dominated by white oak in the early stages of stand development. Douglas-fir will grow in these white oak stands and will eventually dominate, depending upon the absence of frequent, low-intensity fire.

Tracy's sanicle (*Sanicula tracyi*), a Forest Sensitive plant, is often associated with white oak/California fescue woodlands. The plants appear to prefer the bare ground spaces in between the clumps of fescue and partial canopy cover. Tracy's sanicle is also found growing in ecotonal areas where Douglas-fir and oak interface. The most apparent threat to Tracy's sanicle is the loss of oak woodland due to Douglas-fir encroachment and the change of the woodland ecology due to the encroachment and spread of exotic plant species.

The encroachment of conifers or oaks in grasslands appears to be negligible. A cursory comparison between 1944 and 1990 aerial photographs shows no apparent change in grassland sizes or amounts. Some grasslands are on unstable geologic substrates (melange) with poor drainage which inhibits the establishment of conifers. White oak may persist on these unstable sites however. Other grasslands are on more stable geologic substrates and are probably influenced more by recurring fires than by pedologic or geomorphic characteristics (Thiesen, personal communication).

Although the foregoing information applies to land within the Forest Service boundary, it is probably representative of the entire watershed. TTF data which covers the whole watershed are not compatible with SRNF data, so an analysis of the entire watershed could not be done.

Table 9. The subseries in the white oak series within the National Forest boundary in the North Fork Eel River watershed.

Subseries	Acres	Percent
Black oak	7,333	37
Canyon live oak	799	4
Gray pine	5,344	27
Douglas-fir	3,354	17
White oak	3,059	15

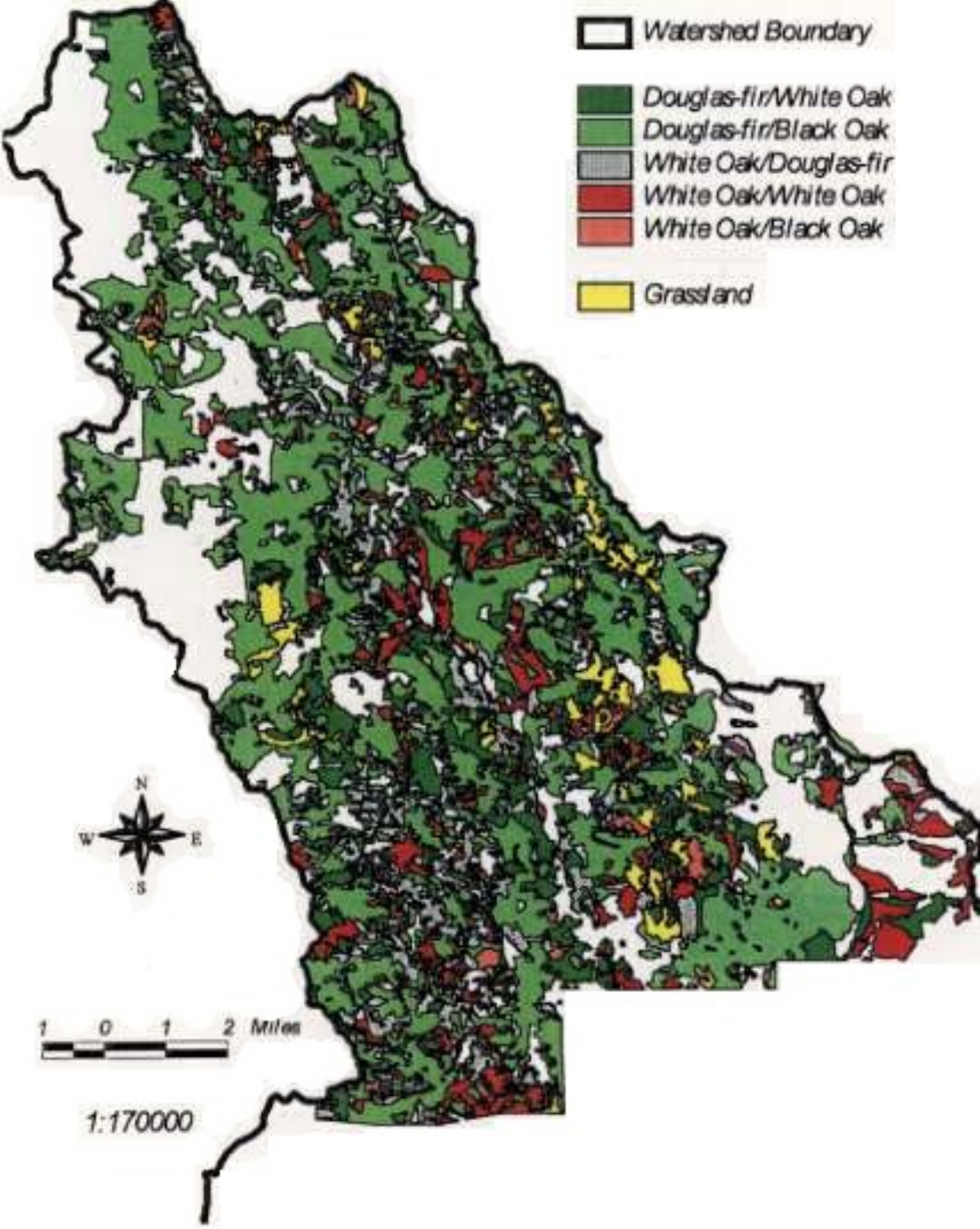

Figure 10. Distribution of vegetation series and sub-series relating to oak woodlands for Six Rivers National Forest land within the North Fork Eel river watershed.

Disturbance factors

Fire :

Current trends in fire occurrence suggest that the potential for larger stand-replacing fires may be increasing as the density of conifers has increased in the watershed. The Travis Fire in 1987 is an example of this trend. It was the largest fire in this area during the 90-year period of record, and became as large as it did for several reasons, including the amount of down material and the density of vegetation.

Fire Occurrence : The following is a summary of recorded fires in the last 90 years (see Appendix D for more detailed data). Fire report forms are available for the North Fork Eel River watershed back to 1930, while summary data are available for the Trinity National Forest from 1911 to 1924. Approximately 305 fires occurred on National Forest land within the North Fork Eel watershed between 1911 and 1992. Fire data for private lands are available from CDF for the years 1980 to 1992, that records an additional 23 fires. Number of occurrences and acres for each decade are shown below in Table 10.

Table 10. Number of fire occurrences and acres burned per decade in the North Fork Eel River watershed.

Period	Human Caused Number(Ac)	Lightning Number(Ac)	Total Number	Total Acres	Average AC/Year
NFS Land:					
1911-19	29 (165)	9 (202)	35	367	41
1920-29	17 (1013)	3 (59)	20	1072	214
1930-39	31 (673)	12 (2)	43	6	61
1940-49	7 (1664)	19 (35)	26	675	154
1950-59	11 (283)	32 (96)	43	1699	34
1960-69	4 (5)	66 (9)	70	379	7
1970-79	11 (29)	21 (7)	32	74	3
1980-89	5 (7)	17 (11523)	22	36	1048
1990-92	0(0)	14 (14)	14	11533	5
Private Land (CDF):					
1980-89	15 (154)	0 (0)	15	154	14
1990-92	6 (161)	2 (270)	8	431	144
Total	133 (4154)	195 (12280)	328	16434	213
%of Total	41 (25)	59 (75)			

Nearly all of the recorded fires were small, with only nine larger than 100 acres, and only three larger than 500 acres (750, 750, and 11,500 acres). Lightning was the recorded cause for only two of the fires larger than 100 acres; the principal human cause was incendiary. Yellow pine and Douglas-fir were noted as components of two of the larger fires, both of which were surface fires.

The largest fire recorded in this area was named the Travis Fire, which occurred in late summer of 1987 and grew

to 11,500 acres. It was caused by six separate lightning starts. Initial attack was delayed for three days because resources were obligated on the Blake Fire. Aerial support was also delayed due to their prior assignment to other fires in the region. Fire intensities west of Jones Ridge were mostly light and scattered due to previous fires (e.g., Red Mountain fire) and

the natural mosaic of fuel types. Most of the fire area was and is covered with grass and shrubs. The western area still contains many glades which burn rapidly. East of Jones Ridge in the Mad River drainage, the fire burned at very high intensities due to large amounts of logging slash that remained in harvest units. Only oaks were left standing, and fire damage to soils was very high.

For the years with data for both private and National Forest lands (1980-92), there were substantially more human-caused fires on private land than on public land (twenty-one versus five) and comparatively few lightning-caused fires (two on private compared to 31 on National Forest land). During this period, the two fires larger than 100 acres both occurred on private land. One was attributed to lightning (270 acres) and the other was caused by a motor vehicle (120 acres).

Fire Hazard : Fire hazard addresses suppression effectiveness once a fire ignites. Hazard assessment is based on two critical fire behavior factors which affect resistance to fire control: rate-of-spread and flame-length. Probable resource effects can be related to the rate at which fire will spread over an area. Flame-lengths are related to suppression effectiveness in terms of whether hand crews, equipment, or aerial attack can successfully suppress the fire. Fires that require aerial attack would have the greatest potential for resource destruction with extensive crown fires and higher tree mortality.

Fire behavior models predict rates-of-spread and flame-lengths from vegetation type (fuel models), slope class, and weather (Andrews, 1986). For this analysis, vegetation types, in terms of subseries and seral stages, were only available for National Forest lands. These subseries and seral stages were converted to Fire Behavior Fuel Models (Anderson, 1982) using District fire input. A two-fuel model was used to reflect understory conditions for the majority of the conversions. These fuel models were overlaid with NFDRS slope classes and combined with typical June and August weather for input into the BEHAVE fire model Eel D (Andrews, 1986) which calculated rates-of-spread and flame-lengths. The 37 subseries produced 11 unique fuel model combinations for this watershed as shown in Table 11 below..

Table 11. Fuel model combinations for the North Fork Eel River watershed.

Fuel Model No	Description
1	Short grass (1 ft)
2	Conifers (grass and understory)
5	Shrubs (2 ft)
6	Dormant shrubs, hardwood slash
8	Closed conifer litter
9	Hardwood litter
10	Closed conifers (litter and understory)
11	Light logging slash

Separate rates-of-spread and flame-lengths were calculated for each individual fuel model and each combination. Then, the rate-of-spread, weighted by percent cover, was calculated. Flame-lengths corresponding to the fuel model that was most frequently applicable were used for this analysis. Both a June and an August weather scenario were used (Table 12) to represent average and severe conditions.

Table 12. Fuel model moisture conditions.

Parameter	June	August
Mid-flame windspeed (mi/hr)	5	7
1-hr fuel moisture (%)	6	2
10-hr fuel moisture (%)	8	4
100-hr fuel moisture (%)	14	8
Live herbaceous fuel moisture (%)	133	75

(Fuel moistures are designated by "hour" categories, which correspond to diameter size classes. 1-hr = <0.25"; 10-hr = 0.25 to 1"; 100-hr = 1 to 3").

The fire behavior results are shown in Tables 13 and 14.

Rate-of-spread (ROS) and flame-length (FL) are represented qualitatively for mapping and discussion purposes (Figures 11, 12, 13, 14), with corresponding suppression effectiveness assessments (Tables 13 and 14).

Table 13. Fire suppression effectiveness.

Rating	ROS (ft/min)	FL (ft)	SUPPRESSION
Low	0 - 5	0 – 2	3-person handcrew or engine
Moderate	5 - 11	2	45-person handcrew or engine
High	11 - 22	4	2 engines, handcrew, water tender, aerial support
Very High	22 – 33	6 – 8	all above plus dozers and aerial support
Extreme	> 33 >	8	beyond initial attack, into extended attack

Table 14. Relative proportions of calculated ROS and FL for the June and August weather*ƒ* scenarios for National Forest land within the North Fork Eel River watershed:

Rating	ROS (June)	ROS (Aug)	FL (June)	FL (Aug)
Low	21%	0%	33%	0%
Moderate	27	22	33	28
High	22	7	28	32
Very High	5	18	6	2
Extreme	25	53	0	38

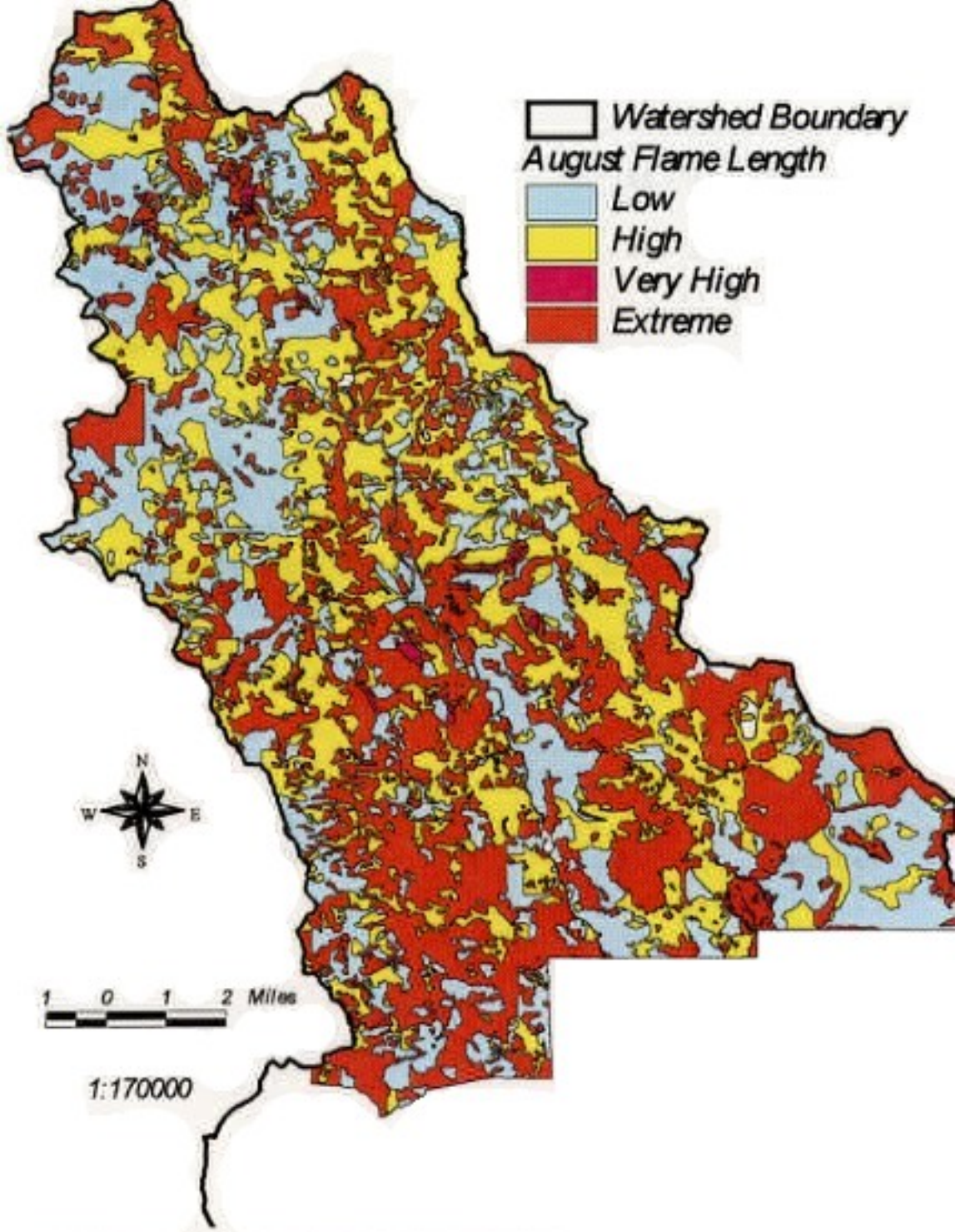

Figure 11. Fire hazard rating for flame length during August for Six Rivers National Forest land within the North Fork Eel River Basin.

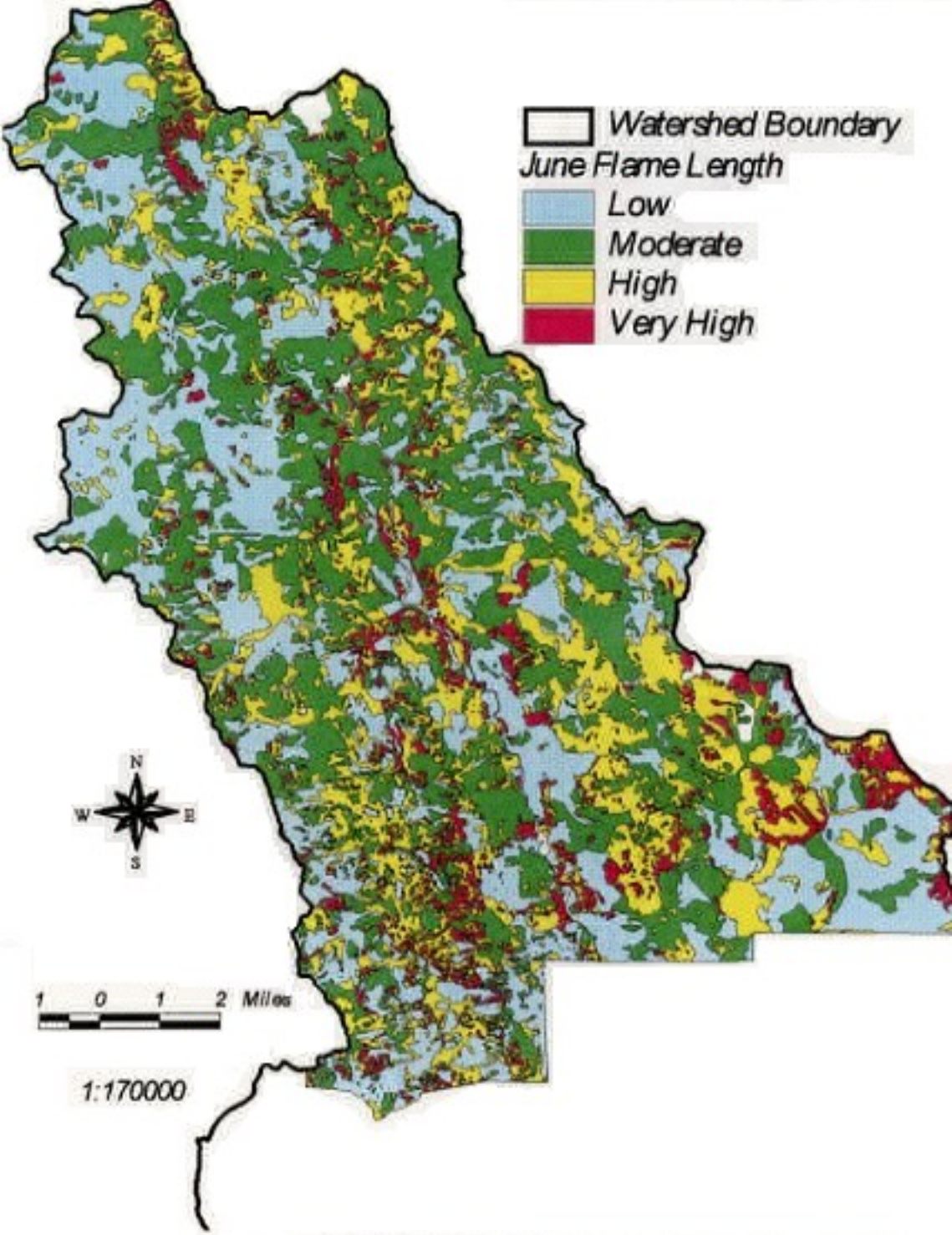

Figure 12. Fire hazard rating for flame length during June for Six Rivers National Forest land within the North Fork Eel River Basin.

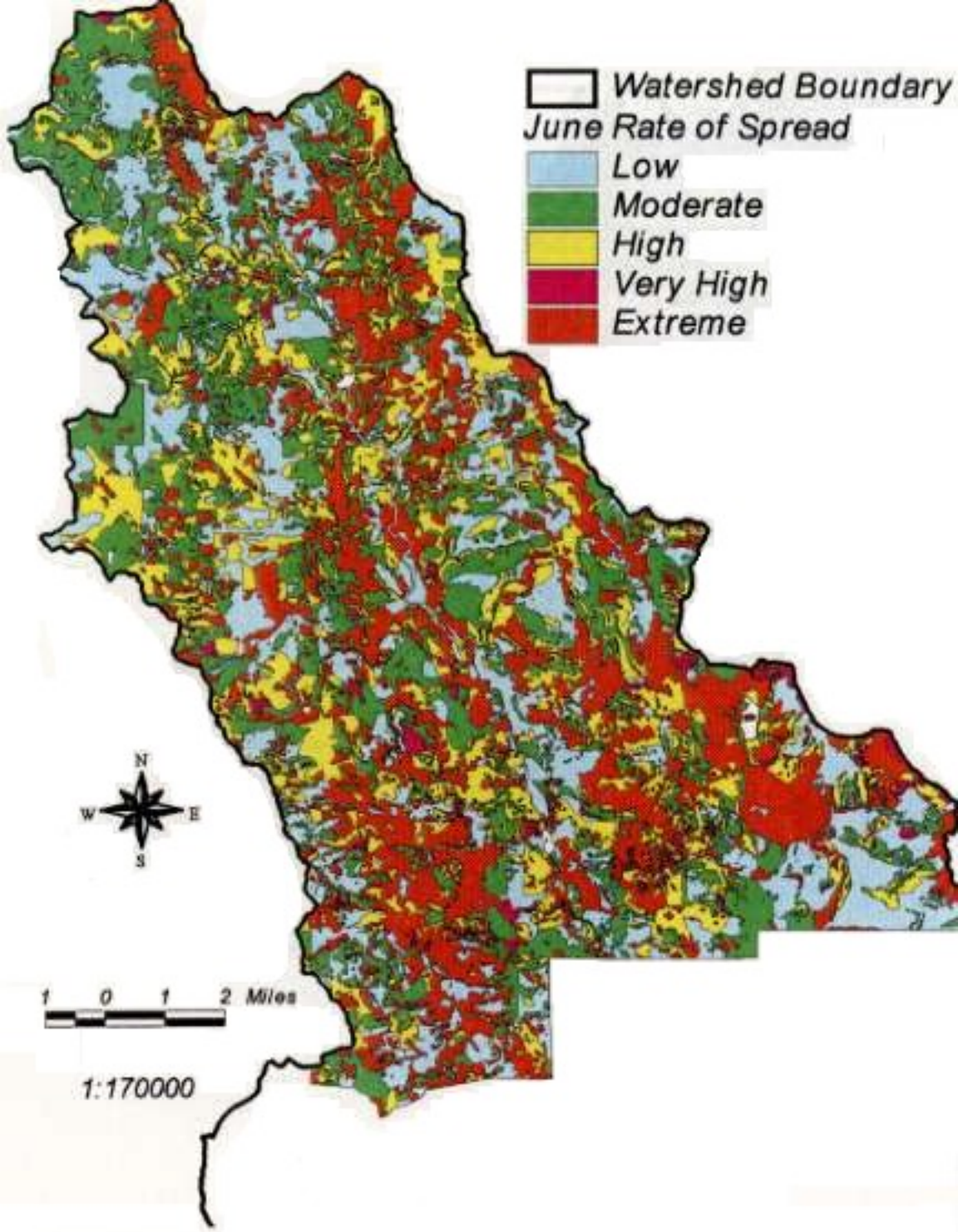

Figure 13. Fire hazard rating for rate-of-spread during June for Six Rivers National Forest land within the North Fork Eel River Basin.

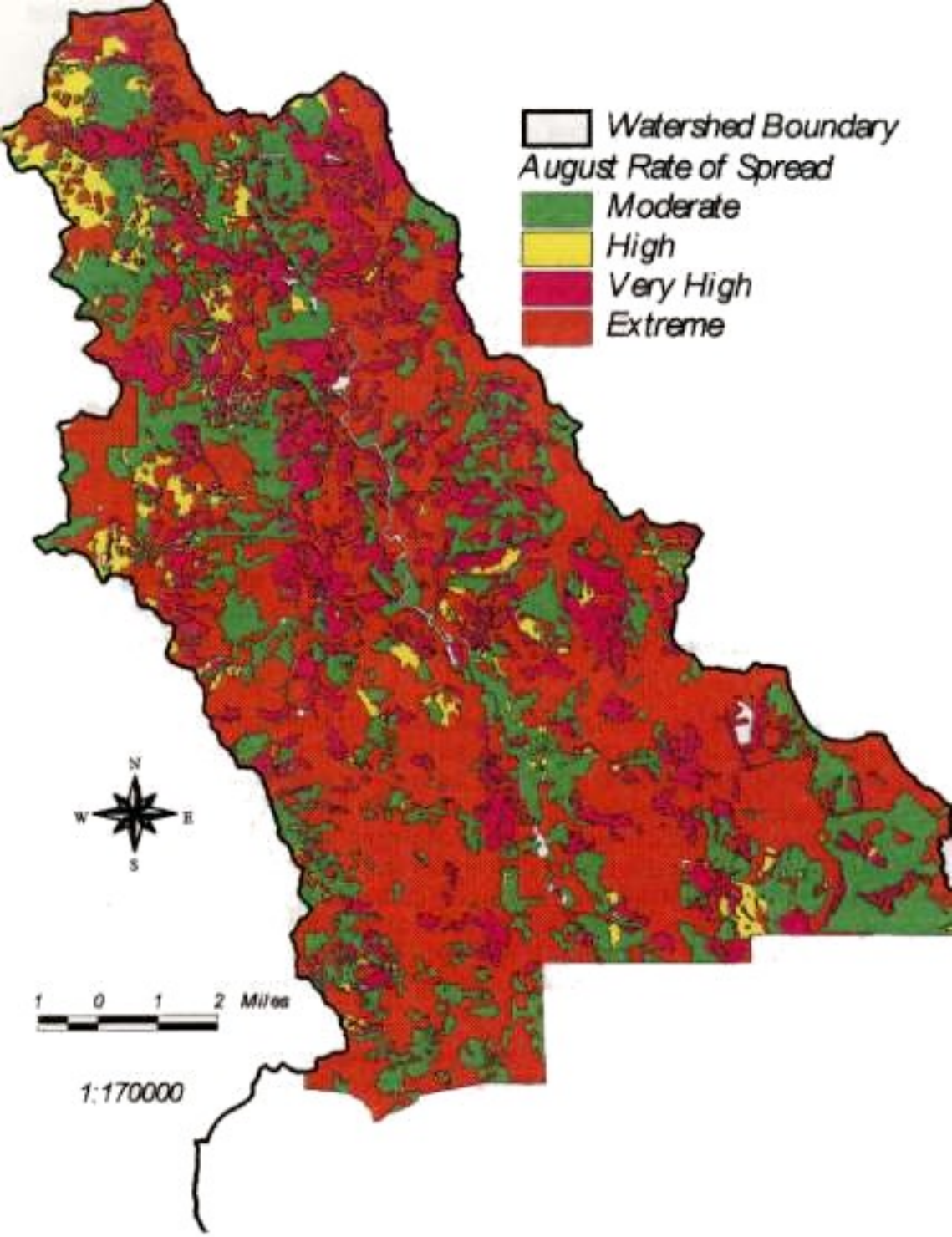

Figure 14. Fire hazard rating for rate-of-spread during August for Six Rivers National Forest land within the North Fork Eel River Basin.

Fire Suppression : Suppressing fires while they are still small requires a mix of initial attack resources that is more mobile than what has been required traditionally. The current organization for the California Department of Forestry (CDF) and the Mad River Ranger District emphasizes ground attack as the primary initial attack resource, with support from air attack forces for extended attack. District support includes one five-person handcrew, one engine, and one patrol. The CDF would supply crews from Alderpoint (eight or nine crews from the California Department. of Corrections) and Garberville (one engine). CDF also can send crews from the Mendocino Ranger Unit during the Travis Fire. Fires within the Yolla Bolly could also be attacked by White Rock (Shasta Trinity National Forest) or Covelo (Mendocino National Forest) Ranger District crews.

From the initial attack standpoint, the Forest has been able to secure funding for the same base organization for several years, but current funding is declining with further reductions expected in Fiscal Year 1997. Once a fire escapes initial action, reinforcements are requested from cooperating agencies and form the "militia," that is, Forest Service employees from functional areas other than fire management. Recent downsizing, attrition, and reduced budgets have resulted in a significantly reduced militia. Consequently, initial reinforcement will be delayed, and in some cases, fires which in the past would have been contained by initial attack forces are likely to require extended action. This was the scenario for the Travis Fire, which was finally controlled at 11,500 acres.

SYNTHESIS AND INTERPRETATION

Key Question 1 : How do the current distribution of seral stages and vegetation types in the North Fork Eel River watershed compare to the Historic Range of Variability (HRV) and Recommended Management Range (RMR)?

Historic range of variability (HRV) was calculated for the Six Rivers Land and Resources Management Plan (LRMP). These values estimate the percentage ranges of early-mature, mid-mature, late-mature and old-growth stands within the Douglas-fir, white fir and tanoak series that have been present historically in the South Zone of Six Rivers National Forest. The HRV estimates show the historic distribution of each of the seral stages within each series under the climatic and disturbance regimes found in the zone. The estimated percentages are the basis for recommended management ranges (RMRs) for these areas of National Forest land. SRNF vegetation mapping data for the North Fork Eel River watershed were compared to the HRV and RMR values. After comparing SRNF data with TTF vegetation data, it was evident that the Six Rivers National Forest HRV and RMR values could not be applied to the whole watershed because of the poor correlation.

Tables 15, 16, and 17 compare the percentages of each seral stage in the Douglas-fir, white fir and tanoak series within the Six Rivers National Forest boundary. This comparison includes private land within the National Forest boundary. Tables 18, 19, and 20 show the same comparison for the National Forest only.

These comparisons should be evaluated with caution because of the differences in scale between the watershed and the zone. Mid-mature Douglas-fir stands appear to be more extensive in the watershed than the HRV for the zone, but these stands comprise one-third of the total for the entire zone. Within the zone, old-growth Douglas-fir stands are below the minimum HRV and RMR (Table 15). Tanoak early-mature stands are below the minimum RMR and mid-mature stands are above the maximum RMR in the zone (Table 16). White fir early-mature and mid-mature stands are both over the maximum RMR for the zone (Table 17). For the Six Rivers National Forest land within the North Fork Eel River watershed, Douglas-fir old-growth stands

are below the minimum HRV and RMR and mid-mature stands are over the maximum HRV and RMR (Table 18). Early-mature tanoak stands in the watershed are below the minimum RMR and old-growth stands are just at the maximum RMR (Table 19). Early-mature white fir stands are over the maximum RMR and late-mature stands are over the maximum HRV and RMR (Table 20). The acres shown in excess of the maximum and minimum RMR can be used as a guideline for timber management (especially regeneration harvests), although most considerations about the number of acres to treat should be decided at the scale of the zone.

According to the TTF data, 47 percent of the Douglas-fir type in this watershed is in size class 3 and 4 with a dense overstory. These attributes roughly correspond to early-mature, mid-mature, late-mature, and old-growth seral stages. Without being able to distinguish among these seral stages, however, it is difficult to compare this information to the HRV and RMR values developed for the South Zone. Analysis of these two data sets (TTF and

SRNF) has led to the conclusion that Douglas-fir stands are well represented in size classes 3 or 4 and in the early-mature or mid-mature seral stages throughout this watershed. The abundance of these stands reflects the amount of succession that has taken place in this watershed over the last 100 years or more.

Table 15. The percent of each seral stage in the Douglas-fir series for all lands (includes private holdings) within the Six Rivers National Forest boundary in the North Fork Eel River watershed and the South Zone. These seral stage percentages are compared to the HRV and RMR of the South Zone. The number of acres over the minimum and maximum RMR are also shown.

Douglas-fir		NF Eel	Total Zone	South Zone HRV % Min.	South Zone HRV % Max.	South Zone RMR % Min.	South Zone RMR % Max.	South Zone Acres over RMR Min.	South Zone Acres over RMR Max.	NF Eel Acres over RMR Min.	NF Eel Acres over RMR Max.
Shrub/forb	acres	2,397	10,530								
		5 %	6 %								
Pole	acres	1,214	7,450								
		3 %	4 %								
Early-mature	acres	15,806	52,143					25,374	-6,415	8,221	-784
		33 %	31 %	16 %	40 %	16 %	35 %				
Mid-mature	acres	20,523	62,564					24,082	4,621	9,621	3,932
		43 %	37 %	7 %	40 %	23 %	35 %				
Late-mature	acres	5,331	23,520					8,462	96	3,675	1,065
		11 %	14 %	2 %	14 %	9 %	14 %				
Old-growth	acres	2,131	11,103					-7,301	-22,358	7,350	3,084
		4 %	7 %	7 %	20 %	11 %	20 %				

Table 16. The percent of each seral stage in the tanoak series for all lands (includes private holdings) within the Six Rivers National Forest boundary in the North Fork Eel River watershed and the South Zone. These seral stage percentages are compared to the HRV and RMR of the South Zone. The number of acres over the minimum and maximum RMR are also shown.

Tanoak		NF Eel	Total Zone	South Zone HRV % Min.	South Zone HRV % Max.	South Zone RMR % Min.	South Zone RMR % Max.	South Zone Acres over RMR Min.	South Zone Acres over RMR Max.	NF Eel Acres over RMR Min.	NF Eel Acres over RMR Max.
Shrub/forb	acres	146	858								
		2 %	5 %								
Pole	acres	434	803								
		7 %	5 %								
Early-mature	acres	1,792	2,943					-804	-2053	-316	211
		27 %	19 %	12 %	36 %	24 %	32 %				
Mid-mature	acres	1,971	5,454					2,019	457	137	522
		30 %	35 %	8 %	36 %	22 %	32 %				
Late-mature	acres	925	2,796					922	-171	1,184	134
		14 %	18 %	5 %	19 %	12 %	19 %				
Old-growth	acres	1,321	2,762					-986	-1,767	590	-260
		20 %	18 %	21 %	29 %	19 %	29 %				

Table 17. The percent of each seral stage in the white fir series for all lands (includes private holdings) within the Six Rivers National Forest boundary in the North Fork Eel River watershed and the South Zone. These seral stage percentages are compared to the HRV and RMR of the South Zone. The number of acres over the minimum and maximum RMR are also shown.

White fir		NF Eel	Total Zone	South Zone HRV % Min.	South Zone HRV % Max.	South Zone RMR % Min.	South Zone RMR % Max.	South Zone Acres over RMR Min.	South Zone Acres over RMR Max.	NF Eel Acres over RMR Min.	NF Eel Acres over RMR Max.
Shrub/forb	acres	482	2,995								
		21 %	8 %								
Pole	acres	39	1,897								
		2 %	5 %								
Early-mature	acres	589	11,005					4,491	2,681	12	42
		25 %	30 %	18 %	36 %	18 %	23 %				
Mid-mature	acres	685	11,732					4,493	874	-6	63
		29 %	32 %	8 %	35 %	20 %	30 %				
Late-mature	acres	335	4,525					1,268	-180	4	18
		14 %	13 %	4 %	13 %	9 %	9 %				
Old-growth	acres	219	4,037					1,142	56	-4	3
		9 %	11 %	8 %	11 %	8 %	11 %				

Table 18. The percent of each seral stage in the Douglas-fir series for Six Rivers National Forest in the North Fork Eel River watershed and the South Zone. These seral stage percentages are compared to the HRV and RMR of the South Zone. The number of acres over the minimum and maximum RMR are also shown.

Douglas-fir		NF Eel	Total Zone	South Zone HRV % Min.	South Zone HRV % Max.	South Zone RMR % Min.	South Zone RMR % Max.	South Zone Acres over RMR Min.	South Zone Acres over RMR Max.	NF Eel Acres over RMR Min.	NF Eel Acres over RMR Max.
Shrub/forb	acres	2,270	9,062								
		6 %	7 %								
Pole	acres	1,060	5,444								
		3 %	4 %								
Early-mature	acres	9,884	35,587					13,435	-12,092	3,729	-3,579
		26 %	26 %	16 %	40 %	16 %	35 %				
Mid-mature	acres	18,029	51,913					21,496	5,374	9,182	4,566
		47 %	39 %	7 %	40 %	23 %	35 %				
Late-mature	acres	5,150	21,594					9,405	2,687	1,688	-2,158
		13 5	16 %	2 %	14 %	9 %	14 %				
Old-growth	acres	2,072	10,752					-4,031	-16,122	-2,159	-5,621
		5 %	8 %	7 %	7 %	11 %	20 %				

Table 19. The percent of each seral stage in the tanoak series for Six Rivers National Forest in the North Fork Eel River watershed and the South Zone. These seral stage percentages are compared to the HRV and RMR of the South Zone. The number of acres over the minimum and maximum RMR are also shown.

Tanoak		NF Eel	Total Zone	South Zone HRV % Min.	South Zone HRV % Max.	South Zone RMR % Min.	South Zone RMR % Max.	South Zone Acres over RMR Min.	South Zone Acres over RMR Max.	NF Eel Acres over RMR Min.	NF Eel Acres over RMR Max.
Shrub/forb	acres	146	788								
		3 %	6 %								
Pole	acres	399	685								
		7 %	5 5								
Early-mature	acres	1,084	1,617					-1,584	-2,640	-212	-644
		20 %	12 %	12 %	36 %	24 %	32 %				
Mid-mature	acres	1,539	4,698					1,848	528	351	-188
		29 %	36 5	8 %	36 %	22 %	32 %				
Late-mature	acres	916	2,709					1,188	264	268	-811
		17 %	21 %	5 %	19 %	12 %	19 %				
Old-growth	acres	1,314	2,707					-528	-1,199	18	-252
		24 %	20 %	21 %	29 %	24 %	29 %				

Table 20. The percent of each seral stage in the white fir series for Six Rivers National Forest in the North Fork Eel River watershed and the South Zone. These seral stage percentages are compared to the HRV and RMR of the South Zone. The number of acres over the minimum and maximum RMR are also shown.

White fir		NF Eel	Total Zone	South Zone HRV % Min.	South Zone HRV % Max.	South Zone RMR % Min.	South Zone RMR % Max.	South Zone Acres over RMR Min.	South Zone Acres over RMR Max.	NF Eel Acres over RMR Min.	NF Eel Acres over RMR Max.
Shrub/forb	acres	482	2,720								
		21 %	8 %								
Pole	acres	39	1,627								
		2 %	5 5								
Early-mature	acres	589	9,424					3,590	1,970	166	49
		25 %	29 %	18 %	36 %	18 %	23 %				
Mid-mature	acres	685	10,408					3,926	685	215	-20
		29 %	32 %	8 %	35 %	20 %	30 %				
Late-mature	acres	335	4,303					1,386	90	124	30
		14 %	13 %	4 %	13 %	9 %	13 %				
Old-growth	acres	219	3,927					1,334	362	31	-39
		9 %	12 %	8 %	11 %	8 %	11 %				

Key Question 2 : To what extent has livestock grazing altered the distribution and composition of plant communities within the North Fork Eel River watershed compared to historical conditions?

No formal study of the effects of grazing on plant communities in the North Fork Eel River watershed has been done. However, some historical records indicate that changes in plant species composition in grasslands resulted from intensive livestock use. For example, interviews with local residents by Davy (1902) revealed several shifts in grass species composition from 1853 to 1902 (Keter, 1995). Most of the changes took place during the late 1800s when livestock use was at its peak. These changes are still evident today in terms of the dominance of annual grasses (such as *Bromus tectorum* and *Cynosorus echinatus*), some noxious forbs (such as *Hemizonia* and *Madia*), and clover (*Trifolium* sp.) in grasslands of the watershed which were once dominated by perennial grass species and native herbs.

Regional studies in the West suggest possible effects of intensive grazing on the plant communities in the watershed. The distribution or extent of some conifer and oak plant communities may have increased with grazing intensity. Grazing intensity in some areas may increase the establishment of conifers and oaks into a grassland (Archer and Smeins, 1991). As grasses are depleted, there is less competition with conifer and oak seedlings. Because of intensive grazing, grassland extent may have been reduced in the watershed due to encroachment of conifers in some areas. This probably occurred during the period of intensive grazing from 1865 to 1905 (Keter, 1995).

Riparian plant communities may also have been affected by grazing in the North Fork Eel River watershed in the following ways: (1) compaction of soil which results in less water available to plants, (2) removal of foliage from trees and shrubs, (3) physical damage to vegetation by the rubbing or gnawing of bark, and (4) altering the growth form of plants by eating the apical meristem and initiating lateral shoot growth. Fifteen-to-twenty percent of the riparian reaches sampled in the North Fork Eel River watershed in 1995 showed some visible effects of livestock grazing, but no details of the effects of grazing were collected. For riparian areas sampled in grasslands, the main species affected were rushes and sedges (Palmer-Wallace, personal communication).

Key Question 3 : How does the current fire regime compare to the historic range of fire conditions in the North Fork Eel River watershed, and how have past and current fire regimes been altered by vegetation management and fire suppression?

Fire has been and continues to be the dominant natural factor affecting vegetation in the North Fork Eel River watershed, as well as the rest of the South Zone of Six Rivers National Forest and southern portions of the Eel River Basin.

The frequency, intensity, and duration of these fires have changed as human occupation and utilization of the land has changed. With the elimination of burning by Native Americans in the late 1800s and active fire suppression since the 1940s, density and composition of plant communities have shifted, resulting in dense stands of Douglas-fir and other conifer species in this watershed. The increased density of conifers has increased the probability of catastrophic fires. Compared to the past fire regime with small, high frequency, variable intensity fires, the current fire regime presents a higher potential for less frequent, larger, high intensity fires.

Fire regimes have also been altered by management activities. These activities may shorten fire return intervals (e.g., logging followed by slash burning) or lengthen them (e.g., intensive livestock grazing which decreases fire spread due to removal of herbaceous fuels). Fire regimes of grassland communities have been affected by the shift from native to principally exotic species which dry out earlier in the summer and leave a continuous fuel across grasslands during the fire season. Perennial bunch grasses stay greener and are more fire resistant longer into the summer. The interstitial spaces within bunchgrasses also serve to break up the fuel base for fire, except where bunchgrass areas have been without fire for some time and leaf litter or dead grass stalks have accumulated. Changes in plant species composition also can change rates-of-spread and fire intensity.

Key Question 4 : How has fire suppression affected vegetation characteristics, thereby influencing the diversity, abundance, and distribution of wildlife species? Can fire be introduced into this area through prescribed burning to offset these effects?

Since active fire suppression began in the North Fork Eel River watershed, succession has been able to take place

with considerably less disturbance from fire. This has resulted in an increase in overstory cover and greater density of trees and shrubs. The composition of the dominant plant communities has changed from primarily open oak woodland and conifer stands to dense stands of conifers. This change in composition and structure has changed the composition of wildlife species utilizing these habitats.

It has been suggested that deer populations have decreased significantly due to the reduction of oak woodland habitat since the influx of settlers to the North Fork Eel River area in the 1860s (Keter, 1995). Other animal species associated with oak woodlands may also have been reduced in number as their habitat diminished. The complex habitat structure found in Douglas-fir stands with black oaks (both live and snags) provides excellent habitat for owls.

Prescribed burning combined with silvicultural treatments could be used in this watershed to offset the encroachment of conifers. The use of prescribed fire could open up areas and create habitat for deer and other species that depend on acorns and other food sources in oak woodlands. In order to implement a prescribed burning program, areas within the watershed that would benefit from treatment need to be identified. Then, criteria need to be established that would help to select areas for burning. Some of these areas may include white oak stands that are actively being encroached by Douglas-fir.

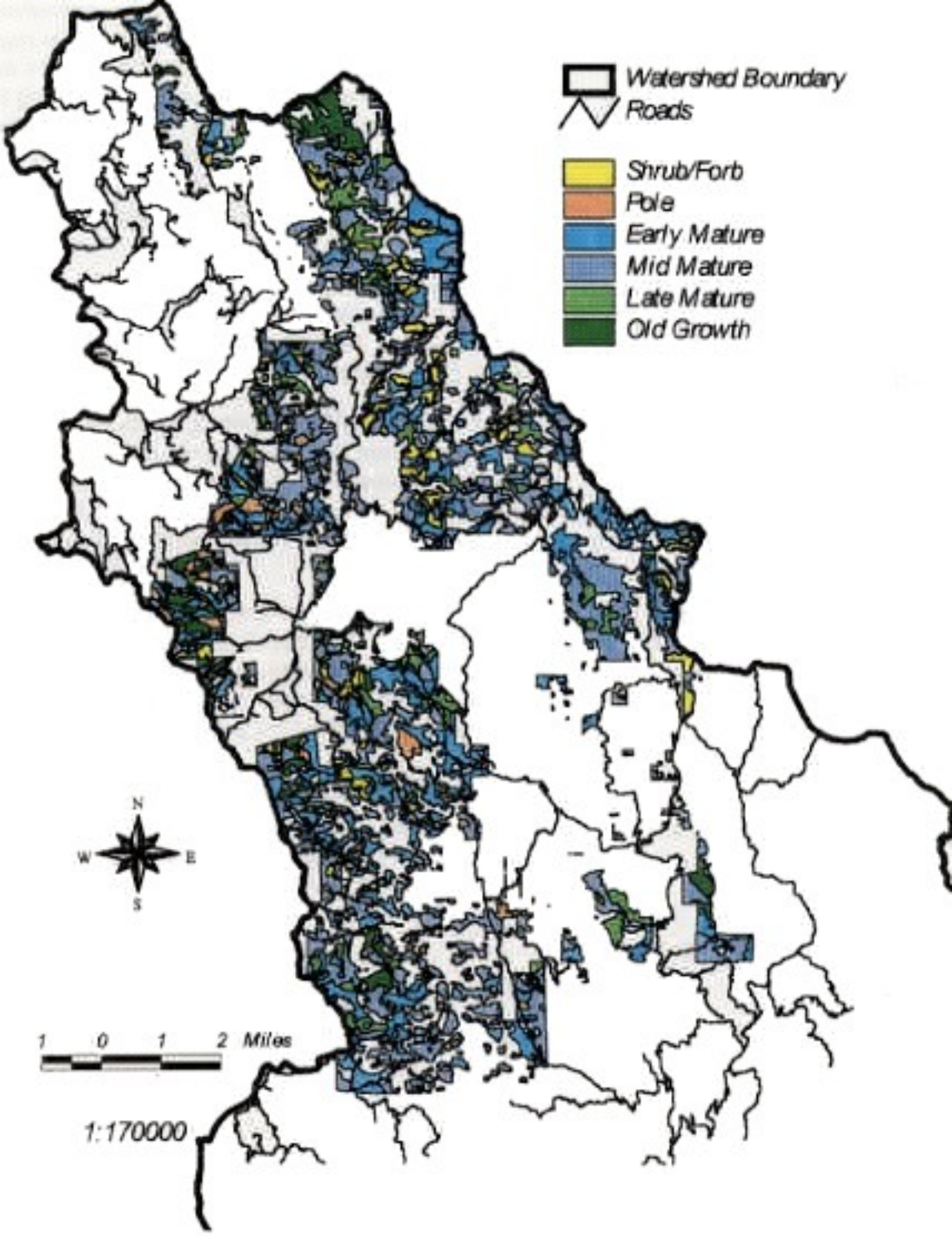

Figure 15. Commercial tree species seral stage distribution for Matrix land and roads for Six Rivers National Forest land within the North Fork Eel river watershed.

Key Question 5 : What are the susceptibilities of upslope areas to mass wasting and accelerated erosion when disturbed by management (roads, logging, grazing)?

The susceptibility of upslope areas (i.e., not steep river canyons) to management disturbance is controlled by the geologic materials and soils, as well as the presence of landslides and types of vegetation on those materials. The actual effects of management depend to a greater extent on the nature of that management and how and where it is conducted.

The North Fork Eel River watershed can be broadly divided into relatively weak melange terrane, moderately competent graywacke bedrock, and other relatively competent bedrock. Melange areas contain many active earthflows and tend to have higher surface runoff rates. Zones of intense shearing are typically the least stable areas. Roads on melange may increase gullying by concentrating or diverting surface runoff. Large cuts and fills tend to be susceptible to localized slope failure. The more stable roads on melange are usually on gentler slopes with modest cuts and fills, have adequately sized culverts, and do not increase runoff into downslope drainages.

Moderately competent graywacke units have similar problems, usually localized on sheared material and/or steep slopes associated with past landsliding. These higher risk areas may be near the threshold of failure and require only minimal disturbance to activate them. After a slide develops in these materials, there is a tendency for continued headward enlargement of the scarp. Restoration of such a slope is generally difficult and not cost-effective.

The relatively competent rock units include well-cemented greywacke sandstone, as well as minor lithologies such as chert and greenstone. Slopes are often steep with minimal development of coarse-grained soils that support canyon live oak and brush. Slopes are occasionally subject to rock-slide and rock-fall as well as soil creep and shallow sliding. Road construction is usually stable although expensive.

Most logging activities have and will occur on graywacke units, although there are some mixed conifer stands on melange. Tractor yarding and clearcutting can increase erosion and mass wasting rates, especially if harvesting is done on steep slopes adjacent to streams. Onsite and offsite damage can occur from removing vegetation and organic soil layers on skid trails and through broadcast burning which also can remove organic layers, decrease interception and increase surface runoff and particle entrainment from raindrop impact. Vegetation removal also changes the groundwater regime which may increase surface runoff and increase susceptibility to mass wasting. Selective logging from stable road systems can greatly diminish these adverse effects on sediment production.

Grazing in upslope areas is primarily a concern on melange substrates where most grasslands occur. Current grazing impacts appear to be concentrated in riparian areas; upslope impacts are not readily evident. Overgrazing and poor livestock management techniques increases compaction and local creep rates, and also changes vegetation composition. These changes may increase surface runoff and erosion, but may not be highly significant when compared to the high natural rates of erosion and mass movement on these hillslopes.

Key Question 6 : How much do mass wasting and erosion affect plant community productivity and "health" in this watershed?

The North Fork Eel River watershed has a high rate of mass wasting and erosion because of rapid uplift and the abundance of unstable geologic material. The most obvious effect is visible along the main stem and major tributaries where debris slides cover hundreds of acres and are not likely to be re-vegetated until rates of uplift and landscape lowering are more balanced.

Melange areas have a combination of unstable substrate, high surface runoff, and clayey soils that strongly influence their vegetation towards grassland and oak woodland types. Some parts of the melange are so unstable and erodible that they will likely persist as grasslands. More stable areas tend to support oak woodlands and mixed conifers, especially if fire suppression continues.

There are also large areas of vegetation on graywacke bedrock that are affected by mass wasting and erosion. Steep, rocky slopes are subject to rockfall and high creep rates which inhibit the development of productive soil. Graywacke units in the Salt Creek drainage and the Yolla Bolly Wilderness appear to have high rates of erosion

and shallow mass wasting in lower-to-middle slope positions that are retarding soil development.

Extensive areas of older landsliding outside of inner gorges appear to be relict, dormant features which do not presently have much effect on existing vegetation. High rates of sediment delivery are concentrated along the main stem and major tributaries of the watershed where it primarily affects riparian vegetation.

Key Question 7 : What areas or allotments have been most impacted from grazing, and what are the opportunities and priorities to stabilize and restore critical habitat altered by grazing?

There is little information on the impact of grazing on these allotments. More surveys need to be done in order to determine where the greatest impacts have occurred. Presently there is some restoration taking place along Salt Creek.

Key Question 8 : What changes in habitat have promoted the establishment of exotics within the basin, and what are the dispersal agents for exotics?

Approximately 40 exotic grasses and 85 exotic herbs have been identified in the Specimen Label Information Database (SLID) and in a report by the Humboldt County Agriculture office. These species can be found in all the watersheds throughout the Eel River Basin. Percent cover varies by species, and certain species are more "aggressive" or tenacious than others. For example, *Dactylis glomerata* tends to occupy roadsides and does not appear to out-compete native plants in most ecosystems (Harrison et al., USDA).

The most common exotic plants found in the SLID plots include:

Grasses — *Bromus hordeaceus, Bromus tectorum, Bromus diandrus, Aira caryophyllea, Dactylis glomerata, Holcus lanatus, Avena* sp., *Cynosurus echniatus, Lolium perenne*;

Herbs — *Rumex acetosella, R. crispus, Hypericum perforatum, Erodium cicutarium, Plantago lanceolata, Cirsium arvense, C. vulgare, Centaurea solstitalis, Hypochoeris sp*.

Populations of star-thistle (*Centaurea solstitalis*) have also been observed in the North Fork Eel River watershed (Keter, 1995).

One of the most tenacious exotic grasses is *Bromus tectorum*. This species is one of the most common throughout the basin and dominates some grasslands in the watershed. This species is rather tall and can shade out shorter, perennial grass seedlings and out-compete them for water (Menke, 1992). Oat grass (*Avena* sp.) is a problem for the same reason. Filaree (*Erodium* sp.), which is found throughout the basin including in the North Fork Eel River area, grows in a rosette form, thereby blocking emergence of perennial grass seedlings (Menke, 1992).

Many of the exotics in California grasslands are annual Mediterranean grasses, and to a lesser extent forbs. Exotics are well-adapted for dispersal with seed characteristics such as hairs to aid in wind transport, or barbs for better attachment to animals. Certain exotics are also palatable to livestock. Thus, dispersal agents are wind, native animals, and domestic livestock. Exotic seed can also be introduced via the use of machinery, equipment, and vehicles which are carrying seed.

Ground disturbance from heavy grazing, road construction or fire that removes vegetation contributes to the introduction and spread of exotics. Historic grazing practices (overstocking, grazing cattle in fenced areas, etc.) have contributed significantly to the establishment and spread of exotics. Livestock help to spread exotic plant species by: (1) dispersing seeds in fur and dung, (2) opening habitat for weedy species, and (3) reducing competition for non-native plants by heavy grazing on native plants. Because of the widespread presence of exotics, almost any disturbed ground (especially in open settings like grasslands or coastal bluffs) will become occupied in part by exotics. Many of these exotics are shade-intolerant, pioneer species that are not usually found in closed canopy forests. Exotic seed banks are typically immense and long-lived in the soil or litter. This shift from a diverse group of native plants to a relatively homogenous group of exotics on the ground surface as well as in the seed bank is likely to perpetuate the dominance of exotic grasses and forbs in a given area.

Key Question 9 : What considerations should Federal land managers follow to reduce the impact of private land management on forest fragmentation? How can we integrate private land management into federal planning and ecosystem management?

This is a matter of addressing cumulative effects under the National Environmental Policy Act (NEPA). Forest fragmentation was not analyzed for this document. However, some opportunities exist outside of NEPA where vegetation information can be examined on a watershed basis before implementation. It is also possible to assemble relevant information from public and private lands both within and beyond the National Forest boundaries to evaluate possible project effects on fragmentation of the landscape. At a minimum, TTF data are generally available for preliminary analysis. The Federal land manager can then adjust the project to fit external constraints, or can cultivate partnerships with other landowners to meet the desired goals of reducing the amount of fragmentation while producing economically beneficial timber outputs.

Methods for integrating private land management with federal planning include: (1) consolidating inholdings, (2) encouraging cooperative agreements, (3) habitat conservation plans with the U.S. Fish and Wildlife Service, (4) identifying data gaps, (5) documenting activities on private lands, (6) evaluating logging impacts on private lands, and (7) using mitigation banks to offset effects of habitat loss.

ISSUE 3: NORTH FORK CONTRIBUTION TO RECOVERY OF TES SPECIES

REFERENCE CONDITIONS

TES Plants

It is difficult to determine historical abundance of TES plant species without pollen core studies, herbaria research that might attest to more widespread distributions of certain species, or ethnographic data, none of which was readily available for this document. It can be assumed that species associated with significantly-altered habitat are less abundant than in the past (i.e., habitats associated with oak woodlands that have experienced conversions relative to the spread of exotic plants, grazing impacts, and alteration of fire regimes; grasslands habitats for similar reasons; forest interior habitats due to fragmentation and conversion to early-seral stages; coastal habitats due to spread of exotics and development). A caveat to this assumption is the lack of understanding about the ecological requirements of many TES plant species; certain species may be able to adjust to change depending on scale, intensity, and temporal factors. One example is Tracy's sanicle (*Sanicula tracyi*) which is observed growing on previously-disturbed sites (road cuts, old skid trails). There is a degree of tolerance to disturbance; however, in most cases we do not have good information about pre-disturbance conditions. To the contrary, mountain lady's-slipper (*Cypripedium montanum*), exists in very small populations and appears intolerant to even minimal human disturbance.

Wildlife

Evidence suggests that Native American tribes were dependent upon black-tailed deer and salmon for subsistence. Deer reportedly occurred in much greater numbers, and elk may have occurred in the larger valleys. Records exist of grizzly bear attacks on early pioneers in the Round Valley area and near Hull Mountain. Numerous records describe extensive deer hunting for hides, which were sold to dealers in the central valley. Bear hides were also marketed for profit.

Predators were not reported to have been a problem to early ranchers. Sheep population increases (in the 1870s) and depression of deer populations due to uncontrolled hide hunting and overgrazing created the situation where predators began to prey on livestock. Coyote populations and predation were believed to have increased as sheep numbers increased and deer populations declined. Mountain lions were reported to be common during the late-1800s. Predator control laws were passed in the early 1900s. A bounty on coyote and mountain lions was established in 1911. These bounties continued through the 1960s. During this period, the USFWS Animal Damage Control trapped coyote and mountain lions to reduce livestock losses.

A large number of hogs were released in the watershed during 1860, causing untold soil-disturbing activity. In some areas of the watershed, feral pigs were abundant. Few feral pigs are believed to presently occur in the North Fork Eel River watershed. A local resident of the area observed that hogs had been eliminated or reduced throughout most of the watershed by persistent mountain lion and bear predation. Small populations of feral hogs still occur on private ranches (Heffner, interviews 1995).

Historical numbers of TE and Special Status species are not known. Abundant salmon and sheep may have

supported nesting bald eagles. Northern goshawks probably were more common with the historical fire regime of more frequent, less intense fires which reduced understory vegetation.

CURRENT CONDITIONS

Table 7 lists the Federally Threatened (FT), Federally Endangered (FE), Federally Proposed, and Special Status wildlife species known or suspected of occurring in the Eel River Basin. Special Status species include Forest Service Sensitive species, Species of Concern (formerly USFWS Category 2 Candidates), and Protection Buffer and Survey and Manage species listed in the FSEIS ROD. No USFWS Candidate species are known or suspected to occur in the Eel River basin.

Table 21 lists the Threatened, Endangered, Proposed and Special Status plant species occurring in the Eel River basin. In addition to the criteria listed in the above paragraph, Special Status species also include rare plants listed by the California Native Plant Society as 1B Plant Species.

TES Plants

The North Fork of the Eel River supports 14 different vegetation series (or habitat types) and the successional stages which characterize each series (see Table?? in Vegetation section). Douglas-fir and white oak are the predominant series and cover approximately 54 percent and 23 percent of the National Forest land in this watershed, respectively. There are several series unique to the Eel River and the North Fork watershed supports both (chaparral and western juniper), and several series occur as relatively small inclusions (white fir, gray pine and black oak) (Figure 7).

This area provides a naturally-fragmented mosaic of vegetation types (coniferous forests, oak woodlands, shrublands, and grasslands) that in part reflect the geomorphology of the area (see Vegetation section). Many areas are in transition as a result of past activities, such as logging, grazing, and the influences of both fire and fire suppression.

Within the North Fork Eel River watershed there are no Federal Threatened and Endangered or Candidate plant species. As for Forest Sensitive Plant Species, there are two; Tracy's sanicle with 15 occurrences and pale yellow stonecrop with one occurrence. It should be noted that information about distribution and abundance is possibly a function of limited surveys conducted for a certain species or in a certain area. The primary habitat for Tracy's sanicle is bare-to-low cover micro-sites within the ground layer of white oak woodlands dominated in the understory by California fescue. Characteristics of the white oak woodland are described in sections covering vegetation, but in general woodlands are distributed on the landscape in a mosaic pattern, often encircling grassy openings and bordering Douglas-fir forests. According to the Six Rivers National Forest ecology database, white oak woodlands occupy approximately 23 percent of the North Fork Eel River watershed. This is the largest percentage of any Eel River subbasin. As discussed in other sections, the abundance, distribution and quality of oak woodlands has changed significantly since pre-settlement times due to numerous factors. It is not quantitatively clear if those changes have adversely affected Tracy's sanicle; however, it appears that the spread of exotics and the lack of fire to set-back competition (and thereby enhance opportunities for establishment of Tracy's sanicle) are the two most influential changes affecting the quality of the habitat.

Pale yellow stonecrop occupies outcrops of various parent materials but most commonly ultramafic rock. Jeffrey pine is an indicator in the North Coast Range of ultramafic settings. The ecology database shows a very low percentage (approximately one percent) of Jeffrey pine in the North Fork Eel River watershed. Even within ultramafic settings, outcrops are very localized. The abundance of this habitat is relatively low in the watershed.

Relative to another sensitive plant, localized habitats within the Jeffrey pine series (approximately one percent of the basin), support pale yellow stonecrop. This species typically occurs on outcrops of ultramafic origin; therefore, its habitat is very localized and isolated.

Table 21: Threatened, Endangered, Proposed and Special Status Species in the Eel River Basin
December 19, 1995

Special Status Species include USFWS Candidate species, Species of Concern (SC); FS Sensitive Species (FSS); California Native Plant Society 1B Plant Species (CNPS 1B); Protection Buffer and Survey and Manage Species

listed in the Record of Decision (ROD)

K=known occurrence S=suspected occurrence *=nesting/breeding E=believed extirpated ?=surveys needed

Common Name	Scientific Name	Status	Basin
McDonald's Rockcress	Arabis macdonaldiana	FE,FSS	S.Fork, K
Humboldt Bay Wallflower	Erysimum menziesii ssp. eurekense	FE	Delta, K
Water Howellia	Howellia aquatilis	PT	M.Fork, ?
Raiche's Manzanita	Arctostaphylos stanforiana ssp. raichei	SC	Middle, K
Humboldt Milk Vetch	Astragalus agnicidus	SC,FSS	S.Fork, K
Leafy Reed Grass	Calamagrostis foliosa	FSS	S.Fork, K
Humboldt Bay Owl's Clover	Castilleja ambiguassp. humbodtensis	SC	Delta, K
Mendocino Coast Indian Paintbrush	Castilleja mendocinensis	SC	S.Fork, ?
Pt. Reyes Bird's Beak	Cordylnthus maritimus ssp. palustris	SC	Delta, K
Clustered Lady's Slipper	Cypripedium fasciculatum	SC, ROD	V.Duz, K
Mountain's Lady's Slipper	Cypripedium montanum	ROD	Middle FK, K, Main, K, V.Duz, K
Snow Mtn. Willowherb	Epilobium nivium	FSS,SC	Main, K Mid, K
Oregon Fireweed	Epilobium oreganum	SC,FSS	Main, ? V.Duz, ?
Brandegee's Eriastrum	Eriastrum brandegeae	SC,FSS	Main, ?
Kellogg's Buckwheat	Eriogonum kelloggii	SC	S.Fork, K
Snow Mtn. Buckwheat	Eriogonum nervulosum	SC,FSS	Main, K, Upper, K
Menocino Gentian	Gentiana setigera	SC	S.Fork, ?
Glandular Western Flax	Hesperolinon adenophyllum	SC	Main, K
Drymaria-like Western Flax	Hesperolinon drymariodes	SC,FSS	Main, K
Two-flowered pea	Lathyrus biflorus	SC,FSS	V.Duz, K
Beach Layia	Layia carnosa	FE	Delta, K
Western Lily	Lilium occidentale	PE	Delta, K
Anthony Peak Lupine	Lupinus antoninus	SC,FSS	Main, K, Mid, K
Lassics Lupine	Lupinus contancei	SC,FSS	V.Duz, K
Milo Baker's Lupine	Lupinus milo-bakeri	SC	Main, K
Lassics Sandwort	Minuartia decumbens	SC,FSS	V.Duz, K
Scabrid Raillardella	Raillardiopsis scabrida	FSS	V.Duz, K, Main, K, M.Fork, K
Coral Fungi	Ramaria gelatiniaurantia	ROD	S.Fork, K
Bryophyte	Orthodontium gracile	ROD	Main, K
Tracy's Sanicle	Sanicula tracyi	SC,FSS	V.Duz, K, Main, K, N.Fork, K
Red Mtn. Stonecrop	Sedum eastwoodia	SC	S.Fork, K
Pale Yellow Stonecrop	Sedum laxum ssp. flavidum	FSS	V.Duz, K, Main, K, N.Fork, K
Red Mtn. Catchfly	Silene campanulata ssp. campanulata	SC	S.Fork, K
Kneeland Pennycress	Thaspi californicum	SC,FSS	V.Duz, K
Beaked Tracyina	Tracyina rostrata	FSS	Main, K, S.Fork, K

Wildlife

Threatened and Endangered Species :

The North Fork Eel River watershed provides habitat for the peregrine falcon and northern spotted owl, and it contributes to a limited extent to their recovery. The historical abundance of these species is not known, however fire suppression probably has allowed portions of the white oak vegetation series to succeed to a Douglas-fir/ black oak type, and allowed the Douglas-fir series to maintain more of its area in the mature successional stages (see discussion in Vegetation section). Extensive logging in the watershed has probably displaced many of the spotted owls that occurred on private and public lands. However, the watershed is presently capable of supporting more late-successional species, including spotted owls, than it did under historical fire regimes.

Peregrine Falcon: The Six Rivers National Forest (SRNF) has designated habitat in the North Fork Eel River watershed (a total of 2,075 acres) for two peregrine falcon aeries.

There are numerous cliffs and rock outcrops within this watershed that may provide suitable nest ledges. The increasing frequency of peregrine falcon reports may reflect an increasing population or better and more frequent surveys. There are at least eight sites in the North Fork Eel River watershed with potentially suitable cliffs.

Bald Eagle: This species is not known or suspected to nest in the watershed, but several sightings have been documented. Recent reports of bald eagles have been made for Blue Nose Ridge, and in the Round Valley area of the Middle Fork Eel River watershed , just south of the North Fork Eel River watershed (Bertram, 1986).

Northern Spotted Owl: See Appendix E for discussion of northern spotted owl suitable habitat. Answers to TES species questions from the 1994-96 Watershed Analysis Guidelines also are in this appendix.

Suitable habitat will be referred to as nesting, roosting and foraging (NRF) habitat combined. See Appendix C: Data Used for Vegetation Analysis for a discussion of the two data sets available for the North Fork Eel River watershed and the difficulty in establishing a seral stage relationship between the two sets. These two data sets are the Timberland task force (TTF) data and the SRNF vegetation mapping data. The attributes in the TTF data set that corresponded best to seral stages in the SRNF data were size class and canopy closure (see Figures 4 and 5 for relationship between classification systems used in these two data sets).

Acres of suitable NRF habitat on SRNF was queried using the tanoak, Douglas-fir, and white fir series which contained trees at least 21-inch diameter at breast height (d.b.h.) and with at least 60 percent total canopy cover. Size class 3 (TTF), in combination with dense canopy closure (greater than 60 percent), corresponded almost equally well with early-mature, mid-mature and old-growth attribute in the SRNF data and thus overestimated acres of suitable habitat. The best correspondence between the data sets to determine spotted owl habitat seems to occur using canopy closure (TTF) alone. Acres of NRF habitat watershed-wide was queried using canopy cover of 60 percent or better (dense) (TTF). The total acres of NRF habitat (70,712) shown in Figure 5 is undoubtedly an overestimation due to the inclusion of dense, younger unsuitable stands. For a visual comparison of NRF habitat derived from the two data sets, see Figure 16 (SRNF data) and Figure 3 (TTF data).

There are 31,206 acres (36 percent) NRF habitat within the Forest Service boundary in the North Fork watershed (Figure 16). Table 23 breaks out NRF habitat by land allocation and seral stage. Fifty-seven percent of the NRF habitat occurs in LSRs, and Administratively or Congressionally Withdrawn areas. Determination of suitability did not consider patch size or spatial arrangement.

The North Fork Eel River watershed contains approximately 24,300 acres in Late-Successional Reserves (LSRs): part of LSR RC307 (13,045 acres), LSR RC320 (10,310 acres), LSR RC321 (936 acres), and six 100-acre LSRs around owl activity centers in the Matrix (see Figure 17). LSR RC307 is a portion of the larger LSR continuing to the northwest into the Van Duzen River watershed. Nine thousand one hundred and ninety-six acres (67 percent) of the North Fork Eel River watershed's portion of LSR RC307 is considered NRF habitat. The other two LSRs are managed by the Bureau of Land Management (BLM) and provide connectivity to the south and with the two wilderness areas in the watershed: the North Fork Wilderness and the Yolla Bolly Wilderness (Figure 17). These two wilderness areas total 18,003 acres and contain 6,015 acres (33 percent) NRF habitat.

Dispersal habitat for northern spotted owls was analyzed for the SRNF portion of the watershed using the 50-11-40 criteria. This criteria assumes that 50 percent of each quarter township (nine square miles) must have forest conditions equivalent to 11-inch d.b.h. trees with 40 percent total canopy cover or better for adequate spotted owl dispersal. Preliminary assessments indicate the watershed is not deficient in dispersal habitat in any quarter township.

A total of 15 spotted owl activity centers have been found within the entire North Fork Eel River watershed (Table 22)with overlap from six additional territories occurring outside the watershed boundary. There is potential for more centers to be found during pending surveys. Of the 15 activity centers within the watershed boundary, three are in LSR, two are in Wilderness, six are in Matrix and four are on private land. The six activity centers occurring in the Matrix have 100-acre core areas designated around them.

Table 22. Northern spotted owl pairs and territorial singles occurring in LSRs, Wilderness, Matrix and private land in the North Fork Eel River watershed.

		INSIDE WATERSHED	OUTSIDE WATERSHED	
ALLOCATION	AGENCY	PAIRS/T. SINGLES	PAIRS/T.SINGLES	TOTALS
LSR RC307	SRNF	3 / 0	1 / 0	4 / 0
LSR RC320	BLM	0 / 0	0 / 0	0 / 0
LSR RC321	BLM	0 / 0	0 / 0	0 / 0
WILDERNESS	SRNF	1 / 1	1 / 0	2 / 1
MATRIX	SRNF	5 / 1	3 / 1	8 / 2
PRIVATE LAND		4		4

Table 23. Allocations and seral stages of northern spotted owl Nesting, Roosting, and Foraging habitat within the National Forest boundary in the North Fork Eel River watershed.

Owl habitat	Habitat type		Admin. withdrawn	Congress. withdrawn	LSR	Matrix	Private	Grand total
Owl NRF habitat	Douglas-fir/ tanoak LM/OG	acres	453	2,071	4,109	2,815	255	9,703
			5 %	21 %	42 %	29 %	3 %	100 %
	Douglas-fir/tanoak MM	acres	2,356	3,873	4,034	7,823	2,187	20,273
			12 %	19 %	20 %	39 %	11 %	100 %
	White fir LM/OG	acres	46	46	430	34	0	554
			8 %	8 %	78 %	6 %	0%	100%
	White fir MM	acres	0	26	623	27	0	676
			0 %	4 %	92 %	4 %	0 %	100%
Owl NRF habitat acres		acres	2,855	6,015	9,196	10,698	2,441	31,206
Owl NRF habitat %			9 %	19 %	29 %	34 %	8 %	100 %
Non-NRF habitat		acres	3,953	11,988	4,587	22,474	13,249	56,251
			7 %	21 %	8 %	40 %	24 %	100 %
Total acres			6,808	18,003	13,783	33,172	15,691	87,457
Total %			8 %	21 %	16 %	38 %	18 %	100 %

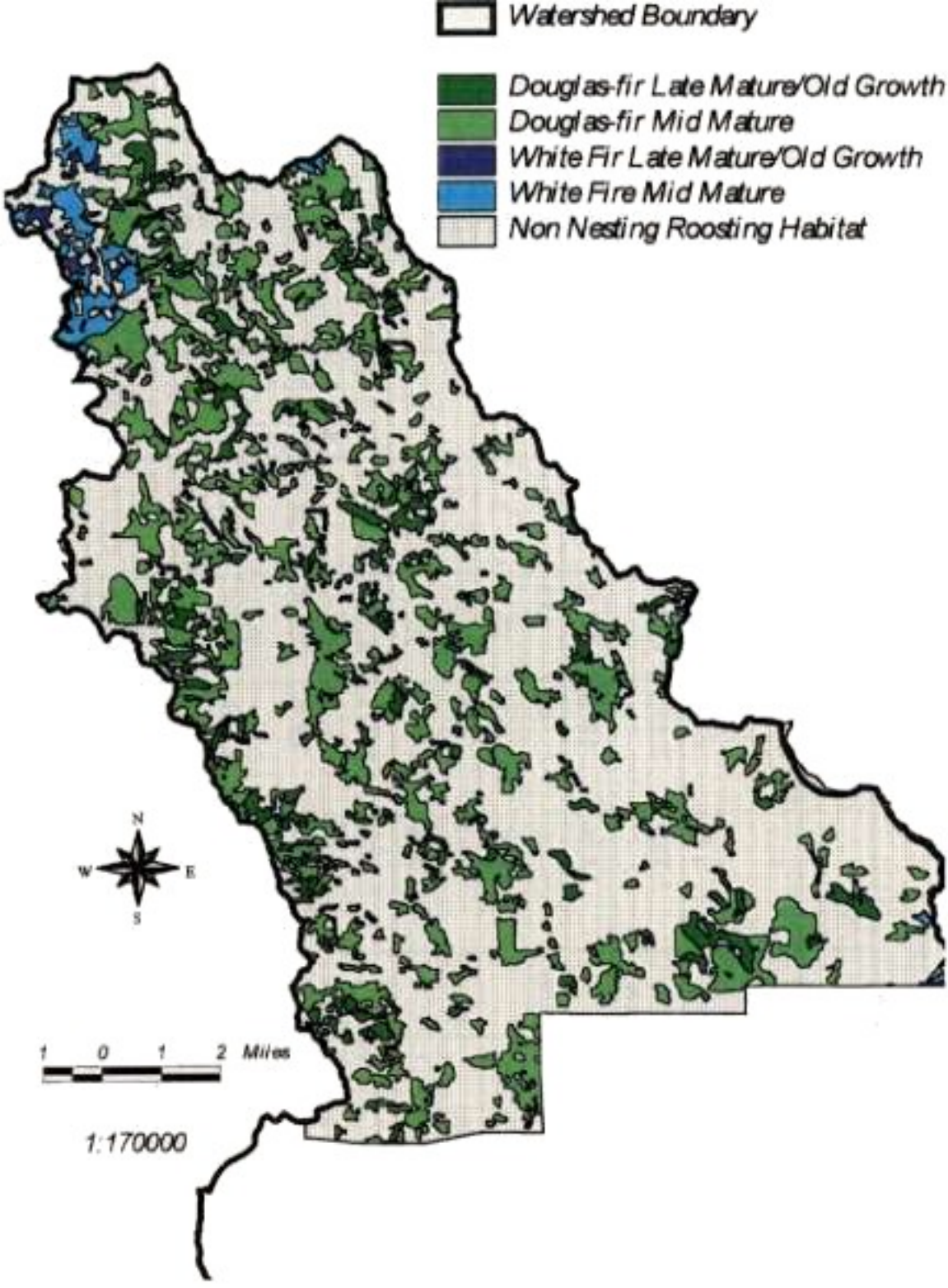

Figure 16. Northern spotted owl habitat for Six Rivers National Forest land within the North Fork Eel River watershed.

The USFWS considers an owl territory to be "taken" when the number of NRF acres drops below 500 acres of NRF within a 0.7 mile radius circle around the activity center or 1,340 acres within a 1.3 mile radius circle. Preliminary "take" assessments have been conducted on the 11 activity centers on public land within the watershed boundary. The three activity centers within the LSR contained adequate acreage of suitable NRF habitat. The two activity centers in the North Fork Wilderness were below "take," although one was below the "take" threshold only in the 1.3 mile circle. Of the six activity centers in the Matrix, only one was above the "take" threshold completely, one was deficient only in the 1.3 mile circle, and the other four were below "take" in both the 0.7 mile circle and the 1.3 mile circle. The level of NRF in relation to these "take" circles may have implications for vegetation management activities that may be undertaken in these areas.

Other vegetation series, such as the white oak stands in transition to Douglas-fir/black oak probably are providing "atypical" foraging habitat and might be contributing suitable nesting habitat. This needs further investigation.

Critical habitat for the northern spotted owl was designated by USFWS in 1992. The critical habitat unit (CHU) CA-37 is largely contained within LSR RC307which occurs in both the North Fork Eel River and Van Duzen watersheds. However, 3744 acres of CHU occur outside the LSR, in both Administratively Withdrawn (625 acres) and Matrix (3,119 acres) lands (see Figures 16 and 17). An estimated 42 percent of the CHU in Matrix is likely to occur in Riparian Reserves.

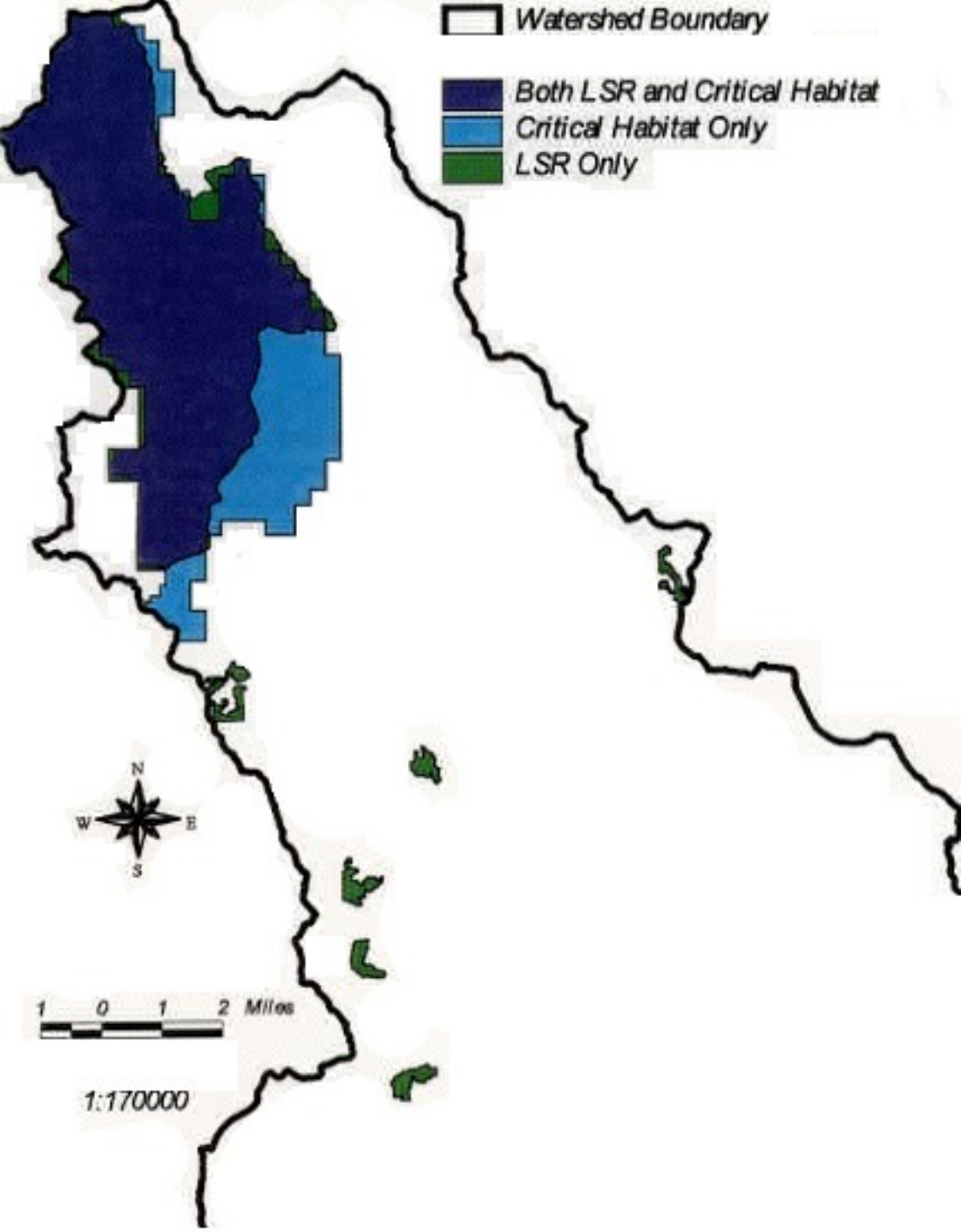

Figure 17. Late-Successional Reserves and Northern spotted owl critical habitat for Six Rivers National Forest land within the North Fork Eel River watershed.

Marbled murrelet: The entire watershed lies within marbled murrelet Zone 2 (between 25 and 50 miles from the Pacific Ocean) (see Figure 1).A Range and Distribution study for the marbled murrelet was initiated in 1995 in southern Six Rivers National Forest and northern Mendocino National Forest on land that occurs within 50 miles of the Pacific Ocean. The study identified marbled murrelet suitable habitat as mid-mature, late-mature, and old-growth Douglas-fir and tanoak; of which approximately 27,500 acres occur on Forest Service land in the North Fork Eel River watershed. The "most suitable" murrelet habitat was identified as late-mature and old-growth habitat and included 7,400 acres in the watershed. Fifty sites in the area, covering approximately 5,000 acres (27 percent) of suitable murrelet habitat, were selected randomly and surveyed with no detections. This study was proposed for two years, and the Forest has requested partial funding for the second year. If marbled murrelets are not detected in 1996, the habitat that occurs in the South Zone of SRNF will be considered not suitable habitat for marbled murrelets.

Forest Service Sensitive species

See Appendix E for life histories and habitat discussions. The Forest Service Sensitive species Pacific fisher and northern goshawk are known to occur within the watershed. There are five known goshawk territories in the North Fork Eel River watershed; four are on SRNF land and one is near BLM land in Salt Creek (Figure 2). Other species, such as willow flycatcher and American marten, may occur incidentally but suitable habitat for these species is very limited. The willow flycatcher is dependent upon on willow or willow/alder communities. Total riparian vegetation in the watershed is limited to 50 acres in the watershed. The pine marten is associated with high elevation mixed conifer vegetation, of which approximately 2,350 acres occur in LSR RC307. The great gray owl is not likely to occur since high elevation, meadow habitat is lacking in the North Fork Eel River watershed.

Other Special Status species :

Bats: See Appendix E for life histories and habitat discussions. Seven species of bats listed either in Appendix J2 of the FSEIS ROD or the USFWS Species of Concern are likely to inhabit the North Fork Eel River watershed (Table 7). No surveys for bats or their habitats have been done in the watershed, but a cave near Long Ridge on private land is reported to be occupied by unknown bat species (Bryan, personal communication). There are numerous other cliffs and outcroppings that could be used for roosting, plus approximately ten old, abandoned structures that should be surveyed as potential roost sites (Keter, personal communication).

Herpetofauna: See Appendix E for life histories, habitat discussion, and threats. Surveys for reptiles and amphibians in riparian areas, were conducted on many tributaries within the watershed in 1995. Due to the nature of these surveys, results can only confirm the presence of a species but cannot confirm absence. Twenty-one species were identified, of which 14 were associated with perennial streams, 11 were associated with intermittent streams, and nine were associated with both. Of the Special Status species listed in Table 7, the surveys confirmed the presence of tailed frog, western pond turtle and foothill yellow-legged frog. Southern torrent salamanders were not found during the surveys and are suspected of being limited by the warm water temperatures, the lack of riparian vegetation, and the intermittent conditions found in many of the headwater areas (Wicktor, personal communication, 1995). The exotic bull frog (adult or tadpole) was not detected during these surveys. Recent surveys conducted in the southern part of the watershed (the Big Bend Ranch area) found northern red-legged frogs as "common in suitable habitat" (Leopardo, 1994).

The riparian vegetation needed by the frogs, pond turtles, and torrent salamanders was probably never abundant in the watershed and has been even further reduced by timber harvest, fire, grazing, and major floods. Although many of the intermittent creeks do not support true riparian plant communities, this habitat was still utilized by fifteen herpetofauna species, including six amphibian species (Wicktor, 1995).

Black-tailed deer and elk: The North Fork Eel River watershed includes several key areas for portions of the Ruth deer herd that utilizes approximately 45,000 acres, most of which is winter range (Figure 18). The Covelo subunit of the Mendocino deer herd occurs in the southern part of the watershed and covers 56,000 acres. It does not appear that elk occurred extensively in this watershed.

Other Survey and Manage species

Surveys for reptiles and amphibians were conducted within the SRNF portion of the North Fork Eel River watershed

in 1995, and Del Norte salamanders were not detected. Queries of the Survey and Manage database did not identify any known locations of vertebrate or invertebrate species within this watershed.

Special Habitats

Wetlands: Several ponds and wet meadows occur in the watershed; as well, numerous springs occur along the Yolla Bolly Terrane, in the headwaters of Red Mountain Creek, and in the vicinity of Grizzly Mountain (see Figure 19). Several of these areas have a geologic substrate that provide for large subsurface water storage, and are that providing adequate flows of cold water to support aquatic species.

Unique habitats: Numerous cliffs and rock outcrops provide possible nesting or breeding substrate for wildlife species. Some of the cliffs have been evaluated for peregrine falcon enhancement potential (see Appendix E).

One cave has been reported to exist on private land. No mine shafts are known to occur in this watershed.

The steep and rocky uplifted terrain may have talus fields which should be evaluated and surveyed for Del Norte salamander. Although this watershed is south of the known range, surveys could extend that range.

Snags and coarse woody debris: See discussions in Forest Plan Mean Snag and Log Densities table (page IV-79), and in HRV section and Snag Recruitment Simulator results (page IV-104).

Other species

Golden eagle was reported near cliffs along the mainstem of the North Fork Eel River.

California red tree vole is known to occur on Lake Mountain Ranch (California Dept. of Fish and Game, Timber Harvest Plan).

Flammulated owls occur in the watershed and there is one recorded sighting of a white-headed woodpecker in LSR RC307 near the boundary between the North Fork Eel River and Van Duzen watersheds.

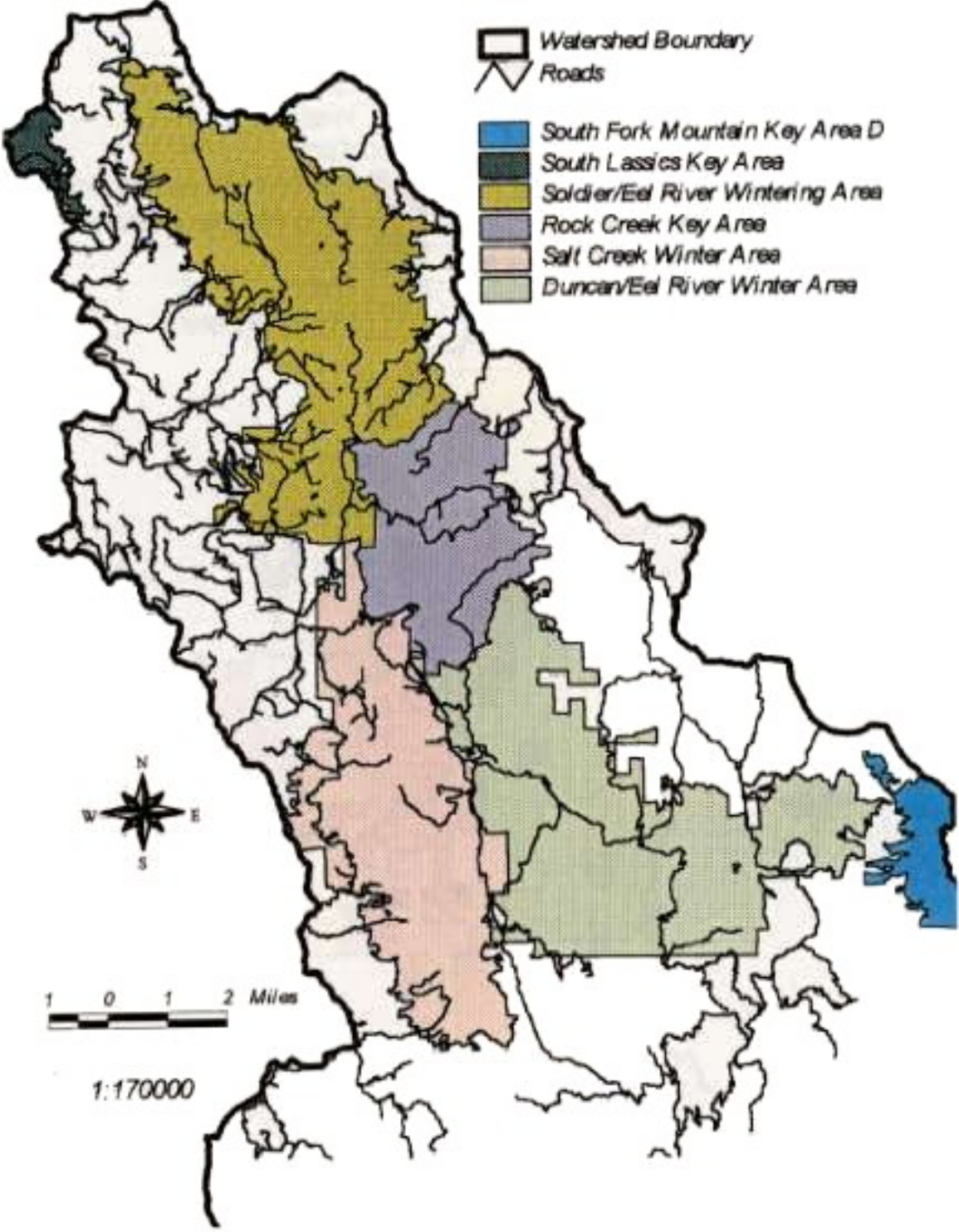

Figure 18. Deer habitat zones and roads for Six Rivers National Forest land within the North Fork Eel River watershed.

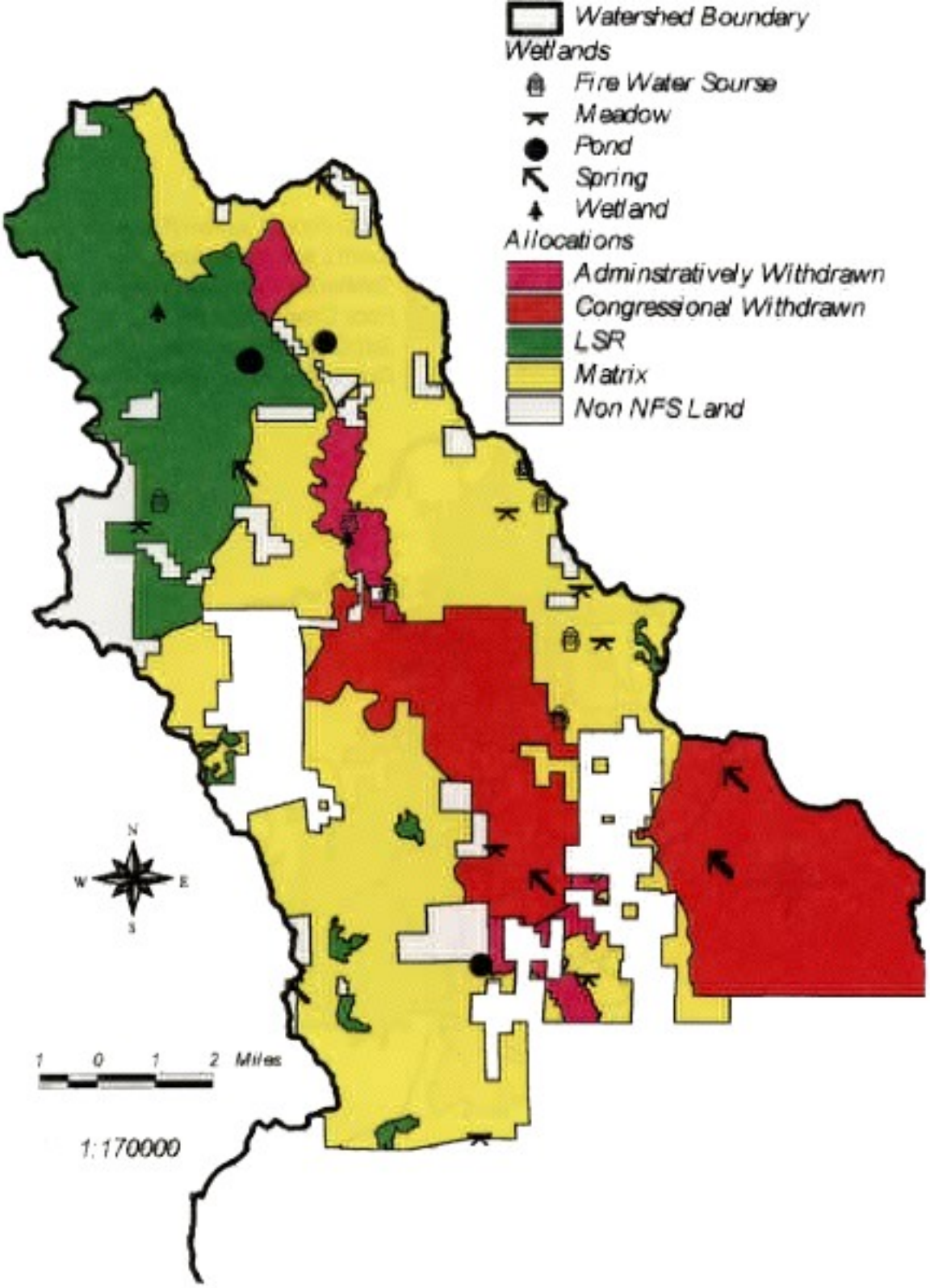

Figure 19. Northwest Forest Plan land allocations and wetland habitats for Six Rivers National Forest land within the North Fork Eel River watershed.

SYNTHESIS AND INTERPRETATION

Key Question 1 : Does adequate habitat exist to maintain viable populations of TES and Special Status species in the watershed, and what are the current limiting factors?

Threatened, Endangered and Sensitive (TES) Plants

Comprehensive inventories are lacking for both pale yellow stonecrop and Tracy's sanicle, and information about habitat requirements is incomplete. However, plants associated with grasslands and oak woodlands are likely to have been affected by the invasion of exotic grasses. Although the ecology and habitat requirements of many TES plants are not fully understood, it can be assumed that the extent and rate of exotic introduction and spread has adversely affected species that have evolved in native habitats, and will continue to do so. (See the discussion in the Vegetation section.)

Species associated with outcrops are often limited solely by their habitat specialization. Rock outcrops are relatively stable settings that are not as influenced by succession, wildfire, and human management (except for aggregate development) as are most other habitats. In that respect, adequate habitat exists. Further isolation of habitat due to greater use of some outcrops as rock sources or for mining could become a limiting factor for pale yellow stonecrop in the watershed by reducing dispersal sites.

White oak woodlands are widely distributed in the watershed but their quality has changed. Woodlands located on the edge of Douglas-fir forests are particularly vulnerable to further encroachment and overtopping by conifers. White oak is intolerant to shade and without active management Douglas-fir poles and saplings within the oak woodland will grow to shade out the oaks and their grass/forb associates. Spread of exotic plants also may alter ecological relationships by displacing natives and thus changing the inter-species relationships of plants evolved to a particular system, as well as changing the fire regime.

Wildlife

This watershed shows an apparently high degree of natural fragmentation (although no formal forest fragmentation analysis has been conducted) and vegetation diversity that includes the presence of grassland, chaparral, and oak woodlands or savannahs, as well as the dominance of younger seral stages. There are many complex and interrelated factors affecting wildlife in the North Fork Eel River watershed. The most influential changes have been fire prevention (since the early 1900s), fire suppression (since 1960) has kept most fires under 15 acres, and the invasion of exotic grasses and forbs that now dominate the grass and oak savannah. Timber harvest, road construction, and livestock grazing have also contributed to change.

Fire suppression has facilitated the encroachment of Douglas-fir and black oak into white oak woodlands with a resulting increase in early- to mid-mature conifer habitat, but a 44 percent decrease in white oak woodlands. Fire suppression also has allowed the buildup of fuels and increased the risk of a stand-replacing fire. This increase of young and mature forests on public lands may have been partially offset by the high level of timber harvest on private lands in the southern part of the watershed.

Timber Harvest : Approximately 1,250 acres of coniferous forest has been harvested through 1990 on Forest Service lands in the watershed. Much of it appears to have been selective intermediate harvest in mid-mature stands. Regeneration harvests have generally occurred in small scattered blocks. An estimated 200 acres of the mixed conifer type was recently harvested near the Travis Ranch on BLM lands (LSR 320). The BLM has also applied shelterwood/seed tree harvest methods in the Douglas-fir and ponderosa pine timber types within the Lake Mountain units (LSR 321).

Roads : Roads in the northern-half of the watershed cover about 600 acres of Forest Service lands. Impacts to wildlife species occur from direct loss of habitat plus the road's potential to disturb or displace sensitive species during critical periods. Frequent use near active nest or den sites or within key summer or winter ranges may adversely affect, or even displace, some species. Some North Fork subwatersheds appear to be extensively roaded, but the intensity of use seems to be seasonal and fairly light.

Road densities by subwatershed are shown in Table 24. Road data are incomplete for areas outside the Forest

boundary. Road densities on the Forest range up to 3.7 miles per square mile. A reduction of open road densities within the LSR to less than two mi/sq.mi. and within key deer winter range to less than three 3 mi/sq.mi. would ensure moderate quality habitat for fisher and deer, respectively. Further analysis of densities relative to deer herds are underway, but current road data indicate that reducing open road densities in the Kettenpom and West Fork subwatersheds should be evaluated.

Exotics : Perennial grasslands were probably one of the most vulnerable communities in the watershed, although little is known about the original plant and animal species composition. The native perennial grasses have generally been replaced by exotic annual grasses and herbaceous weeds that appear well-adapted to both the climate and livestock grazing. Along with the loss of native perennial grasses and forbs, some loss of soil stability within melange areas and increased surface and gully erosion have occurred. This vegetative change was a contributing factor in the decline of black-tail deer populations, along with competition from sheep and cattle for forage and historic losses to hide hunters. Deer poaching in remote rural areas is reported to have always occurred, usually for subsistence. With increased road access to key areas, this problem is likely to continue.

Table 24. Road densities by subwatershed in the North Fork Eel River watershed.

Subwatershed	Watershed acres	Square miles	Road miles	Roads Sum/$H^2$0	Road mi/ section
Wilson/Asbill Creeks*	21,916	34.24	6.98	7.41	0.22
			0.43		
NFk/Canyon/Bear Creeks*	17,460	27.28	3.78	3.78	0.14
Hulls Creek*	27,171	42.45	0.58	0.58	0.01
Casoose Creek*	10,210	15.95	0.18	0.18	0.01
Casoose/Antone/Lynch Crks	6,262	9.78	7.26	7.26	0.74
Peterptor Creek*	5,939	9.28	3.69	5.74	0.62
			2.05		
Mid North Fork Eel River	30,330	47.39	63.23	74.67	1.58
			10.18		
Red Mountain Creek	12,075	18.87	10.16	10.16	0.54
Salt Creek	15,594	24.37	38.54	40.66	1.67
			2.12		
Kettenpom Creek	10,108	15.79	7.74	56.24	3.56
			48.5		
West Fork North Fork Eel	11,830	18.48	40.74	50.08	2.71
			9.34		
Upper North Fork Eel	11,118	17.37	11.15	36.85	2.12
			18.64		
			6.7		
TOTAL	180,013	281		294	

***Road assessment not current.**

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TE Wildlife Species

Peregrine falcon: The eight potentially suitable cliffs for peregrine falcon, in conjunction with active sites in neighboring watersheds, will continue contributing to Recovery Plan goals for the falcon. Six Rivers National Forest has designated 14 falcon areas forest-wide to meet a recovery goal of seven breeding pairs; two of those areas are located in the North Fork Eel River watershed. Due to the proximity of cliffs to one another and the territoriality of the peregrine falcon, National Forest sites in the watershed are not likely to support more than two or three breeding pairs. Cliffs in this area are usually only monitored as part of aerial surveys because most are relatively inaccessible. The most suitable cliff sites were evaluated in a 1979 survey for enhancement. If monitoring locates occupied nesting sites, there may be opportunities to improve or maintain active nest sites or to develop additional ledges.

Bald eagle: The bald eagle has been observed within the North Fork Eel River watershed, but this watershed provides little opportunity for nesting or wintering bald eagles. There are unsubstantiated reports of bald eagles nesting near the mouth of the North Fork of the Eel River, but this area is considered marginal due to the limited availability of nest trees. Availability of prey species, such as suckers and *Ptychocheilus grandis*, is not known for this area.

Northern spotted owl: There are presently over 31,000 acres of NRF habitat (mid- or late-mature and old-growth stands) on National Forest lands within the watershed (Fig 16, Table 23). Although there has been some increase in early- and mid-mature habitat from historical times, much of this habitat is more fragmented and drier than similar forests to the north or west. Consequently, late-successional habitat in the watershed may represent marginal conditions for spotted owls. Suitable habitat appears to be increasing as a result of fire suppression that has allowed extensive encroachment of Douglas-fir into some white oak stands. Also, increased accumulation of down woody material has improved habitat for prey species. This encroachment of Douglas-fir is most evident in the mid-mature stands. Although it is likely that spotted owls are using atypical habitats for foraging and occasionally for nesting or roosting, the watershed should not be expected to maintain population densities similar to less-fragmented and moister locales. Mature hardwoods also may provide atypical foraging habitat, especially as Douglas-fir encroaches, which in turn may compensate for naturally low quantities of suitable nesting and roosting habitat that is found in the late-successional age classes.

The large LSR RC307 is likely to continue to support the current number of spotted owl pairs as suitable habitat matures and if large catastrophic losses to fire are prevented. With continued fire suppression and both fuels and hazard reduction to minimize the extent of stand-replacing fires, ingrowth of early- and mid-mature should eventually provide sufficient late-successional NRF habitat. Currently, suitable NRF habitat in this area occurs in more contiguous large blocks with some natural fragmentation. The historic extent of late-successional and old-growth forest was probably relatively small in the watershed because of the dry fire regime, and spotted owl population density is generally less than has been found in the Klamath Province.

Most of the mature Douglas-fir and ponderosa pine in BLM LSR 321 has been harvested with either a shelterwood or seed tree prescription. BLM LSR 320 comprises several large blocks and lies adjacent to the Big Buttes/Yolla Bolly Wilderness. It protects some habitat, but no known spotted owl pairs.

Spotted owls occupying the matrix are likely to decline as it is managed to meet timber production goals for the South Zone. Habitat within the Matrix is likely to become more fragmented, and with a fire cycle of 120 years, the stands are likely to be younger with fewer late-successional forest stands and little old-growth, as well as more non-NRF habitat.

It is important to maintain dispersal habitat that remains in this already fragmented habitat. Preliminary assessment indicates that dispersal habitat is adequate in quarter townships. Figure 20 shows all forested dispersal habitat (>11"d.b.h. and >40 percent CCC). Interim riparian buffer widths (based on minimum 150-feet site potential tree height for the coniferous forest types and 50-feet for the oak woodlands) will be important to maintain until the extent of intermittent streams within the Matrix are determined.

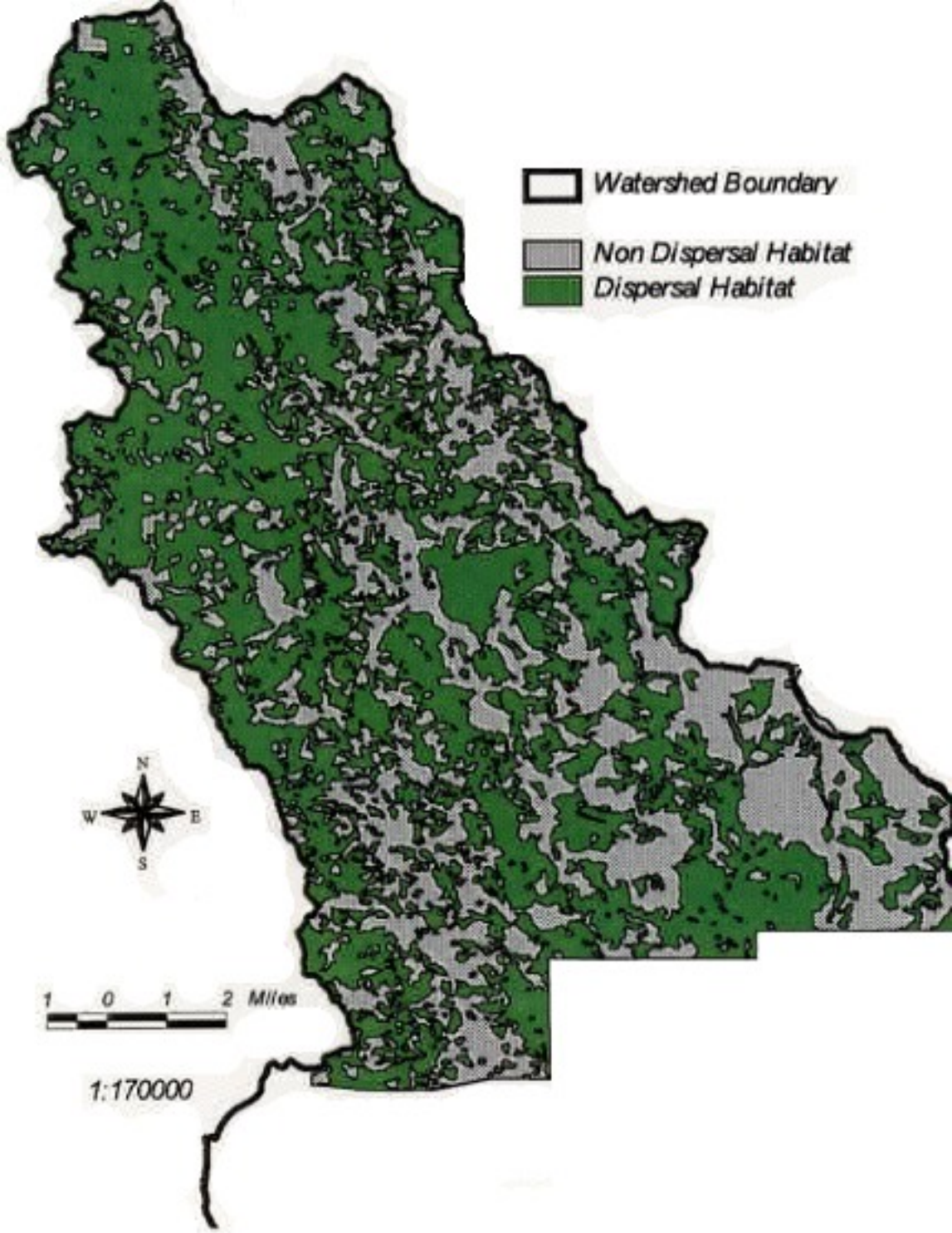

Figure 20. Dispersal habitat for the Northern spotted owl for Six Rivers National Forest land within the North Fork Eel River watershed.

Marbled murrelet: The dry, fragmented, late-successional habitat is not likely to contribute to the recovery of marbled murrelet populations. Potentially suitable habitat surveyed in 1995 appears to be vacant. Approximately 5,000 acres of the most suitable appearing habitat (out of 7,400 acres of late-mature and old-growth stands) were surveyed in the North Fork Eel River watershed and no murrelets were detected. Six Rivers National Forest expects funds to complete the second-year surveys for the Douglas-fir series, and will determine in consultation with the USFWS whether the stands within the South Zone of SRNF or the adjoining area of the Mendocino National Forest provide any suitable murrelet habitat.
Forest Service Sensitive Species

Marten and fisher: There is potentially suitable habitat in the North Fork Eel River watershed to support both the Pacific fisher and the American marten. Fisher are known to occur here. On the other hand, the white fir vegetation series favored by the marten is isolated from similar stands along South Fork Mountain, so the marten may not occur within the North Fork Eel River watershed or the Eel River Basin.

Goshawk: There are four goshawk territories in the watershed, two of which have Family Foraging Areas (FFA is the area within 0.5-mile radius of the nest) within the watershed, and one that is 60 percent within the North Fork Eel River watershed. All three FFAs appear to be deficient in suitable habitat (LRMP, page IV-101). The remaining activity center is located near BLM LSR 321.

Herpetofauna and other riparian-dependent species: Historical composition or extent of riparian communities is not well-known. The riparian vegetation series covers only 41 acres and is comprised primarily of alder and willow. This watershed probably has had only limited riparian vegetation for centuries. Large floods and many other factors have caused increased erosion and decreased streamside vegetation. Twenty-one species of herpetofauna have been identified in the North Fork Eel River watershed to-date (see Survey Results, Appendix E). The Grizzly Mountain area appears to have abundant springs fed by a large groundwater reservoir with sufficient cold water to support tailed frogs. Springs also occur within the Yolla Bolly terrane. Lack of aquatic and emergent vegetation and the ephemeral nature of many streams may limit such species as the red-legged frog and southern torrent salamander (see species life history accounts, Appendix E). There are no known lakes or reservoirs on National Forest lands in the watershed, but there are five known ponds, a wetland, seven meadows, and at least six springs.

Bats: There is little information about caves or mine shafts in the Eel River Basin, and limited information on abandoned buildings or bridges that may provide suitable breeding or roosting sites. Snags probably provide the primary roosting habitat in this watershed.

Key Question 2 : What is the significance of the North Fork Eel River watershed in sustaining TE and Special Status species and their habitat, as well as contributing to recovery of previously more abundant species; and what is the role of Federal lands in this recovery?

TES Plants

Pale yellow stonecrop: This species' range extends from Del Norte and Siskiyou Counties to Glenn and Trinity Counties. Since pale yellow stonecrop is near its most southern extent in the North Fork Eel River watershed, these occurrences could be important from a genetic perspective. There are documented occurrences on both Federal and private land in these counties, so the role the Federal lands play in maintaining the species is probably not critical.

Tracy's sanicle: Range extends from southern Humboldt County east into Trinity County. Like pale yellow stonecrop, Tracy's sanicle is near its most southern extent in the North Fork Eel River watershed. It is relatively widespread in the Mad River Ranger District in oak woodland habitat, and a majority of the populations appear to be located here. From a conservation stand-point, the role of Federal lands in maintaining TES populations is relative. The role of Federal lands for those species whose populations are located primarily on private land may be much less than a species like Tracy's sanicle which has most of its populations on Federal land.

Wildlife

The North Fork Eel River watershed provides essential habitat for the peregrine falcon and spotted owl, and contributes to a limited extent in their recovery. The watershed is not likely to contribute significantly to the recovery

of either the marbled murrelet or bald eagle. (See the Aquatic section for information about steelhead.)

Compared to adjacent areas, peregrine falcon are widespread and abundant throughout the Eel River Basin (Jurek, personal communication). Six Rivers National Forest has designated 1,275 acres of essential habitat for two peregrine falcons and has conducted cliff evaluations at six other potential nesting areas on Federal lands within the watershed.

The watershed lies in the southern part of the Klamath Province and the California Coastal Interior as identified in the Draft Recovery Plan for the northern spotted owl (USDI, 1992). This area is drier and more fragmented with owl densities that are lower than in other parts of the Klamath Province. In some places, the owls are sparsely distributed, while in others they may be concentrated in the vicinity of isolated blocks of suitable habitat.

It is possible that in the past (before fire suppression), this area supported fewer owl pairs than it does at present. The three LSRs in this watershed protect substantial federal acreages of mature and older forest habitat for the spotted owl, other late-successional dependent species, and anadromous stocks at risk (Table 25). Suitable owl habitat also occurs in the North Fork Eel River watershed and the Yolla Bolly Wilderness (3 NSO activity centers) and Wild River areas.

Table 25. Late-Successional Reserve acreage in the North Fork Eel River watershed.

LSR NUMBER	AGENCY	ACRES IN WATERSHED	TOTAL AC
RC307	SRNF	13,000	57,500
RC320	BLM	10,100	15,000
RC321	BLM	936	936

Federal lands in this watershed probably are important in assuring the recovery of late-successional dependent species such as the northern spotted owl. The federal portion of the watershed currently supports more suitable mid-mature successional habitat than it did historically, as a result of fire suppression. While much of the privately-owned southern portion has been extensively harvested and will continue to be managed intensively for timber production, it may still be important for dispersal of owls. Federal lands are considered refugia for many species since surrounding private lands are usually more extensively logged and are typically managed under shorter rotations. Consequently, mature and late-successional habitat will continue to be concentrated on Federal lands. Although BLM lands consist in part of isolated blocks within extensive private lands, they may provide connectivity between larger areas.

Key Question 3 : What management actions are appropriate in the North Fork Eel River watershed to facilitate the recovery of, or mimic natural processes for TE and Special Status species?

TES Plants

Recovery is not a major issue in the North Fork Eel River watershed relative to plants. However, restoration related to oak woodlands would contribute to the quality of habitat for Tracy's sanicle and might encourage its expansion. Management actions could include prescribed fire, manual removal of conifers which are overtopping white oaks but are too large or resistant to be manage by prescribed fire, and reintroduction of native ungulates in association with migratory grazing. Other worthwhile management actions could restore processes which promote the establishment of native plants and serve to eliminate exotic species, and could reduce the potential to introduce or increase the spread of exotics.

Wildlife

Basic surveys are needed to determine habitat requirements and geographic extent of many species. Monitoring of occupied and suspected TE species habitat is essential to establish trends towards recovery, and to eventually provide sufficient data to permit de-listing.

Peregrine falcon: The peregrine falcon is currently under consideration for reclassification to threatened. Continue surveys for occupied nests and develop territory plans after nest sites have been located, consistent with the Six

Rivers National Forest LRMP and the Peregrine Falcon Recovery Plan. The Forest has manipulated peregrine nesting sites to ensure reproductive success. While this has been discontinued in the North Interior Recovery Zone, it may still be possible if warranted. Also, maintenance of ledges to remove sharp angular rock debris and the replacing of it with finer material may be appropriate.

Spotted owl: Survey LSR and other Congressionally Reserved lands. These surveys could be used to monitor achievement of recovery plan objectives by indicating if LSRs are functioning as refugia for late-successional species, evaluating if nontypical "suitable habitat" is being used, and possibly eliminating the need for Limited Operating Periods. This would help to establish an accurate and current baseline for the owl in response to the Conservation Recommendation in the Biological Opinion to the Forest Plan.

Other measures include:

Evaluate the "take" assessment circles for the availability of potentially suitable but atypical habitat.

Pursue actions that would accelerate attainment of late-successional/old-growth habitat where "take" circles are deficient and maintain dispersal habitat for NSO.

Pursue the application of Prescription 5 from Forest Plan to Matrix lands, and develop prescriptions for the hardwood series.

Marbled murrelet: Complete Murrelet Range and Distribution Surveys for Douglas-fir series when funds become available in 1996.

Special Status species: Initiate surveys including the Survey and Manage Species listed in Table C-3 of the ROD (pp. C-49 to C-61) that are likely to occur within the North Fork Eel River watershed.

A management assessment should be prepared for each LSR to determine what habitat manipulation could accelerate attainment of late-successional forest conditions. Silvicultural treatments such as thinning and prescribed burning are acceptable within LSRs if justified. Prescribed burning also could be used in other parts of the watershed to reduce fuel levels and maintain oak woodland habitats.

Herpetofauna: Many management actions that facilitate recovery of salmonids will also benefit the amphibians and some reptiles (turtles). These actions include restoration of riparian vegetation to increase cover and bank stability, controlling adverse impacts of grazing by elimination, delay or fencing, and any other actions that decrease erosion and stream sedimentation (see discussions in Fish and Vegetation sections).

Bats: Specific standards and guidelines apply to bats (FSEIS ROD, page C-43). In general, they include surveys of caves, mines, and wooden bridges or abandoned buildings for the presence of bats. If bats are present, a buffer of 250-feet is maintained until guidelines are developed for the site. Some species are very vulnerable to disturbance, and surveys should be conducted by state-certified bat biologists. Mitigation measures may include bat-accessible barriers that close caves or mines, seasonal closures of caves, and retention of snags and hollow living trees (ISCE, 1995).

Key Question 4 : What considerations should be included in prescriptions for vegetation management to reduce risks to TE and Special Status species, and what prescriptions can be developed to sustain habitats within their respective Recommended Management Range for TE and Special Status species?

TES Plants

Considerations vary by plant species, especially regarding their needs for overstory cover. In general, the following guidance is appropriate: provide for minimal ground disturbance (digging, removal/disturbance of topsoil), maintain partial shade (except for those species located in coastal or grassland environments), maintain microhabitats (logs and associated vegetation that might be providing shade), follow practices that reduce introduction and spread of exotic plants, modify prescribed burning practices (i.e., fall burns, spring burns, spot-burning), and maintain/restore oak woodlands.

Wildlife

All species need suitable habitat that is adequate for breeding, feeding and resting, as well as having security from

disturbances that could cause death or displacement. Management Area Direction and Standards and Guidelines (which include direction from the ROD) in the Forest Plan provide substantial direction for most Special Status species to protect essential habitat, maintain adequate special habitat components (i.e., snags, CWD, buffer ponds, and wetlands), and impose seasonal restrictions on activities that occur near sensitive nesting or denning sites and would adversely affect sensitive species.

Prescription 5 from the LRMP provides guidance to selectively harvest young and mature forest stands in a way that is intended to create or maintain "functional" mature and older habitat conditions, and also retains special habitat components (such as snags and CWD - FLMP Table IV-8).

Prescriptions for Matrix lands include Intermediate and Regeneration harvest with retention of legacy trees. Prescriptions for LSRs include thinning stands less that 80-years old, plus limited salvage. Prescriptions for the hardwood series are not yet developed, pending acquisition of hardwood seral data. There is also a need to evaluate the affects of different management activities within the chaparral and grassland vegetation series.

Key Question 5 : What exotic species are affecting or expected to affect TE and Special Status species in adverse ways? What factors contribute to the introduction or dispersal of exotic species in this watershed, and what control measures are needed to reduce or eliminate their impact?

TES Plants

The introduction of non-native, annual grasses has dramatically affected grassland and oak woodland habitat in the North Fork Eel River watershed. Invading species appear to be successful because livestock grazing has changed the environment rather than because they are inherently better competitors. However, once established, they can inhibit or prevent restoration of native biodiversity. It is unclear how much these changes have affected TES plants. Perennials provide a more sustainable forage for livestock and native herbivores because of their ability to persist into the late summer.

Factors that contribute to the introduction of exotic plants include ground disturbances from overgrazing, fire, timber harvest and road building. Dispersal agents are wind, native animals, domestic livestock and vehicles. (See the Vegetation section, especially Key Question 8, for further discussion).

A variety of biological controls are available for control of exotic species. Management can pursue biological controls where they are approved and are likely to be effective; and can reintroduce prescribed fire to influence species composition.

Wildlife

Exotic grasses and noxious weeds have eliminated or dominated native plants in some grasslands, and forage value has probably been lowered. The loss in native spring and summer forbs and herbaceous plants has likely affected most grazing and browsing wildlife, and may be reflected by low reproductive success, fewer young, and lower survival rates.

There are several non-native animals that have varying impacts on native wildlife species. Feral hogs, as well as dogs and cats, are not likely to be a significant problem in the watershed. Feral hogs apparently still occur on some ranches in the southern part of the watershed where they are probably hunted for a fee.

Bull frogs (*Rana catesbiana*) are known to be a significant predator of red-legged and yellow-legged frogs, young pond turtles, and salmonid fry (Jennings, 1992). They were not detected in the upper reaches of the North Fork during surveys in the summer and fall of 1995 (Appendix E), but this species does occur in other Eel River subbasins and may occur in the lower reaches of the North Fork.

Bull frogs could invade the North Fork Eel River in response to decreased intensity and increased intermittency of precipitation (i.e., the amount and timing of winter flows). On the other hand, high peak flows are likely to increase their mortality. In reaches where bull frogs are well established, yellow-legged frog populations are extremely small compared to un-invaded reaches (Kupferberg, 1995).

Changes in aquatic habitat have tended to be unfavorable to these herpetofauna and favorable to bull frog reproduction. Such changes include reduction or elimination of dense riparian vegetation and reduction in the

water depth of pools, both of which typically raise water temperatures.

Barred owls have been expanding into areas occupied by northern spotted owls and first were detected in northwestern California in 1981 (Harris, 1991). Barred owls have displaced spotted owls in some areas and hybridization between the two species has been documented. Habitat changes have tended to favor the expansion of barred owls at the expense of spotted owls because barred owls are more habitat generalist associated and can utilize more open and/or fragmented habitat than can spotted owls. Although barred owls have not been documented in the watershed, they have been detected in the Mad River drainage to the north and in the Middle Fork Eel River to the southeast.

Key Question 6 : What are the effects of grazing on TE and Special Status Species?

TES Plants - see discussion in Vegetation section.

Wildlife

Livestock Grazing : Historically, intensive grazing had a marked effect on black-tail deer habitat. Livestock grazing began with cattle, followed by significant numbers of sheep in the late 19th-century that grazed and degraded the grasslands in this area, and then there was a return to cattle in the early 20th-century. The introduction of livestock to the rangelands and the resultant spread of exotic annual plants has adversely affected the deer populations. The dietary overlap between cattle and deer has been estimated at 30 percent.

Currently, federal permitees graze about 4,500 Animal Unit Months (AUMs) of cattle on 87,000 acres of allotments. This includes approximately 77,000 acres on Six Rivers National Forest and about 10,000 acres of BLM lands with 1,740 AUMs (Table 8). In addition, there are about 22,000 acres of suitable range on private lands in the watershed that are used by five ranchers to support 530 head (Table 26).

TE species : Measurable effects of grazing on peregrine falcon, spotted owl, or marbled murrelet are unlikely to occur. On the other hand, there could be indirect effects on some prey species of the owl or falcon, but these changes have probably already occurred. For example, forage used by livestock is not available for wildlife such as herbivorous prey species. Forage allocation for existing wildlife populations is essential to prevent over-utilization, and seasonal needs must be considered to prevent or reduce over-winter mortality. Agricultural pesticides and herbicides associated with livestock use can also have indirect effects from toxic accumulation in prey species. Peregrine falcon and bald eagle are especially susceptible to eggshell thinning that results from these chemicals.

Table 26. Historic livestock numbers by county.

	CATTLE			SHEEP			HOGS
Year	Humboldt	Mendocino	Trinity	Humboldt	Mendocino	Trinity	Mendocino
1852		1,275					
1854	1,812						
1856	3,604						
1857	6,597						
1858	9,500						
1860	4,538	38,444	3,126	14	9,300	260	
1861	26,678						
1865					2,000		
1866*		43,423			42,117		38,999
1870	17,747	11,337	1,253	12,660	49,839	130	
1880	28,318	13,253	2,958	186,038	295,869	24,150	
1880*		8,445			277,215		9,064
1963*		30,100			102,600		3,500
1975*		32,700			40,500		1,400
1981*		32,000			40,000		1,500
1995				10,000			

Note: Adapted from T. Keter.

*Mendocino deer herd plan.

Table 27. Range allotments within the Six Rivers National Forest boundary of the Eel River.

Allot #	ALLOTMENT/Unit	Permittee	RPD Update	Watershed	Water-shed %	Total Acres	NF Total Acres	NF suitable	Grazing NFS-AUM	Waved Pvt.	Current AUMs
5408	PINE MOUNTAIN	R. Burgess	2004			4,954	4,544	680	116	0	99
				Van Duzen	80%						
				Main Eel	20%						
5402	BUCK MOUNTAIN	Vacant	2005			14,975	13,535	3,629	706	0	0
	North & South			Van Duzen	90%						
				Mad River	10%						
5410	VAN DUZEN		2005			26,061	22,392	5,728	1,147	0	496
	Crooks Creek	R. Burgess		Van Duzen							
		W. Millsap		Van Duzen							
	Green Mtn.	Vacant		Van Duzen					0	0	0
5409	SOLDIER CREEK	Vacant	2001			10,493	9,135	3,975	168	0	0
				North Fork	90%						Cont.
				Van Duzen	10%						
5406	LONG RIDGE	D. Parker	2006			16,940	15,124	8,047	851	304	717
				North Fork	95%						
				Main Eel	5%						
5412	ZENIA	R. Burgess	2001			15,502	14,201	5,054	528	172	680
	North & South	M. Stilwell		North Fork	80%						
				Main Eel	20%						
5404	HOAGLIN		2000	North Fork		7,548	7,058	1,678	238	0	277
	East	D. Parker									
	West	Vacant									
5411	VAN HORN	Brown Inv.				84,180	73,400	14,947	3,675	738	4,389
	Red Mountain		2003	North Fork		23,470	19,290				220
	Rock Creek			North Fork		7,866	4,089				100
	TOTAL ACRES					127,809	109,368	28,791	3,754	476	2,269

Herpetofauna: It is very difficult to isolate the relative importance of cattle grazing from other factors that impact riparian areas. However, some observations suggest that even moderate levels of cattle grazing can severely impact California red-legged frogs (Jennings, 1988) and have contributed to their decline. Cattle tend to concentrate along stream margins which often increases soil compaction, contributes to streambank erosion, decreases water quality, fills pools, and makes stream channels wider and shallower. Grazing cattle also remove or trample riparian vegetation used for cover or egg attachment by amphibians. These habitat changes would likely have a negative impact on northern red-legged frog, tailed frog, western pond turtle, and southern torrent salamander (see Appendix E for discussion on species life histories).

Bats: Overgrazing may also reduce riparian foraging habitat used by bats. Long-term riparian vegetation changes may have significant impacts on bats if the native vegetation was a critical component for the bats' preferred prey (Idaho State Conservation Effort, 1995). All species of bats listed in Table 7 use riparian areas to some extent for foraging.

As a footnote, all grazing permits on National Forest lands are undergoing review and modification in 1996. A Range Project Decision Document will eventually replace old Allotment Management Plans, and are scheduled for completion over the next decade. Many of the allotments in the North Fork Eel River watershed will be evaluated under this direction by the year 2000 (see Table 27).

Key Question 7 : Where and in what ways do changes in water levels (including lowered groundwater tables and diminished streamflow) adversely affect species of concern?

Herpetofauna are extremely vulnerable to fluctuations in water availability. Natural factors that govern the annual flow characteristics of streams include the amount of winter rainfall and snow accumulation, as well as intrinsic hydrogeologic conditions (porosity, transmissivity) that provide for underground water storage in a catchment. Differences in these properties may affect summer baseflows substantially. Decreased streamflows also may result from drought, diversions, residential use, overgrazing, or timber harvest. Groundwater storage and delivery to streams in the North Fork Eel River watershed appear to be governed by the occurrence of major fracture zones and the presence of thick geomorphic deposits such as coarse colluvium. Fractured ultramafic rocks are another source of sustained baseflows. Streams draining these types of terrane tend to be perennial, such as Cox, Bradburn, Bluff, Red Mountain, Panther and Bar Creeks. Tailed frogs were found only in the latter two which are fed by springs that appear to be maintained by large groundwater reservoirs in the Grizzly Mountain area.

As a result of human uses or modifications of a watershed, ephemeral streams that once formed ponds in late summer or early fall may today have minimal subsurface flow or be completely dry. As springs dry up, habitat becomes unavailable to salamanders and frogs. These various stresses can greatly increase the vulnerability of herpetofaunas to predators, and are known to adversely affect red-legged frogs (Jennings, 1993).

Six species of amphibians were observed in eight intermittent reaches of the North Fork that were surveyed in 1995 (see Appendix E for survey results). All age classes were observed while water was still present early in the year, but in late summer, these reaches were completely dry. Intermittent creeks may be dry by late summer, but they may still serve as habitat for certain amphibian life stages.

Key Question 8 : What cooperative restoration is feasible and necessary to reduce risks to habitat for TES species? (Connectivity corridors will be addressed at the river basin-level.)

TES Plants

There are a number of promising areas to approach: seek cooperation with private landowners to implement a prescribed burn program throughout the watershed that will reduce encroachment on TES plant habitat; seek cooperation in keeping domestic livestock off of Federal land which is not under permit; implement practices for permitted grazing which reduce habitat degradation; and, cooperate with efforts to protect TES species located on private land.

Wildlife

The integration of private vegetation management with federal planning is discussed at length in the Vegetation section. Additional opportunities include:

1) implementation of a cooperative prescribed burn program;

2) cooperation in keeping non-permitted livestock off Federal land or placing them under permit?

3) cooperation in controlling adverse impacts of permitted grazing; and

4) analyze dispersal needs for late-successional and riparian dependant species on a basin-level.

USFWS — 4D rule encourages private landowners to maintain suitable owl habitat when such habitat is deficient on Federal lands. Opportunities to protect falcon nest protection zones for cliffs on private lands (i.e., The Nature Conservancy has purchased occupied peregrine falcon habitat for eventual purchase by State "Land and Water Conservation Fund"). Also some of the occupied sites on private lands are considered secure due to "benevolent landowners." Cooperation is essential to manage access to public lands to ensure adequate access to Congressionally designated Wilderness and Wild Rivers while protecting private rights and improving road conditions.

Key Question 9 : What are the present or potential conflicts between economic opportunities and resource uses in the North Fork Eel River watershed, and TE or Special Status species?

Economic uses in the watershed that may conflict with TE and Special Status species include timber production, associated road construction, livestock grazing and recreation. However, these are merely potential conflicts and there are many possible opportunities for each of these activities to blend sound ecosystem management with economics. This issue is especially complex because the influence of a particular management strategy on one species must be considered in conjunction with the impacts and benefits to other species.

Timber production and road construction should be evaluated with the following criteria in mind:

(1) minimization of adverse effects of fragmentation on habitat effectiveness;

(2) maintenance of dispersal opportunities for late-successional and riparian-dependent species; and

(3) minimization of sediment production from management actions.

Concerns about grazing focus upon the impacts of over-grazing on grasslands and riparian areas (see discussion under Key Question 7). Other considerations include:

(1) the need to ensure that forage allocation for proper use provides for wildlife consumption and cover, and minimizes adverse disturbance during critical periods (breeding or in some cases wintering);

(2) the need for constraint in grazing use in areas where invasion by exotic plants is extreme to maintain the native grass and forb component; and

(3) the need to focus efforts on reversing the loss of riparian vegetation and associated negative impacts to riparian areas and associated species that result in reduced wildlife cover, increased bank erosion and stream sedimentation, and increased water temperatures.

Recreation opportunities such as trails and campgrounds should be designed to avoid impacts to Federally-listed wildlife, such as peregrine falcon aeries or spotted owl nest areas. The reduction of open road densities and seasonal closing of roads in key deer wintering areas to eliminate or reduce poaching should be considered in recreation planning.

ISSUE 4: NORTH FORK CONTRIBUTION TO PRESERVE ANADROMOUS STOCKS IN THE EEL BASIN

REFERENCE CONDITIONS

Physical Environment

Major Geologic Terranes : There are three primary types of Franciscan Assemblage rocks in the North Fork Eel River watershed: melange, relatively competent greywacke or metagreywacke, and less competent, mixed greywacke and shale. A small percentage of the watershed (probably less than five percent) is underlain by chert, metavolcanic rocks, ultramafic rocks (including serpentinite), and alluvium. Bedrock units generally occur in elongate belts that trend roughly N30W which is typical for Franciscan rocks in the Northern California Coast Ranges. Units are commonly separated by major thrust faults that are often zones of intense shearing where the resulting weakened rocks are subject to slope failure. There also appear to be a number of secondary faults and shear zones that trend roughly N60E. Nearly all of these faults had been inactive during the Holocene, except possibly the Lake Mountain Fault Zone. The major drainages within the watershed also reflect the regional structural trend.

Mélange areas are distinguished by generally hummocky topography with small earthflows and landslide scars that are usually visible in grasslands. Melange accounts for approximately 30 percent of the bedrock found in the watershed on National Forest lands. This unit has a sheared argillite matrix containing blocks of graywacke, serpentinite, metavolcanics, and chert. The blocks usually stand out topographically from the "softer" texture of the sheared matrix. Melange areas experience widespread instability, especially in wet years. They are also prone to surface runoff and gullying because of sparse vegetation for rainfall interception and the generally low infiltration capacity of surface soil layers. Extensive grasslands and white oak woodlands occur on the melange and are probably due to instability, low permeability, intense surface hardening during the dry season, and periodic fire. Hardwoods and conifers may encroach if any of these factors are changed. Past intensive grazing may have helped to create and maintain the grasslands because of compaction and increased creep rates. The large, deep-seated earthflows associated with this rock type contribute large amounts of sediment to the stream system. The inconsistent erodibility of the melange unit results in variable valley forms, slope and channel processes, and sediment transport/storage regimes.

Less competent graywacke units include deeply-weathered saprolite, weakly-cemented sandstone, and sandstone with inter-bedded shale. They typically form moderate slopes that support high conifer productivity. The saprolites have excellent water-holding capacity and support tanoak vegetation types with large conifers on wetter slopes. Their deeply-weathered nature suggests that these parts of the watershed have been geomorphically stable for many thousands of years. This unit also contains numerous small areas of highly-sheared fine sediments that are virtually indistinguishable from the true melange units. Most geomorphic types are present in the less competent graywacke, with large inactive deep-seated slides being the predominant mass wasting type.

Competent graywacke units typically form sharp ridges with steep slopes and are composed of land forms including rock outcrop, rockslide/rockfall, and steep eroding hillslope. They tend to be competent because of their medium-to-coarse grain size, degree of cementation, and typically low to moderate level of metamorphism. They are visible on aerial photographs as steep, poorly-vegetated areas that are often brush covered or support canyon live oak with occasional Douglas-fir stands. Examples of this unit include Hayden Roughs, the cliff areas on Haman Ridge, and sections along the North Fork Eel River.

Minor rock types include ultramafics, serpentinite, chert and metavolcanics. Ultramafic areas such as Red Mountain are usually serpentinized and support distinct vegetation types such as Jeffrey pine and incense cedar. Serpentinite areas represent ultramafic rocks that are completely altered to serpentine minerals. They always support unique vegetation types due to the high magnesium/calcium ratio. Serpentinite areas have low permeability, are easily-weathered, and are subject to mass wasting on moderate slopes. Chert outcrops are often elongate, parallel to the trend of the enclosing unit. Chert typically forms steep, rocky slopes with minimal soil formation and are often dominated by canyon live oak. Metavolcanics are usually metamorphosed pillow basalts (greenstone) and are resistant blocks within melange units (for example, Hetten Rock and Hettenshaw Peak which

stand out from the surrounding melange). Metavolcanics commonly support sparse brush and canyon live oak. The ultramafic body in the Red Mountain area is deeply fractured and weathered, subject to large, deep-seated failures and is an important groundwater reservoir.

Two large alluvial areas, Kettenpom Valley and Hoaglin Valley, and other smaller areas, are probably remnants of a more continuous basin floor that existed within the last few million years. These old floodplain features are above the incised stream network and were formed before the current tectonic activity that has produced the steep-sided, narrow valleys of the North Fork Eel River and its lower tributaries. These alluvial flats above incised gorges are a local feature, not found in the upper Mad River watershed, which is less than 10 miles away. They are prone to headward erosion by deep gullies, apparently due to piping of groundwater which may have resulted from past clearing of trees and associated raising of water tables.

Landscape Elements : The North Fork Eel River watershed is geomorphically young, particularly the incised canyon areas; upland and alluvial areas are somewhat older where soils are more developed. Streams have been superimposed on this landscape, a few of which still exhibit a meandering pattern. Most, however, form a rectilinear pattern that appears to follow structural weakness in the bedrock on N30W and N60E trends, more or less. Local tectonic forces may also have influenced landscape development. The less-incised, partly dendritic drainage of Salt Creek, as well as the flatter valleys on the west side, may be an expression of recent differential uplift (i.e., less uplift than surrounding terrain).

Landsliding and Sedimentation : Sedimentation rates are high in the watershed because of high uplift and stream incision rates into relatively weak bedrock units. This combination has produced a fairly high incidence of debris slides adjacent to stream channels. Several large slides and slumps are major point sources of sediment where their depositional areas extend to the channels. Sediment derived from human disturbance of the landscape appears to be a relatively small percentage of sediment loads in the North Fork Eel River.

Relative Sensitivities of Geologic Units : Slope stability varies greatly in the watershed from very competent graywacke, which rarely fails except in rockslides and rockfalls, to melange terrain which experiences high seasonal creep rates and small earthflow events. However, debris slides are the most significant mass wasting feature in terms of frequency and amount of sediment delivered to streams.

Mélange: Within the watershed, melange is typically a dark gray argillite enclosing blocks of sandstone, chert, greenstone, conglomerate, meta-andesite, and serpentinite. This terrane is prone to natural and human-induced disturbance. Sensitivity to mass wasting is dependent on the texture and degree of shearing at the specific location since there is considerable variation within the tens of thousands of acres mapped as melange. During the past 50-to-100 years, typical geomorphic processes include small earthflows (less than one acre), gullying, erosion, reactivation of toe zones, road-related cut bank collapse, fill failure, and diversions of road run-off. Most of the larger (greater than 20 acres) slump/earthflows do not appear to be active and are probably hundreds-to-thousands of years old. The primary human-caused disturbances are related to roads and include road surface erosion, cut bank collapse, fill failure, drainage diversion, and stream crossing failures. The most significant sediment input probably comes from drainage diversions that result in gullying below the diversion, and crossing failures which deliver sediment directly to streams and may create debris torrents.

Less Competent Graywacke: This unit includes: saprolite, poorly-cemented sandstone, interbedded sandstone and shale, and sheared argillite. Some zones within this unit are geomorphically the same as melange and would be mapped as melange if they were larger. The remaining areas have characteristics intermediate between the melange and competent graywacke. These areas are primarily susceptible to rotational-translational slides and appear to be older features that are not currently active. They are recognized by distinct benches, steeper scarp areas, and occasional depositional areas. There may be some minor reactivation of scarps but these features are probably quite stable and typically support productive conifer stands. Some of the smaller rotational-translational slides adjacent to channels are more recent and are probably more significant to sediment input than the larger features. Debris slides in the less competent graywacke areas are concentrated along inner gorges where stream incision is increasing hillslope gradients. Debris slides into channels are probably the largest source of sediment in the North Fork Eel River and are the dominant active geomorphic feature of the less competent graywacke.

Competent Graywacke, Chert, Meta-volcanics, and Conglomerate: These competent units are not prone to

mass wasting except in rock-slide or rock-fall events. They are typically steep, rocky areas with relatively poor soil development and low productivity.

Ultramafic: These areas are generally stable unless they are strongly serpentinized which results in softer rock with minimal vegetation that is susceptible to surface erosion and gullying.

Alluvium: The alluvial areas in the watershed have relatively high erosion potential but virtually no mass wasting. Most of the areas in alluvium are very flat (less than five percent) with some areas being gentle slopes which usually have a thinner cover of alluvium. The primary types of erosion are gullying due to headward expansion of drainages, and surface runoff caused gullying on roads.

Locations Susceptible to Landsliding : The inner gorge is definitely where the most sediment is entering the system because of the over-steepened slopes and input from the toes of slump/earthflows and rotational-translational slides. It is also the location with the highest frequency of debris slides and the most recently active ones. As a rough guess, probably most of the inner gorge area in this watershed experiences active landsliding and accelerated erosion over a period of 500 to 1,000 years.??

Slump-earthflow terrane, which is primarily situated on melange, is an active geomorphic environment with extensive gullying and small earthflows, but it does not appear to have experienced large-scale landsliding in the past 50-to 200 years. These features are apparently stable under the current climatic and seismic regimes. Reactivation of these and other deep-seated landslide features may only occur during extremely wet winters and perhaps with a simultaneous large seismic event.

Shear zones are linear areas along active or inactive faults that are prone to instability because the rocks have been sheared and have lowered resistance to slope failure. A good example of this is the thrust fault contact between ultramafic rocks and melange on the west side of Red Mountain where a large slump-earthflow has formed. A similar situation may exist on the west side of Hettenshaw Peak where slump-earthflows appear to originate at the melange/greenstone contact. Most of the geologic contacts in the North Fork Eel River watershed are probably inactive thrust faults and are potential sites of instability that warrant close examination prior to human disturbance.

Two appendices included with this document, entitled "Geologic Controls on Riparian Process and Function" and "Bedrock Geology Map Legend," provide more detailed descriptions of the physical environment and processes in the watershed.

Biological Environment

No information is available in regard to how many of the stream channels had riparian vegetation. It is assumed that there were areas of good riparian canopy. Due to the dynamic nature of the stream channel, based on flow regime and degree of channel incision, the density of riparian vegetation may vary over time. With the introduction of cattle and sheep in the late 1800s, observed impacts were reduction of riparian vegetation by grazing, plant damage due to overgrazing, compaction of soils which could reduce recruitment of vegetation, and collapse of streambanks due to trampling. Refer to the Vegetation Issue for more information regarding riparian vegetation.

No historical information exists regarding the water quality within the watershed. Water quality is assumed to have been good, with some increases in turbidity during periods of high flows and active hillslope erosion that introduced sediments to the stream system. The introduction of high numbers of cattle and sheep during the late 1800s had impacts to water quality. Livestock impacts on riparian vegetation decreased stream channel shading and may have impeded regrowth after storm events removed vegetation, therefore opening the channel to more solar radiation and increasing water temperature. Stream bank trampling increased sedimentation and decreased bank stability. Large amounts of animal waste caused an increase in nutrients to the stream system, which along with warm water temperatures increased algal growth and subsequent oxygen depletion. Base water temperatures in the North Fork Eel River are not known but are suspected to be higher than most coastal drainages due to the climate of the watershed.

Fisheries Resource : The North Fork Eel River was used by American Indians for cultural purposes and as a fishing site for subsistence. American Indians would fish at night using weirs and light torches to lure the fish to the

traps. Early settlers also caught fish for subsistence, imitating American Indian methods, and they built their homes near springs for the water source (Keter, 1995).

The size of historic runs of anadromous fish stocks and the population of resident fishes are unknown. Based on interviews conducted with people knowledgeable about the watershed, the following fish stock information was compiled (Keter, 1995):

Anadromous fish stocks:

Coho (*Oncorhynchus kisutch*) - There is no evidence that coho existed in the North Fork of the Eel River.

Chinook (*O. tshawytscha*) - A spring and fall run of chinook may have been present in the North Fork. Spring chinook, but not fall, were observed prior to 1964. There is no evidence chinook were ever present above Split Rock.

Steelhead (*O. mykiss*) - Two runs of steelhead may have been present, a winter and spring run. Based on interviews, the spring run was dominant. It is estimated that the number of steelhead, prior to 1860, was approximately 6,930 fish (based on 150 fish/mile). Numbers may have been higher historically due to better habitat conditions.

Pacific Lamprey (*Lampetra pacifica*) - A historic run in late spring existed, which American Indians fished for subsistence uses.

Resident fish stocks:

Resident rainbow trout (*O. mykiss*) - This species is present throughout the watershed, averaging six-to-ten inches, with an average adult length of six inches.

Sacramento Sucker (*Castomus occidentalis*) - Suckers were not fished in the past due to the healthy trout and anadromous fish stocks.

Based on current fish habitat survey data, it is estimated that there was at least 46.2 miles of anadromous fish habitat in the North Fork of the Eel River. The historical suitable habitat condition for anadromous and resident fish is not known. It can be assumed, from estimated population levels and recorded stocks of anadromous fish, that the habitat was in good condition.

CURRENT CONDITIONS

Physical Processes

The bedrock geologic units that were described in the reference conditions, the active tectonic setting, and large storm events, are the dominant influences on stream channel morphology and flow characteristics, which are described in more detail in Appendix G. The following information on the current stream channel conditions is mainly derived from the same appendix.

General Channel Characteristics :

The major stream channels below about 2,600 to 2,800 feet elevation are strongly incised with high, steep, inner gorges dominated by shallow slope failure, debris slides and rockfall. These major streams have high energy flood flow regimes that undercut adjacent slopes and move sediment efficiently, resulting in a lack of woody debris in these channels. Many fan and floodplain deposits are being undercut along the larger channels, indicating that aggraded areas are currently being incised. Local aggradation is persistent in some areas of the mainstem channel and larger tributaries and has site-specific causes that do not appear to be correlated with valley width. Thus, aggradation of the larger channels appears to be less extensive than in the past, with many formerly aggraded areas now incised and actively downcutting through deposits. This indicates a recovery trend since the 1964 flood.

Streams above the 2,600 to 2,800 feet elevation range are generally less incised, but may have locally steep inner gorges reflecting variably weathered bedrock. Slumping of the inner gorge is common among these channels, and they are prone to periodic debris torrents. Both processes add large amounts of sediment to these streams which is stored in the channel between disturbance events.

Small streams in the watershed have large amounts of sediment stored in the channels through natural disturbance events and are important to the system as sediment storage areas. Mobilization of this sediment and its transport to downstream fish habitat during increased peak flows is of major concern. Road related run-off is the most probable cause of increased peak flow in the small streams, and avoiding these increases in stream discharge is the most important disturbance issue.

The mainstem channel and its major tributaries with distinct valley bottoms are dominated by coarse substrate and incised channels. Both the substrate and active incision limit the extent of riparian vegetation to narrow stringers of alder, willow, and associated species concentrated on streambanks and small flood plains. Riparian vegetation is fairly rare on smaller streams, but where it does exist, it consists mainly of willows, sedges, and rushes in the small channels and on the banks.

The flow regime is typically intermittent in this watershed, especially in the lower-order streams, perennial flow being associated with colluvial groundwater reservoirs in the larger streams and with groundwater storage in fractured bedrock associated with the Lake Mountain Fault.

Important Stream Channel Descriptions :

The following descriptions highlight some of the important current conditions of a sample of streams in the watershed. These streams usually have late-season flow, making them especially important as riparian and aquatic habitats. Late-season flow is associated with groundwater reservoirs, often formed by either fractured bedrock or coarse colluvial channel substrate.

The substrate of both Panther Creek and Bar Creek are dominated in some areas by coarse, bouldery debris from rockfall, high angle slope failures and debris flows, both of these streams having strong late-season streamflow. Upper Panther Creek also has transport reaches that move sediment through the system, enhancing fish habitat. Combined with the groundwater reservoir, late-season flow and topographic shading, there is a complex riparian environment that supports tailed frogs.

The lower reaches of Cox Creek have perennial streamflow, while the upper, less-incised reaches lack perennial flow, as does its tributary Tub Creek. The bouldery debris in the lower incised reaches forms the source of the groundwater sustaining the flow of water to the channel and the riparian zone.

Upper Little Red Mountain Creek is predominately transportional with colluvial reaches. Riparian vegetation is mainly willow growing within the channel, with alder present where streamflow becomes perennial.

The Bluff Creek subwatershed contains some of the highest quality fish habitat in the North Fork Eel River; this appears to be associated with the Lake Mountain Fault Zone. A north-south lineation of springs and wet areas near the west end of Double Gate Ridge and the west summit of Little Round Mountain suggests fault disturbance and structural control of Bluff Creek and its tributaries. Riparian vegetation is visible on aerial photographs along some of these streams, including small first- and second-order streams. This is due to perennial flow in this sub-drainage, along with possible cooler water temperatures. Bluff and Kettenpom Creeks also have strongly incised lower reaches that may have colluvial groundwater reservoirs. Bradburn Creek is also associated with the Lake Mountain Fault Zone and has late season streamflow.

Effects of Management Practices :

Management practices that have affected physical aspects of the watershed include roading, timber harvesting, fire, grazing, and mining. Road construction has had the most obvious effects on geomorphic processes in the North Fork Eel River watershed. There were few roads in the watershed until the 1950s, and most of those were for general access and located on middle-to-upper slopes. Some sections of these roads have been and are still subject to small-scale road prism or cutslope failure (especially in melange terrain), and may contribute to rill and gully erosion downslope where drainage is increased or improperly controlled. They have probably not been a major disturbance factor in the sediment regime of the watershed. The majority of local logging roads have been built since the 1964 flood. These roads are typically in lower slope positions and subject to the same processes of road prism and slope failure, as well as drainage diversion. Direct and indirect impacts to streams and fish habitat are almost always greater from these lower slope positions. These problems are more likely to occur on weaker

geologic units or in the vicinity of past landsliding (dormant slide terrain).

The current primary road system generally follows the main ridges and is relatively stable. The secondary road system consists of mostly short spurs along lateral ridges and upper slopes. Many of these roads are also quite stable, particularly on the west side of the watershed. A number of the secondary roads on the east side of the watershed have ongoing erosional problems (Roads 3S34, 3S33, 3S07, 3S09). Some midslope roads have diverted small drainages and increased discharge below culverts causing gullying downslope. This is evident along County Road 502 east of Round Mountain. Other roads that have ongoing sediment-related problems are: 3S17C, 5S30, 3S14, the Berry road, and possibly roads off of Long Ridge. Fill failures have occurred where roads were constructed on steep slopes with inadequate shear strength or where groundwater saturated the fill. A large fill failure that extends to a tributary of Panther Creek is located just south of Grizzly Mountain. There are several locations where roads built across melange have intercepted groundwater causing cutbank seeps and associated problems with road drainage. There are also several locations where roads built across melange have caused instability resulting in cutbank collapse, fill failure, debris slides, and slumping of the road prism.

Timber harvesting has occurred to an increasing extent in the North Fork Eel River watershed since World War II. Most of the harvesting has been done by clearcutting on private lands. This has probably increased rates of sediment production in some parts of the watershed. Patch cuts that have been made on National Forest lands do not appear to have caused any large mass wasting features, but they may have caused some small debris slides along lower-order streams that have had localized affects on slope stability and erosion processes. There also probably has been increased surface runoff from clearcuts that may have increased sedimentation.

Fire is probably the most significant disturbance affecting the vegetation in the North Fork Eel River watershed. Natural wildfires and deliberate burning by Native Americans and ranchers probably kept substantial areas in grassland and woodland types before the turn of the century. This may have resulted in somewhat higher erosion rates than if natural encroachment of trees and brush had occurred. Fire suppression since the 1940s has changed the fire regime and hence the sediment regime. Short-term rates are probably lower, but the potential for more extreme but infrequent fire behavior may actually have increased the long-term erosion potential for this watershed.

Grazing had a major impact on the watershed between 1850 and 1905, when large herds of sheep and cattle were present. There were likely severe impacts in riparian areas and on unstable melange slopes, but those effects are no longer very evident in the modern landscape. Probable effects included increased stream bank failure, increased surface runoff, higher soil creep rates on trampled hillslopes, and accelerated erosion from those hillslopes. The effect of grazing on landslides in the watershed is not well-known since the most intense grazing took place over a century ago. Current grazing is not a significant factor in mass wasting although it is probably increasing sedimentation within riparian zones.

Mining has caused only minimal disturbance in the watershed, consisting of one small open pit, a few exploration trenches near Red Mountain, and limited underground mining for manganese. There are also a number of aggregate source pits in exposures of competent graywacke, chert, and metavolcanic rock. These have little potential to affect off-site resources.

Biological Processes

Refer to the Vegetation section for more information on riparian vegetation. Data from 1995 riparian surveys are currently being analyzed (Wicktor, 1996). The number of cattle grazing in the watershed today is greatly reduced from the levels of the 1800s (Table 26). Impacts from cattle are still observed within the watershed, but specific locations have not been documented. Accounts of reduced riparian vegetation and streambank damage occur in field notes.

High turbidity levels and high water temperatures are the most critical issues for water quality in the North Fork Eel River. Nutrient loading by cattle is still an issue, but not to the degree it was historically. Water temperatures may have increased in the river due to aggradation and widening of the stream channel after the 1964 flood event, but the amount of temperature change since the historic period is unknown. The 1964 flood filled many pools and delivered large amounts of sediment to the stream channel. Water flows became shallower and spread over a larger area, becoming more susceptible to solar heating. It is assumed that the change in hillslope vegetation from oak-grasslands to more conifers has altered groundwater flow. If so, aquifers are now delivering less cold water to

pools during the summer. The influence of groundwater on pool temperatures may also be less because of their reduced depth.

Fisheries Resource :

The North Fork Eel River and its fish are still important to the culture of Native Americans who continue to harvest fish for subsistence and cultural purposes. Based on surveys and interviews, the following current fish stock information was pieced together:

Anadromous fish stocks:

Chinook - No chinook have been observed above Split Rock in recent surveys. However, a jaw was found at the mouth of Cox Creek in 1980. Asbill Roughs and Split Rock may be a barrier to migrating adult chinook salmon.

Steelhead - The winter steelhead run is the most dominant anadromous fish run in the North Fork Eel River, but data are not available to estimate current population size. Isolated sightings of summer steelhead occurred as late as 1990 (USDA Forest Service 1967-1992), but overall the run is in danger of extinction (Higgins et al., 1992). Red Mountain Creek and West Fork of the North Fork of the Eel River contained the highest average densities of one and two-year old steelhead per pool of all tributaries surveyed in 1995 (Thornburgh, 1995).

Pacific Lamprey - Lamprey have decreased in number along with salmonids. Spawning sites noted in surveys conducted from 1967 to 1992 indicate the presence of lamprey in the watershed.Resident fish stocks:

Resident rainbow trout and Sacramento sucker - Current population size and distribution of these species within the watershed is unknown.

California roach (*Lavinia symmetricus*) - Roach were introduced to this area about 1970. Current population size and distribution within the watershed is unknown, but this species is found in high densities within the main river system up to the West Fork of the North Fork branch. A limited study in the South Fork Eel River showed minimal feeding (niche) overlap between roach and juvenile steelhead (Fite, 1973).

The extent of anadromous fish habitat may be the same as what was estimated for historical distribution, but suitable habitat conditions for anadromous and resident fish have declined. Fish habitat has been greatly impacted by sedimentation. Aggradation of sediment has reduced spawning and rearing habitat, decreased aquatic invertebrate production, and increased temperatures. The next section contains more discussion on the conditions and physical factors which have contributed to the decline of aquatic habitat quality.

SYNTHESIS AND INTERPRETATION

Key Question 1 : What is the relative importance of the North Fork for fish stocks in the Eel River Basin?

About 50 percent of the North Fork is Federal land, and is designated as either Key Watershed, Wilderness, or Wild and Scenic River. Therefore, restoration and protection should be emphasized in the North Fork compared to other Eel River subbasins.

Of the anadromous fish watersheds on the Mad River Ranger District, the North Fork Eel River would receive the highest emphasis for protection and habitat development.

Although there are no supporting data, according to Scott Downie (California Department of Fish and Game), the 2+/3-year old steelhead are larger in the North Fork than elsewhere in the Eel River.

No *Ptychocheilus grandis* have been seen above Split Rock, therefore there are no predators present in large numbers to influence juvenile growth or survival.

There is habitat present above Split Rock for chinook salmon. So, if and when a management plan is developed for fish to bypass Split Rock, there will be spawning and rearing habitat available for chinook.

American Indian cultural and subsistence use continues to be important.

Overall, the North Fork is the smallest of the Eel River subbasins and has the smallest population of anadromous fish of any of the subbasins.

Key Question 2 : What conditions have contributed to the decline of native fish populations in the North Fork Eel River?

1851 brought the beginning of commercial fishing in the lower Eel River. Fishing occurred mostly during the fall runs and ceased in late November with the increased water flows. Winter and spring runs to the North Fork Eel River may not have been affected by commercial fishing; but this is questionable due to the lack of biological data and the timing of the runs (the fall runs at the mouth of the Eel River may have been winter runs in the North Fork). After World War II, mechanized ocean-going fishing fleets were common. Sport fishing was becoming popular and many resorts were built along the lower Eel River. It is suspected that these two activities combined contributed to the decline of salmonid populations or made their recovery more difficult after the 1964 flood.

The fishery was relatively productive until the 1964 flood, even with land management activities.

The loss of riparian cover was due to high sediment and debris-laden flows, increased sedimentation of habitat from landsliding during major flood events in the last 50 years, and increased surface erosion from roaded, harvested, and grazed areas. Since riparian communities are already very limited in extent within this watershed, loss of the riparian cover is especially detrimental.

Aggradation of sediments, especially in parts of the mainstem channel, has reduced spawning and rearing habitat, decreased aquatic invertebrate production, and increased water temperatures.

Split Rock, a large rock in landslide debris, is located about 3.5 miles above the mouth of the North Fork between Asbill and Wilson Creeks. Although this rock came down during the 1964 flood, the area probably had active debris slides prior to 1964. Split Rock is a selective barrier to salmonids, depending on the timing of fish migration and the water flow, which varies yearly.

The extremely limited historic records of flow/water level data for the North Fork Eel River makes it difficult to determine what if any impacts water level fluctuations have had on anadromous fish and aquatic habitat. The available flow data from a USGS gaging station near Mina consists of daily average flows from 1953 to 1975, and daily average temperature and suspended sediment from 1972 to 1974. The effect of water level fluctuations on salmonids and habitat is currently listed as a data gap.

Today there are fewer anadromous fish than historically. The increase in roads and logging on both private and public lands may have contributed to increased stream channel habitat degradation, or hindered channel recovery and improvement of fish habitat.

Key Question 3 : How has grazing influenced watershed conditions, particularly aquatic and riparian habitats?

During the ranching period of 1850-1905, a large number of sheep and cattle were allowed to range throughout the watershed. The grazing impact to the system was much greater than today. The large feral pig population also contributed to soil disturbance.

Some of the impacts of grazing observed and documented (Keter, 1995) are:

(1) Disturbance of riparian vegetation;

(2) Increased soil erosion from trails and disturbance of highly-erodible Franciscan soils on steep slopes;

(3) Collapse of overhanging banks due to trampling;

(4) Increased pollution (water quality) from animal waste;

(5) Increased erosion from damaged plant cover; and

(6) Increased peak runoff which changes stream morphology.

Today, the number of livestock being grazed in the North Fork Eel River watershed is much less than in previous years (Table 26). Although the impact of livestock on aquatic and riparian habitats is less, grazing still may be slowing or preventing recovery of the system. Areas may still exist where cattle are reducing or eliminating riparian vegetation and compacting soils within riparian zones; but intensive surveys to determine these areas are lacking.

The change in species composition of grasslands from primarily perennials to annuals may also have had an effect on erosion and sedimentation in this watershed. Longer-lived, native perennial bunchgrasses, with their extensive fibrous root systems, are likely to be more effective in stabilizing slopes (Lowry, 1991). Initial establishment of bunchgrasses may take longer. Once established, these grasses can stabilize surface and sub-surface soils, retain and recycle nutrients more efficiently, and they are less flammable (stay greener longer through the summer) than annual exotics. The perennial bunchgrasses also leave residual "thickets" of dead leaf blades which can reduce the effect of erosional forces and increase the amount of organic matter in the soil surface.

Key Question 4 : What is the extent of *Ptychocheilus grandis* in the North Fork Eel River, and do they influence the migration of salmonids into the upper drainage?

During 1995 surveys by USFS and CDFG, no *Ptychocheilus grandis* were reported above Split Rock. One unconfirmed *Ptychocheilus grandis* sighting was reported by a range permittee in 1995 at the mouth of Salt Creek. However, there are numerous roach and suckers in the watershed which can be mistaken for *Ptychocheilus grandis*.

Ptychocheilus grandis do not influence migration of adult salmonids into the North Fork Eel River. Juveniles migrating to the ocean or to mainstem rearing areas may be subject to *Ptychocheilus grandis* predation. The interaction between *Ptychocheilus grandis* and salmonids of differing age classes is currently under study (Harvey, 1995).

Water temperatures within the North Fork would not exclude *Ptychocheilus grandis* if they reached above Split Rock.

Key Question 5 : What are the important physical factors (e.g., mass wasting, aggradation) limiting aquatic habitat quality in the watershed, and how much can they be influenced by human intervention?

Flow: The limited surface flow during the summer months could affect survival of juveniles when the flow goes subsurface or from increased water temperatures due to solar heating. Migration of adults into the watershed is influenced by flow, especially in attempting to negotiate passage past Split Rock. Water flow may be influenced by management activities (e.g., vegetation management, road building). Flow in the North Fork Eel River, particularly during summer months, may have been altered by changes in vegetation, management practices, and environmental changes.

Pools: The number and depth of pools in the North Fork Eel River watershed have decreased. The few remaining pools are stratified and may provide refuge for juvenile salmonids during summer months. However, some of these pools may not be deep enough to provide refuge until the first autumn rains.

Temperature: Water temperatures are potentially lethal and growth-inhibiting in some tributaries and within the mainstem of the North Fork Eel River. A 1995 survey recorded temperatures in the tributaries and mainstem from 15.5 up to 25 degrees Centigrade. Due to this, "...summer and fall are very inhospitable to those fish which did not move downstream as the late spring flows diminished. Because of the low flows and intermittent nature of the North Fork of the Eel River during summer and fall, along with very high water temperatures, only those salmonids holding in deep pools have a chance for survival." (Reneau and Barnes, 1982.)

Sedimentation: Fine deposits of material can decrease invertebrate numbers and diversity, resulting in decreased food for juvenile fish. Most of the material introduced into the stream channel comes from hillslope processes. Faults, shear zones, high primary clay content and weathering in the sedimentary and melange rock units result in high sediment production. Spawning habitat has been negatively impacted and reduced due to high amounts of fine sediment in areas of the mainstem channel, especially those areas that have persistent local aggradation.

Inner gorge landslides: Relatively persistent shallow landslide processes occur along incised canyons of principal streams. Only a very small fraction of these landslides were influenced by management practices. Small- to

moderate-sized earthflows are active in much of the melange terrane. Some impacts could be mitigated where poor road construction or lack of road maintenance has accelerated surface erosion gullying or mass wasting.

Rearing habitat: Shallow pools and a relative scarcity of large structural elements within the channel limit the amount of habitat available for rearing. The relative scarcity of large woody debris (LWD) probably is due to poorer sites on canyon slopes that do not support large conifers; but also much of the wood that is delivered is transported down the system. Since this is a prime area for delivery, it may be possible to accelerate LWD recruitment or import material to areas of the channel that are not transport dominated.

Unstable streambanks: The high sediment load during the 1964 flood may have impacted the riparian zone by either burying or scouring riparian vegetation, resulting in a lack of vegetation to stabilize banks. As well, the impact of past grazing and isolated grazing problems today have caused damage. It may be possible to stabilize streambanks through riparian planting projects, cattle exclusion, or other stream restoration techniques.

Key Question 6 : To what extent has vegetative management altered hillslope hydrologic and stream channel processes?

Based on information provided by Keter (1995), the hydrologic cycle has been altered by the following historic land use practices:

Forty-to-sixty years ago, streams flowed at higher water levels. Springs in the region have dried up or flows are greatly reduced during the summer dry season. Homesteads in the watershed no longer show evidence of having a water source near the claim, "...a homestead had to have a spring on it or you couldn't live there." (Interview 448).

Ranching and homesteading increased runoff due to soil compaction, loss of ground cover, and reduction of riparian vegetation.

A significant factor affecting the hydrologic cycle and groundwater was the change in vegetation distribution. An increase in Douglas-fir forests, a decrease in oak woodlands, and an increase in brush and understory vegetation increased interception and evapotranspiration and reduced groundwater recharge.

No quantitative data are available for the effects of timber harvest on groundwater, but groundwater flows could have been increased locally down gradient from extensive clearcuts. This is probably a negligible effect on Federal lands in the watershed.

Logging practices that disturb the ground and expose soil, such as tractor-yarding and road construction, have probably accelerated surface erosion and gullying and may have increased the incidence of mass wasting.

Currently, summer flow in the North Fork Eel River is slow to non-existent.

Although not supported by data, changes in the hydrologic cycle may be due in part to changes in fire suppression and burning practices.

Key Question 7 : How and to what extent have logging, road construction and maintenance affected "natural" mass wasting and sediment regimes (gullies, small impacted streams) in the watershed?

After World War II, limited logging and road building occurred on private lands. In the 1970s, timber harvesting and road building accelerated on public lands.

Logging may have contributed to the impacts of the 1964 flood. However, areas in the Eel River Basin which are untouched by logging also experienced major erosion and landsliding during the flood. This appears to be the case for the North Fork Eel River watershed, since only limited logging had taken place prior to 1964 (Keter, 1995).

Logging practices, such as tractor-yarding and high lead trails, can create conduits for runoff and sediment, although these conditions are not apparent in this watershed. The loss of root strength on regeneration sites leads to a greater potential for mass movement, including soil creep. It is likely that these effects have been more severe on the private lands in the watershed.

Road building may undercut weak slopes, place unstable fills on weak slopes, and inhibit daylight groundwater flow. Each of these activities can accelerate landsliding in terrains near their threshold of stability. Although no

evidence exists to indicate this is a common problem throughout the watershed, minor cases do occur. It is necessary to be aware of stream crossing designs, especially where roads cross melange, since melange has a high potential for drainage diversion and accelerated erosion/gullying. These latter problems have a high probability of occurring in the North Fork Eel River watershed.

A lack of proper maintenance could result in continued failures of slopes where failed cutslope material has been removed; gullying of roadbeds when debris from cutslope failure plugs inboard ditches; and, mass wasting and culvert plugging from excess sedimentation. These are the main issues in the North Fork Eel River landscape.

Road stream crossings are sites where erosional problems often occur, and the number of stream crossings in a subwatershed can provide an indication of the potential for road-related erosional problems in an area. The total number of stream crossings is only an estimate of the potential for road-related erosion because a single, large midslope crossing may have more effect than five small upperslope crossings.

The following (Table 28) presents an estimate of stream crossings in subwatersheds of the North Fork Eel River. These estimates were based on (1) actual intersections of blueline streams with an existing Geographic Information System (GIS) road layer check-plot, or (2) probable crossing conditions indicated by topographic expression (contour crenulations) (see Figure 21).

Table 28. Estimated stream crossings in the North Fork Eel River watershed.

Subwatershed	Crossings in "Weak" Geol Substrate	Crossings in "Competent" Substrate
West Fork	55	26
Soldier	10	21
Kettenpom/Bluff	11	69
Upper Mainstem	29	18
Salt	5	24
Middle Mainstem	54	9
Red Mtn	14	1
Casoose	22	0
Lower Mainstem	84	38
Hulls	124	37
Asbill	11	15

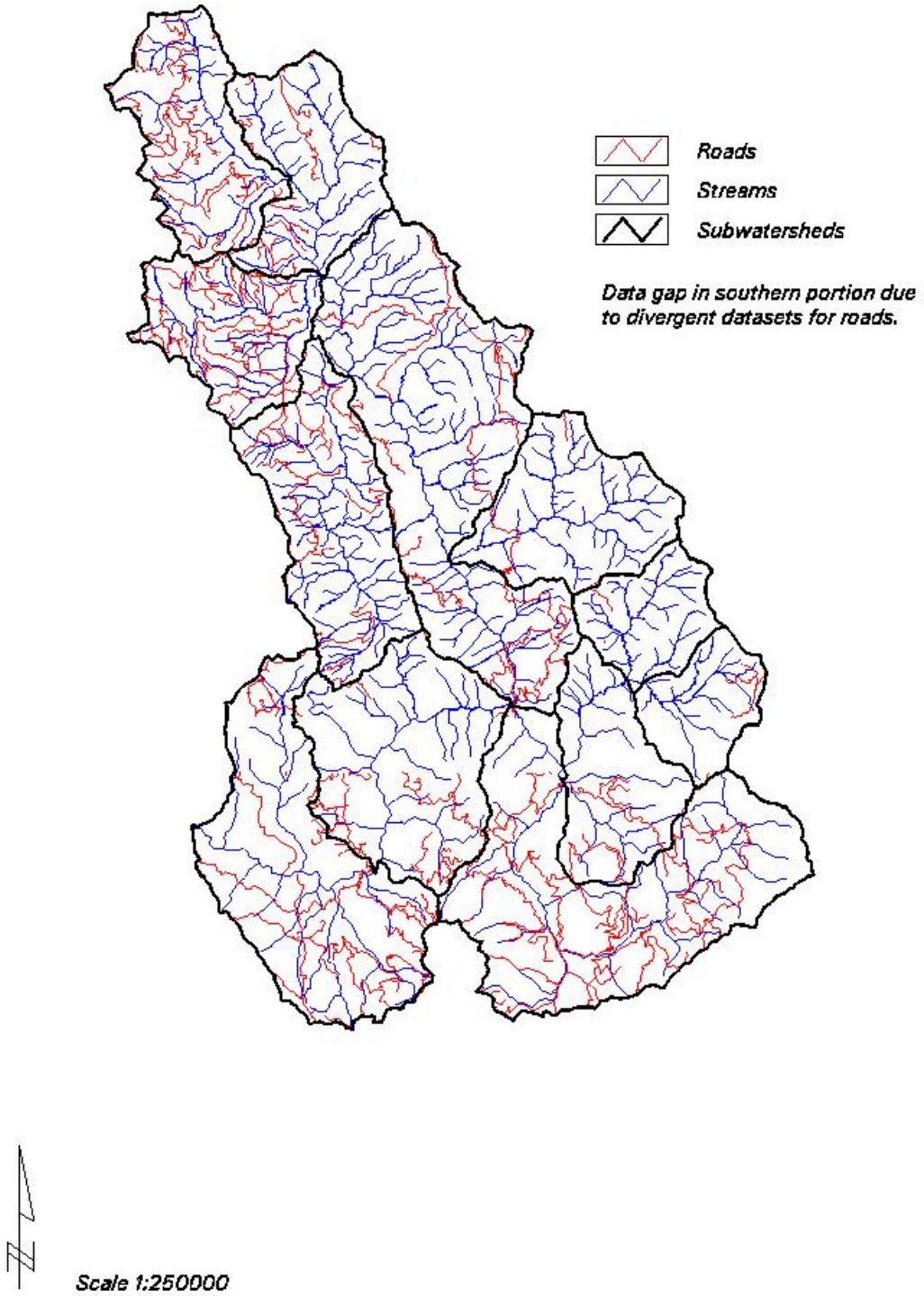

Figure 21. Streams, roads and subwatershed boundaries within the North Fork Eel River watershed.

ISSUE 5: FEDERAL ACCESS STRATEGIES

REFERENCE CONDITIONS - not applicable to this issue.

CURRENT CONDITIONS

Roads are the primary component of access. Presently, more miles of road exist in the North Fork Eel River watershed than at any time before. National Forest lands contain approximately 215 miles of Federally managed and maintained roads; BLM lands contain about 30 miles. Approximately 36 percent of the National Forest System roads (73 miles) are native surface roads which are more prone to surface erosion than roads with aggregate surfacing. Cartographic Feature File (CFF) data indicate that there are about 500 miles of primary and secondary roads in the North Fork Eel River watershed (this is known to be a low estimate but total road miles are not known). An unknown amount of smaller, minor roads are also present.

Factors that have led to increased road mileage in the basin include: availability of heavy equipment in the region, need to access and haul timber, need to access private parcels and/or homesites. Prior to the 1930s, access was limited to trails and stage routes. Large trails were developed by sheep ranchers in the 1860s and 1870s to move livestock through the region. Due to its remoteness, logging did not begin in the watershed until modern machinery became available after World War II. Logging roads were first constructed on the private lands in the 1950s and 1960s. Road construction on Forest Service and BLM lands occurred mostly in the 1970s and 1980s. During the 1990s, many old logging roads on private land have been once again opened to re-access parcels with timber.

Roading patterns differ between public and private land. Roads on public lands have been systematically extended to access subsequent logging units, whereas right-of-way agreements among private landowners have tended to produce a more redundant road system with individual access to each parcel. Road construction and maintenance are expensive. Most non-industrial landowners cannot bear the expense of engineered construction or regular road maintenance.

Roads that traverse highly-erodible melange areas are most susceptible to problems. Earthflows and gully erosion are fairly common in this terrane. Road construction can increase both processes. Inboard ditches on these roads may become filled by weak soils that slough from cutbanks. This increases the potential for diversion of runoff onto road surfaces and accelerated erosion. Culverts are also more susceptible to plugging in the melange terrane, causing the diversion of water, gullying and possibly debris slides where the diverted water finally runs off of the hillslope. Roads that are cut through melange are also more likely to intercept groundwater resulting in continual road drainage problems. Examples of roads that cross melange and have many of the above problems are 3S34, 3S33, 3S07 and 3S09.

Increased road construction on National Forest land has provided public access to areas that were previously almost inaccessible. This created greater opportunities for certain types of recreation, including more miles of road for Off-Highway Vehicle (OHV) use and increased access to the river. It also has made some areas much more accessible for the poaching of fish and wildlife, marijuana cultivation, and other illegal activities. Public access to BLM, Tribal, and private lands is very limited.

Data from a recent road use survey, as well as interviews with watershed residents, indicate that vehicle traffic on the roads is very light. The remoteness of the area, combined with the mix of public/private lands, are likely the primary reasons for low traffic volume.

SYNTHESIS AND INTERPRETATION

Key Question 1 : What are the principal concerns in this watershed for managing public access?

- Allowing and maintaining access to trailheads and Wilderness areas.
- Access to private property.
- The sole public access route to the river is through the Six Rivers National Forest.
- Access to grazing allotments, hunting areas, and collecting areas for local residents.
- Access for fire management and other administrative needs.

- The effects of open access are: increased potential for poaching, other illegal activity, damage by uncontrolled OHV use, TES disturbance, road damage in wet season and the resultant increased sedimentation to streams, increase in fire starts, and the increased spread of exotic plants.

Key Question 2 : What are the key physical conditions or processes that influence road management decisions in the North Fork Eel River watershed?

- Much of the landscape is sensitive to disturbance — particularly the melange areas — and to a lesser degree, the areas underlain by the incompetent graywacke and ultramafics; road construction causes permanent modification to the landscape with long-term change of surface and subsurface drainage and potential increased sediment delivery to the stream network; and, roadcuts are highly visible in this landscape.
- Roads located on mid- and lower-slopes are more susceptible to mass wasting and need careful evaluation for impact and design.
- Native materials in the basin are highly erodible; roads may contribute significantly to surface erosion, gully erosion, and mass wasting.
- Roads that cross melange terrane are more likely to cause diversions of surface runoff due to of the higher potential for inboard ditches to be blocked by cutslope sloughing, the higher potential for plugged culverts, and a greater likelihood of groundwater interception; such diversions can lead to major erosion problems.
- Additional roads, especially with inboard ditches, can increase peak flows and may have the resultant downstream effects of mobilized sediment.

Key Question 3 : How should the transportation system on Federally managed lands be maintained? Specifically, how should the Forest Service and the BLM address the increasing number of requests from the private sector for residential and commercial access, given the potential for cumulative impacts to the landscape and its dependent resources?

- Primary focus should be on maintenance of stream crossing integrity preventing diversions and gully erosion; a secondary concern is surface erosion of road prisms, especially on steep roads and weaker lithologies.
- There have been substantial impacts to stream channels and dependent fish stocks over the past several decades, due in part to the accessing of private lands. Before additional rights-of-way or special-use permits are granted for access across Federal lands for private and commercial use, the cumulative effects of these permitted uses need to be evaluated. While the Forest Service and the BLM cannot deny access to private land if there exists no other reasonable access, future right-of-way and special-use permits should also be based on the identification of those areas that are most important for various species and are also most sensitive to road construction or expansion (Figures 21 and 22).
- Maintain road to the designed maintenance level, or decommission road if it had been originally designed for closure, if the road is no longer needed, or if the road is a continuous erosional problem; the amount of roads must conform with ROD standards.
- On private lands, the tax incentive is to repair degraded roads rather than to invest in higher standard roads.
- With changes in county zoning and subdivision plans, there will probably be increased requests for access through public lands.

Key Question 4 : What parts of the watershed have the greatest transportation needs in order to manage the public lands adequately?

- Recreational access to the river is, and will increasingly be, a high priority; current public access is limited to National Forest lands only.
- Grazing permitees in Six Rivers National Forest require access to their allotments.

- BLM lands, except for the Mina parcel, have no public access and none is considered necessary at this time.
- Matrix lands where logging may occur, will have future transportation needs.

Key Question 5 : What are the highest priority restoration areas with respect to adverse impacts on riparian/aquatic habitats?

- Roads in areas where public access is not critical and that contain large areas of sensitive lands are the best candidates for road removal projects.
- Restoration should target the subwatersheds which are least-damaged from past activities, which currently contain high quality fish habitat (as listed in the Fish issue), and that are likely to contribute good quality (e.g., cool) water to the river.
- Restoration needs to be primarily preventative in nature because once a fluvial system has lost its equilibrium through large sediment inputs, it is generally not cost effective or prudent to manipulate system processes in an attempt to restore those systems.
- The greatest benefits probably would come from approaching existing or potential "disasters" involving large failure volumes or major diversion potential in melange terrain.

What roads have the highest priority for decommissioning or upgrading to prevent resource damage?

- Presently, specific road segments that are high priority for decommissioning are not known, inventory is planned to help determine this; most BLM roads are involved in reciprocal rights-of-way with private landowners which precludes decommissioning.

Key Question 6 : What factors should be considered in the construction or decommissioning of roads and stream crossings to benefit aquatic species?

- Location is almost always a key consideration; geomorphic processes at a location must be considered; the melange terrane tends to be the least stable part of the watershed.
- Native surfaces are highly erodible, especially in melange; aggregate surfacing should be considered whenever feasible; also consider upgrading or adding surfacing to existing roads located near sensitive aquatic habitats.
- opportunities for partnership with tribal or private lands should be considered; for the greatest benefit to aquatic species, address the entire watershed in developing restoration strategies, extending beyond the Federally managed portion.

Key Question 7 : What factors should be considered in constructing or decommissioning roads and associated stream crossings to benefit species of concern?

- Restrict access near active Threatened and Endangered species sites to eliminate disturbance.
- Manage access into key deer range to allow access for hunters during hunting season while also minimizing poaching out of season; (deer are concentrated and vulnerable in accessible winter ranges).
- Monitor open road densities in important wildlife areas (e.g., LSRs, goshawk and deer territories). **Key Question 8 : How can recreation on public lands be developed with little or no impact to adjacent private landowners?**

- Clearly mark boundaries between Federal and private lands; signing must be visible to recreationists and other users; maintain and clearly sign trails to help minimize trespass.
- As Six Rivers National Forest develops recreation plans, adjacent landowners should to be involved to aid in eliminating potential impacts.

CHAPTER 4 - CONCLUSIONS AND RECOMMENDATIONS

Introduction

This chapter is organized according to the five major issues identified in the Key Questions (Chapter Two). Under each issue, one or more groups of related actions that the Watershed Analysis Team considers to be important to pursue in subsequent project development are presented, along with related Strategies and Data Gaps. These latter are designated as either critical or non-critical in accomplishing the recommended actions. This chapter represents an interdisciplinary effort to identify realistic ecosystem management priorities for the North Fork Eel River watershed.

ISSUE 1: NORTH FORK EEL RIVER CONTRIBUTION TO LOCAL ECONOMIES

A. ACTIVELY SUPPORT LOCAL ECONOMIC OPPORTUNITIES

Key Findings:

There are opportunities in the North Fork Eel River watershed for the support of seasonal or temporary employment in local business ventures; to provide access to forest products and other natural resources necessary to those businesses; and to provide some level of recreation. These opportunities contribute to local income, but they are not sufficient to provide economic stability to the dependent communities.

Small-scale timber harvest may be feasible in oak woodland stands that are being actively encroached upon by Douglas-fir. This could benefit local economies while moving the landscape toward its previous "open" condition, and it would aid in improving habitat for wildlife and in reducing fire hazards.

Recommended Actions :
When planning timber harvest projects, provide sales for extended times (multi-year) and in small volumes to allow smaller local companies to be competitive.

Purchase/contract with local professional and skilled services and determine where they can be used in place of seasonal government hires. (This would be supported by the development of a local skills bank).

Support cottage industries that are dependent upon non-timber forest product extraction through the Special Forest Products Program.

Support local guide services that provide fee hunting by helping them to avoid trespassing on private property.

Related Strategies :

Critical

Further develop and enhance the Special Forest Products program which constructs stewardship-oriented and implementable guidelines for collectors, explores a pricing strategy that is a standard province-wide, develops educational material for distribution, and implements patrols to ensure that the conditions of permit are adhered to in practice.

Non-critical

Forest Service, and possibly BLM, pursue opportunities with Round Valley Tribal Government to develop a regional or watershed-level recreation development and a management strategy that would enhance compatible and diverse recreational experiences on Federal and Indian lands within the North Fork Eel River watershed.

Implement a "stewardship" concept that encompasses harvest, site preparation (burning), planting, and erosion control. This would involve having a private sector entity take on full-cycle responsibility for on-the-ground management of a designated area within the watershed (between 500 and 2,000 acres), with ongoing technical guidance from the Forest Service.

Where timber harvest is concerned, support the needs of private timberlands with road rights-of-way, and

implement CRMPs and RMP.

Related Data Gaps :

Critical

When operating in basins/subbasins which contain potential sensitive plant habitat and where little information exists on known populations, sample habitats on a basin-wide scale.

When operating in areas of white oak woodlands or black oak sites within conifer forests where basin-wide information is available, conduct surveys of project area for the presence of Tracy's sanicle.

Little is known about the presence of non-vascular species in the basin, including Survey and Manage (S & M) species; conduct an area, subbasin, or basin-wide census for these species. (Note: Project specific surveys will be required in any event for projects implemented after 1999).

Non-critical

Given the similarity of Tracy's sanicle to a taxon found in Lassen and Plumas Counties, undertake taxonomic investigation.

B. PROVIDE FOR AN ACCEPTABLE LEVEL OF GRAZING

Key finding :

Grazing impacts need to be assessed in this watershed so that managers and various resource specialists can better understand both the positive and the negative effects of livestock use on the landscape.

Recommended actions :

Develop and implement a strategy to provide optimal grazing while meeting wildlife and riparian needs.

Related strategies :

Critical

Control negative grazing impacts by: fencing sensitive riparian areas; delaying or eliminating grazing from heavily impacted areas; providing watering troughs to attract cattle away from streams; and including more effective monitoring and supervisory provisions when grazing permits are renewed.

For widely-distributed sensitive plant species, conduct investigations to assess the affects of grazing on both plants and their habitat.

Related data Gaps :

Non-critical

Perform surveys to find areas that have been critically impacted by grazing. This action could be combined with the North Fork Eel River watershed allotment assessments to be completed in 1997.

Evaluate the affect of livestock grazing on Tracy's sanicle populations.

C. RECREATION DEVELOPMENT

Key findings :

There are a variety of opportunities within the North Fork Eel River watershed to support recreational development and employment related to recreation. Due to the land ownership pattern, National Forest lands provide the only public access to the area of the river which has the greatest potential for future recreational development. The Round Valley Tribe owns a considerable amount of land along the river, but much of it is currently not accessible to them. This situation provides an opportunity for the Tribe and the Forest Service to develop a recreational partnership and to design experiences that would meet both the individual, isolation-oriented wilderness hikers and the water-oriented, large-group recreationist experiences.

Recommended actions :

Evaluate recreational needs and develop recreational opportunities that are compatible with the subsistence needs of Native American communities in the North Fork Eel River watershed. This includes: (1) development of regional- and watershed-level recreation development and management plans that promote compatible and diverse recreational experiences on both public and tribal lands (cooperative among BLM, Six Rivers National Forest, and Round Valley Tribe); (2) support the needs of guides, fee hunters, subsistence hunters, anglers (both recreational and subsistence) and private property owners by increasing the signing of property lines; (3) develop a brochure (and/or video) describing recreational opportunities and services in the watershed as a cooperative effort among BLM, Six Rivers National Forest, and Round Valley Tribe; and (4) develop a trail linking the North Fork Eel River watershed and the Yolla Bolly Wilderness.

Related Strategies :

Non-critical

Consolidation of Forest Service and BLM lands that will create improved access for recreation development, particularly to the Wilderness.

Related Data Gaps :

Critical

Need information and understanding of fishing in the North Fork Eel River by Native Americans who reside within the watershed or come from the Round Valley Indian Reservation.

Need information and understanding of the Round Valley Tribal Government's objectives for lands along the North Fork Eel River.

Need information to understand the hunting needs and uses by local tribal communities.

Need to understand the uses, values, and rights associated with the Rohnerville Rancheria and its use by members of the Tribe in the North Fork Eel River watershed.

When operating in areas with potential sensitive plant habitat, conduct surveys of the project site and the general area for the presence of sensitive plants.

D. AGREEMENT TO PROTECT WAILAKI SITES AND INFORMATION

Key Findings :

Wailaki archaeological and historical sites on the North Fork Eel River have great cultural, religious, and historical value. The Tribal Government is very concerned about their protection and obtaining access to, or copies of, these materials (either on-site or previously collected by agencies) for their own study.

Fishing is still a cultural subsistence activity and also has ceremonial purposes. The Tribal Government wants to participate in fishery enhancement activities and wants also to promote better understanding of the cultural and biological aspects of the watershed between Tribal members and Federal agencies.

Recommended Actions :

Develop a government-to-government agreement between public agencies and the tribe which would allow access to and provide information about Wailaki village sites. Develop strategies with all entities, including the Tribal Government, that can be implemented across agencies for protection, interpretation, and management of the village sites and their surroundings.

Federal agencies and the Tribal Government should develop an inter-governmental strategy for the entire North Fork Eel River area (including tribal lands) by: (1) discussing overall fishery maintenance and enhancement needs, (2) identifying where the Tribe can help meet overall objectives, and (3) identifying priorities about types and locations of activities.

Related Data Gaps :

Critical

Need information and understanding of Round Valley Tribal Government's objectives for lands along the North Fork Eel River.

Non-critical

Need information and understanding of fishing on the North Fork Eel by Native Americans living within the watershed or coming from the Round Valley Indian Reservation.

Need to understand the uses, values, and rights associated with the Rohnerville Rancheria and use by its members in the North Fork Eel River watershed.

ISSUE 2: POTENTIAL VEGETATIVE PRODUCTS AND DESIRABLE VEGETATION CONDITIONS

A. OAK WOODLAND RESTORATION

Key findings :

The amount and extent of oak stands in the watershed has decreased from historic conditions. The encroachment of Douglas-fir into oak stands due to fire suppression has been the main reason for this decrease. Some oak stands remain today primarily due to soil conditions that limit the growth and establishment of Douglas-fir. Acorn production from oaks was a primary motivation for burning in areas of the North Fork Eel River watershed. Indian communities depended upon acorns for food as well as for use in ceremonies and rituals. Although acorn use has declined from past levels, it is likely to increase in the future, particularly for religious ceremonies.

Recommended Actions :

Assess the ecological condition of oak woodlands. Determine the amount and frequency of acorn production, wildlife use, the viability of associated herbaceous species (i.e., *Sanicula tracyi*), and resource availability for Native Americans. Also assess soil conditions (e.g., depth, rock fragment content, permeability) to determine if Douglas-fir have the potential to invade/dominate a site.

Where native oaks are losing their ecological integrity and causing unfavorable impacts to Native American cultural activities, native plant habitat and species diversity and other wildlife habitat, implement the following proven oak management techniques as appropriate to particular sites or areas:

-planting oak trees or acorns

-eradicating non-native vegetation

-reintroducing native plant species and meadows

-conducting burns under specific prescriptions.

Related Strategies :

Critical

Use EUI data and maps to find areas where oaks persist because of inherent soil conditions, as well as areas where conifers may be encroaching on these stands.

Remove conifers from deciduous oak stands where feasible or as needed. Prescribed fire could also be used to deter conifer encroachment and provide acorns for Native Americans and wildlife. The inherent variability of oak woodlands should be considered in planning prescribed fire. Avoid generic applications.

Non-critical

Fire monitoring plots should be established in selected subseries of interest (e.g., oak woodlands) to assess the short- and long-term effects of fire on the ecosystem.

Small-scale timber harvesting may be feasible in oak woodlands that are actively being encroached by Douglas-fir. This could benefit the local economy while moving the landscape toward its previous open condition, and also improving habitat for wildlife and reducing fire hazards.

Related Data Gaps :

Critical

Need to understand the uses, values, and rights associated with the Rohnerville Rancheria and use by its members in the North Fork Eel River watershed.

Areas where conifer removal is taking place to improve oak habitat should be monitored for changes in oak

regeneration and plant species composition.

Restoration projects for oak woodland communities should be handled as a study with variable treatments and monitoring.

Prior to implementing prescribed burns, survey project areas for presence of Tracy's sanicle. Install pre- and post-fire monitoring plots to evaluate effects of fire on the species.

Non-critical

A detailed investigation of soil conditions in some oak stands should be carried out to assess whether they are at risk of conifer encroachment.

B. SILVICULTURAL TREATMENTS

Key Findings :

The North Fork Eel River watershed provides economic opportunities for commercial extraction of Special Forest Products, including timber. There are 4,566 acres of mid-mature Douglas-fir stands over the maximum RMR on Six Rivers National Forest lands. There are 49 acres of early-mature white fir and 30 acres of late-mature white fir over the maximum RMR.

The economic structure of these local, dispersed communities has always involved a multiple-income strategy. This strategy involves acquiring money or goods in a variety of ways. The North Fork Eel River watershed can support seasonal and/or temporary employment as well as local businesses and entrepreneurial ventures. It can also provide access to natural resources necessary to those businesses. However, this watershed alone cannot provide economic stability to these rural communities.

Recommended Actions :

Harvest acres where seral stages within vegetation series are over the maximum RMR. Regeneration, as well as selective harvest, is theoretically feasible in mid-mature Douglas-fir stands and early- and late-mature white fir stands. The acres available for harvest are shown under the "key finding” heading and Tables 15 and 17. Before developing specific harvest proposals, some consideration should be given as to how the acres treated will affect the seral stage distribution in the South Zone of Six Rivers National Forest.

It is strongly recommended that an analysis of the South Zone be conducted to answer several key questions. These include:

(1) Where should the Forest manage the South Zone within the RMR? Low? Middle? High?

(2) How should the acres over the maximum RMR, or even the minimum RMR, be allocated among the various watersheds in the South Zone, including the North Fork Eel River watershed?

Critical

Silvicultural treatments, fuel treatments, and prescribed fire to improve wildlife habitat include: thinning in early-mature stands within NSO activity centers below the take threshold (less than 1,340 suitable acres within 1.3 miles of activity center) to accelerate development of late-seral characteristics; creating canopy gaps of 0.25-0.5 acre in suitable mid-mature stands to potentially enhance horizontal and vertical vegetation diversity in the stand.

Riparian Reserve widths recommended in the ROD should be retained until further studies on potentially unstable inner gorge areas, use as wildlife corridors, and provision of habitat for riparian-dependent species are completed.

Non-critical

For timber harvesting:

provide sales for extended times (multi-year) and in small volumes to allow smaller local companies to be competitive; and implement a "stewardship" concept to encompass harvest, site preparation (burning), planting, and erosion control; this involves having a private sector entity take on full-cycle responsibility for on-the-ground

management of a designated area within the watershed, with ongoing technical guidance from the Forest Service.

Non-critical

Purchase/contract with local professional and skilled services and determine where they can be used instead of practicing seasonal hiring; need to develop a skills bank to implement.

Support those cottage industries relying on non-timber forest product extraction through the Special Forest Products Program.

Related Data Gaps :

Critical

When operating in basins/subbasins which contain potential sensitive plant habitat and where little information exists on known populations, sample habitats on a basin-wide scale.

When operating in areas where sensitive plants have been documented, conduct surveys of the project area for their presence.

Non-critical

Early-mature and mid-mature Douglas-fir stands on National Forest lands in the watershed could be harvested while staying within the estimated HRV for the Southern Zone of Six Rivers National Forest. Although this is theoretically feasible, the distribution of seral stages should be mapped for the entire watershed, including private lands in the southern section of the watershed. This information would provide a more valid comparison of seral stages between the North Fork Eel River watershed and the South Zone.

C. FIRE SUPPRESSION

Key findings :

Fire regimes (frequency, intensity, extent) have changed within this watershed. Fuels data for National Forest lands indicate the possibility of high to extreme fire behavior, even under early summer conditions. Ladder fuels are common and they create the potential for crown fires and result in tree mortality and habitat destruction.

Recommended Action :

Consider and implement fire suppression strategies that are appropriate to meet safety and resource objectives.

Related Strategies :

Critical

Given the current risk for high-to-extreme fire behavior, initial attack for all wildfires will be an aggressive suppression strategy. In selecting appropriate suppression responses, fire-fighter safety must remain the highest concern. Fire managers also must ensure that planned actions will be effective and will remain effective over the expected duration of the fire.

When properly equipped Forest Service engines and trained personnel are available, they will take fire suppression action to protect structures within the Forest's area of responsibility for all reported fires that involve a threat to life or pose a threat to National Forest resources.

Low impact tactics for suppression, logistics, aviation, hazardous materials, rehabilitation, and demobilization should be considered throughout the watershed, and should also be applied if at all possible in LSRs and Wilderness. These tactics may result in more time being spent watching, rather than disturbing, a dying fire to ensure that it does not rise again. They may also require additional rehabilitation measures that were not carried out previously.

Further analysis and discussion with cooperating agencies and adjacent landowners should be undertaken to determine fire risks and hazards and their associated effective fire suppression, prevention, and fuel treatment strategies for the entire North Fork Eel watershed. This will be an integral part of ongoing development of the

Forest's Fire Management Action Plan.

Non-critical

Alternative suppression strategies, including confinement and containment (rather than complete control), should be considered as a way to reduce long-term hazards for this area. These alternatives should be considered particularly in areas that have been designated as good candidates for large-area understory burns, including the Wilderness.

Pre-attack planning should be addressed in this and adjacent watersheds to determine the need and placement of water sources, helispots, communication links, and other areas of concern.

Fireline construction using bulldozers or other heavy equipment on weak geologic units (e.g., melange or other sheared bedrock) needs to be scrutinized for unacceptable negative impacts and construction should be avoided where possible. Safety and suppression effectiveness would continue to be the highest priority in all areas. Location maps of these sensitive areas should be made available to the Emergency Command Center well in advance of fire season to be incorporated on run cards.

Related Data Gaps : None.

D. FUELS MANAGEMENT

Key Findings :

Fire will continue to be a part of the ecosystem, and the use of fire through prescribed burning provides an opportunity to restore ecosystem processes, to improve and maintain wildlife habitat, and to reduce hazards. Adjusting the timing, intensity, and strategy of prescribed burns will be necessary to minimize impacts on human welfare and to maximize benefits to forest resources.

As an example, it may be less destructive to use "natural" differences in fuel moisture to restrict the extent of prescribed burns within riparian areas as opposed to putting in handlines. Also, in areas near population centers, smoke management concerns may require modification or the finding of alternative burning prescriptions.

Recommended Action :

Consider and implement appropriate fuel treatments based on assessments of site-specific wildfire risk and hazard and the requirements of other resources.

Related Strategies :

Non-critical

Vegetative management and/or natural fuels reduction needs to be considered in certain areas of the watershed, while addressing potential risk, hazard, and values. Removing ladder fuels through thinning, mechanical treatment, or understory burning could reduce the potential for crown fires. Specific areas that could benefit from fuel treatment include: oak woodlands to deter conifer encroachment and maintain the acorn supply for Native Americans; prescribed natural fire in those parts of the Wilderness with rocky ridges and natural fire barriers; and, LSRs where fuel loadings and arrangements present an unacceptable hazard.

The goal of fuel treatments, alternative suppression strategies, and silvicultural techniques should be a return to "natural" fire regimes of frequent, low-intensity fires. Prescribed fire should be used to help reintroduce fire into the ecosystem and reduce accumulated fuels that contribute to stand-replacing fire events.

In order to keep fire within its natural return frequency, a reburn schedule will have to be planned and committed to. After the initial burn, future treatments will require much less planning and personnel, thus reducing associated costs. Under moderate weather conditions, some wildfires may respond with low-to-moderate fire severity, in a fashion similar to a prescribed burn. This may allow the use of alternative suppression strategies.

Strategically-placed shaded fuelbreaks should be considered to improve access safety for firefighters along primary roads and ridges, to provide defensible locations to prevent wildfires from either entering or leaving National Forest

lands, and as anchor points for large area understory burning projects. Shaded fuelbreaks could also be used as a first step in isolating and protecting areas where understory burning may not be currently desired or practical (e.g., LSRs, plantations, logged land exchange areas, Botanical Areas). These fuelbreaks could reduce the need to construct the wide dozer firelines often needed for large fires, as well as reduce the potential impacts to resources from heavy equipment and the need for intensive rehabilitation.

Concentrations of fuels created by management activities should be reduced according to site-specific wildfire risk so that the wildfire hazard level of the surrounding area is not increased to an unacceptable level. The selected treatment methods should consider resource values and environmental limitations as well as costs.

Inherent risks in under-burning should be recognized and accepted. Large area burns must be the norm, both for economic and ecological efficiency, and some degree of mortality must be accepted as a natural outcome of having fire play out its natural role in the ecosystem. Large areas may burn in mosaics with varying fire intensity and severity. While this may mimic natural under-burning, the resource objectives of the retention of coarse woody debris and preservation of remaining trees and snags increase the likelihood for reburning, spotting, and the killing of some trees. Killed trees could either be left standing to provide snags and downed logs later on or they could be removed. There is also the increased possibility for a prescribed burn to escape the planned burn area, but it is anticipated that prescribed burning under advantageous weather conditions may reduce subsequent detrimental wildfire effects by decreasing available fuel and breaking up the fuel ladder.

Prescribed fire is currently the most economical treatment available for managing forest fuels. In some cases, other more expensive fuel treatment methods such as handpiling and/or rearrangement of fuels will need to be implemented to achieve environmentally and ecologically sensitive objectives. Hazard reduction objectives also may be satisfied through biomass utilization (if there is a market demand) or stand structure manipulation. These alternative fuel treatments may be combined with prescribed burning to reduce the fuel loading to acceptable levels before actual burning.

Pre-burn planning in the North Fork Eel River watershed should assess the potential for the spread of exotic plants from off-site and on-site sources. Care must be taken when dealing with the invasion of exotic plant species. Repetitive burning may eliminate these species, but it might also remove desirable plant species from the seed bank.

Silvicultural treatments and fuel treatments, including prescribed fire, should be used to improve wildlife habitat by: (1) thinning in early-mature stands within NSO activity centers to accelerate development of late-seral characteristics; (2) creating canopy gaps of 0.25-0.5 acres in suitable mid-mature stands to potentially enhance horizontal and vertical vegetation diversity in the stand; and, (3) reducing fuel loadings and ladder fuels in order to reduce the risk of high-intensity fire.

Related Data Gaps :

Critical

Fire effects data are lacking, including effects on native and exotic plant and animal species. Adaptive management strategies provide an opportunity to experiment with burning prescriptions which affect fire intensity and burning duration. Studies to determine the effect of smoke on nesting birds and their young need to be initiated. Helicopter ignition is often used during prescribed burning operations, and the effect of helicopter noise on nesting bird species is also a current concern.

Non-critical

Data on fire regimes (distribution, intensity, and frequency) are somewhat limited for the entire Eel River Basin. Fire frequency data are not available before the 1910s for National Forest land and before 1980 for private land. Further data analysis would be necessary to determine the fire regime for this watershed.

Fire monitoring plots should be established in selected sub-series of interest (e.g., oak woodlands) to assess the short-term and long-term effects of fire on the ecosystem. The protocol used for fire monitoring includes the collection of basic information, detecting identified trends, and ensuring that fire and resource management objectives are met.

Fuel treatments, alternative suppression strategies, and silvicultural techniques need to be investigated with the goal of returning to "natural" fire regimes of frequent, low-intensity fires. Large fires may have occurred historically, but their intensity has increased dramatically, as demonstrated by the Travis Fire.

ISSUE 3: NORTH FORK EEL RIVER WATERSHED CONTRIBUTION TO TES SPECIES RECOVERY

A. FULFILL ROD REQUIREMENTS FOR TES SPECIES

Key Findings :

Peregrine falcon and spotted owl occupy the North Fork Eel River watershed. Critical and other key habitats have been designated on Federally managed lands for protection. These habitats are essential to the recovery of these species. However, there is little current data specific to the watershed for either species. Monitoring of occupied habitat is essential to determine how successful current direction is at maintaining suitable habitat and stable or increasing populations. There are opportunities to accelerate the development of early- and mid-mature habitat towards functional mature and late-successional conditions. Some of the most suitable habitat on National Forest lands in the Eel River Basin were surveyed for marbled murrelet in 1995; none were detected. These surveys will be repeated in the Douglas-fir vegetation series in 1996 to determine whether the Mad River Ranger District has suitable habitat.

Recommended Actions :

Peregrine falcon monitoring — Province-wide and interagency:

Cliff evaluation at occupied sites to determine if ledges are active or potential; possible further actions are maintain ledges, improve them (e.g., increase size), or create alternate ledge sites.

Complete territory management plan (Recovery Plan, Item 325).

Determine management needed to protect site from disturbances (fire and human), and maintain foraging habitat within RMR.

Snag inducement near active sites if roost/perch sites are lacking.

Pond improvements to favor riparian prey species (e.g., ducks).

Spotted owl:

Complete LSR assessments for Six Rivers National Forest LSR 307 and BLM LSRs 320 and 321.

Survey known activity centers to determine current occupancy.

Review "take" assessments at occupied activity centers to manage habitat deficient owl areas towards recovery by accelerating succession. Evaluate atypical habitats that are contributing suitable NRF habitat.

Evaluate early-mature stands less than 80-years of age for thinning.

Evaluate early-mature stands 80- to 120-years for thinning with REO review and approval.

Determine the LSR's vulnerability to fire, and identify high hazard areas.

Manage fuels along open primary and secondary roads to reduce hazard.

Manage road access to reduce fire risk and seasonal disturbance, and to minimize loud and continuous disturbances during critical periods.

Decrease fragmentation by identifying fragmented stands and finding opportunities to increase growth.

100-acre LSRs in Matrix:

Evaluate vulnerability to fire and disturbance.

Manage fuels adjacent to stands to reduce risk of stand-replacing fire.

Manage road access to reduce fire hazard and disturbance.

Related Strategies :

Critical

Continue implementation of Recovery Plan action items, in consultation with the U. S. Fish and Wildlife Service (USFWS).

Related Data Gaps :

Critical

Complete Range and Distribution Study for the marbled murrelet, at least in the Douglas-fir series. Consult with the USFWS at the completion of this study to determine the suitability of forest habitat on the Mad River Ranger District (Six Rivers National Forest) and the Mendocino National Forest.

Monitoring of northern spotted owls could serve multiple purposes: effectiveness monitoring for the Northwest Forest Plan, analysis of suitable habitat being used in this watershed, and baseline biological data for LSRs.

Non-critical

Continue to survey for Federally listed Threatened and Endangered species. These surveys could: eliminate the need for limited operating periods; provide information on species occurrence and habitat use; and act as indicators to determine if the LSRs are contributing to the recovery of these Federally-listed species as intended. Priority species would be marbled murrelet, northern spotted owl, peregrine falcon, and Proposed Species.

Conduct studies of the habitat being used by the northern spotted owl to determine if other than typical habitat should be considered suitable in this watershed. This analysis could possibly change the amount of suitable habitat in the take assessment circles.

B. FULFILL ROD REQUIREMENTS FOR OTHER SPECIAL STATUS SPECIES

Key Findings :

The goshawk appears to be declining forest-wide. Pacific fisher and northern goshawk are known to occur in the Eel River Basin, but their current number or distribution are not well-known. The American marten and willow flycatcher may also occur, but potentially suitable habitat for these species is limited and may be too isolated for regular use. The LSRs are expected to provide enough suitable habitat to support reproductive pairs of both species.

The western pond turtle, foothill yellow-legged frog and tailed frog also occur in the North Fork Eel River watershed but only the yellow-legged frog appears to be widely-distributed.

Key summer and winter range for black-tailed deer occur in the watershed. Subsistence hunting and poaching is common in this remote area. Key deer foraging habitats, such as oak woodlands and grasslands, have undergone dramatic changes, and exotic plant species now provide a substantial part of the forage resource.

There are no known sites of Survey and Manage invertebrate wildlife species in the North Fork Eel River watershed. The red tree vole has been reported in the watershed.

Recommended Actions :

All Special Status species: Need to validate the assumptions that LSR, Riparian Reserve, and Forest Plan direction adequately provides for other late-successional species with surveys that identify occupied habitat and successfully breeding sub-populations. Determine whether marten or willow flycatcher are likely to occur in this watershed.

Northern goshawk: Evaluate historic sites and potentially suitable habitat for occupancy. Review area assessments (0.5-mile circle) to manage deficient goshawk sites toward recovery (i.e., selective thinning and prescribed burns).

Black-tailed deer: Evaluate road densities/access in key summer and winter ranges, and manage access to reduce poaching. Evaluate oak woodlands, chaparral and annual grasslands forage production, and the relative quantities deer are likely to use. Provide forage allocation for deer in updated Range Project Decision documents.

Protection Buffer Species: Certain Standards and Guidelines (S & Gs) incorporated from the Scientific Analysis Team (SAT) report will result in protection for certain rare and locally endemic species in LSRs (ROD, page C-19), and Matrix (ROD, page C-45). Briefly, mitigation measures for white-headed woodpecker and flammulated owl involve maintenance of adequate numbers of large snags and green-tree replacements for future snags (ROD, page C-46).

Bats: When Special Status bats are present, a buffer of 250 feet around the site is maintained until guidelines are developed for the site. Since some bat species are very susceptible to disturbance, surveys should be conducted or coordinated by state-certified bat biologists. Mitigation measures may include bat accessible barriers that close caves or mines, seasonal closures of caves, retention of snags and hollow living trees (Interagency Scientific Committee, 1995).

Evaluate Riparian and Wetland communities for Riparian Reserve status and improvement opportunities.

Related Strategies :

Critical

The basic strategy for Special Status species is to ensure adequate consideration during project design and sufficient protection (mitigation) during project implementation to preclude the listing of these species.

Specific S & Gs for bats apply to land in the Matrix (FSEIS ROD, page C-43). In general terms, these S & Gs include the necessity of the surveying of caves, mines, and abandoned wooden bridges and buildings for the presence of bats (Interagency Scientific Committee, 1995). Occupied caves should be evaluated for nomination under the Federal Cave Resources Protection Act of 1988.

Standards and Guidelines for Survey and Manage (S & M) species benefit amphibians, mammals, bryophtes, mollusks, vascular plants, fungi, lichens, and arthropods. Table C-3 in the ROD (pages C-49 to C-61) shows which species are involved. Surveys for other species under Survey Strategy 2 (ROD, Table C-3) must be completed prior to activities implemented in 1999 or later.

Riparian Reserve widths recommended in the ROD should be retained until further studies on potentially unstable inner gorge areas, use as wildlife corridors, and provision of habitat for riparian-dependent species are completed.

Develop protocol for surveying non-vascular Survey and Manage species and acquire the expertise necessary to implement protocol.

Related Data Gaps :

Critical

Surveys for Del Norte salamander must precede the design of all ground-disturbing activities that will be implemented in 1997 or later. Also need to survey for other Special Status species (including S & M species). These surveys could eliminate the need for limited operating periods (LOP); provide information on species occurrence, distribution, and habitat use; and evaluate how well LSRs serve as refugia for old-growth dependent species as intended. Priority species would be northern goshawk, fisher, marten, willow flycatcher, and other ROD-designated and S & M species.

Non-critical

Identify special habitats, including caves, mines, old buildings, wooden bridges, ponds, seeps, talus deposits. Survey and inventory Special Status species associated with these special habitats.

Review wetlands classification and develop crosswalk to USFWS Wetlands Classification System.

Consider further monitoring of tailed frogs. This species may be an indicator of stable aquatic zones and may also indicate when riparian zones have recovered in terms of water quality.

ISSUE 4: NORTH FORK CONTRIBUTION TO PRESERVE ANADROMOUS STOCKS IN THE EEL RIVER BASIN

A. IMPROVE RIPARIAN CONDITIONS

Key Findings :

Public priorities for riparian restoration include: planting streamside vegetation to increase shade, decrease water temperature, provide large wood recruitment, and control streambank erosion and landsliding; and, the correction of upland erosion that may affect riparian areas by planting activities on landslide scars.

Recommended Actions :

Identify areas where restoration can augment natural site recovery. The best candidates are sites that have partly stabilized and where increased revegetation can help to "hold" the site over the long-term.

Consider installing in-stream structures to form complex, deep pool habitat for aquatic species, based upon biological and habitat data.

Consider planting projects to restore riparian vegetation that will provide stream shade.

Related Strategies :

Critical

Inventory landslides for potential revegetation on National Forest lands in the watershed (scheduled for Fiscal Year 1996). Focus on subwatersheds with known high quality fish habitat. Revegetation activities would likely occur on some of these slides during the next several years.

Inventory road-related sediment sources on Forest Service roads (and possibly some private roads) within the watershed to find and correct site specific problems (also scheduled for Fiscal Year 1996). High priority areas include parts of "high value" subwatersheds (West Fork, Bluff/Kettenpom, Red Mountain, Hull's, Asbill, and possibly Soldier Creek) with high drainage densities, and older roads located on melange or sheared bedrock. Other sediment sources, such as gullies and areas impacted by heavy grazing, could also be inventoried and included in a list of priorities for the entire watershed.

Non-critical

Explore cooperative efforts with private landowners and other groups to restore riparian vegetation, reduce erosion and sedimentation, and to manage grazing — especially in riparian areas.

Related Data Gaps :

Critical

Data collected in the 1995 field season in the North Fork Eel River watershed on riparian vegetation structure and function needs to be analyzed to help guide future restoration or rehabilitation work. These data will also help to establish Riparian Reserve boundaries.

Non-critical

Need more biological information (e.g., species composition and distribution) about exotic plants and their effects on native populations.

Need to conduct watershed-wide stream habitat inventories to help prioritize protection or restoration in various subwatersheds.

B. RESTORATION RELATED TO ROADS

Key Findings :

Public surveys indicate that roads, gully and other erosion, replanting, stream protection, private/public partnerships, and prescribed burning are the priorities for restoration in the North Fork Eel River watershed.

The following subdrainages are especially important for protection and/or enhancement because they are already providing good fish habitat and supporting good densities of salmonids: West Fork, Bluff/Kettenpom, Red Mountain Creek, Hull's Creek, and Asbill Creek.

Road types, maintenance levels and locations are known at this time, but road conditions are not adequately known for the watershed. Given the unstable and erodible nature of much of the watershed, roads pose a high risk of creating or contributing to serious erosion during a large storm event (Table 22). Many roads in this watershed also contribute sediment on an annual basis, as shown by numerous gullies related to surface runoff from roads.

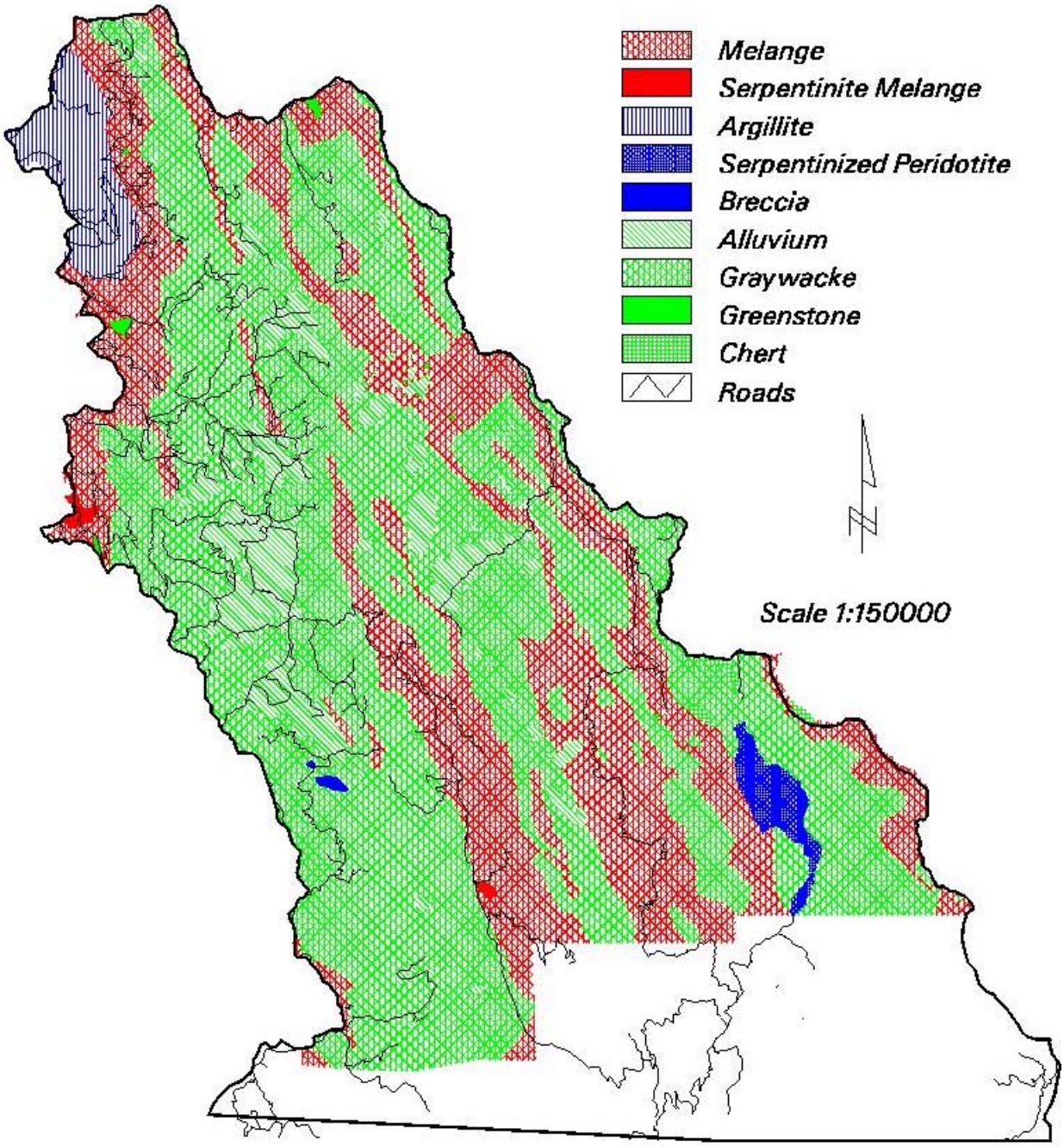

Figure 22. Bedrock geology and roads for Six Rivers National Forest land within the North Fork Eel River watershed.

Recommended Actions :
In the subdrainages with the best remaining fish habitat (as listed above), protect Federally managed lands where good conditions exist and restore deteriorated areas where feasible. Emphasize decommissioning and flood-proofing of roads in these subwatersheds, especially areas underlain by melange, to maximize the likelihood of cost-effective restoration efforts.

Also evaluate the feasibility and cost-effectiveness of restoring natural hillslope drainage within melange. This may require full outsloping of the road prism back to a near-natural hillslope configuration.

Although a large fraction of sediment input is from naturally occurring debris slides, there are many opportunities to reduce sediment production and delivery from roads. Priority restoration work includes: decommissioning roads in problem areas, especially where mass failure is particularly severe (e.g., south side of Grizzly Mountain); designing culverts to withstand 100-year storms; installing waterbars; applying protective aggregate surfacing to prevent gullying; armoring existing culvert outlets in erodible terrain; and, stabilizing landslide scars.

Minimize the potential for road drainage increasing peak flow in small streams within the watershed due to interception of groundwater flow. Increased peak flows could release stored sediment from these small channels and adversely affect downstream fish habitat.

Related Strategies :

Critical

Decommissioning and other road restoration may need to consider relevant geologic site factors that could affect project success. Generally, a geomorphic site map will show relevant stability and sedimentation considerations for the geologic materials that are present. The presence of sheared materials would be especially important to note. Site investigations should identify: evidence of existing or potential slope instability; specific ways the project could affect sediment production or transport; potential for the project to change groundwater regimes; and, any design modifications or maintenance that would be needed because of those conditions.

Consider public access needs as part of restoration planning.

Non-critical Opportunities for Forest Service and BLM partnerships with private landowners and Tribal governments should be explored to better define access and road restoration needs. An example is the recently initiated partnership between the Mad River Ranger District, the National Resource Conservation Service, and the Trinity County Resource Conservation District to promote restoration on private lands.

The road network on private lands is denser and may pose greater risks to fish habitat than the road network on public lands. Road maintenance, repair and restoration may be too expensive for small landowners. Where possible, assist or encourage private landowners to acquire relevant geologic information (such as texture of geologic materials present, indicators of abnormal groundwater conditions, and indicators of incipient slope instability) before prioritizing or beginning road restoration work on their lands.

Purchase or contract with local professional and skilled services, and determine where they can be used instead of practicing seasonal hiring; would need to develop a skills bank to implement.

Related Data Gaps :

Critical

An inventory of road-related sediment sources on Forest Service roads in the watershed is scheduled to begin in Spring 1996. Roads will be prioritized for inventory according to the following criteria: presence of melange and sheared bedrock, drainage density, age of road, and location within an "important" subwatershed (West Fork, Bluff/Kettenpom, Red Mountain and possibly Soldier Creek). A complementary inventory would be desirable on private lands in Hull's and Asbill Creeks.

Non-critical

The general relationship between geologic substrates and road-related sedimentation problems is known, but the specific relationships between site factors and road system failures are not as clear. As road inventories are conducted for watershed improvement opportunities, documentation of geologic site factors could improve our knowledge of these relationships, and hence the predictability of future problems. Questions that may be addressed include: what are the indicators of groundwater perturbations at sites where fills have saturated and failed?; what particular melange or weathered greywacke textures are commonly associated with cutslope failure that may lead to blocking of inboard ditches?; and, what are typically stable and unstable cutslope heights in melange terrain?

C. OTHER WATERSHED RESTORATION

Key Finding :

Natural disturbance rates and sedimentation in the North Fork Eel River watershed appear to be much more significant than those caused by management disturbances. Stabilization of existing natural features does not appear feasible because of their size, their location primarily within inner gorges, and the amount of engineering and equipment that would be required to attain worthwhile results.

Recommended Actions :

Identify areas where we can augment natural site recovery. Sites that are partially stabilized and where increased revegetation can "secure" the site over the long term are the best candidates. Surface vegetation treatments of landslide scars may be successful in some cases.

Consider installing in-stream structures to form complex, deep pools, and habitat for aquatic species, based on biological and habitat data.

Consider planting projects to restore riparian vegetation that will provide stream shade.

Related Data Gaps :

Critical

An inventory of landslides for potential re-vegetation on National Forest lands within the mainstem and major tributaries is scheduled for Fiscal Year 1996. This inventory is concentrated in sub-watersheds with known high quality fish habitat. Revegetation work should occur on some of these slides during the next several years.

Non-critical

Other sediment sources, such as gullies and areas impacted by heavy grazing, could also be inventoried and included within a list of priorities for the entire watershed.

Burning and replanting of timber sale units has occurred within the Eel River Basin. The effects of such activities on mass wasting and sediment regimes are unknown and should be examined to determine if there are impacts to the landscape.

ISSUE 5: FEDERAL ACCESS STRATEGIES

A. ROAD SYSTEM MANAGEMENT

Key Finding :

Road types, maintenance levels and locations are known, but road conditions are not adequately known for the North Fork Eel River watershed. Administrative costs of developing projects are usually high in isolated and inaccessible areas. Intermingled ownership of Federal, State, Tribal lands in the watershed may create additional problems with conducting economically viable projects.

The North Fork Eel River's status as a Key Watershed requires that there be no net increase in road miles. Parts of the terrain are highly susceptible to disturbance. Any new roads through sensitive areas may further increase sediment production in the watershed despite potential offsetting effects of decommissioning other roads. Roads may capture subsurface flow and thereby increase surface runoff into small drainages or cause gully erosion; the increased sediment yield can negatively affect aquatic habitat. These effects are most common where large cuts and fills are placed in melange terrain.

Recommended Actions :

Develop an Access Travel Management Plan for this watershed. It should contain pertinent road data, identify access needs, and address potential problems and priorities. Areas that should be emphasized are: road status (open, blocked, temporary or abandoned); stream crossing integrity (including diversion potential); road surfacing (existing or needed); road drainage (insloped/ditched or outsloped); and needs for seasonal closure.

Minimize new road construction within this watershed. Any new roads should be located on competent geologic units with low-to-moderate slopes as much as possible. New roads proposed on steep slopes or on weak geologic units (melange, other sheared bedrock) need to be reviewed very carefully and alternative means of access explored to avoid disturbing critical hillslope processes and increasing sediment yield to streams.

New roads should avoid large cuts and inboard ditching in melange terrain. Drainage conditions of existing roads that will be kept open (especially in melange terrain) should be reviewed and modified to an outsloped configuration where necessary and feasible.

Related Strategies :

Critical

Minimize the potential for road drainages causing increased peak flow in small streams within the watershed by outsloping and waterbarring.

Non-critical

Quality aggregate sources appear to be relatively scarce within or near the North Fork Eel River. This limited resource should probably be managed prudently, although adequate quantities of good quality rock may be available within a reasonable (economically) distance for maintaining or upgrading these roads.

Consolidate inholdings that will provide better access for recreation development, particularly in Wilderness, and reduce administrative costs to enhance the economic feasibility of some projects and to allow for more effective maintenance of facilities and roads.

Related Data Gaps : None.

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