Lower McCloud River Watershed Analysis

Shasta-Trinity National Forest
Shasta-McCloud Management Unit

3/18/98

Preface

This Watershed Analysis is presented as part of the Aquatic Conservation Strategy adopted for the President's Plan (Record of Decision for Amendments to Forest Service and Bureau of Land Management Planning Documents within the Range of the Northern Spotted Owl, including Standards and Guidelines for Management of Habitat for Late-Successional and Old-Growth Related Species (ROD)).

The preparation of a Watershed Analysis for the Lower McCloud River Watershed follows direction in the Aquatic Conservation Strategy that requires watershed analysis "for roadless areas in non-Key Watersheds, and Riparian Reserves prior to determining how land management activities meet Aquatic Conservation Strategy objectives" (ROD B-20).

This document follows the format provided in Part 2 of *Ecosystem Analysis at the Watershed Scale: Federal Guide for Watershed Analysis - Version 2.2* (August 1995). This format consists of six steps:

1. Characterization of the watershed
2. Identification of issues and key questions
3. Description of current conditions
4. Description of reference conditions
5. Synthesis and interpretation of information
6. Recommendations

This document is guided by two levels of analysis:

- **core topics** - provide a broad, comprehensive understanding of the watershed.
  Core topics are provided in the Federal Guide for Watershed Analysis (8/95) to address basic ecological conditions, processes, and interactions at work in the watershed.
- **issues** - focus the analysis on the main management questions to be addressed.
  Issues are those resource problems, concerns, or other factors upon which the analysis will be focused. Some of these issues prompted initiation of the analysis. Other issues were developed from public input in response to scoping or were identified by the team during the analysis process.

Key analysis questions are developed for each issue. These questions are organized by analysis step to help focus the analysis and to provide organization to the document while addressing the issues.

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Chapter 1

Characterization of the Watershed

The purpose of this chapter is to identify the dominant physical, biological, and human processes or features of the watershed that affect ecosystem functions or conditions. The relationship between these ecosystem elements and those occurring in the river basin or province is established. This chapter provides the watershed context for identifying elements that need to be addressed in the analysis.

The major topics covered in this chapter are:

- Location
- Watershed Setting
- Relationship to Larger-Scale Settings
- Physical, Biological and Human Features
- Land Allocations and Management Direction

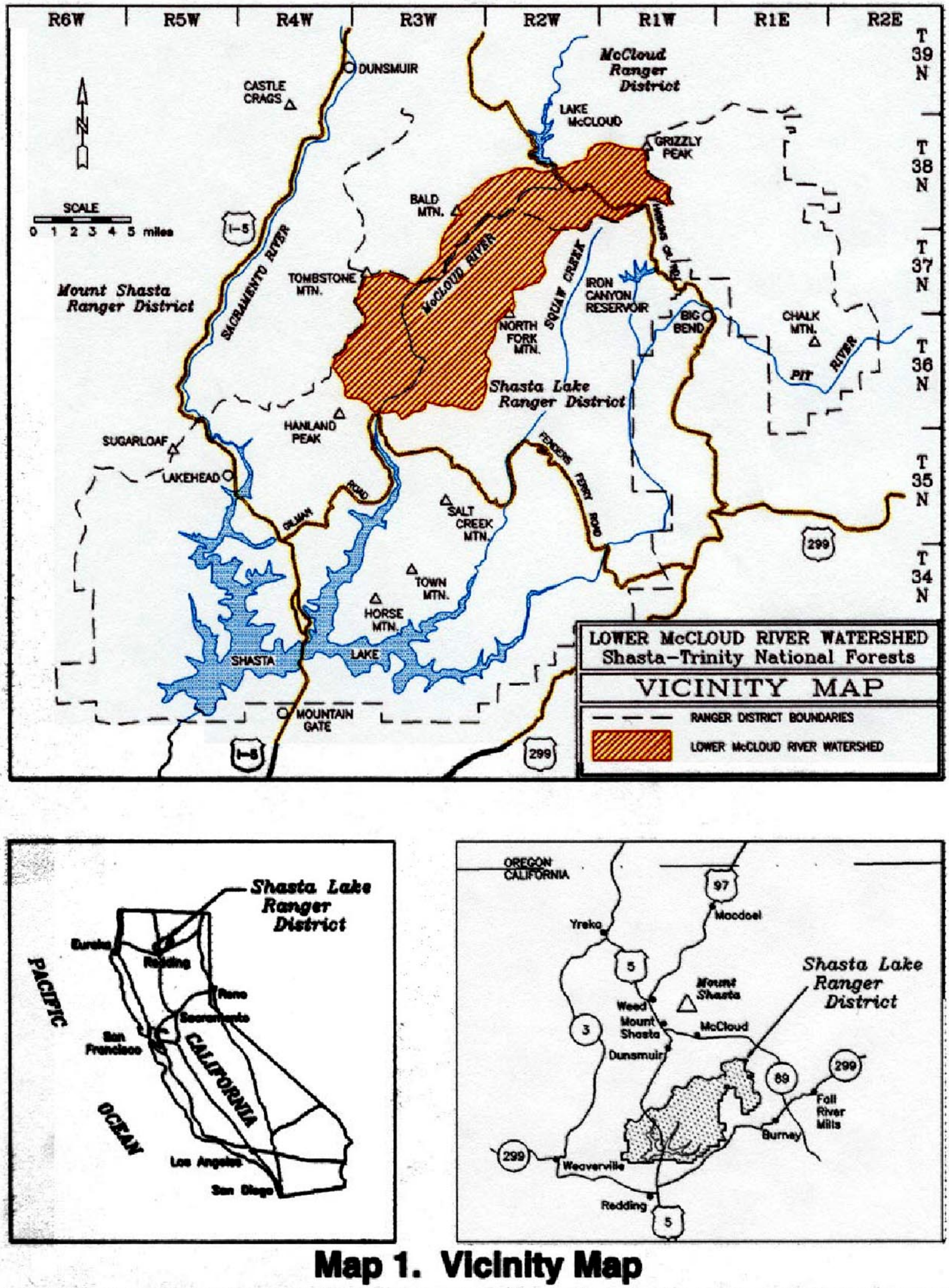
Location

The Lower McCloud River Watershed is located along the Lower McCloud River Canyon between Lake McCloud and Shasta Lake. The watershed is located about 35 miles north of Redding, California and lies within Shasta County. The entire watershed falls within the boundary of the Shasta-Trinity National Forest (see Map 1 - Vicinity Map).

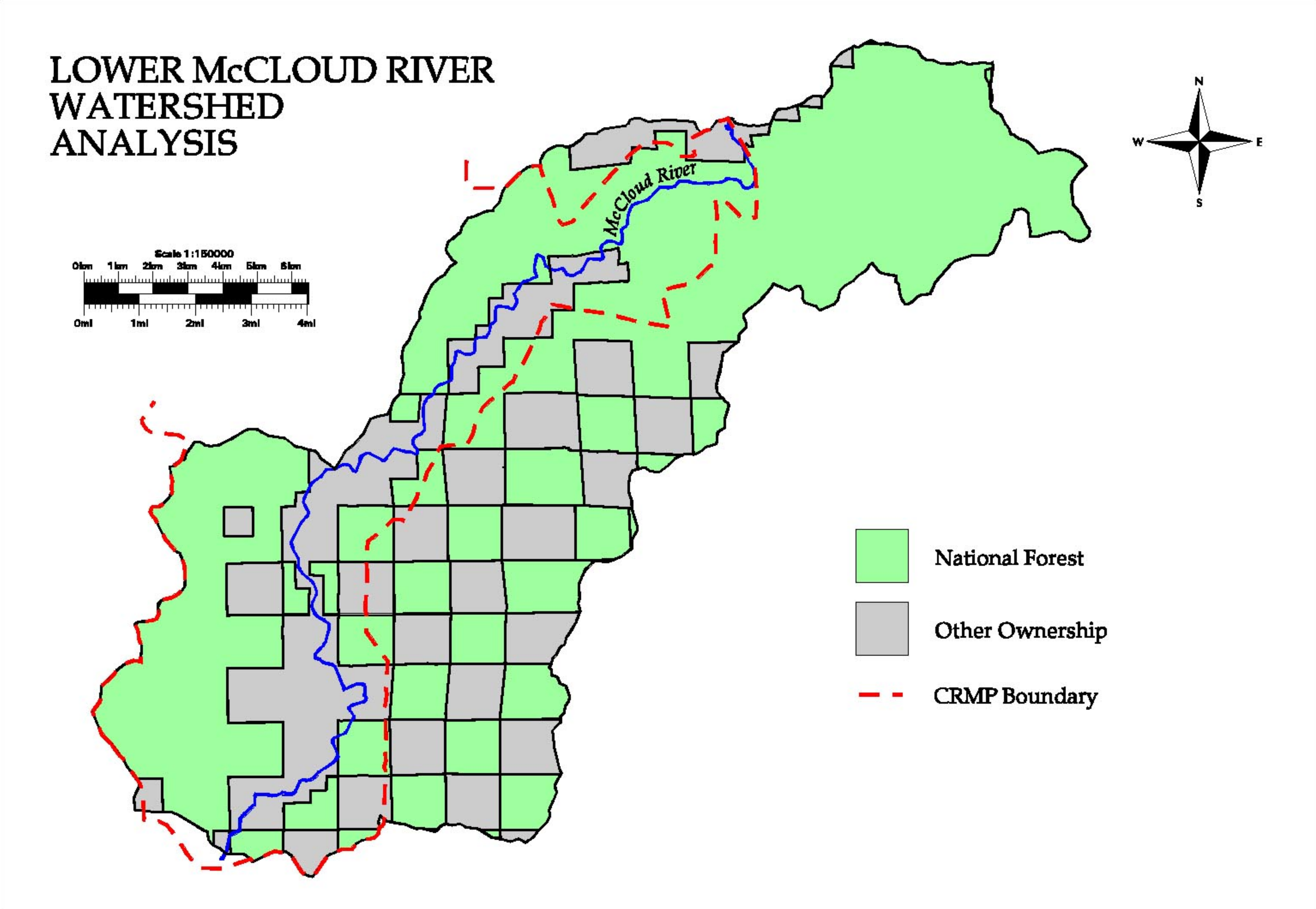
Watershed Setting

The Lower McCloud River Watershed is about 67,070 acres in size, of which 45,120 acres are National Forest. Watershed boundaries used in this analysis include the area drained by the McCloud River from Lake McCloud downstream to McCloud Bridge, where the river enters Shasta Lake. The Hawkins Creek, Claiborne Creek, and Chatterdown Creek sub-watersheds are included in the Lower McCloud River Watershed. However, Squaw Valley Creek is considered as a separate watershed and will be included in a future analysis.

The majority of the watershed is characterized by a checkerboard land ownership pattern. A corridor of mostly private land follows the McCloud River. Large blocks of National Forest land occur in the Hawkins Creek drainage and along the major ridge that forms the southwest border of the watershed. The land ownership pattern for the watershed is displayed on Map 2 - Land Ownership.



Map 1. Vicinity Map



Map 2. Land Ownership

Relationship to Larger-Scale Settings

Many physical, biological, and human processes or features span areas much larger than a watershed. To appropriately characterize and analyze specific aspects of the watershed, the watershed needs to be placed in its logical setting with respect to these larger scales.

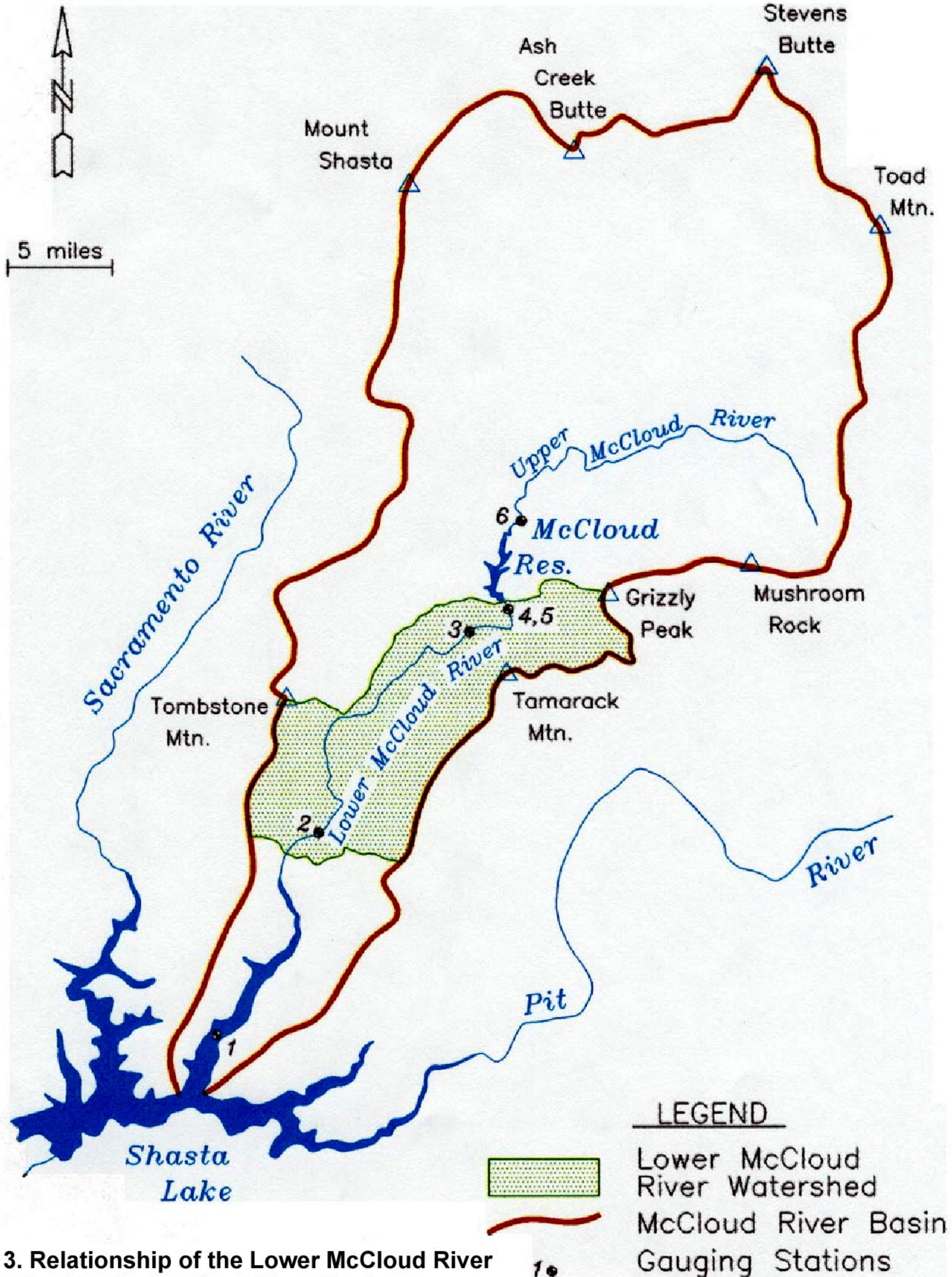
Two larger-scale settings need to be considered when addressing the Lower McCloud River Watershed:
- The McCloud River Basin
- Late-Successional Reserve RC-335

The McCloud River Basin
The McCloud River Basin drains an area of roughly 800 square miles. Its headwaters are at Colby Meadows near Bartle. The river flows southwesterly for approximately 50 miles to its terminus at Shasta Lake (see Map 3 - McCloud River Basin).

Physical conditions and land use patterns in the McCloud River Basin are best described by dividing the basin into three sections:
1. The Upper McCloud River (above Lake McCloud)
   - Terrain is generally flat to gentle slopes and includes the McCloud Flats.
   - Vegetation consists of mixed-conifer and ponderosa pine forest.
   - Land use is predominantly timber management and grazing with recreation use concentrated along the river
2. The Lower McCloud River (between Lake McCloud and Shasta Lake)
   - Terrain consists of a deep canyon through which the river flows.
   - Vegetation is predominantly mixed-conifer and Douglas-fir forest. A large area west of the McCloud River is dominated by hardwoods and chaparral vegetation.
   - Timber management has occurred in the Hawkins Creek drainage and the upper slopes on the southeast side of the river. Most of the remainder of this portion of the river basin remains essentially unroaded.
3. The McCloud Arm of Shasta Lake
   - Terrain consists of a deep canyon through which the river flows. However, this section of the river has been inundated by Shasta Lake.
   - Vegetation is predominantly gray pine, knobcone pine, and chaparral.
   - High density recreation use occurs on the lake and its shoreline. Much of the remaining area is rugged, inaccessible, and essentially unroaded.

Late-Successional Reserve RC-335
The Lower McCloud River Watershed is one of six watersheds within or crossing Late-Successional Reserve (LSR) RC-335 (see Map 6 - Late-Successional Reserve RC-335). On an even larger scale, both the Lower McCloud River Watershed and LSR RC-335 need to be considered in relationship to adjacent LSRs (see Map 7 - Adjacent Late-Successional Reserves) and how linkage is provided across the landscape.

Further discussion is found on page 1-8.



Map 3. Relationship of the Lower McCloud River Watershed to the McCloud River Basin

Physical Features

Dominant Physical Features

The dominant physical feature of the Lower McCloud River Watershed is the main canyon through which the river flows. Although the river flows at elevations of approximately 1500 to 2500 feet above sea level, elevations along the major ridges surrounding the watershed are roughly 4500 to 5000 feet. The highest elevation is at Grizzly Peak (elev. 6252 feet).

Lake McCloud is located at the upstream end of the watershed. The watershed drains into Shasta Lake at the downstream end.

Dominant features in the watershed are shown on Map 4 - Dominant Physical Features.

Climate

The Lower McCloud River Watershed is characterized by the highest rainfall on the Shasta-Trinity National Forests. Mean annual precipitation exceeds 70 inches throughout the watershed. The Claiborne Creek and Chatterdown Creek drainages exceed 80 inches. Most of the precipitation is from winter storms of several days duration and moderate intensity. Approximately 90% of annual precipitation occurs from October through April.
Warm, dry summers are punctuated by occasional thunderstorms.

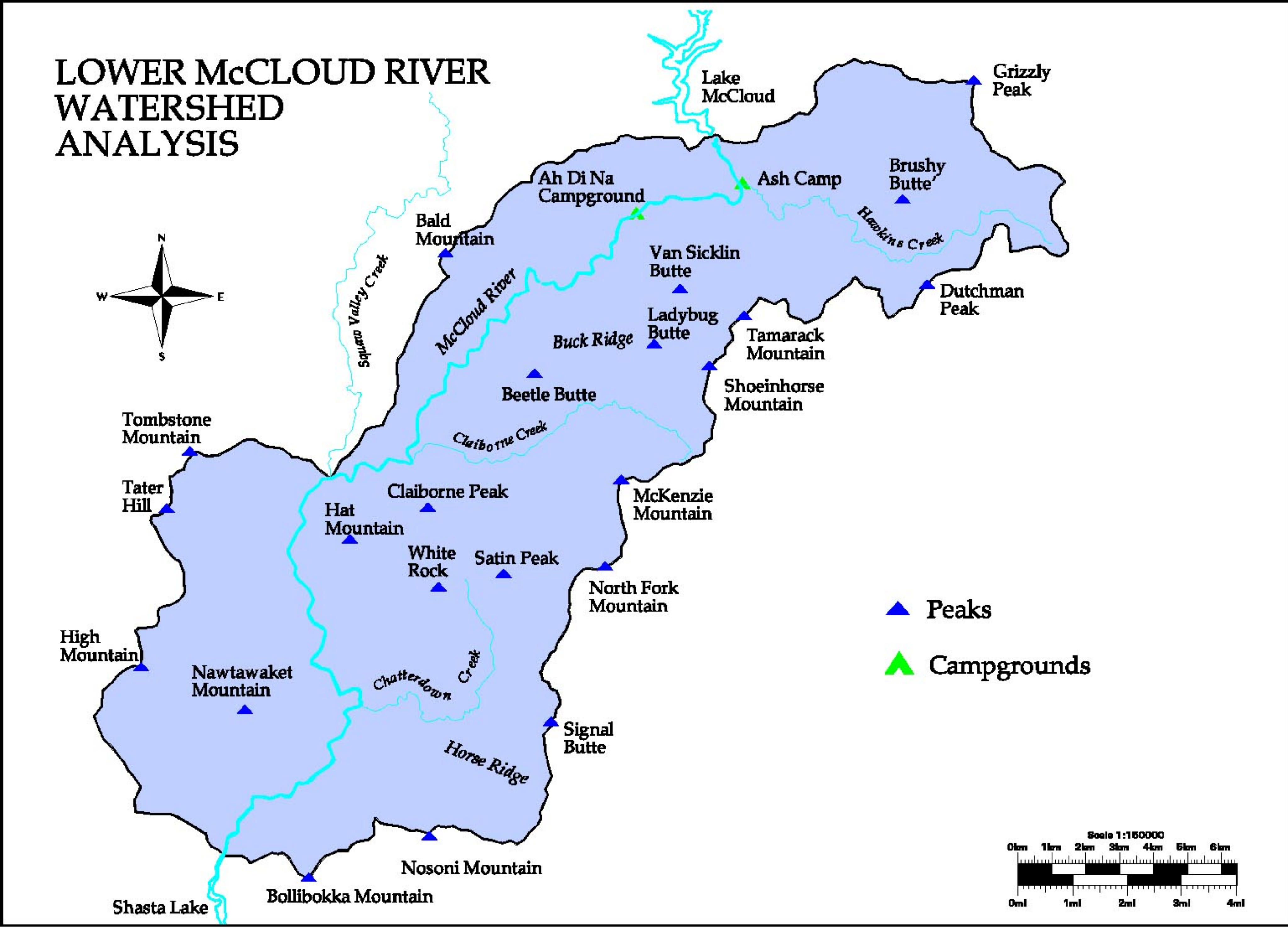
Erosion Processes

The Lower McCloud River Watershed has a moderate to high potential for mass wasting events. This potential is proportionately higher in the steeper inner gorge areas and in response to extreme precipitation events. Under undisturbed conditions, mass movement events are relatively rare.

Soils in the analysis area are shallow and stony and have slow rates of natural erosion. Given the steep slopes and high rates of precipitation, some degree of natural surface soil erosion is normal in this watershed. The threat of catastrophic wildfire presents a potential to seriously increase hillslope erosion.

Hillslope erosion processes in the Lower McCloud River Watershed have been altered by timber harvest and road construction. Roads have had the greatest impact on the erosion processes. The majority of road related impacts are greatest south and east of the McCloud River where road densities are highest (see Map 5 - Transportation System). Recurring road problems include rutting, fill slope failures, plugged culverts and drains, and minor slumps and slides. Road systems have also disrupted drainage patterns on hillslopes resulting in increased hillslope erosion and gullying.

Most land-use activities have increased the hillslope erosion processes; however, the impacts from most of these activities tend to be relatively short lived. Areas impacted by timber harvesting have revegetated. Roads that have not experienced use over the last decade have revegetated and appear to have stabilized.



Map 4. Dominant Physical Features

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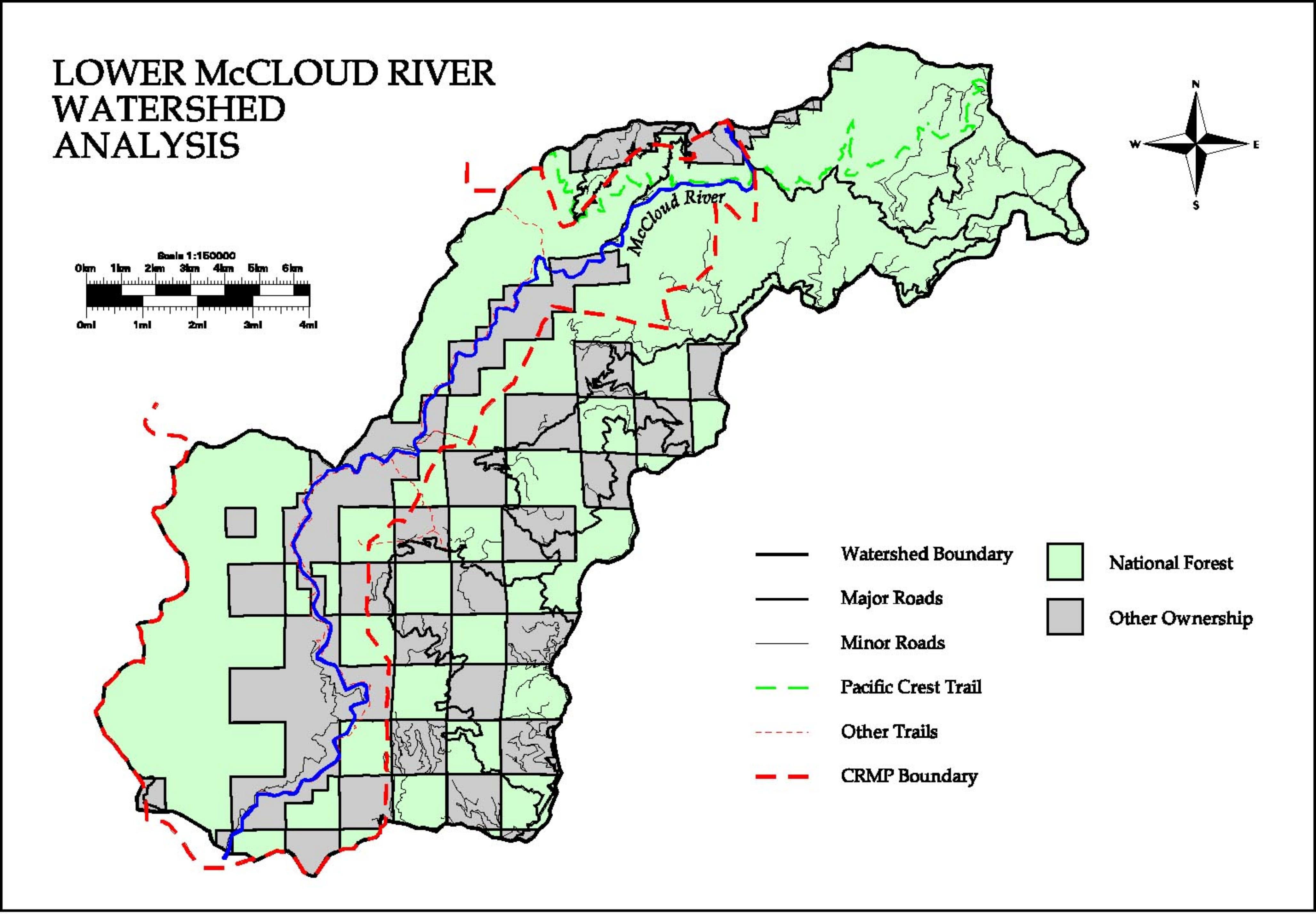


Map 5. Transportation System

The effectiveness of fire detection and suppression in the watershed may have altered the natural erosion process by decreasing hillslope erosion. Increased amounts of vegetation and slash tend to have a stabilizing effect.

While it has not been a significant problem to date, future high intensity wildfires have the potential to seriously increase hillslope erosion in the watershed Effective fire suppression has resulted in abnormally high concentrations of fuels throughout the watershed. The build-up of vegetation could result in high intensity fires which, unlike fires of lower intensity, have the potential to destabilize hillslopes by completely burning vegetation through the rooting zone. The complete loss of vegetation could destabilize the upper soil profile and increase hillslope erosion in the watershed.

Hydrology

The McCloud River is the dominant hydrologic feature in the watershed. The river drains steep, mountainous terrain between Lake McCloud and the McCloud Arm of Shasta Lake. Major tributaries to the McCloud River within the watershed include Hawkins, Claiborne, Chatterdown, and Squaw Valley Creeks.

Streamflow in the Lower McCloud River is regulated by the Pit River Hydroelectric Project at Lake McCloud, where water is diverted through a tunnel complex into the Pit River drainage at Iron Canyon Reservoir for the generation of electrical power.

Minimum instream flows are maintained in the Lower McCloud River to provide adequate downstream flows for fisheries habitats. Generally, instream flows stay well above the minimum release.

The diversion of water at Lake McCloud does not significantly influence the larger peak flow events in the watershed. Tributaries immediately below Lake McCloud supply over three times more runoff to the McCloud River than is supplied by the entire Upper McCloud River Basin.

Stream Channel

Stream channel morphology in the Lower McCloud River Watershed is a reflection of natural geologic and fluvial processes and, in some cases, land-use activities. Channel morphologies in the watershed are very much alike because the channels have formed in similar parent materials and climatic conditions.

Stream channels in the Lower McCloud River Watershed are broadly classified as follows:

- **Upland channels (swales, colluvial or bedrock channels)**
  - sources areas for sediment.
  - most vulnerable to land-use impacts due to abundance and steep topography.
  - most of these channels have not been influenced by land-use impacts.
- **Cascade channels**
  - generally exhibit perennial flows.
  - steep and dominated by boulder substrates.
  - sediment is transported through cascade channels during peak flows.
  - less influence by land-use activities than upland channels.

- **Step-pool channels**
  - lower gradients than cascade channels.
  - characterized be a pattern of alternating steps and pools.
  - waterfalls often occur where bedrock is exposed.
  - most step-pool channels have not been impacted by land-use activities.
  - sediment delivery from upland channels can result in aggradation of smaller, low-gradient step-pool channels.
- **Pool-riffle or plane-bed channels**
  - the McCloud River and lower reaches of its larger tributaries
  - majority of fisheries are found in these channels

The McCloud River lies deep within the McCloud River Canyon. The canyon bottom contains a series of abandoned terraces, the lowest of which functions as a floodplain. The active channel of the river has decreased in size due to streamflow diversions at Lake McCloud. The canyon widens below the Caliborne Creek confluence. The wider canyon bottom reflects the increase in streamflow to the river from Claiborne and Squaw Valley Creeks.

Water Quality

The quality of water in the Lower McCloud River Watershed is influenced by both natural processes and land-use activities. Beneficial uses dependent on high quality water include fish and aquatic life (including riparian vegetation), domestic drinking water for private landowners along the McCloud River, and recreation benefits associated with fishing and rafting. Due to the absence of lakes, springs and wetlands, almost all water quality concerns in the Lower McCloud River Watershed are related to the channel network.

The Lower McCloud River is well-known for its trophy-size trout and large trout populations, and is a state designated Wild Trout Stream. Spawning runs of brown and rainbow trout from Shasta Lake occur within the river each year. Water quality parameters critical to fisheries include: adequate flow, temperature, and sediment.

The cumulative impacts of natural hillslope erosion processes, roads, and timber harvesting exert the greatest influence on water quality parameters. Changes in most water quality parameters only occur during peak flow events and then quickly drop to pre-storm levels.

Turbidity in the McCloud River occasionally increases in the fall when water levels in Lake McCloud drop resulting in the delivery of sediments to the lower river.

Catastrophic wildfires have the greatest potential to detrimentally influence water quality in stream channels in the watershed. A large, wildfire combined with large peak flows the following winter would increase suspended sediment, turbidity, bedload, and other parameters to detrimental levels. Low gradient channel reaches would likely be choked with sediment and would take years to recover from the impacts.

Biological Features

Vegetation

The dominant vegetation type in the Lower McCloud River Watershed is mixed conifer and Douglas-fir forest. Species composition tends to follow elevation and temperature gradients ranging from white fir/red fir forests at the highest, coldest areas in the northeast portion of the watershed to ponderosa pine/gray pine/chaparral in the lowest, hottest areas at the lower end of the watershed.

The landscape around High Mountain, Tombstone Mountain, Bald Mountain and Grizzly Peak is dominated by large areas of hardwood and chaparral vegetation. These areas tend to have low productivity due to topographic position and geologic parent material.

The remainder of the watershed is highly productive due to soil quality and high rainfall. These areas have demonstrated a high capacity to recover from disturbance.

Vegetation has been modified by past timber harvest activities in Chatterdown, Claiborne, Ladybug, and Hawkins Creek drainages and on the slopes above Ah-Di-Na Campground. The remainder of the watershed is essentially unroaded and has had little modification to the naturally occurring vegetation.

The current array and pattern of vegetation is the result of several processes, including:

- fire
- climate
- timber harvest
- soils
- grazing

Maps and further discussion on vegetation are provided in Chapter 3.

Species and Habitat

Wildlife species of special concern in the Lower McCloud River Watershed are:

- American Peregrine Falcon
- Bald Eagle
- Northern Spotted Owl
- Shasta Salamander
- Northern Red-Legged Frog
- Northern Goshawk
- Willow Flycatcher
- Pacific Fisher
- American Marten
- Northwestern Pond Turtle
- Black-tailed Deer
- Elk
- Neotropical Migratory Birds

Bat species of special concern include:

- Long-eared Myotis
- Fringed Myotis
- Long-legged Myotis
- Pallid Bat
- Silver-haired Bat
- Townsend’s Big-eared Bat
- Yuma Myotis

Rare plant species of special concern are:

- Arnica venosa
- Lewisia cotyledon spp. howellii
- Neviusia cliftonii
- Raillardiopsis scabrida
- Ageratina shastensis (=Eupatorium shastense)

These species are addressed more fully in the main document because of their status. Other species not listed, but still of concern can be found in Table 3-22 of Chapter 3.

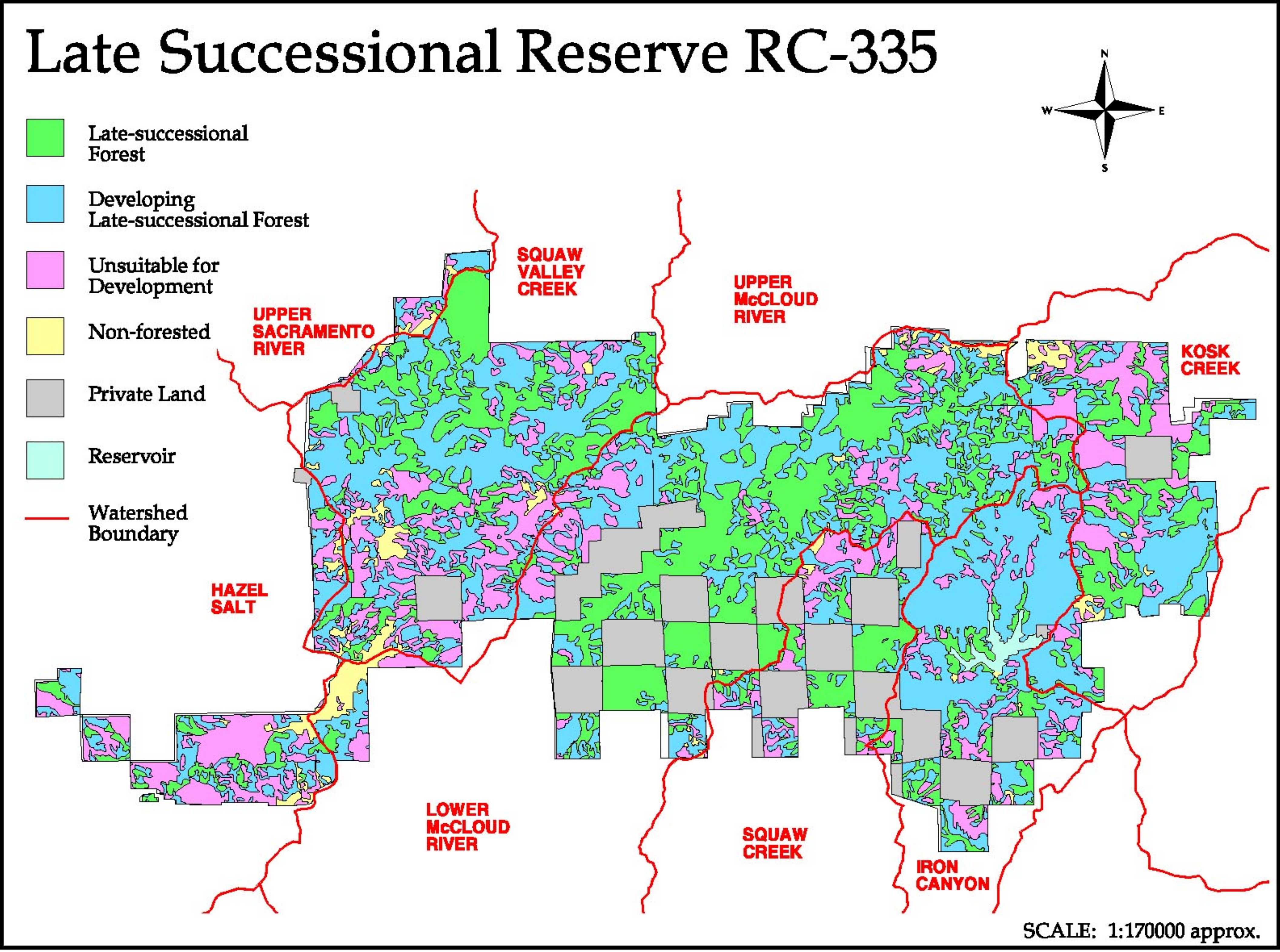
For old growth associated species, like the Northern spotted owl, Pacific fisher, American marten, and Northern goshawk, this watershed represents their most south-central range within Northern California as Shasta Lake, the City of Redding, and the Central Valley are found directly south. In addition, this watershed is part of a larger landscape of habitat which enables movement of old growth species from further north, into the Sierra Mountains to the southeast and the Klamath Mountains to the southwest. This watershed is also unique, in that it contains a large portion of the late successional habitat found in LSR RC-335.

Except for the Northwestern pond turtle and Northern red-legged frog, the remaining species of concern listed are expected to exist in isolated areas within the watershed or very sparingly. Peregrine falcon sightings have occurred in two separate locations where rock outcrops occur, indicating use, but no eyries have been identified. Bald eagles from the McCloud Reservoir are believed to utilize the northern part of the watershed for foraging, based on visual sightings. Shasta salamander occur abundantly in the watersheds to the south of the Lower McCloud River Watershed but are not known to occur within the watershed itself. They are known to occur in isolated areas northwest of the watershed. Black-tailed deer and elk do utilize the watershed, but mostly along the main river or streamcourses in small numbers. Mainly, the watershed is believed to be used as a transition zone between summer range in the north and winter range in the south around Shasta Lake. As with the Shasta salamander, habitat for cave dwelling bats, such as the Townsend's big-eared bat, is more abundant south of the watershed, near Shasta Lake, and becomes less abundant the further north in the watershed, based on the number of known caves found by local caving groups and the Forest Service.

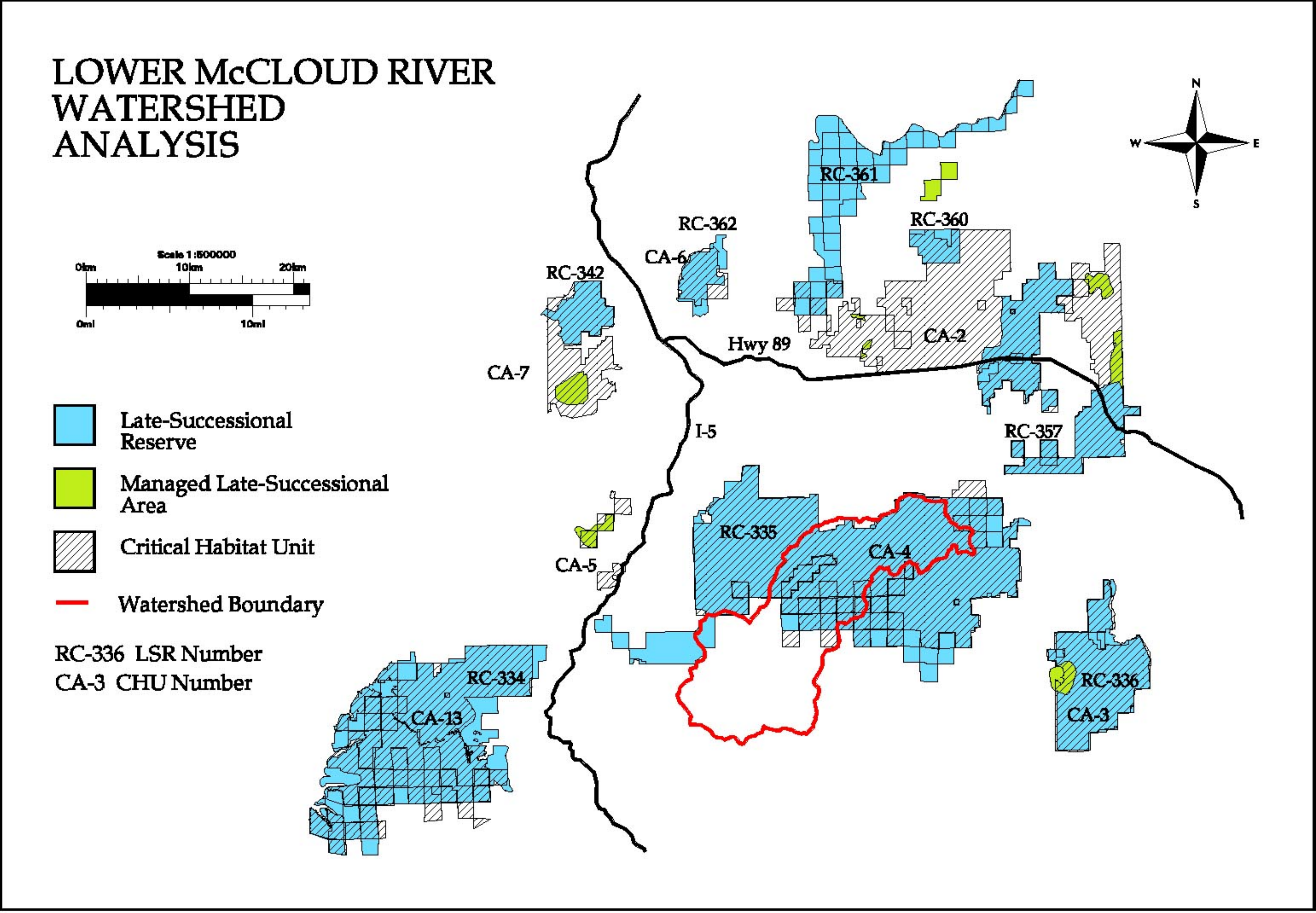
For the Northwestern pond turtle, Northern red-legged frog, willow flycatcher and other riparian associated species, the McCloud River and its major tributaries provide habitat. Though surveys have occurred, only the willow flycatcher has been detected. Outside the watershed, though, many other aquatic and riparian associated species have been detected. This is expected to be a function of survey effort and not the quality of the habitat within the watershed.

The major tributaries of the McCloud River provide habitat for most of the aquatic and riparian associated species in the watershed. Management of Riparian Reserves is expected to provide for or minimize impacts to these species.

Numerous old-growth associated plants, bryophytes (mosses and liverworts), lichens, and fungi are likely to occur in the watershed due to the abundance of old growth habitat. No surveys have been undertaken to date to inventory or monitor populations of these species.



Map 6. Late Successional Reserve RC-335



Map 7. Adjacent Late-Successional Reserves

Late-Successional Reserve (LSR)

The southeastern portion of the northern spotted owl's distribution is represented by the Shasta-McCloud subprovince. Within this subprovince, LSR RC-335 is the largest LSR and the LSR established for maintaining linkage and genetic interchange with the Northern California subspecies (see Map 7 - Adjacent Late-Successional Reserves). This LSR is also considered the key to maintaining the viability of the subprovince by providing a source population (Gertsch, 1994). Concerns within this LSR include the checkerboard land ownership, extensive logging history, dry climate and its high risk to natural catastrophes like wildfire.

Linkage with other LSRs, especially LSRs RC-334 to the southwest and RC-357 to the northeast, is also a concern because of limited dispersal habitat between LSRs (see Map 7). Highway I-5 and private property separate RC-334 and RC-335. Private property also separates RC-335 from both RC-357 and RC-336.

Table 1-1: Summary of Late-Successional Reserves within and adjacent to the Lower McCloud River Watershed and their function.

LSR#	CHU#	National Forest Acres	# of Pairs Expected	Activity Centers present	Comments
RC-335	CA-4	88,771	15	12 P; 4 TS	see main text
RC-334	CA-13	84,625	8	6 P; 2 TS	Linkage between No. Interior Coast and Shasta-McCloud subprovinces
RC-336	CA-3	21,354	4	1 P; 1 TS	Closest link to Calif. subspecies. Four pair opportunity.
RC-357	CA-2	25,782	15	4 P; 2 TS	RC-357 is one of four LSRs that maintain easterly distribution of the subspecies.

- LSR# - Late-Successional Reserve numbers.
- CHU# - Critical Habitat Number
- # of pairs expected - as described in Gertsch 1994.
- Activity Centers - P = pair; TS = Territorial Single.

The Lower McCloud River Watershed is the greatest contributor of late-successional forest in the LSR and provides the largest contiguous stands of late-successional forest (STNF, 1996). The Iron Canyon Watershed Analysis is the only completed watershed analysis in the LSR at this time. Further analysis of the late-successional habitat within the entire LSR is needed to fully understand the role of the Lower McCloud River Watershed in the overall functioning of the LSR.

Currently, 35% of the watershed contains old growth habitat. An additional 22% of the watershed contains mature forested habitat. The majority of both the old growth and the mature forested habitat occurs within the LSR. The amount of old growth has increased rapidly over the past 50 years and the current trend is for continued increases in the future.

Dispersal between LSR RC-335 and adjacent LSRs to the southwest and the southeast is a concern due to fragmented habitat conditions. Dispersal in the southern part of the watershed is not a concern since little suitable habitat exists outside the LSR.

Critical Habitat Unit (CHU)

Critical habitat for the threatened northern spotted owl is a legal designation identified under the Endangered Species Act, having been designated on January 15, 1992 (57 FR 1796). The intent of critical habitat is to provide the physical and biological features that were the basis for determining the habitat to be critical. Those physical or biological features are referred to as "primary constituent elements", and may include, but are not limited to:

1) space for individual and population growth, and for normal behavior;
2) food, water, air, light, minerals, or other nutritional or physiological requirements;
3) cover or shelter;
4) sites for breeding, reproduction, rearing of offspring, germination, or seed dispersal;
5) habitats that are protected from disturbance or are representative of the historic, geographical, and ecological distributions of a species.

The primary constituent elements for northern spotted owl critical habitat include:

1) forests which provide nesting, roosting, or foraging habitat, including stands which currently provide foraging habitat for resident spotted owls, even if the stand may not currently provide nesting conditions;
2) forest stands with adequate tree size and canopy cover to provide some protection from avian predators and at least minimal foraging opportunities. It is important to note some dispersal habitat may not provide nesting, roosting, or foraging habitat, though nesting, roosting, and foraging habitat will provide for dispersal;
3) lands that have the potential to produce nesting, roosting, foraging, or dispersal habitat sometime in the future, though not currently in such a habitat condition.

Critical habitat within the Lower McCloud River Watershed includes portions of Critical Habitat Unit (CHU) #CA-4 (see Map 7) which was seen by the Interagency Scientific Committee (ISC) as the best opportunity to create a fairly large habitat conservation area (12 future expected pairs) in the Shasta-McCloud subprovince. Surveillance in 1991 revealed no current pairs in the southern portion of the area, although the survey was not complete. A substantial amount of acreage was added to the CHU to improve the shape (edge:area ratio) and increase the potential of supporting pairs to about 15. This CHU is one of the keys to maintaining the viability of the subprovince and providing a source population, and may be the most important area to protect in the subprovince. It is also a vital area for providing linkage and an opportunity for genetic interchange between the northern and California subspecies. This CHU is 4 miles east of CA-5, 9 miles southeast of CA-7, 1-5 miles south of CA-2, and 4 miles northwest of CA-3.

Management prescriptions that emphasize wildlife habitat account for 81% of National Forest land in the watershed, including:

- Prescription VI - Wildlife Habitat Management (LMP 4-66)
- Prescription VII - Late-successional Reserves (LMP 4-43)
- Prescription IX - Riparian Management (LMP 4-59)

Human Uses

Due to its remote location and poor access, the area included in this analysis is the least used segment of the McCloud River by the general public. Some recreation use occurs at Ah-Di-Na Campground and at Ash Camp. The Pacific Crest Trail crosses the north part of the watershed. Rafting and kayaking occur along the river from Ash Camp to Shasta Lake.

Several limestone caves are known to exist in the watershed; however, they are still relatively unknown and use is fairly low.

The Lower McCloud River is well-known for its trophy-size trout and large trout populations, and is a state designated Wild Trout Stream. Fishing activities are strictly controlled on the river and the habitat is in excellent condition.

Native Americans occupied the Lower McCloud drainage for thousands of years, and their descendants today retain an active interest in protecting their patrimonial heritage. The Lower McCloud River Watershed area appears to have been a boundary area between the Wintu and the Pit River people. The former claim authority in the Ah-Di-Na area, while the latter claim expertise in the Ash Camp area.

Heritage resources in the watershed tend to be concentrated along the McCloud River. Significant prehistoric sites are located at Ash Camp and at Ah-Di-Na. Ah-Di-Na also features an historic component which has been developed as a public interpretive site.

Several utilities cross parts of the watershed including:

- Sprint fiberoptic phoneline along the Hawkins Creek Road
- COTP high voltage powerline near Grizzly Peak
- PG&E diversion tunnel between Lake McCloud and Iron Canyon Reservoir

In the last 30 years, approximately 104 million board feet of timber has been harvested from the watershed providing employment for local communities.

The transportation system in the watershed totals approximately 180 miles (private and National Forest) and is displayed on Map 5 - Transportation System. Current road density is approximately 1.7 miles of road per square mile of land. Roads are mostly related to past timber harvest activities and tend to be concentrated south and east of the McCloud River. Most of the area north and west of the river has a primitive and unroaded character with only occasional low standard roads and jeep trails.

Land Allocations and Management Direction

Management direction for the Lower McCloud River Watershed is found in *the Shasta-Trinity National Forests Land and Resource Management Plan* (LMP) which incorporates direction from the *Record of Decision* (ROD) *for Amendments to Forest Service and Bureau of Land Management Planning Documents Within the Range of the Northern Spotted Owl.*

Management direction for the Lower McCloud River Watershed is summarized in this section. A more detailed description of management direction is included in Appendix B.

Land Allocation

The ROD identifies four land allocations within the Lower McCloud River analysis area (see Map 8 - Land Allocation):

- Late-Successional Reserves (LSR)

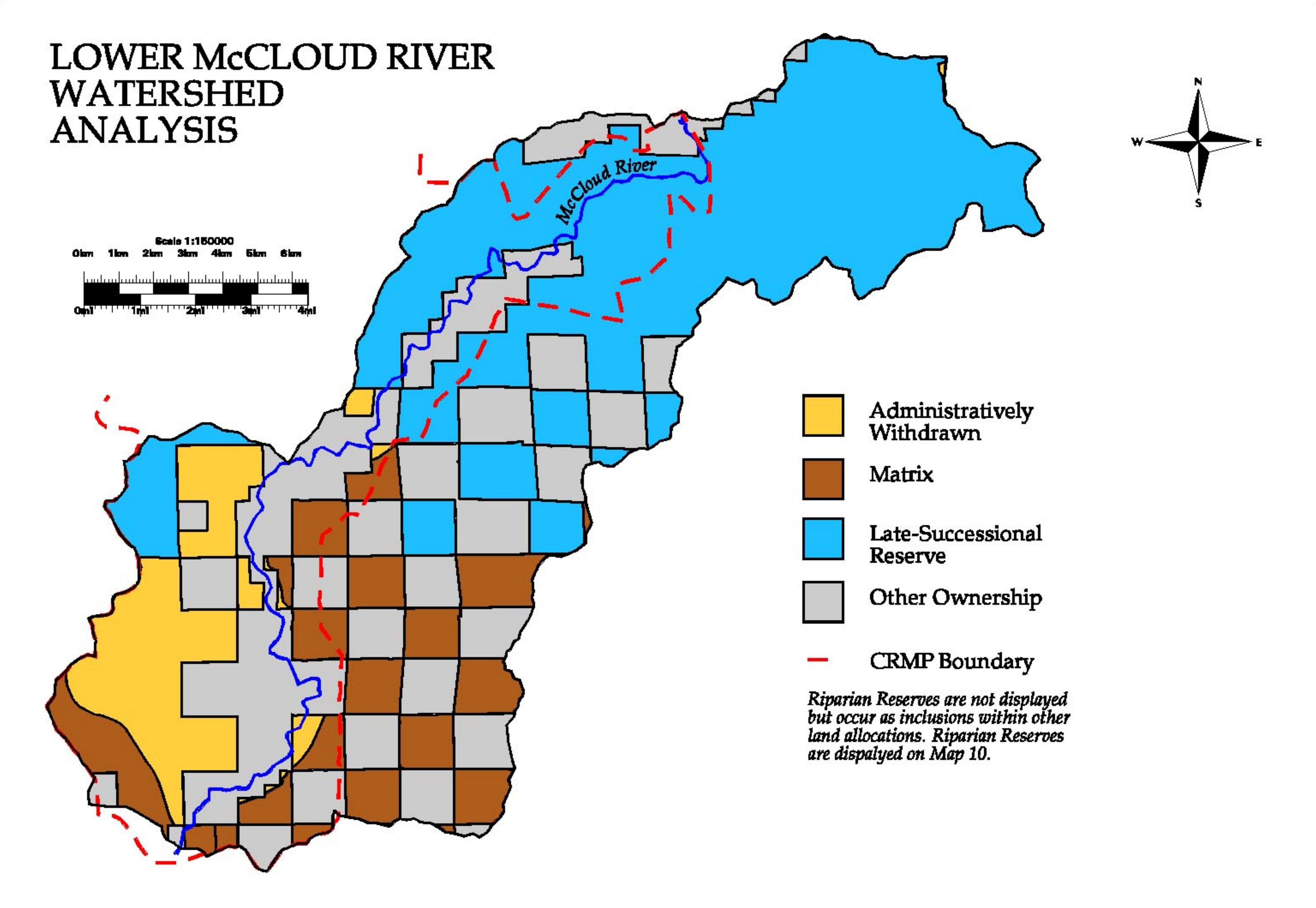
  Late-Successional Reserves are areas that have been established to protect and enhance conditions of late-successional and old-growth forest ecosystems and to insure the support of related species, including the northern spotted owl (LMP 4-37).
- Riparian Reserves

  Riparian Reserves provide an area along streams, wetlands, ponds, lakes, and unstable and potentially unstable areas where riparian-dependent resources receive primary emphasis. Riparian Reserves are important to the terrestrial ecosystems as well, serving, for example, as dispersal habitat for certain terrestrial species (ROD A-5).
- Administratively Withdrawn Areas

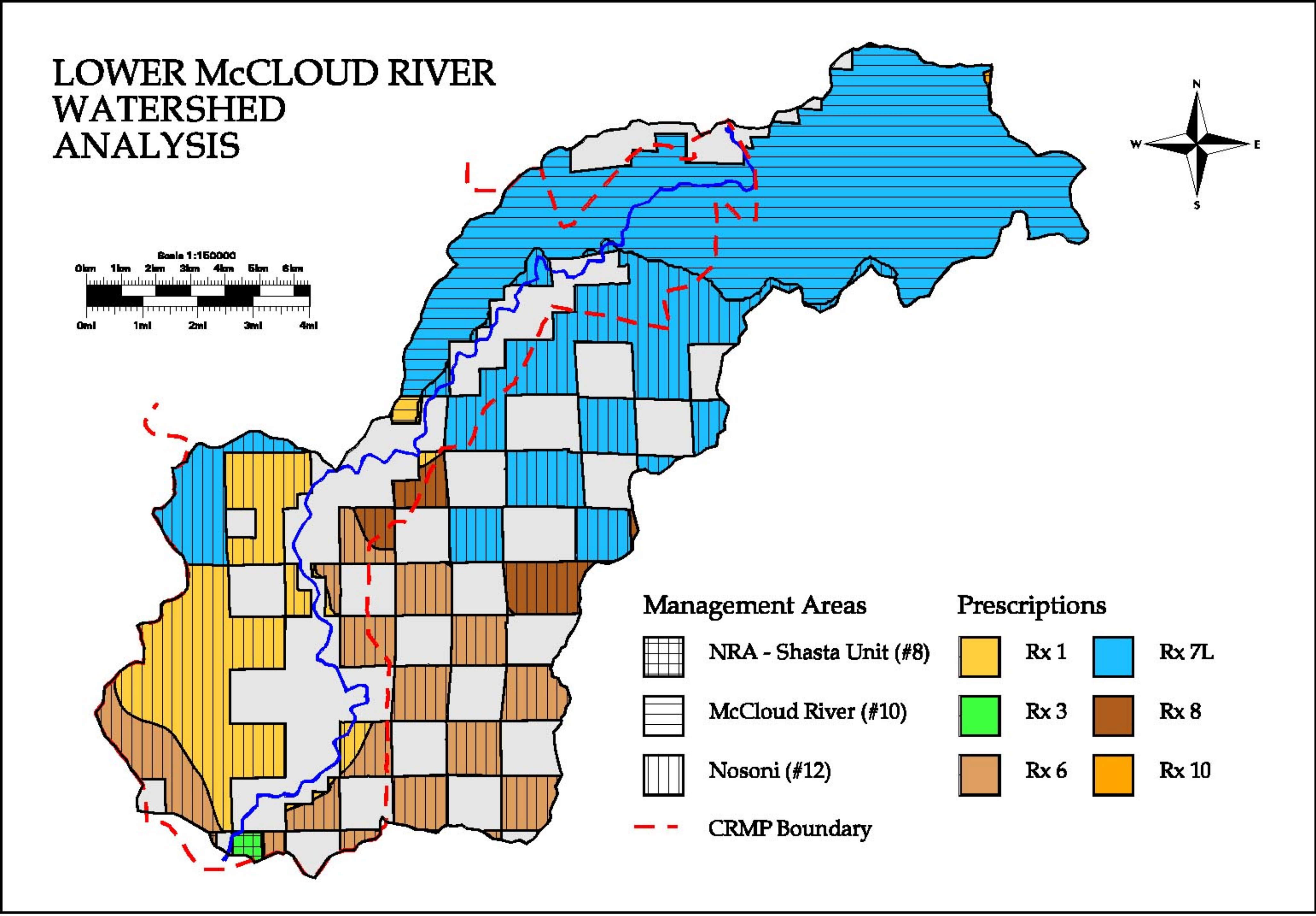
  Administratively Withdrawn Areas are identified in current Forest and District Plans or draft plan preferred alternatives and include recreation and visual areas, back country, and other areas where management emphasis precludes scheduled timber harvest (ROD A-4).
- Matrix

  The Matrix consists of those federal lands outside the three categories of designated areas listed above (ROD A-5). The Matrix are lands on which most timber harvest will occur and where standards and guidelines are in place to assure for appropriate conservation of ecosystems as well as provide habitat for rare and lesser known species (ROD B-10).

Riparian Reserves overlay all other land allocations. Table 1-2 summarizes land allocations and shows the relationship of Riparian Reserves with other allocations.



Map 8. Land Allocations



Map 9. Management Areas and Prescriptions

Management Prescriptions

In addition to the four land allocations identified in the ROD, the LMP identifies eight Management Prescriptions in the Lower McCloud River analysis area (see Map 9 - Management Areas and Prescriptions). These are:

- I - Unroaded Non-Motorized Recreation (LMP 4-45)
- III - Roaded Recreation (LMP 4-64)
- VI - Wildlife Habitat Management (LMP 4-66)
- VII - Late-Successional Reserves (LMP 4-43)
- VIII - Commercial Wood Products Emphasis (LMP 4-67)
- IX - Riparian Management (LMP 4-59) *
- X - Special Area Management (LMP 4-49)
- XI - Heritage Resource Management (LMP 4-50) **

* mapped separately due to complexity. See Map 10 - Riparian Reserves.

** unmapped - occurs as minor inclusions within other prescriptions

Table 1-2: Acreage summary by land allocation and management prescription within the Lower McCloud River Watershed .

Land Allocation or Management Prescription		Area outside Riparian Reserves		Area within Riparian Reserves		Total Area
		acres	%	acres	%	acres
Late-Successional Reserves						
VII	Late-Successional Reserve	17552	61.2	11120	38.8	28672
	Total - Late-Successional Reserve	17552	61.2	11120	38.8	28672
Administratively Withdrawn Areas						
I	Unroaded Non-Motorized Recreation	4373	63.7	2493	36.3	6866
X	Special Area Management (Grizzly Peak Botanical Special Interest Area)	23	95.8	1	4.2	24
XI	Heritage Resource Management	*	*	*	*	*
	Total - Administratively Withdrawn	4396	63.8	2494	36.2	6890
Matrix						
III	Roaded Recreation	104	57.8	76	42.2	180
VI	Wildlife Habitat Management	4556	58.9	3178	41.1	7734
VIII	Commercial Wood Products Emphasis	1094	66.5	550	33.5	1644
	Total - Matrix	5754	60.2	3804	39.8	9558
Total - All National Forest Land		27702	61.4	17418	38.6	45120

* The Heritage Resource Management prescription occurs as minor unmapped inclusions within other prescriptions. Actual acreage in the watershed is small and is not displayed in this table.

Management Areas

Supplemental management direction for specific units of land is provided in the LMP under Management Area Direction (LMP - Chapter 4 - Section G). The LMP identifies three Management Areas in the Lower McCloud River Watershed (see Map 9 - Management Areas and Prescriptions). These are:

- McCloud River (#10) (LMP 4-121)
- Nosoni (#12) (LMP 4-129)
- NRA - Shasta Unit (#8) (LMP 4-111)

Coordinated Resource Management Plan

The McCloud River System has been determined eligible for possible inclusion in the National Wild and Scenic Rivers system. In lieu of recommending Wild and Scenic River designation, the Forest Service has taken the lead in working with adjacent private landowners and public agencies to develop a Coordinated Resource Management Plan (CRMP) for the corridor (LMP 2-6).

In July 1991, the McCloud River Coordinated Resource Management Plan (CRMP) was signed by principal landowners in the McCloud River Drainage and public agencies that administer programs in that area. The CRMP is intended to be an acceptable option to Wild and Scenic designation for the McCloud River.

Coordinated planning is a process designed to achieve compatibility between the uses being made of natural resources in a specified area. A CRMP sets forth the framework for activity planning within the CRMP boundary. This approach uses the best efforts and knowledge of everyone involved; private landowners and involved Federal, State, and local agencies.

Authority for State and Federal agencies to participate in coordinated planning is contained in existing statutes or delegations of authority. The Forest LMP contains Supplemental Management Direction to manage the Lower McCloud River under this CRMP (LMP 4-123).

The intent of the CRMP is to coordinate large-scale resource planning. The following excerpt from the CRMP describes its objectives:

> *The primary objective of the CRMP is to preserve the pristine quality of the river resources described within.*
>
> *The CRMP area includes significant recreation and visual resource values. Objectives for management are:*
>
>> *(a) maintenance of a predominately natural appearing area;*
>>
>> *(b) provision for public use consistent with wildlife and watershed protection and the rights of private landowners.*
>
> *The CRMP area includes significant vegetation resources. The objective for management is:*
>
>> *(a) vegetation use consistent with watershed, viewshed and fisheries values protection.*

Portions of the McCloud River have been designated by the Department of Fish and Game as wild trout waters under the California Wild Trout Program. The general fisheries management objectives of the Wild Trout Program are:

A. Maintenance of wild trout populations at levels necessary to provide satisfactory recreational angling opportunities.

B. Maintenance and enhancement, where appropriate, of the habitat required for optimum wild trout production.

C. Preservation of the natural character of the streamside environment.

These objectives are appropriate for land management practices adopted pursuant to this management plan since they relate to the central issues of the McCloud watershed, including recreation management, timber management, wildlife management, watershed protection, and fisheries management.

The CRMP covers two general areas along the McCloud River:
- Upper River - from Lake McCloud upstream to Algoma Bridge.
- Lower River - from Lake McCloud downstream to Shasta Lake.

The Lower River section is located in the Lower McCloud River and the Squaw Valley Creek Watersheds and is the only area addressed in this analysis. The Upper River section is outside the analysis area.

If, for any reason, the terms of the CRMP are not followed and the Wild and Scenic River eligibility is threatened, the Forest Service will recommend the river for Federal Wild and Scenic designation (LMP 3-23).

Chapter 2

Issues and Key Questions

The purpose of this chapter is to focus the analysis on the key elements of the ecosystem that are most relevant to the management questions and objectives, human values, or resource conditions in the watershed.

This document is guided by two levels of analysis:

- **core topics** - provide a broad, comprehensive understanding of the watershed. Core topics are provided in the Federal Guide for Watershed Analysis (8/95) to address basic ecological conditions, processes, and interactions at work in the watershed. Core topics to be addressed are:
  - Erosion processes
  - Hydrology
  - Stream Channel
  - Water quality
  - Vegetation
  - Species and habitats
  - Human uses
- **issues** - focus the analysis on the main management questions to be addressed. Issues are those resource problems, concerns, or other factors upon which the analysis will be focused. Some of these issues prompted initiation of the analysis. Other issues were developed from public input in response to scoping or were identified by the team during the analysis process.

This chapter describes the major issues identified in the Lower McCloud River Watershed. Key analysis questions are developed for each issue. These questions are organized by analysis step to help focus the analysis and to provide organization to the document while addressing the issues.

The major issues identified are:

- Catastrophic Wildfire
- River Use
- Road Impacts
- Late-Successional Reserve

Issue:

Catastrophic Wildfire

There is a history of large fires both within this watershed and in surrounding watersheds. Fire exclusion has allowed dead and down fuels to accumulate on the forest floor and for understory vegetation to develop, creating live fuel ladders into the forest canopy. There is a concern that fuel conditions in the watershed are a threat to resources and private property.

Key Questions:

Step 3 - Current Conditions

- What is the current fire regime in the watershed?
- What is the potential for catastrophic wildfire in the watershed?
- What resources in the watershed are currently at risk of loss to catastrophic wildfire?

Step 4 - Reference Conditions

- What was the past fire regime for the watershed?

Step 5 - Interpretation

- Under current management, what are the future trends for fire in the watershed?
- What is the desired role of fire in the watershed?
- How can fire be incorporated as an ecological process?

Issue:

River Use

Once the McCloud River leaves National Forest land below Ah-Di-Na, it flows for approximately 20 miles across mostly private land. Public land along this stretch of river is limited to only 1.5 miles of National Forest riverfront at four locations. Rafters and kayakers entering the river below Ah-Di-Na are confined to the river until they reach McCloud Bridge at the lower end of the watershed.

During the analysis process, the interdisciplinary team noted that National Forest land allocations along the east side of the McCloud River between Hat Mountain and Claiborne Creek

Key Questions:

Step 3 - Current Conditions

- What is the current level of river use below Ah-Di-Na?
- What are the impacts of current Forest Service policies and actions related to river use?
- What are current land allocations along the Lower McCloud River?

Step 4 - Reference Conditions

- What were the historical uses along the river and what was the level of use?

Step 5 - Interpretation

- What uses, laws, policies, and actions are compatible with the desires of downstream property owners?
- How can recreational opportunities be provided for river users?
- Are existing land allocations consistent with current land uses?

Issue:

Road Impacts

This issue was developed by the analysis team during a field visit to the watershed. The team observed several drainages in the watershed with high road densities and road design problems.

High road density concerns include:

- habitat fragmentation.
- loss of landbase available to provide various habitat types.
- disturbance to sensitive animal species.
- increased runoff during peak flows.

Road design concerns include:

- fragmentation of aquatic habitat by interrupting fish movement.
- potential for mass wasting.
- movement of fine sediment into riparian areas.
- alteration of surface and groundwater flow patterns.

Key Questions:

Step 3 - Current Conditions

- What are the current uses and needs for roads in the watershed?
- What role does the road system on National Forest land play in providing access for private landowners?
- What are current road impacts on wildlife habitat and water quality and where are they occurring?

Step 4 - Reference Conditions

- Why and how was the road system developed?

Step 5 - Interpretation

- What roads in the watershed are necessary to provide access for private landowners?
- What are the future trends in road use, needs, and management?
- What is an appropriate transportation system for the watershed that would be consistent with the land allocations described in the Forest Plan?

Issue:

Late-Successional Reserve

The Lower McCloud River Watershed is one of six watersheds within or crossing LSR RC-335. Habitat conditions vary among these watersheds. It is important to understand the role of this watershed and the effect that management actions will have on the overall functioning of the LSR.

Key Questions:

Step 3 - Current Conditions
- Where and in what condition does late-successional habitat occur in the watershed?
- What areas in the watershed are not capable of producing late-successional habitat?

Step 4 - Reference Conditions
- What was the historic distribution and condition of late-successional habitat in the watershed?
- What past disturbances and processes have influenced the development of late-successional habitat in this watershed?

Step 5 - Interpretation
- What is the role of this watershed in the functioning of the LSR?
- What is the future trend for development of late-successional habitat in the watershed?
- What can be done to maintain and develop late-successional habitat in the watershed?

Items not Addressed as Issues

Several items that were provided during public scoping were not included as issues in this analysis. The purpose of this section is to acknowledge these concerns and to describe how they were dealt with.

Caves

Protection of caves in the watershed was a concern to several caving groups and individuals. Public scoping asked for comments on two adjacent watersheds - the Lower McCloud and the McCloud Arm Watersheds. Most of the comments related to cave protection focused on the McCloud Arm Watershed, where caves are more abundant and likely to be affected by management activities. Since caves in the Lower McCloud River Watershed were not a driving issue for the analysis, it was decided to address cave protection through the core topics. Cave protection has been identified as a possible issue to be addressed in the McCloud Arm Watershed which is being prepared concurrently. Opportunities exist to link cave protection in the two watersheds into a single management recommendation.

Chapter 3

Current Conditions

The purpose of this chapter is to develop information relevant to the issues and key questions identified in Chapter 2. The current range, distribution, and condition of the relevant ecosystem elements are discussed.

Physical Features

Erosion Processes

The Lower McCloud River Watershed is located within the Eastern Klamath Mountain belt of the Klamath Mountain Province. The rugged topography in the watershed has been formed over millions of years by a combination of fluvial and mass wasting processes. A wide variety of mass wasting features occur within the watershed including deep-seated rotational landslides, shallow debris slides and valley inner gorges. Large limestone outcrops occur on ridgetops in the vicinity of Tombstone and High Mountains and in the Willawaket and Nawtawaket drainages. Limestone outcrops are also occur along the McCloud River.

Land-use activities that have affected hillslope erosion processes in the Lower McCloud River Watershed include road construction, timber harvest and fire suppression. The majority of road related impacts are concentrated south and east of the McCloud River where road densities are highest (see map 5 - Transportation System). Road impacts are due to a number of factors including undersized culverts, lack of maintenance, wet weather road use and the heavy winter storms of recent years. Recurring road problems include rutting, fill slope failures, plugged culverts and drains, and minor slumps and slides. Road systems have also disrupted drainage patterns on hillslopes resulting in increased hillslope erosion and gullying. Field reconnaissance indicates that most roads that have not experienced use over the past decade have begun to revegetate and stabilize. Road related impacts are greatest in the Claiborne and Ladybug Creek drainages. Other areas impacted by roads include Van Sicklin Butte, and the Hawkins and Deer Creek drainages.

The impacts of timber harvest activities are less concentrated than those of roads and are mostly limited to the eastern half of the watershed. The low erosion capacity of soils in the McCloud River Canyon tends to reduce soil erosion from ground disturbing activities. Soils in the McCloud River Canyon are shallow and stony and tend to have slower rates of natural erosion than soils in the Western Klamath Mountains west of Interstate 5. Impacts to hillslopes from clearcutting harvest practices have been greater than impacts associated with thinning activities due to poor conifer recovery. Steep slopes that have been clearcut in the Hawkins and Chatterdown Creek sub-basins have revegetated with brush species Hillslopes that have been selectively cut appear to recover within a decade following treatment.

While some land-use activities have increased hillslope erosion, others may be limiting erosion. Effective fire suppression has resulted in abnormally high concentrations of fuels throughout the watershed. Over the past 50 years fire suppression has functioned as an erosion reducing mechanism by suppressing fires that could have burned appreciable amounts of vegetation in the watershed had they not been suppressed. It is important to note the benefits of fire suppression mentioned above may be offset by impacts occurring during fire suppression activities. Impacts from fire suppression activities in the Butcherknife Creek drainage were apparent during the Butcher Fire in 1996. Impacts included considerable hillslope disturbance from fire lines created by heavy equipment. Considerable amounts of vegetation were removed during fire line construction and hillslopes were scoured down to mineral soil. Erosion control work on the lines was undertaken following suppression activities. Erosion control measures were effective in mitigating hillslope erosion the following winter, but the loss of vegetation on the fire lines will only be mitigated by decades of vegetative recovery.

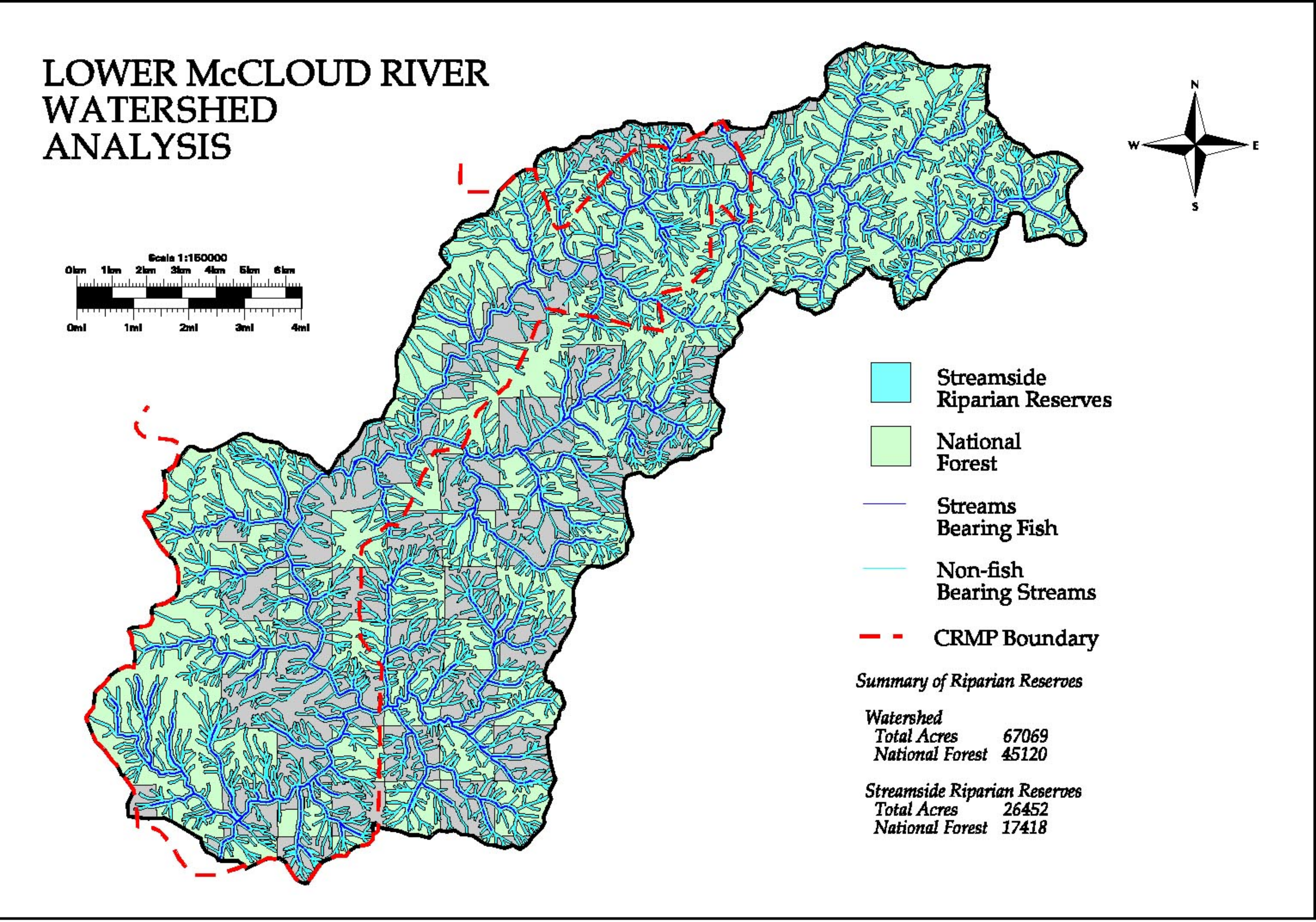
Catastrophic wildfires have the potential to seriously increase hillslope erosion as was demonstrated in the aftermath of the Dee Fire which occurred in the Ladybug Creek drainage in 1989. The potential impacts of high intensity wildfires include total loss of ground cover, increased soil water repellence, increased overland flow, and increased soil erosion. High fuel loads can lead to high intensity wildfires that could destroy the soil organic layer resulting in increased hillslope instability. Mass wasting activity could also increase following wildfires due to increased groundwater levels and surface water concentration in the hollows of dormant unstable features.

Hydrology

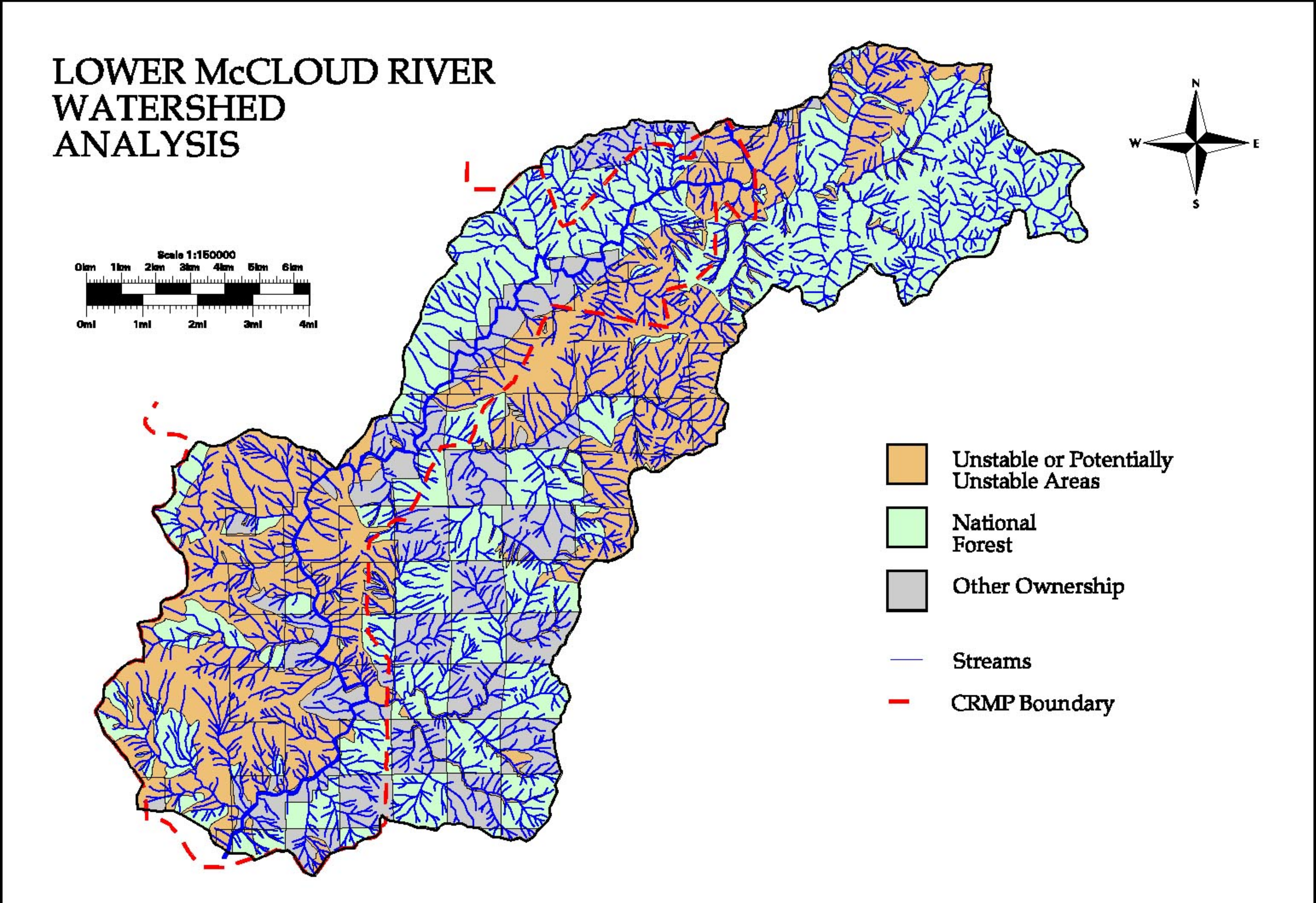
The Lower McCloud River Watershed drains an area of 105 square miles between the McCloud Reservoir and the McCloud Arm of Shasta Lake. The watershed contains a twenty-four mile stretch of the McCloud River. All tributaries to the McCloud River drain mountainous terrain forested primarily by mixed conifer species. In addition to the runoff originating in the watershed, the McCloud River also receives runoff from a 404 square mile area of the Upper McCloud River Basin and the 95 square mile Squaw Valley Creek Watershed. The total basin area drained by the McCloud River at Shasta Lake is approximately 605 square miles with the Lower McCloud River Watershed accounting for 17 percent of the basin area.

The Lower McCloud River Watershed is drained by a dendritic channel network. The drainage density of the watershed is approximately 6.9 miles of stream per square mile. Drainage densities are relatively uniform throughout the watershed. The watershed contains approximately 126 miles of perennial streams, 201 miles of intermittent streams and 394 miles of ephemeral streams. Ephemeral streams differ from intermittent streams in that they flow only in response to high intensity precipitation events or rapid snowmelt. Riparian Reserves in the Lower McCloud River Watershed consist almost exclusively of stream channels and unstable areas (Maps 10 and 11).

Hydrologic features such as wetlands and wet meadows are almost completely absent from the watershed. Only one spring, south of Satin Peak, is shown on USGS topographic maps; however, more unmapped seeps and springs occur throughout the watershed. One large wet meadow complex, known as Little Meadows, occurs in the headwaters of



Map 10. Riparian Reserve



Map 11. Geologic Hazard

Hawkins Creek. About half of the Little meadows area is vegetated with forbs and grasses and the other half is densely vegetated with willow and mountain alder.

The hydrology of the Lower McCloud River Watershed is complex due to differences in runoff characteristics between the watershed and the Upper McCloud River Basin. The Pit River Hydroelectric Project water diversion has also altered base flows in the McCloud River below Lake McCloud. For the purposes of discussion the Lower McCloud River Watershed can be divided into five sub-basins. These sub-basins include Hawkins, Claiborne, Chatterdown, Upper River Tributaries and Lower River Tributaries. Streamflow characteristics are similar in each of the five sub-basins due to similarities in climate, soils and geologic parent materials.

An abundance of streamflow data is available for the McCloud River above Shasta Lake because of the need to monitor instream flows below the McCloud Reservoir. Streamflow data for the Lower McCloud River and vicinity are available from six gaging stations shown in Table 3-1. The locations of the gaging stations are shown in Map 3. Streamflow data from stations 2, 3, 4 and 5 are presented in this analysis.

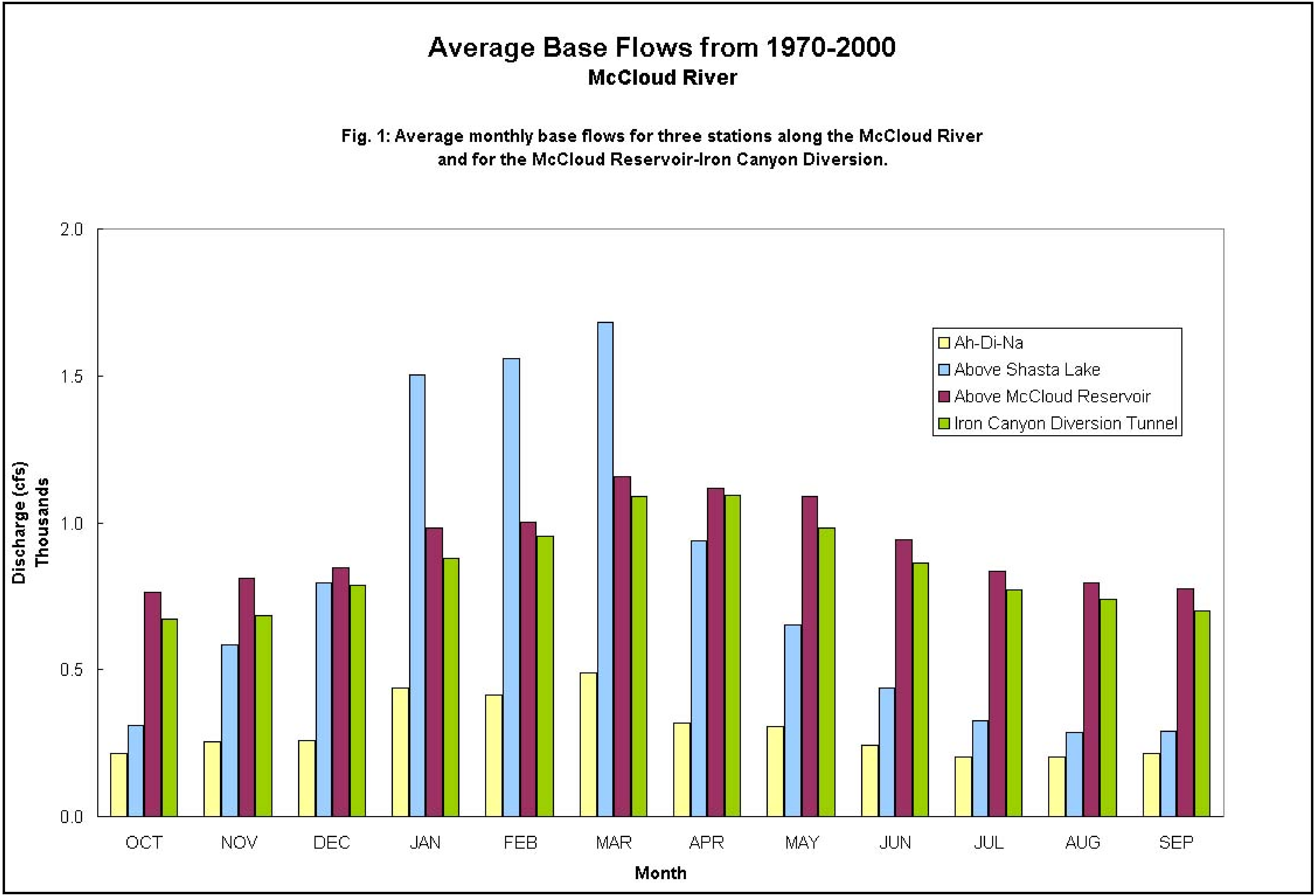
Table 3-1: Streamflow gaging stations for Lower McCloud River Watershed and Vicinity.

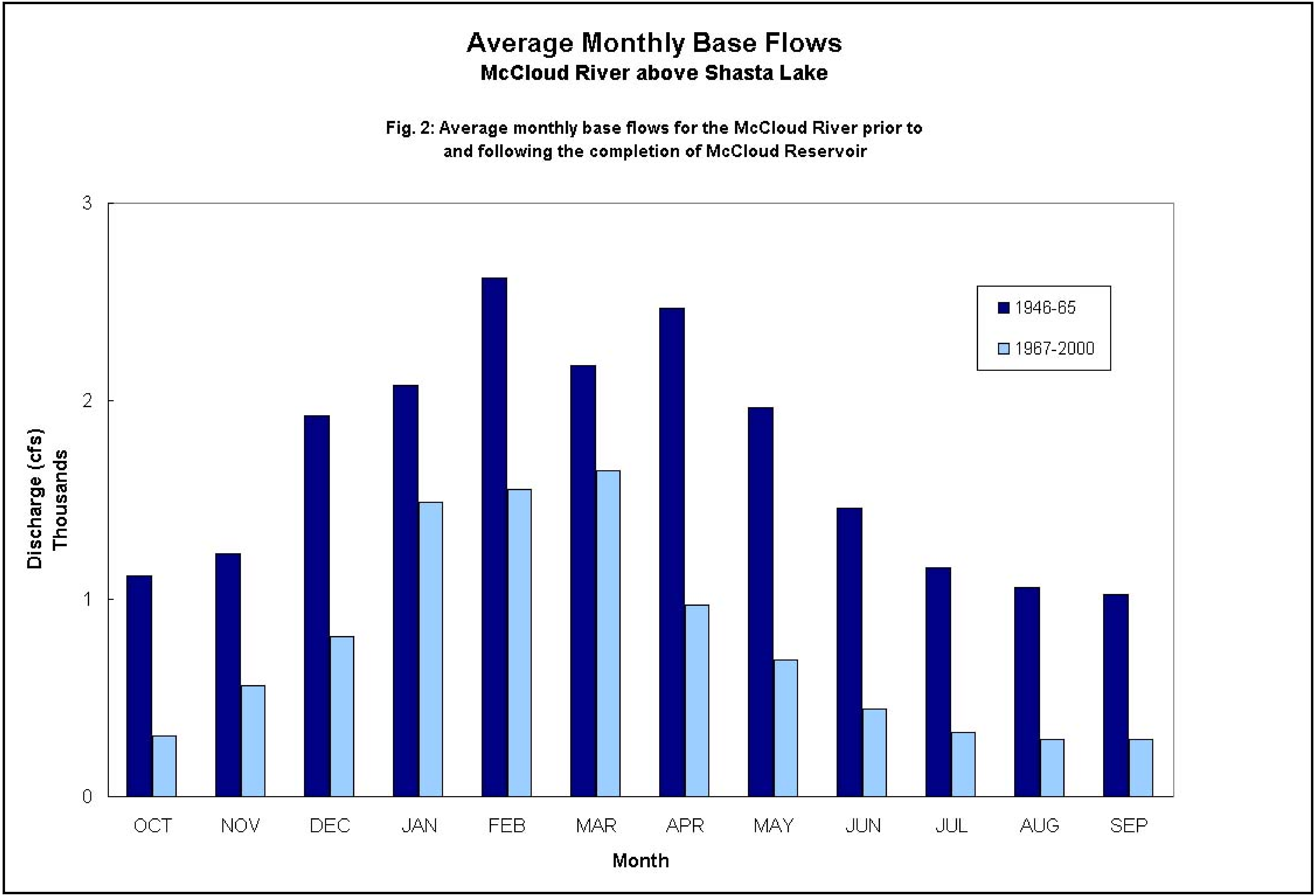
Station Name	Station Number	Period of Record
1. McCloud River at Baird (now beneath Shasta Lake)	11369000	1911-1943
2. McCloud River above Shasta Lake	11368000	1946-1995
3. McCloud River at Ah-Di-Na	11367800	1965-1995
4. McCloud-Iron Canyon Diversion Tunnel	11367720	1966-1995
5. McCloud River below McCloud Dam (partial record)	11367760	1966-1995
6. McCloud River near McCloud (below Angel Creek)	11367500	1931-1995

Base Flows

Base flows in the McCloud River are completely regulated by the Pit River Hydroelectric Project. Most of the water entering the McCloud Reservoir is diverted through a tunnel to Iron Canyon Reservoir in the Pit River Watershed. From Iron Canyon Reservoir the water is again diverted to the James B. Black Powerhouse on the Pit River where it is used to generate hydroelectric power. The average base flows for the diversion tunnel and at three stations along the McCloud River are shown in Figure 1.

Figure 1 illustrates several important base flow characteristics for the McCloud River. First, it is apparent that almost all of the flow entering the McCloud Reservoir is diverted to Iron Canyon Reservoir. In order to provide for fisheries needs, a minimum instream flow of 40 cubic feet per second (cfs) must be maintained at all times below the McCloud Reservoir Dam. Generally, instream flows stay well above the minimum release, rarely dropping below 100 cfs. Minimum releases from the McCloud Reservoir are also dictated by streamflow measured at the Ah-Di-Na gage located 3.9 miles below the reservoir. A minimum instream flow ranging from 160-210 cfs is required at this location in order to ensure adequate downstream flows for fisheries habitats (USGS Water Resources Data, 1994). The additional runoff required to sustain the 160-210 cfs minimum requirement at Ah-Di-Na is supplied by Hawkins Creek and other smaller tributaries such as Squirrel Creek below the McCloud Reservoir.


Average Base Flows from 1970-2000
McCloud River
Fig. 1: Average monthly base flows for three stations along the McCloud River
and for the McCloud Reservoir-Iron Canyon Diversion.
Ah-Di-Na
Above Shasta Lake
Above McCloud Reservoir
Iron Canyon Diversion Tunnel
Discharge (cfs)
Thousands
2.0
1.5
1.0
0.5
0.0
OCT
NOV
DEC
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
Month


Average Monthly Base Flows
McCloud River above Shasta Lake
Fig. 2: Average monthly base flows for the McCloud River prior to and following the completion of McCloud Reservoir
Discharge (cfs)
Thousands
3
2
1
0
1946-65
1967-2000
OCT
NOV
DEC
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
Month

From Figure 1 it is also apparent that average monthly base flows at Ah-Di-Na are generally less than half of the average monthly base flows for the McCloud River above the reservoir. Average base flows for the McCloud River at Shasta Lake only exceed base flows for the McCloud River above the McCloud Reservoir in January, February and March. The decrease in average base flows is made more evident by a comparison of streamflow records prior to and after the construction of the McCloud Reservoir (Fig. 2). Prior to the beginning of the McCloud Reservoir-Iron Canyon Diversion, the lowest daily mean flow recorded in the McCloud River at Shasta Lake from 1946-65 was 825 cfs. Since the beginning of water diversion the lowest daily mean from 1967-94 has been 292 cfs.

Minimum releases in the McCloud River below McCloud Dam and at Ah-Di-Na were set during the Federal Energy Regulatory Commission (FERC) licensing of the McCloud-Pit Hydropower Project in 1961 (Table 3-2). Flows required to sustain salmonid spawning runs from Shasta Lake were used as the criteria for setting minimum flows. The needs of wild and bull trout were not considered during the licensing process due to the lack of recreational fishing use that occurred on the Lower McCloud River in the early 1960s (Rode, 1989). Minimum flows in the river range from 160-210 cfs during normal or wet years and 160-180 cfs during dry years. Variations in minimum flows during dry and wet years reflect annual variations in baseflows in the McCloud River above Lake McCloud.

Table 3-2: Required minimum flow at the Ah-Di-Na stream gaging station in cubic feet per second.

Period	**Normal Year**	**Dry Year ***
January	160	160
February	160	160
March	170	170
April	170	170
May 1-15	170	160
May 16-31	200	160
June	200	160
July	200	160
August	200	160
September	210	180
October	210	180
November	210	180
December 1-15	210	180
December 16-31	170	170

***** A dry year is defined as one in which the California Department of Water Resources April forecast of the April-July runoff of the McCloud River into Shasta Lake is 300,000 acre-feet or less, except that not more than 2 years in succession shall be considered dry regardless of forecast.

Base flows in the McCloud River above the McCloud Reservoir do not fluctuate nearly as much from month to month as base flows in the McCloud River above Shasta Lake. The difference in fluctuations reflects the different hydrologic characteristics between the Upper McCloud and Lower McCloud River Watersheds. The large groundwater influence in the Upper McCloud River Basin results in relatively constant base flows throughout the year. In contrast to the Upper McCloud Basin, the majority of precipitation falling in the Lower McCloud River Watershed falls as rain and is quickly delivered into the channel network resulting in larger, flashier peak flows and larger variations in base flows.

Peak Flows

Peak flow events occur during the winter months when heavy rains saturate the ground and melt the snow pack in the upper elevations of the watershed. The peak flow history for the McCloud River above the McCloud Reservoir, at Ah-Di-Na and above Shasta Lake are shown in Figure 3. The McCloud Reservoir-Iron Canyon Diversion does not significantly influence the larger peak flow events in the watershed, however the size of smaller peak flows occurring at less than 5-10 year intervals has been reduced due to water diversions to Iron Canyon Reservoir. From Figure 3 it is apparent that the Lower McCloud River tributaries, along with Squaw Valley Creek, supply over three times more runoff to the McCloud River than is supplied by the entire Upper McCloud River Basin. The disproportionate amount of runoff per unit area reflects the difference in groundwater storage between the Lower McCloud River Watershed and Upper McCloud River Basin.

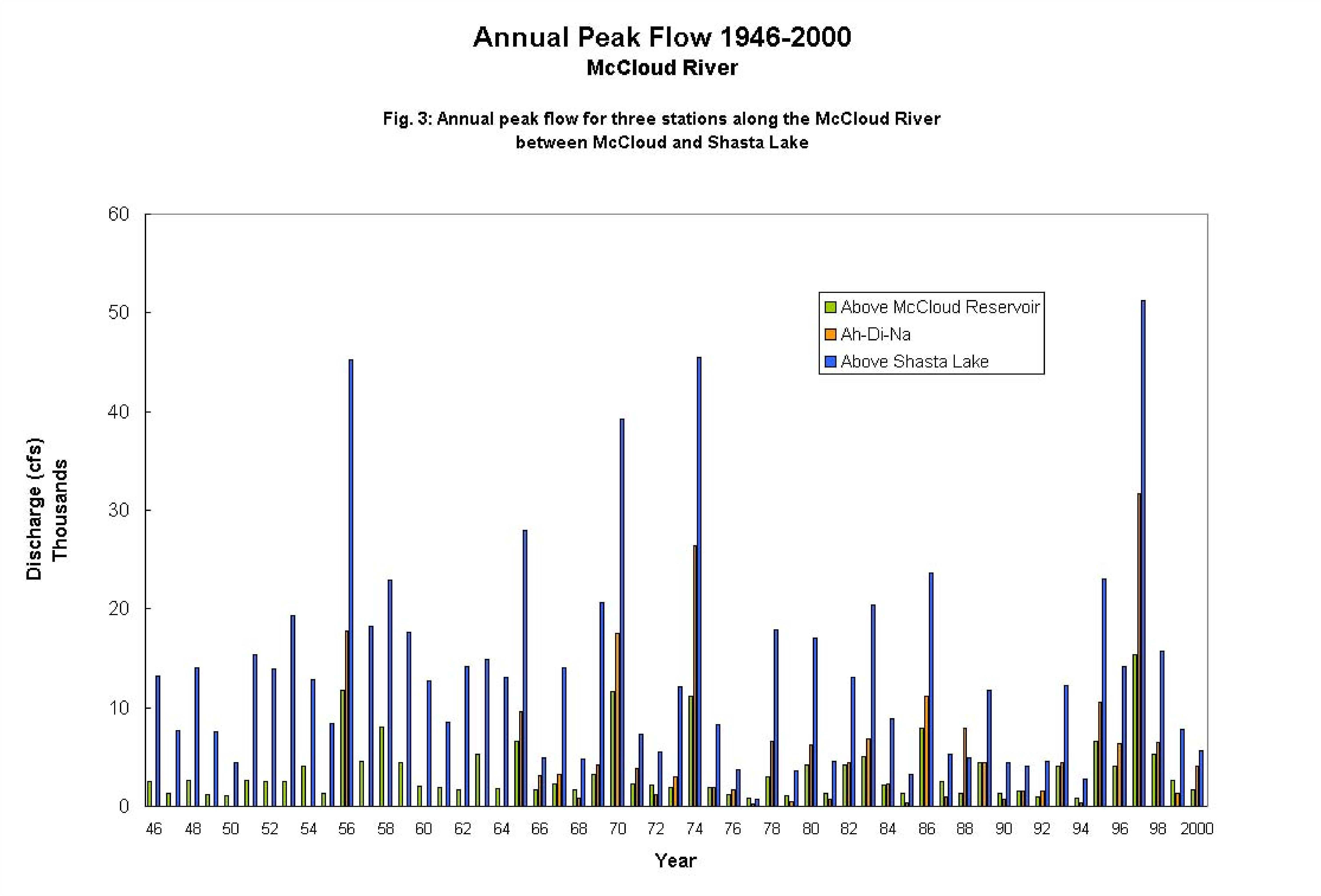
Table 3-3: Predicted peak flows for Lower McCloud sub-basins, watershed and vicinity.

	Flow (cfs) recurring at 2-100 year recurrence intervals					
Area	**2**	**5**	**10**	**25**	**50**	**100**
McCloud River near McCloud *	2440	4530	6350	9220	11800	14800
McCloud River at Baird *	13600	23800	32000	44100	54300	65600
Lower McCloud Watershed (Total)	7450	14580	18950	27620	34110	44120
Hawkins Creek	930	1970	2630	3940	4950	6540
Upper River Tributaries	1510	2990	910	5730	7100	9210
Claiborne Creek	1260	2500	3250	4720	5840	7560
Chatterdown Creek	1480	2850	3670	5280	6480	8310
Lower River Tributaries	2270	4280	5500	7950	9750	12500

* Data from Waananen and Crippen, 1977.

Estimates of instantaneous peak streamflows for 2, 5, 10, 25, 50 and 100 year recurrence intervals were calculated for each of the 5 sub-basins in the Lower McCloud River Watershed according to Waananen and Crippen, 1977 (Table 3-3). Peak flow estimates are also shown for the Upper McCloud River and the McCloud River at Baird (Waananen and Crippen, 1977). The largest flow event measured at the McCloud River station above Shasta Lake occurred in January 1974 when the instantaneous discharge peaked at 45,500 cfs. According to the flow estimates shown in Table 3-3, the 1974 runoff event corresponds to a 100 year flood for the Lower McCloud River Watershed.

Peak and baseflows in the Lower McCloud River Watershed are influenced by both natural processes and land-use activities. Water diversions have the greatest influence over baseflows in the McCloud River; however, other activities may modify peak and base flows throughout the watershed. Natural processes and land-use activities that decrease vegetative cover generally result in increased peak and base flows. High density road



Annual Peak Flow 1946-2000
McCloud River
Fig. 3: Annual peak flow for three stations along the McCloud River
between McCloud and Shasta Lake
Above McCloud Reservoir
Ah-Di-Na
Above Shasta Lake
Discharge (cfs)
Thousands
0
10
20
30
40
50
60
46
48
50
52
54
56
58
60
62
64
66
68
70
72
74
76
78
80
82
84
86
88
90
92
94
96
98
2000
Year

networks also increase flood peaks by intercepting groundwater flow and quickly routing storm runoff to the channel network.

The affect of timber harvest and wildfire on peak flows in the watershed was studied in the Ladybug and Bones Gulch drainages as part of The McCloud River Water Quality Monitoring Project (see Water Quality for more information). Timber harvest and wildfire resulted in increased peak flows in both of the disturbed drainages. Prior to timber harvest (1986-88), the amount of runoff produced from the Ladybug drainage was about twice the amount produced by the Bald Mountain drainage. Following timber harvest and wildfire (1989-91), the runoff from the Ladybug Creek drainage was about three times as much as the Bald Mountain drainage. Peak flows in Bones Gulch also increased during the winter following timber harvest activities. Because hydrologic and geologic characteristics are relatively uniform in the Lower McCloud River Watershed it is expected that increases in peak flows from timber harvest and wildfire will be similar to those that occurred in the Ladybug Creek and Bones Gulch drainages.

Stream Channel Morphologies

The morphology of stream channels in the Lower McCloud River Watershed is a consequence of natural geologic and fluvial processes and, in some cases, land-use activities. Channel morphologies in the watershed are very much alike because the channels have formed in similar parent materials and climatic conditions. In this section, stream channels in the Lower McCloud River Watershed are stratified into eight channel types and the dominant processes responsible for maintaining or altering these channel types are identified. Channel types were derived from the 1995 Aquatic Ecological Unit Inventory (EUI), aerial photo interpretation and field inspection.

Data pertaining to ecological, morphological and biological channel characteristics were collected at forty-seven locations in the Lower McCloud River Watershed with the majority of the sampling locations occurring in the Hawkins and Claiborne Creek sub-basins. The parameters of channel gradient, channel particle size, flow regime, bankfull width and active channel width were combined with site descriptions to classify stream channels into seven classes according to Montgomery and Buffington, 1993, with an additional eighth class added to account for stream channels in the upper Hawkins Creek sub-basin that did not fit any of the previous seven classes (Table 3-4). Many channels within the watershed do not fit neatly into this classification system; however, the system does provide a framework for describing channel types commonly found in the watershed and the processes that influence their function and development.

Channels located in close proximity to the ridgetops or in small drainages tributary to the McCloud River are classified as **swales, colluvial** or **bedrock** channels. Together these three channel classes comprise what are hereafter referred to as **upland channels**. Swales and colluvial channels are source areas for sediment and are most vulnerable to land-use impacts due to their abundance and the steep topography in which they are found.

Generally, most upland channels have not been influenced by land-use activities. Natural hillslope erosion and fluvial processes control sediment delivery to these channels. Woody debris serves an important function in upland channels by storing sediment and increasing channel stability. In some portions of the watershed, such as upper Hawkins and

Chatterdown sub-basins, timber harvest and associated road building has resulted in increased sediment delivery and transport in colluvial and bedrock channels. These impacts are not readily apparent since the majority of the sediment is carried downslope where it is deposited in low gradient reaches.

Impacts to stream channels from timber harvest activities tend to be relatively short lived, generally lasting from 1-5 years following harvest. Impacts from roads often last much longer than those of timber harvest. The road system has influenced upland channels by altering hillslope runoff pathways, increasing hillslope runoff, and increasing sediment inputs. Stream channels have been aggraded above road crossings due to plugged culverts and drains. The majority of road drainage and erosion problems are associated with roads located adjacent to and within canyon inner gorges and riparian areas. These problems are mostly noted in the southeastern part of the watershed where road densities are greatest.

Catastrophic wildfires have the potential to seriously impair upland channels by removing vegetation and destabilizing hillslopes. Increased hillslope erosion occurring during subsequent winter rains can deliver large volumes of sediment to the upland channel network. Increased runoff and hillslope erosion following vegetative loss can result in headward expansion of colluvial channels into swales. Impacts to upland channels in the Ladybug Creek drainage following the Dee Fire of 1989 illustrate the hazards that catastrophic fires pose to the aquatic environment. Straw bale check dams were placed in upland colluvial channels following the fire in order to trap sediment from the burned hillslopes. The check dams were completely filled with sediment during a large precipitation event the following winter.

As the drainage area increases with increased distance downstream, bedrock and colluvial channels evolve into **cascade** channels. Cascade channels generally exhibit perennial flow regimes. They are steep and dominated by boulder and stone substrates. The bedrock reach class also occurs periodically where bedrock is the dominant substrate. With the exception of isolated low gradient reaches, the majority of sediment derived from upland channels is transported through cascade channels during peak flows. Cascade channels have been influenced by land-use activities, although to a much lesser extent than the upland channel network above them.

As channel gradients decrease most cascade channels evolve into **step-pool** channels. Step-pool channels are characterized by a characteristic pattern of alternating steps and pools. Like cascade channels, step-pool channels often are interspersed with occasional bedrock reaches. The bedrock reaches often contain waterfalls which occur at exposed bedrock control points along the channel. Most step-pool channels have not been impacted by management activities. Excessive sediment delivery from upland channels has resulted in channel aggradation in some of the smaller, low gradient step-pool channels such as the lower reaches of Hornet Gulch in the Hawkins Creek sub-basin. In some cases channel aggradation has resulted in the loss of pools and the conversion of step-pool channels to plane-bed channels. Most of the larger tributaries to the McCloud River, such as Claiborne and Chatterdown Creeks, are classified as step-pool channels.

Table 3-4: Channel classes found in the Lower McCloud River Watershed. With the exception of the Alluvial Upland class, channels are typed according to Montgomery and Buffington reach level classification system (Montgomery and Buffington, 1993).

Reach Class	n	Slope	Reach Type	Description
Swale (Upland)	4	Variable	Source	Occur in close proximity to ridgetops, above colluvial and bedrock channels. Do not contain channel features. Contain no evidence of annual scour. Substrate at center of swale dominated by woody debris and soil. Swales located in unstable areas serve as source areas for debris flows. Do not contain riparian vegetation unless associated with springs.
Colluvial (Upland)	9	S>.20	Source	Occur in close proximity to ridgetops. Beginning of colluvial channel denotes point of channel initiation. Upper reaches of colluvial channels ephemeral and lower reaches have intermittent streamflow on an annual basis. Channel substrate consists largely of hillslope colluvium deposited by gravitational forces rather than alluvial processes.
Bedrock (Upland)	1	Variable	Transport	Occur in close proximity to ridgetops but can also occur at lower elevations. Identical to colluvial channel type with the exception that the dominant substrate is bedrock. Colluvial channels may be converted to bedrock channels following debris flow events. Bedrock reaches may also occur in larger, low gradient channels.
Cascade	11	.30>S>.10	Transport	High gradient channels occurring on steep mid-slopes throughout the watershed. Flow can be perennial or intermittent. Channel substrates are dominated by boulders and stones in larger perennials and cobbles and gravels in intermittents. Examples of cascade channels include the mid-elevation reaches of Mica Gulch, Centipede Creek, and Deer Creek.
Step-Pool	11	.10>S>.03	Transport	Occur in mid to lower elevations within well developed canyons and inner gorges. Flow regime is generally perennial. Channel substrates are dominated by boulders, stones and cobbles. Comprise the majority of larger tributaries to the McCloud River including lower reaches of Butcherknife and Nawtawaket Creeks and middle reaches of Claiborne, Hawkins and Chatterdown Creeks.
Plane-Bed	6	.03>S>.01	Response	Diverse channel type found in the McCloud River and portions of its major tributaries. Low gradient, perennial channels. Substrate composition is variable. Lack defined bedform patterns such as point bars and pools. Channels exhibiting plane-bed morphologies include the upper reaches of Hawkins Creek, the lower reaches Claiborne Creek and reaches of the McCloud River.
Pool-Riffle	4	.02>S.001	Response	Comprises majority of McCloud River and may also occur in lower reaches of larger tributaries such as Squaw Valley Creek. Flow regime is always perennial. Substrate types generally consist primarily of stones and boulders in riffle reaches and cobbles and gravels in pool reaches. Bedrock outcrops are common. Channel canopy cover is generally less than other channel types due to size of bankfill channel.
Alluvial Upland	1	.03>S.001	Response	Occur in flat, upland areas. Inspection of aerial photos and maps indicates that this channel type may be unique to the upper reaches of Hawkins Creek in the Little Meadows area. Channel gradients are low and flow regimes are intermittent or perennial. Substrate dominated by sand and gravels. Channels are very unstable and have been impacted by land-use activities.

The McCloud River and the lower reaches of its larger tributaries are classified as **pool-riffle** or **plane-bed** channels. These channels along with step-pool channels harbor the majority of the fisheries found in the watershed. Due to the absence of baseline data it is difficult to determine if these channels have been impacted by management activities, however data collected during the 1995 Ecological Unit Inventory indicate that these channels are stable and in good health and have not been significantly influenced by land-use activities occurring in the watershed.

Pool-riffle reaches are common within the McCloud River Canyon. These reaches are characterized by alternating reaches of boulder-strewn runs and deep pools (Rode, 1990). The canyon bottom contains a series of abandoned terraces, the lowest of which function as a floodplain for the river. A noticeable increase in canyon bottom width occurs below the Claiborne Creek confluence (Wales, 1938). The wider canyon bottom reflects the increase in streamflow to the river from Claiborne and Squaw Valley Creeks. Reduced baseflows in the McCloud River have resulted in decreased flow depths and wetted channel widths. Despite the decreased flows, historic floodplain and in-channel bedforms remain largely unmodified because the majority of peak flow runoff originates in tributaries to the McCloud River below the McCloud Reservoir.

The **alluvial upland** channel class was created for this analysis in order to describe channels in the Little Meadows area that did not fit any of the other reach classes. Alluvial upland channels have low gradients (<3%) and often have sandy beds. These channels have been impacted by timber harvest and road building activities that occurred during the 1980s. Significant channel downcutting, bank erosion and channel aggradation has occurred throughout the Little Meadows channel network. Additional impacts associated with the transportation system continue to affect channel stability in this area.

Water Quality

The quality of water in the Lower McCloud River Watershed is influenced by both natural processes and land use activities. Beneficial uses dependent on high quality water include fish and aquatic life (including riparian vegetation), domestic drinking water for private land owners along the McCloud River, and recreation benefits associated with fishing, rafting and hiking. Due to the absence of lakes and wetlands most water quality concerns in the Lower McCloud River Watershed are related to the channel network.

The quality of water in the watershed was assessed by determining how natural processes and land-use activities have influenced sediment, water column and streamflow water quality parameters in the watershed (Table 3-5). Impacts from recreation activities (rafting, fishing) were assumed to be negligible in comparison to other land-use practices. Impacts from grazing were not considered since this activity no longer occurs in the watershed.

The cumulative impacts of natural hillslope erosion processes, roads, and timber harvest exert the largest influence on water quality parameters. Changes in most water quality parameters only occur in response to winter precipitation. Large increases in suspended sediment and turbidity often occur during high flows. Suspended sediment and turbidity quickly drop to pre-storm levels following peak flow events. In contrast to suspended sediment and turbidity, changes in bedload concentrations following peak flows may be long lasting.

The clarity of water in the McCloud River fluctuates from excellent during most of the year to highly turbid for short periods of time during the spring and fall. The overall effect of water retention at the McCloud Reservoir has been to decrease turbidity and suspended sediment levels in the McCloud River for the majority of the year.

Changes in turbidity levels in the McCloud River may occur independently of high flows due to the influence of the McCloud Reservoir and Mud Creek. Turbidity in the McCloud River occasionally increases in September and October when water levels in the McCloud Reservoir drop resulting in the delivery of sediment, largely derived from Mud Creek, to the lower river (Dave Bowers, PG&E, personal communication). The naturally high turbidity levels of Mud Creek are caused by glacial runoff from the Konwakiton Glacier. Bi-annual surges in turbidity occur in response to snowmelt runoff from Mud Creek in the spring and reservoir drawdown and glacial melt in Mud Creek during the fall. Higher turbidity levels also occur during valve testing or sluicing at the McCloud Dam. Impacts to the McCloud River from highly turbid flows are greatest in the reach between the dam and Hawkins Creek (Rode, 1989).

The health of spawning gravels in the McCloud River was studied by Scott McBain in 1989 for the Nature Conservancy. McBain found that spawning gravels in the river contained high concentrations of dissolved oxygen. The high levels of dissolved oxygen showed that gravel deposits in the river had high permeabilities and that surface flows were mixing with the gravels. McBain concluded that the health of spawning gravels was excellent in the reaches of the river that were investigated during the duration of the study (McBain, 1989).

Water temperature recorders were placed in the McCloud River and selected tributaries during the summer of 1996 in order to collect baseline data for the watershed. Water temperatures for the McCloud River below the McCloud Reservoir, at Ah-Di-Na and above Nawtawaket Creek are shown in Figure 4. The figure illustrates the steady increase in water temperature downstream of the dam and the diurnal fluctuations that occur throughout the summer. The trend of increasing temperatures is illustrated with a simple comparison of mean water temperatures at the three stations on the McCloud River during August, 1996. Mean water temperatures in the McCloud River below the dam, at Ah-Di-Na and above Nawtawaket Creek were 50.7, 52.3, and 61.4 degrees Fahrenheit respectively.

A comparison of water temperature data for Nawtawaket, Claiborne and Chatterdown Creeks for the month of August 1996 shows that water temperatures are not uniform in each tributary (Figure 5). Water temperatures in Claiborne and Chatterdown Creeks are similar while water temperatures in Nawtawaket Creek are surprisingly lower. The lower water temperatures and minimal daily fluctuations in Nawtawaket Creek may be due to the lack of land disturbance in the Nawtawaket Creek drainage, groundwater influences, and shorter residence times of surface runoff in this drainage.

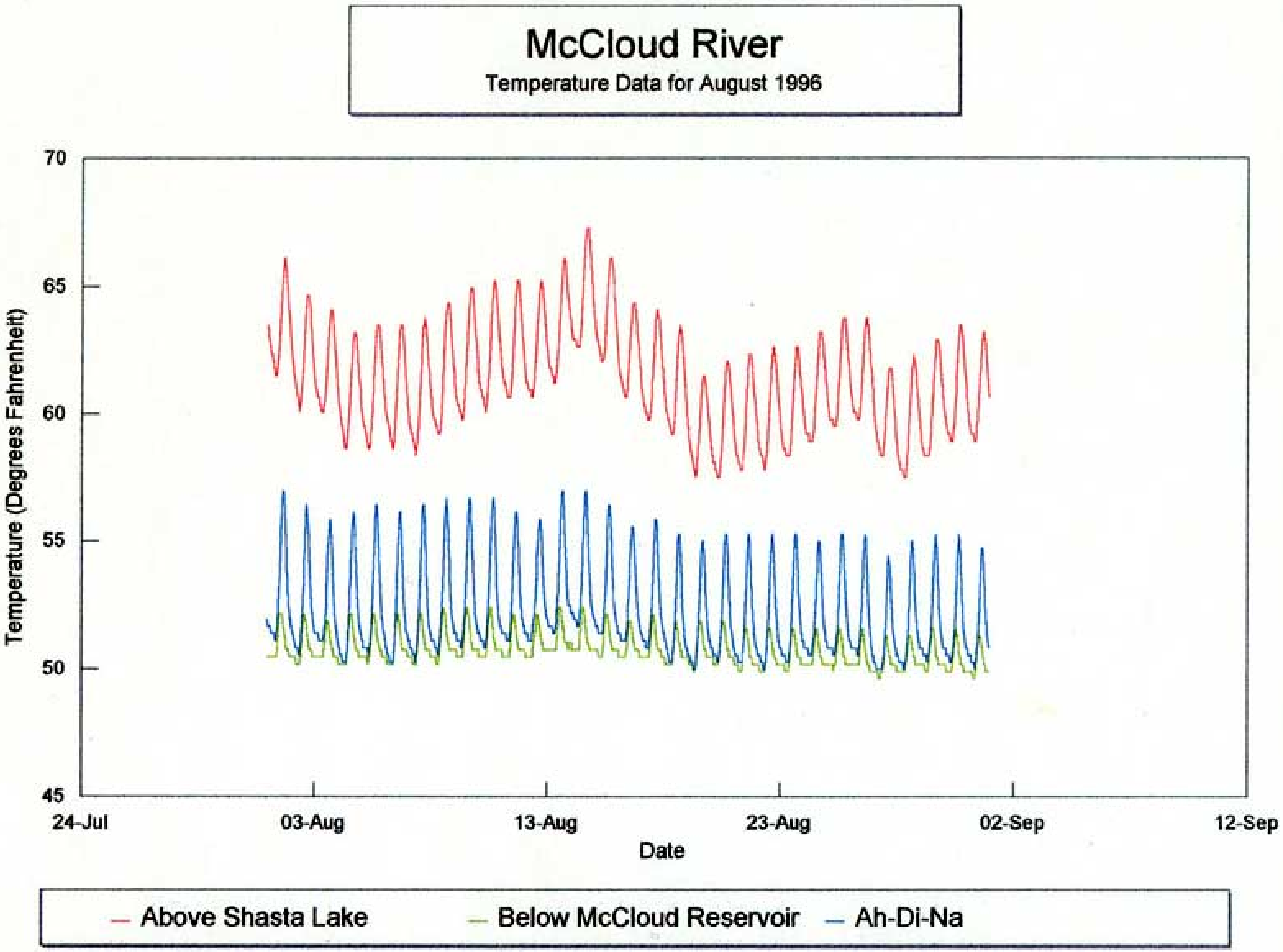


Fig. 4: Temperature data for the McCloud River for August, 1996. Daily fluctuation in water temperature increases with increasing distance downstream of McCloud Reservoir.

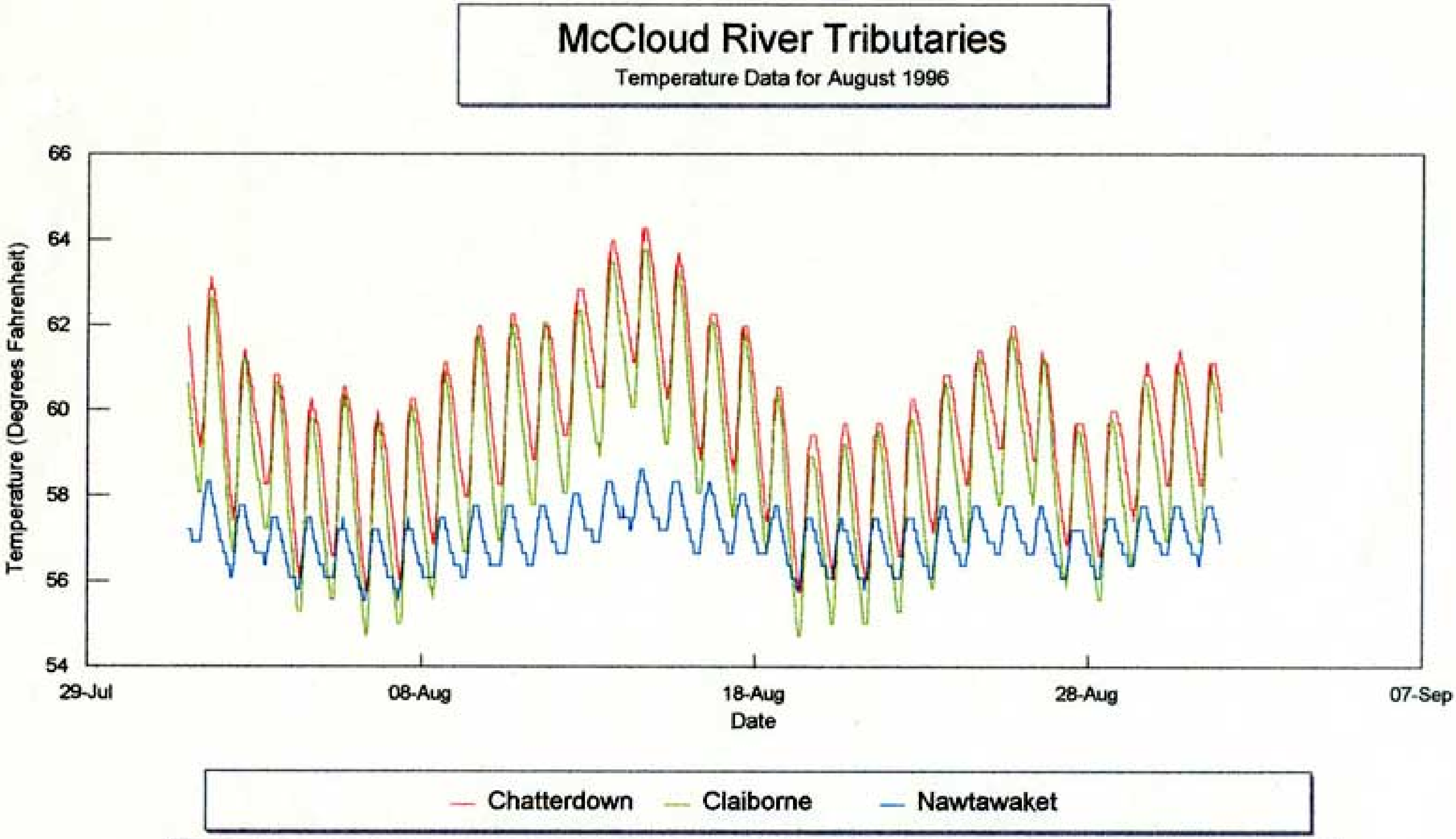


Fig. 5: Temperature data for three tributaries to the McCloud River for August, 1996.
Lower temperatures in Nawtawaket may be due to shorter residence times or groundwater influence.

Table 3-5: Water quality impacts from natural processes and land-use activities in the Lower McCloud River Watershed

WATER QUALITY PARAMETERS	NATURAL PROCESSES		LAND-USE ACTIVITIES		
	HILLSLOPE EROSION PROCESSES	WILDFIRE *	ROAD IMPACTS	TIMBER HARVEST	RESERVOIR STORAGE AND WATER DIVERSION
Turbidity	↑ turbidity during peak flows.	↑ turbidity from both wildfire and fire suppression activities.	↑ turbidity during winter precipitation events. Most sediment is delivered during first fall precipitation event.	↑ turbidity during peak flows associated with harvest activity.	↓ turbidity in McCloud River below McCloud Reservoir. ↑ turbidity for short periods in spring and fall.
Sedimentation	↑ sedimentation during peak flows.	↑ sedimentation from both wildfire and fire suppression activities.	↑ fine sediment deposition in channels receiving road surface runoff.	↑ sedimentation in sub-basins with extensive harvest activities.	↓ sedimentation in McCloud River downstream of McCloud Reservoir. ↑ sedimentation for short periods in spring and fall.
Bedload	↑ bedload transport particularly in low gradient reaches during peak flows.	↑ bedload particularly in low gradient, upland channels with low sediment transport capacities.	Potential ↑ in bedload in channels draining roaded, unstable terrain.	Potential ↑ bedload concentrations in upland ephemeral and intermittent channels.	↓ bedload and spawning gravels downstream of McCloud Reservoir.
Temperature	Negligible effect.	↑ temperature due to loss of canopy over upland channels.	Negligible effect.	Potential minor ↑ in temperature due to logging adjacent to stream courses.	↑ water temperature for reach of McCloud River below McCloud Reservoir.
Dissolved Oxygen	↓ dissolved oxygen content due to ↑ fine sediment inputs.	↓ dissolved oxygen content due to ↑ water temperature and ↑ fine sediment inputs.	Potential to ↓ dissolved oxygen due to intergravel sedimentation.	Potential to ↓ dissolved oxygen due to intergravel sedimentation.	Potential ↓ in dissolves oxygen in McCloud River below McCloud Reservoir.
pH	Negligible effect.	Potential ↑ in pH from ammonia-based fire retardants.	Negligible effect.	Negligible effect.	Negligible effect.
Peak Flows	Negligible effect.	↑ peak flows.	↑ peak flows due to increased runoff.	Small ↑ in peak flows.	Small ↓ in peak flows occurring at less than 10 year intervals.
Low Flows	Negligible effect.	↑ base flows.	Potential ↓ in base flows due to loss of groundwater storage (road cuts).	Small ↑ in base flows for several years following harvest.	Large ↓ in peak flows.

* Impacts from wildfire dependent on fire intensity and magnitude of precipitation events occurring over the following years.

Water temperatures in the McCloud River below Lake McCloud have increased as a result of reservoir operations. Prior to the construction of the reservoir water temperatures in the river were largely regulated by Big Springs which provided a constant flow of 45 degrees Fahrenheit water to the river. Prior to the construction of the reservoir high water temperatures in the McCloud River at Baird never exceeded 60 degrees Fahrenheit (Rode, 1990). Following completion of the reservoir stream temperatures as high as 75 degrees Fahrenheit have been recorded in the lower river by the Department of Fish and Game (Rode, 1990).

The **McCloud River Water Quality Monitoring Project** (1986-1997) provided the Forest Service with a unique opportunity to evaluate the impacts of land-use activities on water quality in the Lower McCloud River Watershed. The study, conducted by the Nature Conservancy, used a paired watershed approach to monitor selected water quality parameters in two disturbed watersheds (Ladybug Creek and Bones Gulch) and an undisturbed watershed (Bald Mountain Creek).[1/] The goals of the project were to "establish baseline levels for water quality within the McCloud region" and "to demonstrate the project's feasibility and to promote hydrological studies as part of the normal land management decision-making process" (Bolda and Meyers, 1995). The results of the study are summarized below. For a complete description of the McCloud River Water Quality Monitoring Project refer to Bolda and Meyers, 1997.[2/]

[1/] The watersheds referred to in the study are referred to as drainages in this report in order to prevent any confusion with the Lower McCloud River Watershed.

[2/] Final report for McCloud River Water Quality Study presented in Journal of Soil and Water Conservation.

Suspended sediment, turbidity, peak flows and pH were measured in Bald Mountain, Ladybug and Bones Gulch drainages in order to examine how water quality parameters responded to disturbance activities. The percentage of each drainage impacted by each disturbance activity is shown in Table 3-6. The study results indicate that some water quality parameters were influenced by timber harvest activities in the Ladybug and Bones Gulch drainages.

Statistically significant differences in the concentration of suspended sediment were observed between the Ladybug and Bald Mountain drainages during storm events in 1991 following a three year period during which 32.1 percent of the Lady Bug Creek drainage was logged. The lack of a significant difference in suspended sediment concentrations between the Bones Gulch and Bald Mountain drainages suggests that suspended sediment concentrations did not increase substantially in response to the timber harvest activity that occurred in Bones Gulch.

The increase in suspended sediment concentrations in Ladybug Creek may have also been attributable to salvage activities associated with the Dee Fire which burned approximately 41 percent of the Ladybug Creek drainage in 1989. Bolda and Meyers note that:

> “although Ladybug did not show an increase in suspended sediment immediately following the fire in 1990, the added disturbance of road building and salvage logging appeared to result in an increase in the concentration of suspended sediment the following winter. Once the salvage logging activities ceased and the area was replanted, the concentration of suspended sediment returned to pre-disturbance levels” (Bolda and Meyers, 1997).

Despite the large peak flows during the winter of 1994-95 there were no statistically significant differences in suspended sediment concentrations for any of the streams. The lack of a significant difference in suspended sediment concentrations indicated that the Ladybug drainage was recovering from disturbance activities. Turbidity levels increased in all of the streams during peak flows, however no significant differences in turbidity occurred between streams during the study. The study also did not document any significant differences in pH between disturbed and undisturbed drainages following the use of ammonia-based fire retardants.

Table 3-6: Percentage of drainage impacted by management activities. Data from Bolda and Meyers, 1995. Flow represents average discharge from January-March, 1986-94.

Drainage	Area (ac.)	Flow (cfs)	Roads	Logging	Fire
Ladybug Creek	1375	19	3%	32%	41%
Bones Gulch	692	8	1%	7%	0%
Bald Mountain	1030	11	0%	0%	0%

Biological Features

Vegetation

Vegetation and habitats within the Lower McCloud River Watershed are diverse, with large sweeps of forested lands, chaparral covered slopes, deep canyons, and many perennial and intermittent streams. The complex topography of the watershed allows for an array of microhabitats and a diversity of species to exist, depending upon slope, aspect, soil type, elevation and disturbance regime. Areas of high productivity soils, coupled with rainfall amounts averaging 70-80+ inches per year, allow for rapid tree growth in the absence of catastrophic disturbances. The recent history of aggressive fire suppression has resulted in the development of large areas of dense, complexly structured forests, largely replacing the early seral and open canopied fire-created habitats that dominated the watershed at the beginning of this century.

Table 3-7: Summary of vegetation types and seral stages for the Lower McCloud River Watershed.

		Entire Watershed		**LSR portion of watershed**	
Seral Stage	**Strata**	**acres**	**%**	**acres**	**%**
Non-forested	NF	128	0.3	48	0.2
Brush (chaparral, shrub size hardwoods)	SX	1857	4.1	788	2.7
Hardwood (black oak, canyon live oak)	HCO,HNC	6847	15.2	1533	5.3
Early seral - plantation	XX1	2184	4.8	1545	5.4
Early seral - open canopy (<40%)	M2P	84	0.2	58	0.2
Early seral - closed canopy (>40%)	M2G	26	0.1	26	0.1
Mid seral - open canopy (<40%)	M3P,M4P,NC	8397	18.6	4231	14.8
Mid seral - closed canopy (>40%)	M3G	10022	22.2	6756	23.6
Late seral - closed canopy (>40%)	M4G	15576	34.5	13685	47.4
Totals		45120	100.0	28672	100.0

Conifer forest occupies approximately 36,000 acres of National Forest land within the Lower McCloud River Watershed. This is subdivided into two general forest types:

Mixed conifer - in which no single species comprises 80% or more of the trees.
Douglas-fir - where Douglas-fir comprises 80% or more of the trees.

Besides Douglas-fir, other conifer species in both forest types include white fir, ponderosa pine, sugar pine, and incense-cedar. California black oak and canyon live oak occur in both of these general forest types in varying densities. Oak also occurs in pure stands on approximately 15% of the watershed - mostly in the southwest portion. The distribution of vegetation types is displayed on Map 14 Vegetation Types.

The remaining chapters of this document use the following size and density codes to describe timber stands and wildlife habitat in conifer forest:

Size Class Codes

Size Code	Size Class	Crown Diameter	Approx. DBH
1	Seedling		<6”
2	Sapling	<12 ft.	6”-11”
3	Pole/Small Tree	12-24 ft.	11”-24”
4	Medium/Large Tree	>24 ft.	>24”

Density Class Codes

Size Code	Stocking	Canopy Condition	Canopy Closure
P	Poor	Sparse/Open	10-40%
G	Good	Moderate/Dense.	40-100%

For example: 3G would indicate a stand with 12-24' crown diameters and 40-100% crown cover.

Seral stage and habitat distribution for conifer forest within the Lower McCloud River Watershed is summarized in Table 3-8

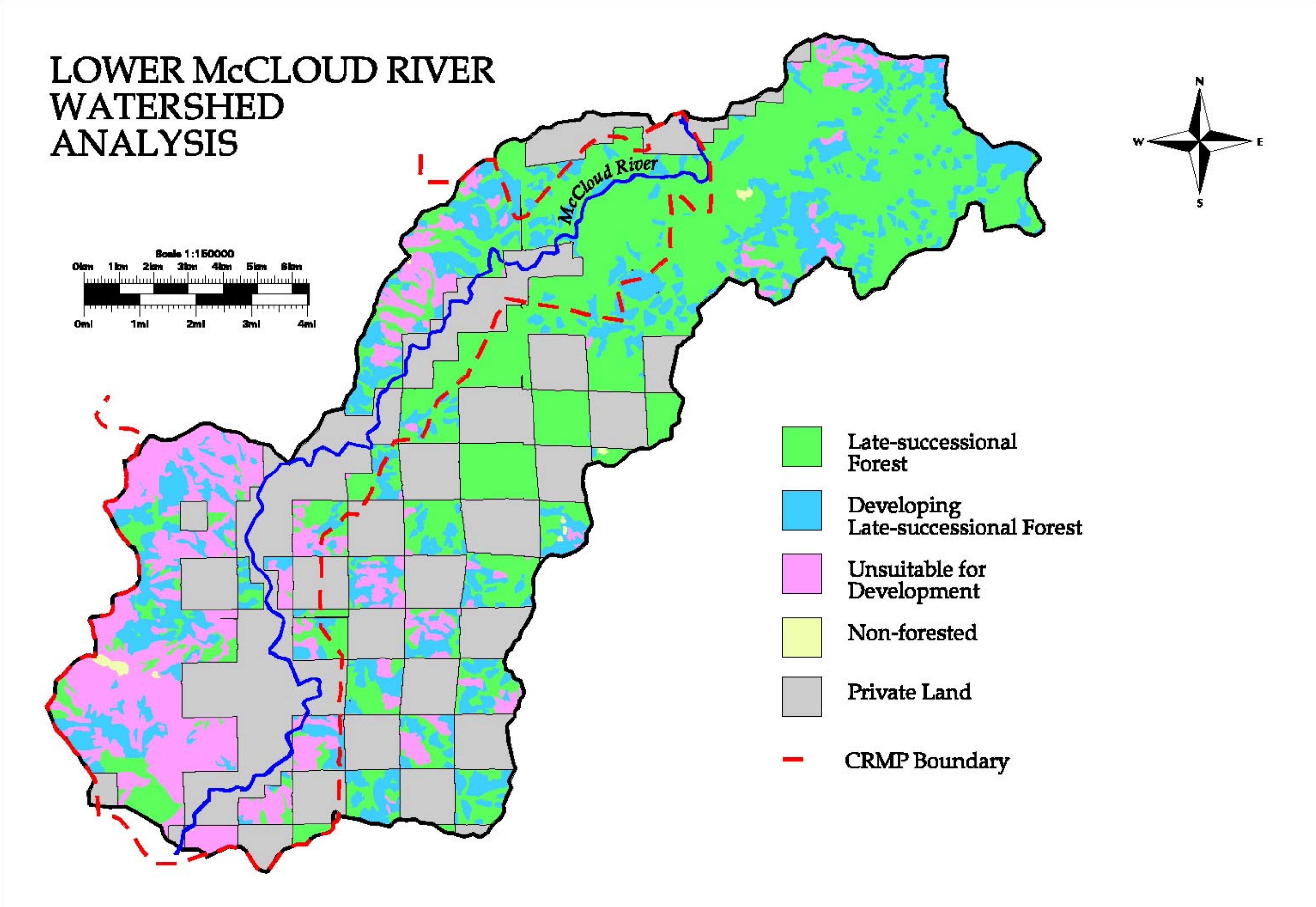
Table 3-8: Seral stage and habitat distribution for conifer forest within the Lower McCloud River Watershed

Seral Stage	**Strata**	**avg. dbh**	**canopy closure**	**acres**	**%**
early seral *	1, 2	<11”	0-100%	2,294	6.3
mid seral	3P, 4P	>11	10-40%	8,397	23.2
mature	3G	11-24”	40-70%	10,022	27.6
late seral	4G	>24”	40-70%	15,576	42.9
Total conifer forest				36,289	100.0

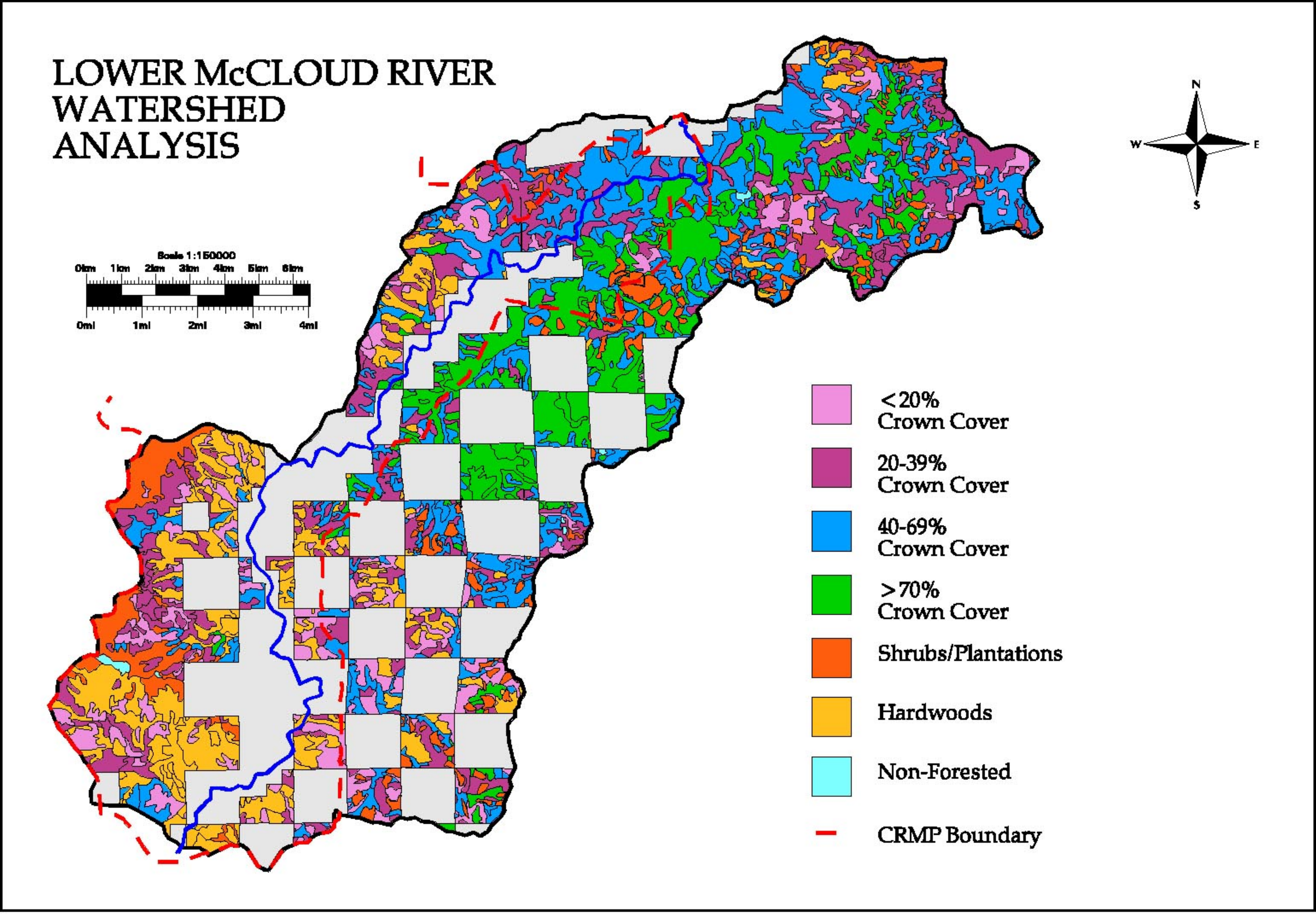
* includes both natural young stands and plantations

Just over 8,600 acres of additional lands are composed of hardwood-dominated stands, scattered knobcone pine, gray pine or chaparral. Most of this in the southern and western portions of the watershed.

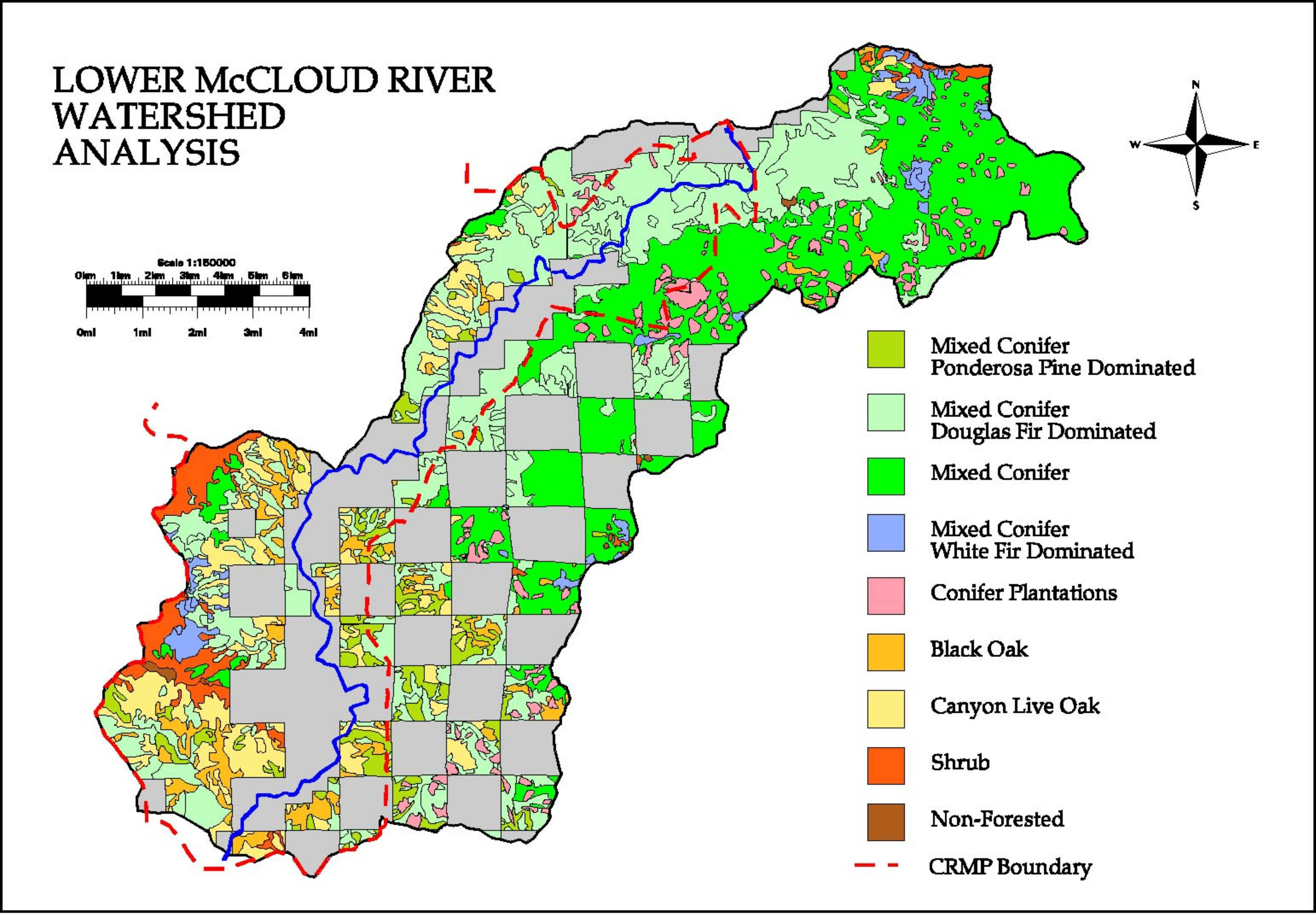
The McCloud River and its numerous tributary streams form a complex network of aquatic and riparian habitats throughout the watershed. Big-leaf maple, vine maple, willow, alder, dogwood, hazelnut, thimbleberry, blackcap raspberry, and Pacific yew are found in



Map 12. Late-Successional Forest



Map 13. Forest Canopy Cover



Map 14. Vegetation Types

riparian areas, along with a diverse assemblage of rushes, sedges, ferns, and dense stands of Indian rhubarb forming the dominant herbaceous understory along perennial streams.

Understory and chaparral shrub species are very diverse and are dominated by greenleaf manzanita, snowberry, serviceberry, buckbrush, deerbrush, mountain mahogany, tanoak, and Oregon ash. Redbud, buckeye, coffeeberry, Indian plum, and mock-orange also occur throughout the watershed in second growth forest and at the lower elevations. Shrub species rarely seen elsewhere on the Shasta-Trinity National Forest also occur here, such as Sierra bladdernut, hop tree, and snowdrop bush. The herbaceous understory layer is also very diverse, with dozens of wildflowers occurring commonly throughout the watershed. Several rare species which occur rarely, or not at all outside of the McCloud River Basin, occur in the watershed. These are Shasta eupatorium, rough raillardella, veiny arnica, and Howell’s cliff-maids. Shasta snow-wreath has not been located but is likely to occur in the watershed also. These species are discussed in detail under “Species of Concern”.

Vegetation diversity is also evident in the forb/grass layer, where present, with more than 60 species of wildflowers common in the watershed.

Old Growth Habitat

Current old growth habitat acreage within the Lower McCloud River Watershed is shown in Table 3-9

Table 3-9: Old growth habitat in the Lower McCloud River Watershed by land allocation.

Land Allocation	**acres**	**% of land allocation**
Late-Successional Reserve	13,685	47.7%
Administratively Withdrawn Areas	271	3.9%
Matrix	1,620	16.3%
Entire Watershed	15,576	34.5%

The oldest stands of old growth habitat (>200 years) are largely confined to canyon bottoms and stream courses and comprise approximately 1,000 acres. A majority of the old growth is found within Late-Successional Reserve (LSR) RC-335. Most of the remaining is within matrix lands.

Approximately 60% of current old growth habitat occurs as mixed conifer stands. The remaining 40% occurs as Douglas-fir dominated conifer stands.

In addition to the 15,576 acres of existing old growth habitat, an additional 9,957 acres have been identified as being capable of producing old growth habitat within the next 50 years. This determination was made by tracking the development of stands in the watershed over the past 50 years using old aerial photos. Indications are that 3P and 3G conifer forest on sites with high soil productivity can be expected to develop into old growth habitat within 50 years. Queries of the GIS database identified 9,957 acres of existing 3P and 3G forest on sites with high productivity.

Old growth habitat within the watershed exists as larger contiguous patches within the interior of the watershed and as linear contiguous patches along the eastern and western borders of the watershed (Map 12). The large patches often exceed 640 acres and at least a mile in width. The linear patches are also in the 640 acre range, but are no wider than 1/3 of a mile and often 1/8 to 1/4 mile in width. Small timber harvest units most often created these narrow bands within the northeastern section of the watershed (Horned Owl Gulch and the east slope of Butcherknife Creek eastward). Elsewhere, the linear patches may be a natural function of the ecosystem (McCloud River, south and west from Ah-Di-Na Campground to the McCloud River Club; and South of Tater Hill, along Oak Creek).

For the large patches, connectivity by old growth habitat occurs as narrow patches of habitat, whether along a stream or over a ridge. Two linear patches are also connected to the larger patches (habitat area west of McCloud River, just south of Ah-Di-Na and along Butcherknife Creek and the headwaters of Sheep Creek. Larger and wider areas of connectivity between all size patches is also provided for through mature forested habitat.

The most isolated old growth (and even potential old growth habitat) occurs along Hawkins Creek, Bald Mountain Creek and neighboring tributaries, and Oak Creek. Whether the lack of connectivity is man caused or natural is unknown without further analysis, but is thought to mostly be natural, with some man caused changes in the Hawkins Creek area.

The quality of old growth habitat varies depending on stand structure, understory vegetation, and layering of the crown canopy. The most favorable conditions occur in conifer forests with a layer of understory vegetation, a wide range of tree sizes, and dense multi-layered crown canopies. Less favorable conditions occur when forest stands develop large acreages of uniform, even-aged trees with little variation in size, and a single crown layer. Stand history determines the future characteristics of the forest. Two scenarios have been identified as commonly occurring in the Lower McCloud River Watershed:

1. 3P stands developing after fire - these stands began as scattered large trees over an understory of brush and saplings. Under conditions of high soil productivity and high rainfall these stands develop rapidly under fairly open conditions. After 50 years, these stands develop into forests of mature trees with a scattered overstory of larger, overmature trees. Brushy openings are common throughout these forests where stand development is slower.
2. 3G stands developing as even-aged forest - these stands develop from dense sapling stands that have had little disturbance. These stands develop slower because of competition due to overstocked conditions. Without disturbance or manipulation, these stands tend to retain uniform tree size and canopy conditions. Openings are less common and there is less understory vegetation due to dense canopy cover.

Old growth habitat that has developed from 3P stands tends to exhibit more desirable conditions. In the Lower McCloud River Watershed, approximately 55% of current old growth habitat was in a 3P condition in 1944 (based on old aerial photos), 40% developed from 3G conditions, and the remaining 5% was already in an old growth condition. This indicates that the majority of old growth habitat in the watershed (55%) developed in conditions that tend to favor the development of desirable characteristics.

Mature Forested Habitat

Mature forested habitat in the Lower McCloud River Watershed is summarized in Table 3-10.

Table 3-10: Mature forested habitat in the Lower McCloud River Watershed by land allocation.

Land Allocation	acres	% of land allocation
Late-Successional Reserve	6,756	23.6%
Administratively Withdrawn Areas	648	9.4%
Matrix	2,618	26.3%
Entire Watershed	10,022	22.2%

Currently 22% of the watershed contains mature forested habitat (suitable foraging habitat), in addition to the OG habitat (see Table 3-6 and Map 12). Again, a majority of the mature habitat is within the LSR, with the remaining in administratively withdrawn and matrix lands. These stands, while not meeting the definition of old growth, often provide high canopy closure and some measure of a multi-storied structure.

Approximately 62 % of current mature forested habitat occurs as mixed conifer stands. The remaining 38% occurs as Douglas-fir dominated conifer stands.

As with old growth habitat, the western and southeast edges of the watershed contain the least contiguous habitat (see Map 12). The mature forested habitat provides for the connectivity between the old growth patches. The pattern of vegetation within the central part of the watershed provides large areas of contiguous late-successional habitat. Natural openings and maturing of early seral patches are expected to allow a healthy pattern of interspersed openings.

Hardwood Forest Habitat

Hardwoods occur within the watershed as both pure hardwood stands and as a component of the conifer forest. The current level of hardwood stands is shown in Table 3-11.

Table 3-11: Hardwood stands in the Lower McCloud River Watershed by land allocation.

Land Allocation	acres	% of land allocation
Late-Successional Reserve	1,533	5.3%
Administratively Withdrawn Areas	3,058	44.4%
Matrix	2,256	22.7%
Entire Watershed	6,847	15.2%

Hardwood stands occur mostly within the northeastern, western and southern portions of the watershed, mainly in matrix lands and seldom within the central part of the watershed.

The net acreage of hardwood stands has increased by approximately 1,000 acres over the past 50 years. Approximately 350 acres has transitioned into conifer forest types as the absence of fire has allowed shade tolerant conifers to invade some hardwood stands and inhibit the regeneration of young hardwoods. However, over 1,300 acres of brush have developed into hardwood forests over the past 50 years - also the result of fire exclusion.

Although the acreage of hardwood stands has been increasing as a result of the transition from the brush seral stage, there are few acres (<400 ac.) of suitable brushfields available to continue this trend. The brush seral stage has declined by half over the past 50 years and much of the remaining brush is on the harsher sites. The continued absence of fire in the ecosystem could result in a loss of hardwood acreage in the future as more hardwood stands are lost to conifer encroachment and few developing brush fields are available to replace them.

With past fire suppression, hardwood habitats are expected to have understory growth of seedlings and shrubs. The extent of these developing habitats, though is unknown. Developing hardwood habitats can also reduce the amount of herbaceous growth usually found in the understory, through shading out of the herbaceous growth or through competition from seedling and shrubs. In addition, acorn production may be hindered due to competition of resources by seedlings and shrubs in the understory.

Hardwoods also function as an important component in conifer forests. Hardwood presence in conifer forests declines as overstory crown cover increases. The absence of fire and disturbance in the watershed this century has allowed conifer stands to develop and inhibit the development of hardwoods. Mature black oak is described as being intolerant of shade. If overtopped, black oak either dies outright or dies back successively each year. Short epicormic branches keep the tree alive for a time, but with continued overtopping, death is inevitable (USDA, 1990). Declining black oaks are evident within dense conifer stands throughout the watershed.

Early Seral/Chaparral Habitat

Early seral/chaparral habitat in the Lower McCloud River Watershed is summarized in Table 3-12.

Table 3-12: Early seral/chaparral habitat in the Lower McCloud River Watershed by land allocation.

Land Allocation	**acres**	**% of land allocation**
Late-Successional Reserve	2,418	8.4%
Administratively Withdrawn Areas	1,007	14.6%
Matrix	726	7.3%
Entire Watershed	4,151	9.2%

Early seral stage habitat in the watershed is currently composed of:

- brush 45%
- natural stands of young conifers 3%
- plantations 52%

The brush component of early seral habitat is divided into:

- chaparral 85%
- shrub size hardwoods 15%

Brush composed of shrub size hardwoods has the potential to develop into hardwood stands and later seral stages when located on areas of high soil productivity. Conifers may gradually encroach upon chaparral vegetation where there is adequate soil. Chaparral vegetation on harsh sites and poor soil is generally not expected to develop into later seral stages.

As with hardwoods, brush habitats are located within the northeastern, western and southern portions of the watershed, but also are scattered in the southeastern portion of the watershed amongst mature and old growth habitats. The young conifer stands include both natural regeneration following fire and planting following fire or timber harvest. Habitat conditions based on the current LMP90 vegetation layer, known fire history, and aerial photos can only be grossly determined. Assessing areas of early or late seral was not possible for non-plantation habitats as the baseline vegetative layer contains no seral stages for these habitats. Many of the chaparral areas are showing the effect of an absence of fire. Large areas of brush are essentially senescent and open grassy areas are largely absent. Areas of early seral may occur within young conifer stands 40 years old.

No open grassland habitat was identified in the LMP90 database. Most herbaceous vegetation is expected to occur within the understory of open canopied (<50%) conifer and hardwood forested habitats, where shrub encroachment has not occurred. Young plantations (< 5 years) would also provide herbaceous habitats.

Riparian and Aquatic Habitat

The watershed is rich in perennial and intermittent streams, providing abundant aquatic habitat and steep, heavily timbered riparian areas. Riparian habitat (alders, maples, willows), though, occurs as a narrow zone with a greater number of plant species than in any of the other habitats mentioned. The plants are mostly flowering shrubs with the most predominant tree being alder. These are subject to river flow fluctuations and scattered with river-deposited rock and gravel. Next to the riparian habitat, the streamside flats are dominated by black oak, incense cedar and occasionally Pacific yew. There is usually a level aspect, rich soils and a thick understory of shrubs and perennials. Along the shaded channels of tributary streams, there exists moist, nutrient-rich soil and lush vegetation (this paragraph abridged from Cranfield, 1984).

Habitat Elements: Snags, Dead/Down

Snags and dead/down wood are in good supply within the watershed, due mainly to the limited extent of large-scale logging operations. In some areas the lack of fire has allowed dead/down wood to build up to excessive levels. Ecological Unit Inventory (EUI) snag counts have estimated the number of snags (>15" dbh & 20’ tall) within the northern portion of the watershed to range from 2.8 to 4.2 snags/acre (based on a 0.2 acre plot and pers. conversations with R.Posey, 1997, Ecologist, Shasta-Trinity NF, Shasta Lake RD). Snag densities are expected to be less the further south in the watershed, the harsher the habitat, and the earlier the seral stage. Dead/down estimates, taken from EUI fuel model data are shown in Table 3-13.

Table 3-13: Current levels of dead and down wood within the Lower McCloud River Watershed

	Tons/Acre			
Seral Stage	<3" dbh	3-10" dbh	>10" dbh	Total
2P & 3P	2.4	0.9	0	3
3N	2.1	13.8	4.2	20
3G	2.1	13.8	4.2	20
4N	0.4	6.3	2.2	13

Dead and down densities within the southern portion of the watershed, as with snags, are unknown, but are expected to follow the pattern of snag densities.

Role of Fire

The Southern Cascades Province is characteristic of a short return interval, low intensity surface fire regime. The mixed conifer series is the most common series found throughout the Lower McCloud River Watershed which includes ponderosa pine at the drier ends of the mixed conifer zones. Mixed conifer and ponderosa pine series as well are both characteristic of short intervals fire adapted regimes. Pine sites may have shorter intervals of disturbance (5-15 years) due to drier site conditions and extended burn seasons where higher elevations and transition zones to mixed conifer stands may experience a change from frequent low intensity surface fires to that of infrequent high intensity stand replacement fires. Correspondingly, higher elevation moist sites within the same fire regime have changed from infrequent low to moderate intensity surface fires to infrequent low, moderate, and high intensity stand replacement fires. Black oak and white oak found in much of the watershed have also evolved under a fire regime of low to moderate intensity surface fires at short intervals.

Hazard and Risk from Wildfire

Fire behavior is a function of fuels, weather, and topography. The fuels leg of this triangle relates directly to standing vegetation as well as dead and down surface fuels. Initiation of crown fire behavior is a function of surface fire line intensity and variable of the tree crown layer. Where forest structure effects fire behavior, fire behavior as well effects forest structures as discussed previously. This resulting effect from fire absence in the Lower McCloud River Watershed is most apparent in standing live fuels that develop dense fire ladders from the surface to live tree canopies. Analysis of stand structure data within the watershed indicates that 70% of the existing National Forest stands are likely to generate or allow crown fire behavior given fire intensity levels expected from characteristics fuel models assigned. Residual surface fuel loads of dead and live fuels are indicators of predictable fire intensity levels . Tree densities, measured as "Crown Bulk Density" (CBD), are indicative of crown fire potential given surface fire intensity levels. The Lower McCloud River Watershed has surface fuels loads that are now only moderately adding to high risk of factors within the fuel profile. Approximately 99.6% of the current stands in the watershed are in a fuel model that predicts flame heights of 4-8 feet under typical summer conditions. Approximately 70% of the current stands in the watershed exceed a safe threshold of 0.10 kg/m^3 of crown bulk density. The historical probability of an ignition start from lightning is moderate to high (0.5 to 1.4 fires per decade per 1000 acres) for 78% of the watershed. This combination of crown bulk density over 0.10 kg/m^3, predicted 4-8 foot flame heights, and high probability of ignition puts the Lower McCloud River Watershed at high potential for catastrophic wildfire.

Areas within the watershed at higher risk to catastrophic fire are those that obtain all the critical characteristics of fuel, weather, and topography that contribute to crown fire or stand replacement fire behavior.

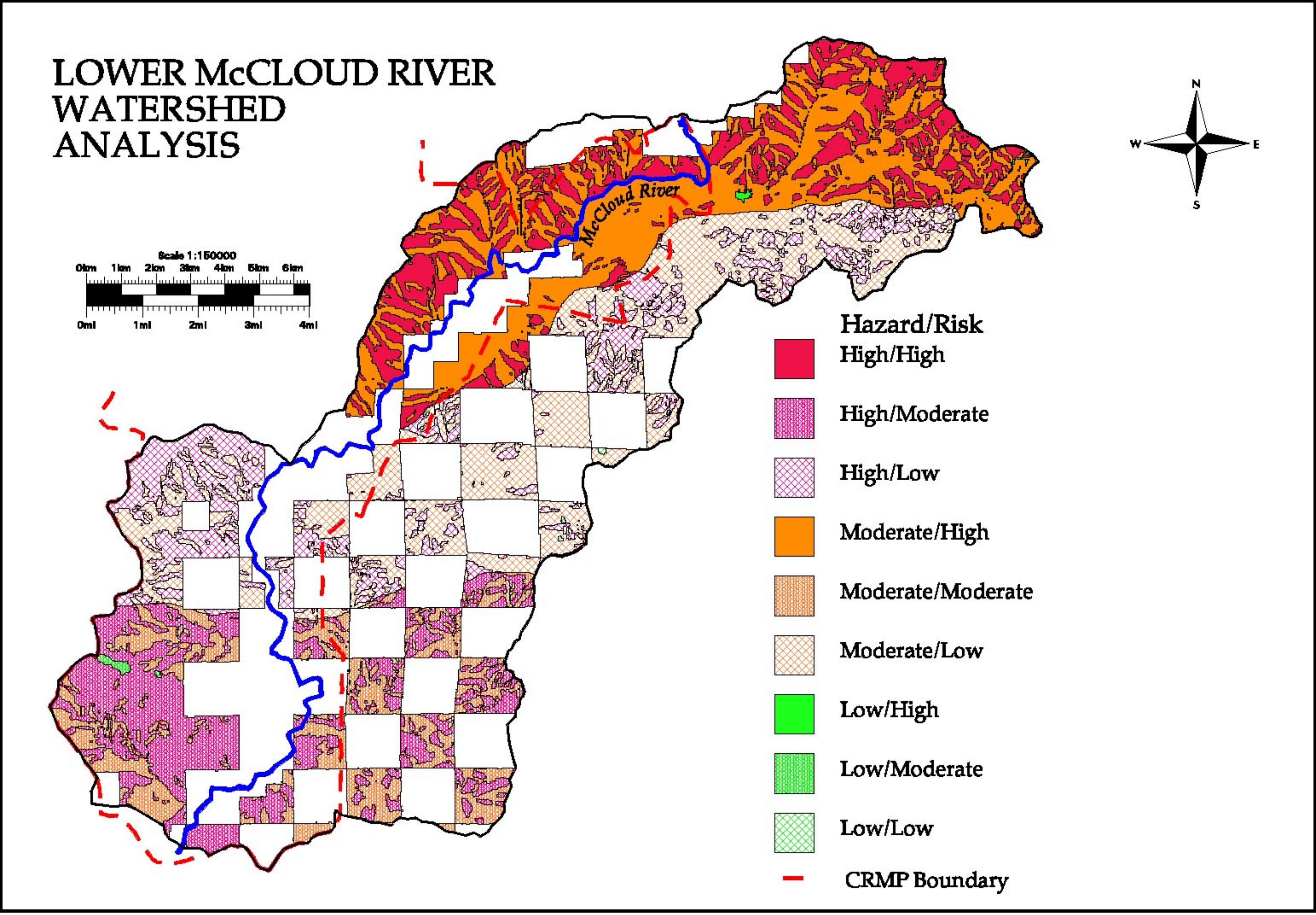
Table 3-14: Critical fire features in the Lower McCloud River Watershed.

	Critical Fire Features	
Land Base Description	**High Risk**	**Moderate Risk**
Fuels		
Fuel models 12, 4, 2	FL = 8 ft.+ / CBD = 0.15	
Fuel models 10,11		FL = 4-8 ft. / CBD = 0.15
Weather		
Season	July - September	June, October
Topography		
High elevation	High lightning occurrence	
Low elevation		Mod. - High fire occurrence
Slope		
0-35%		Moderate rate of spread
35%+	High rate of spread	
Aspect		
south/west	High rate of spread	
north/east		Low - mod. rate of spread

FL = flame length   CBD = crown bulk density in kg/m^3

The Lower McCloud River Watershed has approximately 44,982 acres that have probable potential to produce catastrophic fire behavior. The fire effects on vegetative resources within these high risk areas will likely be replacement in nature.

Fire analysis can identify the fire susceptibility of a watershed in terms of risk and hazard. Risk applies to the probability of an ignition occurring. Hazard identifies the availability of fuels to sustain a fire. Where high risk coincides with high hazard, the probability of catastrophic fire is more likely. Taking these variables into account, fire susceptibility in the Lower McCloud River Watershed is characterized in Table 3-15 and on Map 15 - Fuel Hazard and Risk.



Map 15. Fuel Hazard Risk

Table 3-15: Fire susceptibility in the Lower McCloud River Watershed.

Combined rating of risk/hazard	% coverage of National Forest land	Total acres
High	52%	23,890
Moderate	47%	21,092
Low	1%	36

Species and Habitat

Documentation from sightings, nest locations and habitat/distribution models (Timossi, 1994) have indicated 217 species of wildlife (11 amphibians, 132 birds, 55 mammals and 19 reptiles) are associated with the habitat and elevations characteristic of the Lower McCloud River Watershed (Appendix C). This watershed analysis will emphasize the following groups of species:

- Federally listed endangered
- Threatened or proposed species
- Forest Service sensitive species
- Other species of concern including:
    - survey and manage species
    - protection buffers
    - high profile species:
        - neotropical migratory birds
        - McCloud Flats Deer Herd
        - elk
    - fisheries
    - non-native plants

These species of concern are discussed more in depth in the section 'Species of Concern' found later in this chapter.

Late Successional Habitat

Thirty-one late successional dependent wildlife species are believed to occur within the Lower McCloud River Watershed (Appendix C). Species of Federal concern found in this habitat include the Northern goshawk, Northern spotted owl, silver-haired bat, American marten and Pacific fisher (see 'Species of Concern' section). Generally, the habitat these species are keying into includes late-seral multi-storied forested habitats with >70% canopy cover. Northern spotted owls require large (>24" dbh) snags or broken top trees for nesting. Pacific fisher and American marten require large (>20" dbh) dead/down woody material for denning.

An open, diverse understory not only allows movement under the main canopy, but also enables access to the forest floor and prey species as well as providing for a greater variety of wildlife species than a crowded, fairly monogamous understory. The habitat discussion has identified where habitat in the closed understory condition is most likely to occur in the watershed.

Wildlife species require dispersal habitat between areas of suitable late-successional habitat. Generally, dispersal habitat is mid to late-seral forested habitats with 40% or greater canopy closure with snags and dead/down in quantities to support small mammal populations. Riparian Reserves containing riparian or forested habitat are also important dispersal corridors. Dispersal habitat is expected to be managed for through the LSR and US Fish and Wildlife Service dispersal requirements for the Northern spotted owl.

A botanically diverse assemblage of plants occur in late-successional habitat in the watershed. The herbaceous understory layer includes several species of orchids, wild ginger, prince’s pine, wintergreen, lilies, and numerous fern species.

Many mosses, lichens, and fungi occur in late-seral habitat in the watershed, but these have not been surveyed or inventoried. Much of the watershed is mesic and contains a high level of moisture-retaining large logs, mossy rocks, and deep shaded duff which provides excellent habitat for this assemblage of species and their symbiotic associates.

Old Growth Habitat

The current amount of old growth alone, exceeds the minimum 15% old growth per watershed requirement (Table 3-9 and LMP 4-62). Through maintenance of currently existing old growth habitat within the LSR, the 15% requirement will be met for the watershed. Though the distribution of the old growth is not even throughout the watershed, where is does occur south of the main body, it often follows stream courses. The management of the Riparian Reserves is then expected to help maintain some distribution of late successional habitat in the southern portion of the watershed.

Old growth associated species are expected to benefit overall from the current condition and distribution of old growth in the watershed. As discussed in the habitat section, the largest patches of old growth occur in the north central part of the watershed. These patches will certainly provide expanses of undisturbed habitat for forest interior species. Where habitat is more fragmented, old growth and interior species are expected to still utilize the habitat, but with increased potential for predatory/parasitic disturbance. Some species, though found in the larger patches, may in fact be absent from the smaller patches. Over time though, and with the management of the LSR for old growth/late-successional habitat, the more fragmented areas which were unnaturally created are expected to develop into a more contiguous pattern. Until the habitat between the old growth habitat does develop, it will provide for those species which do utilize edge habitat and early seral habitat.

Mature Forested Habitat

Though there are areas of fragmented old growth habitat, these areas often are surrounded by mature forested habitat which are expected to reduce the effect of fragmentation on old growth associated species. These late seral dependent species may in fact utilize the mature habitat for foraging or dispersal. For “outliers” (those individuals found outside established territories) the mature habitat will be important in supporting these individuals until they are able to utilize more suitable old growth habitat. Some mature habitat, though, currently exhibits some old growth characteristics and may support late-successional species as effectively as old growth habitat. In all, the pattern of old growth, mature and early seral openings is believed to be benefiting a variety of wildlife species guilds (late seral, early seral, forest, etc. - see Appendix C). As the habitat continues to mature, though, fewer guilds are expected to be provided for, with the late seral dependent species guild dominating.

Dispersal Habitat

Dispersal habitat was quantitatively analyzed using 11-40 (>11" dbh, 40% canopy) for the watershed, not for 1/4 township. Currently 62% of the watershed provides for dispersal habitat. Though this exceeds the USFWS dispersal recommendation of 50% for the landscape (Thomas et al., 1990), dispersal habitat is severely limited within the matrix lands (less than 16% currently dispersal). But dispersal southward through the matrix lands, from the LSR, is not expected and not necessarily desired as suitable habitat is found mainly within the LSR. Movement, though, north into the LSR, from LS habitat islands found in the matrix lands, is desired to allow late-successional species found in the matrix to contribute to those populations in the LSR while they can.

Of highest concern is movement of late-successional dependent wildlife species from LSR RC-335 to LSR RC-336 in the southeast and to LSR RC-334 in the southwest. Within the watershed three main dispersal areas between these LSRs have been identified, Map 7. As mentioned in the old growth discussion, the western and eastern areas of the watershed are the most fragmented (less contiguous). Over time the eastern area is expected to develop into a less fragmented dispersal area, but the westernmost area is not. This, apparently, is due to natural conditions. Despite the natural fragmentation, dispersal is not expected to be hindered because the gap between dispersal habitat is only 1/2-3/4 of a mile. Within that gap, cover may be provided where mature oak stands occur. Dispersal between activity centers is not a concern as connectivity between the activity centers currently exists.

Early-Mid Seral or Multi Guild species

Within the watershed, one hundred and two (102) species of hardwood, chaparral, shrub, and grassland associated wildlife species could occur (Timossi, 1994; Appendix C). Of these nine are species of concern and nine games animals, which includes mule deer. Species of Federal concern include the pallid bat, long-eared myotis, fringed myotis, Townsend's bigeared bat all which utilize the habitat for foraging, and Northwestern pond turtle, which uses upland habitat in association with streams. Viability of these species is expected to be provided through special management direction for riparian areas, downed logs, snags, old-growth species, green-tree retention, hardwood retention, seral stage diversity management, forest health, management plans for special land allocations and deer management plans.

Within hardwood stands, herbaceous forage and acorn production is important to many wildlife species, especially game species such as squirrels, turkey, bear, elk and deer. Any herbaceous growth and reduction in the acorn crop, then, would be detrimental, especially if these habitat elements are a limiting factor to a species. It is known which species utilize these habitat elements, but it is not known if these elements are limiting to these same species.

Species benefiting from the late seral conditions of the chaparral habitat would be those which require large patches of undisturbed habitat, much like the needs of forest interior species. Berry production within these stands would benefit many species able to forage there. These late seral chaparral habitats also provide important thermal and escape cover for birds and larger mammals. Smaller mammals benefit from the lower growing shrubs. Detrimental effects to wildlife species would include the loss of foraging habitat for browsers as senescent chaparral is not palatable. Herbaceous forage is also lost as the chaparral overgrows open, early seral habitat.

Aquatic Ecosystems - Aquatic and Riparian Dependent Wildlife Species
Fifty-five (55) species of aquatic and/or riparian dependent wildlife species are believed to occur within the Lower McCloud River Watershed (Appendix C). These include, but are not limited to Pacific giant salamander, Pacific treefrog, American dipper, great blue heron, tree swallow, yellow warbler, beaver, and western aquatic garter snake. Species of Federal concern include the foothill yellow-legged frog, tailed frog, Northern red-legged frog, bald eagle, willow flycatcher, and Northwestern pond turtle (see Species of Concern section). Habitat requirements vary from intermittent standing water with varied amounts of vegetation and vegetation type to permanent, cool water, with instream cover and surrounding dense riparian vegetation. Management of Riparian Reserves through the Aquatic Conservation Strategy is expected to provide for or minimize impacts to species listed in the aquatic and riparian guilds. Western pond turtles may be the exception as they can utilize upland habitat for nesting which may fall outside of the Riparian Reserves.

The major McCloud River tributaries within the watershed are expected to provide habitat for most aquatic and riparian associated species. Species such as the bald eagle, osprey, and beaver are expected to utilize the larger McCloud River. Based on surveys conducted in 1995, sightings for only the willow flycatcher occurred within the watershed (Toroni, 1995). Within adjacent watersheds, though, sighting have occurred for all species of Federal concern except the Northern red-legged frog, indicating a strong possibility that these species do occur within this watershed. The difference of survey results within and outside the watershed may be due to protocol differences or survey season, duration, and intensity and not to absence of species. A discussion for each species within the 'species of concern' section indicates where each species is most likely to occur based on the channel classes in Table 3-4.

Whether sudden and prolonged increases in the levels of sedimentation within step-pool, pool-riffle and alluvial uplands has caused a long term detrimental effect on aquatic and riparian dependent species in the watershed is unknown. Short-term effects on these species, though is suspected. Suspended sediment can kill many aquatic species when their gills become clogged. Where sediment remains settled on rocks and fills in interstitial spaces in the substrate, algal growth, invertebrates, and cover is often reduced if not eliminated. These changes can remove food sources and increase vulnerability to predation and rising temperatures for aquatic wildlife species. As aquatic amphibians and insects are affected, those species which feed on them, such as riparian associated birds, mammals and reptiles are negatively impacted. The duration of the sedimentation and the extent will determine the overall impact to the riparian system as well as the system's recovery capabilities. Stream habitats within the watershed which may be affected in such a way are those associated with roads located adjacent to and within canyon inner gorges and riparian areas, mostly in the southeastern part of the watershed (Bachmann, 1997; hydrology section).

Dispersal of aquatic wildlife along streams is often hindered by road construction and culvert design which blocks one part of the channel or the headwaters from the rest of the channel. Location of obstructions will be identified at the project level analysis.

Aquatic Ecosystems - Fisheries

The Lower McCloud River drainage has been designated as a focal watershed in the draft Forest aquatic habitats strategy. Within the watershed, there are approximately 106 miles of fish bearing streams. There are 16 named streams tributary to the McCloud River that are known to sustain fish (Table 3-16). The largest and most significant of these are Claiborne, Hawkins , and Chatterdown Creeks. Squaw Valley Creek, which is the largest tributary to the Lower McCloud River, falls outside of this analysis area. The other tributaries are of varying importance to fish with the smaller streams providing fish habitat only within the lower reaches. Some of the smaller streams, as well as the upper portions of the larger streams, become intermittent during low flow conditions and provide habitat on a seasonal basis.

Table 3-16: Fish bearing streams and miles of suitable fish habitat within the Lower McCloud River Watershed

Stream	**Fish Habitat** (miles)		**Stream**	**Fish Habitat** (miles)
McCloud River	24.8		Chiquito Creek	1.8
Hawkins Creek	16.4		Tuna Creek	3.2
Squirrel Creek	2.6		Chatterdown Creek	17.8
Ladybug Creek	3.8		Big Grey Creek	0.5
Fitzhugh Creek	1.0		Little Bolliboka Creek	1.2
Bald Mountain Creek	1.6		Big Bolliboka Creek	1.3
Claiborne Creek	17.2		Whittawaket Creek	1.6
Hat Mountain Creek	2.2		Natawaket Creek	4.8
Oak Creek	4.1			

Fish bearing streams are also displayed on Map 10 - Riparian Reserves.

The Lower McCloud River and some of the tributaries are examples of properly functioning stream systems where flows, bedload and the delivery of large wood are in dynamic equilibrium. This has resulted in the formation and maintenance of habitat features, such as deep pools and runs, that are critical to the production of large and mature trout. The number of large trout in the river is indicative of a relatively healthy watershed and a stream system that is properly functioning. The smaller tributaries are also functioning well but are limited for fish habitat because of their small size and steeper gradients. These streams, though not important fish habitat, are critical to the maintenance of proper water quality and sediment delivery.

The Lower McCloud River is known as a premiere trout stream with an abundance of large rainbow and brown trout occurring throughout the lower river. This river has the largest known adfluvial run of trout from Shasta Lake. The Department of Fish and Game once estimated that trout abundance was approximately 8,500 fish per river mile (Rode, per comm.). The abundance of large fish in this river is not only a function of the excellent habitat quality, but also due to the extremely limited take that is permitted from this area as much of the lower river is in private ownership.

In addition to trout, the lower river also contains:

- Sacramento sucker
- Sacramento squawfish
- riffle sculpin
- smallmouth bass
- carp
- blackfish
- golden shiners
- hardhead minnows

The presence of many of these fish is a result of the lake and their abundance decreases rapidly with upstream distance.

Catastrophic wildfire could have an enormous effect on the Lower McCloud River. Presently, flows, bedload and large wood are in balance and function to create a stable channel with deep water habitats for trout. A large wildfire would disrupt the balance by increasing the sediment load and removing large woody debris. Peak runoffs would also be increased. This disruption in channel equilibrium can result in negative changes in the structure and function of the stream ecosystem. Where stream channels are destabilized, riffles elongate and in many cases extend through former pool locations resulting in the loss of pool habitat and large stable debris for cover. This would lead to a decline in the number of older, larger trout in the river as they are dependent on deeper water habitats. Large wildfire could also result in the loss of the riparian vegetation and decrease water quality. Riparian vegetation is critical to maintaining cooler water temperatures, increasing stream biotic potential, and maintaining bank stability. Riparian areas also supply a source of large woody debris which is essential for fish and riparian dependent species. Large fires result in the formation of ash, which in extreme conditions can raise the pH of the stream. Though this drainage has a history of large fires, the effects of these past events are no longer evident.

Presently, roads within the drainage seem to have had little effect on the river. Problems do exist in several of the subbasins, but thus far the impacts have been localized and small in scope. Roads can affect fish habitat in two ways. Roads can result in increased sediment loads through surface erosion and mass wasting, and roads can impede fish movement where stream crossings are improperly constructed. At this time there are no crossings that are known to hinder fish movement and future crossing associated problems can be eliminated through proper design and engineering. Sediment input, on the other hand, is a more difficult problem to address and is potentially more serious as an increase in sediment production can alter channel balance and adversely affect fish habitat. Increased sediments from roads can lead to pool filling, loss of spawning habitat, and reduce benthic invertebrate production. As sediment loads increase beyond the streams ability to handle them, fish habitat becomes simplified as the stream become shallow and wider.

LSRs are important to streams in that they promote conditions favorable to fish and other riparian dependent species. When adjacent to streams they provide shade and serve as a source of large woody debris. Large wood is essential to the creation and maintenance of fish habitat. Large wood serves not only as cover, but acts as flow deflectors and can result in the formation of long-term deep water habitats. These habitats are important to large fish and, in areas were large debris is lacking, large fish are usually uncommon. Large woody debris can also serve as sediment traps and assist stream function by metering sediments through the system. Large wood in the channel serves as winter habitat and helps fish survive high flow events by providing pockets or areas of relatively slow water. Large wood in the riparian zone is also important to many amphibians as it provides critical habitat.

Macroinvertebrate data was collected and analyzed in Lady Bug and Bald Mountain Creeks in 1985, 1986 & 1988 (Mangum, 1985, 86, 88). Bald Mountain Creek is an undisturbed sub-basin while the Lady Bug Creek sub-basin underwent timber harvest and road building in 1986 (see page 3-12). Analysis of data indicates that macroinvertebrate diversity and the biotic condition in Lady Bug Creek did not deteriorate as a result of management activities during the three years of monitoring and that there was rapid recovery from any impacts. No monitoring has occurred since 1988 and impacts of the Dee Fire (1989) in the Lady Bug Creek sub-basin were not monitored.

Habitat Elements (Snags, Dead/Down, Caves, Building and Bridges)

Snags

Forty (40) wildlife species believed to occur within the Lower McCloud River Watershed are dependent on snags for nesting, roosting or denning (see Appendix C). They make up 18% of all the wildlife species within the watershed. Eleven of the snag dependent wildlife species are primary excavators, those species which create cavities. This group includes the white-headed woodpecker and pygmy nuthatch. Forest observation records, breeding bird surveys, and Christmas bird counts have confirmed their distribution in the Shasta Lake Ranger District. Four of the snag dependent wildlife species are bark cavity dwellers, three of which are "survey and manage" bat species. Other wildlife species, besides those considered dependent, will also utilize snags. See Appendix D for description of habitat needs for Snag Cavity Dwellers and Bark Cavity Dwellers.

Suggested snag densities based on the latest models indicate that the following snag and recruitment densities are needed, per acre (These figures are based on the habitat and the cavity dependent species which are associated with them):

Table 3-17: Suggested snag densities for the Lower McCloud River Watershed.

Habitat	**Snags/acre**	**Recruitment/acre**
Douglas-fir	1.5	4.5
Hardwoods	2.5	7.5
Riparian habitat	3.0	9.0
Mixed conifer	4.0	12.0
Ponderosa pine	4.0	12.0

Snag densities within the northern part of the LSR meet, but are not expected to exceed, suggested snag densities. Whether the suggested snag densities are met within the southern part of the LSR or within matrix land is currently unknown. Most of the areas impacted by past timber harvest or located on poor growing sites are expected to be less than the suggested snag densities. For areas of timber harvest, this may be a reflection of a 1.5 snag/acre retention guideline versus the current suggested retention. For poor growth areas, levels may just be naturally lower than what is suggested.

Most of the hardwood stands are considered a non-commercial forest product so, except for fuelwood cutting, harvest of hardwoods is expected to have a minimal impact on naturally occurring snag numbers. The snag density needs for wildlife, then, within hardwood habitat is expected to be met.

Dead/Down

Eleven species of wildlife are dead/down wood dependent species (see Appendix C). None of the species are Federally listed. Many other species, though not considered dependent, do utilize dead/down wood, like the American marten, small mammals, amphibians, woodpeckers, and bear. Unlike snags densities, suggested dead/down densities are based on the needs of dependent and 'non-dependent' species, mainly those species of high profile. These dead/down densities are expected to meet the needs of most, if not all other wildlife species which utilize dead/down. For a description of dead/down requirements for dependent species see Appendix D.

Areas affected by timber harvest or located in poor growing conditions are expected to have less than the recommended levels of dead/down material. All other areas are expected to meet the recommended levels of dead/down material. For small mammals, dead/down needs are expected to be met.

Current levels of dead and down woody material are displayed in Table 3-13.

Caves/Mines/Bridges/Buildings

Twelve wildlife species are known to utilize caves, mines, bridges or buildings for roosting, nesting, or denning. Of these the Shasta salamander, long-legged myotis, long-eared myotis, fringed myotis, pallid bat, and Townsend's big-eared bat are of Federal concern (see Appendix C) Information regarding caves within the watershed, especially the checkerboard ownership section, is limited. This is due to the area's remoteness and limited access, inhibiting exploration of the landscape for caves (J. Wolfe, President, Shasta Area Grotto; pers. communication 3/1997). Where access has allowed exploration, three caves have been identified as having significance to wildlife, archaeology or caving groups. These locations can be found within the watershed project file as they are sensitive data.

The mineral records indicate a number of prospects are located within the watershed, but only the Keane site actually resulted in the development of underground adits (horizontal shafts). The Keane site is an inactive copper mine developed in the 1920s. Seven adits, Ranging from 20-135' in length were created (Logan, 1926). Since 1926, no other records can be found regarding the mine, so there is speculation as to the overall development of the mine. Development of additional adits or the lengthening of existing ones after 1926 is suspected to have ceased as the copper market had slowed down years previously (J.

Demaagd 1997, Minerals, Shasta-Trinity NF, Supervisor's Office). The known length of the adits allows speculation that air vents were not created, causing only one entrance/exit for wildlife species. The Keane site is located at T36N, R3W, Section 4 (Pine Flat area) and T37N, R3W, Section 34 (Hat Mountain area).

Table 3-18: Bridges which may be utilized by wildlife. (pers communication, W. Stephas 3/97, Engineer, Shasta-Trinity NF, Supervisor's Office):

Bridge location	**Type of Bridge**	**Surveyed?**
Rd 38N37 over McCloud River at McCloud River Club	Metal span	No
Pacific Crest Trail over McCloud River at Ash Camp	Wooden span	No
Road 38N11 (Hawkins Creek Road) over Deer Creek	Metal span	No
Road 34N17 over McCloud River at McCloud Bridge	Metal span	No

Table 3-19: Buildings which may be utilized by wildlife.

Building location	**Type of Building**	**Surveyed?**
Ah-Di-Na Campground	Various	No

WILDLIFE SPECIES OF CONCERN

American Peregrine Falcon

Status: Federally Endangered, State Endangered

Presence in watershed:

There are no historical or current eyries within the watershed. Recorded sightings of peregrine falcon have occurred within the southernmost part of the watershed, around the McCloud Bridge (pers. communication with N. Hutchins 1997,Wildlife Biologist, Shasta-Trinity NF, Shasta Lake RD). As indicated in the table below, the site has a high potential for a peregrine eyrie.

Landscape overview:

The nearest peregrine eyrie is Pit 6, located 5 miles southeast of the watershed along the Pit River.

Survey extents:

Observations are being conducted around the McCloud Bridge to determine if an eyrie exists. Another site at High Mountain may also have an eyrie (T. Hesseldenz 1997, pers. communication). Current monitoring to confirm the eyrie's existence has not been conducted.

Habitat description: vertical cliff habitat with large potholes or ledges.

Habitat condition:

Nine sites have been identified as possible locations for peregrine eyries (Boyce & White, 1979) Some have very low potential whereas others have higher potential. This data is only informational as the potential rating has been questioned since predictions have not always matched known outcomes. Without current evaluation of these cliff sites, though, each is assumed to have potential for use by peregrines. The following table identifies each location, potential rating, and whether surveys were conducted.

Table 3-20: Possible eyrie locations, potential, and survey information for peregrine falcon.

Location	T	R	Sec.	Potential	Surveyed
Hat Mountain	36N	3W	34	Possible	Helicopter only
Grizzly Peak	36N	1W	21	No rating	None
High Mountain	36N	4W	12	No rating	None
Bolliboka Mountain	36N	3W	33	Unsuit./Potential	Helicopter only
McCloud Bridge	36N	3W	32	Highly suspected	Helicopter & ground visit
Nawtawaket Mountain	36N	3W	17	No rating	None
White Rock	36N	3W	2	No rating	None
McKenzie Mountain	36N	2W	28	Possible	Helicopter only
Van Sicklin Butte	36N	2W	3&4	No rating	None

*For further information see Boyce and White 1979.

Highly suspected = suitable habitat with signs of peregrine activity
Possible = suitable habitat, no signs of activity
Potential = unsuitable habitat with enhancement potential
Unsuitable = unsuitable habitat without enhancement potential
No rating = cliffs not helicopter surveyed for potential; low priority sites

No further analysis for peregrine was conducted for this watershed, as no known historical or current eyries occur within the watershed.

Bald Eagle

Status: Federally Threatened

Presence in watershed:

There are incidental sightings of bald eagle in the watershed by private landowners along the McCloud River.

Landscape overview:

The nearest nest site located on National Forest land is located 3 miles east at Iron Canyon Reservoir. Eagles are also reported to occur at Lake McCloud (CNDDB, 1996), along the northern border of the watershed. Both sets of eagles are expected to utilize the watershed for foraging. How much the watershed is contributing to either pair is unknown.

Survey extents:

No official surveys have been conducted for eagles in the watershed.

Habitat description: large ponderosa pine trees near lakes or large streams.

Habitat condition:

The level of occurrence for potential nest trees along the McCloud River is not known.

Spotted Owl

Status: Federally Threatened

Presence in watershed:

Federal records show nine spotted owl activity centers (ACs) are located within the Lower McCloud River Watershed. All ACs are located within LSR RC-335. There are no ACs located within the matrix lands and therefore no 100 acre cores.

Of the nine ACs, those located farthest north have been more reproductively successful than those in the south. This could be a function of survey effort, but is suspected to, instead, be a function of habitat fragmentation. The northern ACs (#201, 202, 205, 206) are found within land of continuous Forest Service ownership, whereas, those in the south (#103, 105, 106, 107, 108) are within a checkerboard ownership. Table 3-21 shows the reproductive history of each AC.

Table 3-21: Current status and survey history of spotted owl Activity Centers within the Lower McCloud River Watershed. Based on data through 1996 field season.

Owl AC#	**Status**	**Status Verified**	**Reproduction Verified**
103	T.Single	1982 (S); 1983 (U); 1986 (Y); 1990 (S); 1991 (X)	1986
105	Single	1990 (S); 1991 (X)	No reproduction
106	T.Single	1990 (TS); 1991 (X)	No reproduction
107	T.Single	1982 (S); 1983 (X); 1986 (S); 1987 (S); 1988 (M/F); 1991 (X)	No reproduction
108	Single	1989 (S)	No reproduction
109*	T.Single	1980 (X); 1981 (S); 1989 (S); 1991 (S)	No reproduction
201	Pair	1975 (S); 1976 (S); 1980 (X); 1982 (X); 1985 (X); 1986 (X); 1987 (Y); 1990 (S); 1991 (X); 1992 (X)	1987
202	Pair	1981 (S); 1982 (TS); 1983 (X); 1985 (X); 1986 (TS); 1987 (X); 1989 (S); 1990 (X); 1991 (X); 1992 (P); 1995 (P)	No reproduction
205	Pair	1982 (S); 1983 (S); 1986 (S); 1987 (TS); 1988 (M/F); 1989 (M/F); 1990 (S); 1991 (Y); 1992 (Y); 1994 (S); 1995 (X)	1991, 1992
206	Pair	1980 (X); 1985 (S); 1986 (P); 1987 (S); 1988 (TS); 1989 (S); 1990 (P); 1991 (P); 1992 (Y); 1995 (X)	1992
212*	Pair	1983 (P); 1986 (X); 1987 (Y); 1989 (Y); 1990 (P); 1991 (Y); 1992 (P); 1993 (X); 1995 (X)	1987, 1989, 1991

* These ACs lie outside the watershed, but within 1.3 miles of the boundary. These owls may be using habitat within the watershed.

(P) = Pair (TS) = Territorial Single (Y) = Young
(S) = Single (M/F) = Male/Female - no pair (U) = Unknown
(X) = no detection

Landscape overview:

Two additional ACs (#109 & #212) lie outside the watershed, but within 1.3 miles of the boundary. These owls may be using habitat within the watershed (i.e. within their own home range).

Survey extents:

Approximately 60% of the watershed was performed to protocol for calling routes, SOHAs, and timber sales, in 1991 (Table 3-22). From 1988 to 1990 District biologists or private individuals conducted unofficial surveys within 30% of the watershed. Since 1991 (1992-1996) the survey effort has been limited to historical visits. About 40% of the watershed has not been surveyed for spotted owls. This area is located in the southern part of the watershed, with the northernmost boundary being the McCloud River Club property south and east to Satin Peak and east to Sheep Camp. This is all checkerboard ownership within Matrix lands. Table 3-22 displays a history of surveyed areas within the watershed.

Table 3-22: Surveyed areas within the Lower McCloud River Watershed. Survey areas with the same name, when listed separately, indicate a change in the survey boundary. Based on data through the 1996 field season.

Survey Area	Type	Years Surveyed	Years Surveyed to 1991 Protocol
Ah-Di-Na	Salvage	1991	1991
Buck Ridge	Salvage	1991	1991
Butcherknife Creek	Salvage	1991	1991
Claiborne SL-5	SOHA	1988, 1989	
Claiborne	Timber Sale	1989	
Claiborne	Salvage	1991	1991
Deer Creek	Salvage	1991	1991
Deer Creek AC-206	Timber Sale	1995	
Happy Hunting Grounds	Timber Sale	1989	
Hawkins MC-5	SOHA	1988, 1989	
Lady Bug Area #1	Salvage	1991	1991
MC-6	SOHA	?	
Mica MC-2	SOHA	1988, 1989	
Mica AC-202	Timber Sale	1995	
Mica Gulch	Salvage	1991	1991
Squirrel Creek	Salvage	1991	1991
Trough AC-212	Timber Sale	1995	

Habitat description: mature conifer forests with dense, multi-layered canopies.

Habitat condition:

Northern spotted owl habitat is discussed under the following related headings for the ‘Vegetation’ and ‘Species and Habitat’ sections:

- ‘Old Growth Habitat’ - for Suitable Nesting/Roosting Habitat
- ‘Mature Forested Habitat’- for Forging Habitat
- ‘Dispersal Habitat’ - for Dispersal Habitat

The presence of the LSR, Riparian Reserves, and other late-successional habitats indicate that current and projected management emphases should result in extensive amounts of good quality habitat for the foreseeable future. Catastrophic fire could alter this condition, however. See Map 12 for the distribution of suitable nesting/roosting/foraging habitat and dispersal habitat. Table 3-23 displays the amount of suitable habitat within each AC.

Table 3-23: Acres of suitable nesting, roosting, and foraging habitat for spotted owl Activity Centers within and adjacent to the Lower McCloud River Watershed.

	Circle Radius					
	0.7 mile			**1.3 mile**		
Owl AC#	within watershed	outside [2/] watershed	Total	within watershed	outside [2/] watershed	Total
103	506		506	1538		1538
105	448		448	1670		1670
106	518		518	1611		1611
107	612		612	2260		2260
108	425	50	475	1069	202	1271
109 [1/]		551	551	4	1001	1005
201	860	0	860	2218	5	2223
202	921		921	2704	53	2757
205	882		882	2677		2677
206	830		830	2416	2	2418
212 [1/]	92	483	575	460	1115	1575

[1/] These ACs lie outside the watershed, but within 1.3 miles of the boundary. These owls may be using habitat within the watershed.

[2/] Actual acres of suitable habitat outside the watershed are probably somewhat higher than shown in this table. Acres outside the watershed are based on 1975 data and adjusted to reflect expected growth over the past two decades, but should be verified at the project level.

Shasta Salamander

Status: Forest Service Sensitive

Presence in watershed:

Salamanders have been seen only in the southern portion of the watershed, near the McCloud River Bridge.

Landscape overview:

In the adjacent McCloud Arm, Squaw Creek and Lower Squaw Valley Creek watersheds salamanders are present, though the sighting occurrences are less abundant the further north one travels. This is expected to be a function of the abundance of suitable habitat; less limestone rock exposed, and higher elevations (>3000') where exposure does occur.

Survey extents:

Systematic surveys for the Shasta salamander have occurred in the most southern part of the watershed.

Habitat description:

cool, moist microclimate around limestone caves or outcrops below 3000 feet elevation.

Habitat condition:

Several limestone outcroppings do occur within the watershed (see Peregrine potential eyrie sites), but these are usually located above 3000', are drier sites and not forested. Caves are also present which may have salamander populations, though past exploration has not detected their presence (see 'Habitat Elements' discussion for Caves). Other sites may occur, but could not be detected at this level of analysis using aerial photos, geological maps and soils maps. Their existence will be determined at the project level.

<u>Northern Red-legged Frog</u>

Status: Forest Service Sensitive

Presence in watershed:

No sightings of this species have been reported within the area

Landscape overview:

Red-legged frogs have been found in streams within the adjacent Shasta Lake associated watershed (<u>Bogener and Brouha, 1979</u>).

Survey extents:

While systematic surveys specific to the northern red-legged frog have not been conducted within the watershed, personnel responsible for past stream and wetland surveys looked for this species.

Habitat description:

cool, deep, still to slow moving water such as lakes, ponds, or slow streams.

Habitat condition:

Red-legged frog habitat may occur in the alluvial uplands or Hawkins Creek, if pools are present. Between the pool-riffle and the step-pool reach types, the pool-riffle would have a higher probability of providing suitable habitat as slow moving pools with riparian vegetation and instream vegetation could occur.

<u>Northern Goshawk</u>

Status:

Forest Service Sensitive, Federal Species of Concern, California Species of Concern

Presence in watershed:

Forest records include no nest site within or within close proximity to the watershed. A sighting at Mica Gulch is the only recorded goshawk detection for all spotted owl surveys conducted in the watershed since 1991. Why there are very limited detections within the watershed is unknown, but could be a function of unsuitable habitat, survey effort, or both.

Landscape overview:

The closest known nest site is 9 miles to the northeast in the Bartle Watershed. Immediately outside the watershed, the Nature Conservancy has detected goshawks.

Survey Extents:

Habitat description: late seral, conifer forests near early seral openings.

Habitat condition:

Analysis of the goshawk suitable habitat will not be formally analyzed as management of the LSR is expected to continue providing habitat for the goshawk

<u>Willow Flycatcher</u>

Status: FS Sensitive, California Endangered

Presence in watershed:

This species had been detected in 1995, along Hawkins Creek approximately 1 - 1 1/4 miles downstream from Little Meadows (alluvial upland habitat) and about 1/4 to 1/2 mile south of the McCloud River Club, along the McCloud River. Little Meadows, though not surveyed, is also suspected to have willow flycatchers. Overall, wherever suitable habitat occurs, the willow flycatcher has a high probability of being present.

Landscape overview:

Willow flycatcher occurs along Upper McCloud River. Habitat occurs in adjacent watersheds

Survey Extents:

Habitat description: large clumps of willow separated by openings

Habitat condition:

The location of suitable habitat, outside of the areas identified, is unknown as riparian habitat has not been mapped for the watershed.

<u>Pacific Fisher</u>

Status:

Forest Service Sensitive, Federal Species of Concern, California Species of Concern

Presence in watershed:

There is only one incidental track record of fisher within the watershed (pers communication, G. Stroud 3/97, Nature Conservancy).

Landscape overview:

Survey extents:

Habitat description: large areas of mature, dense forest below 6000 feet.

Habitat condition:

Habitat for the fisher is expected to exist within the LSR, the northern portion of the watershed. Protection and management of the fisher is expected to be provided through management of the LSR.

<u>American Marten</u>

Status: Forest Service Sensitive, California Species of Concern

Presence in watershed:

There are no recorded detections of marten within the watershed.

Landscape overview:

Survey extents:

Habitat description: mature mixed conifer forest types under 4000 feet.

Habitat condition:

Habitat for the marten is expected to exist within the LSR, the northern portion of the watershed. If the marten is present, suitable habitat is expected to be provided through management of the LSR.

Northwestern Pond Turtle

Status: Forest Service Sensitive

Presence in watershed:

Northwestern pond turtles have not been found within the watershed.

Landscape overview:

Northwestern pond turtles have been detected within the adjacent Squaw Creek Watershed

Survey extents:

While systematic surveys specific to this species have not been conducted within the watershed, personnel responsible for past stream and wetland surveys looked for this species. Surveying for this species at the project level is extremely important as they may travel outside the Riparian Reserves for suitable nesting habitat.

Habitat description: deep still water with sunny banks.

Habitat condition:

Suitable habitat may exist along the McCloud River and its major tributaries.

BATS

Eleven bat species may occur within this watershed.
Five of these are Survey and Manage species:

- long-eared myotis
- fringed myotis
- long-legged myotis
- pallid bat
- silver-haired bat

Two of these are Federal Species of Concern:

- Yuma myotis
- Townsend's big-eared bat

Some of these bats require caves, mines, abandoned wooden bridges and buildings for roosting sites, others require snags, still others utilize both types of roost sites. Foraging areas vary from shrub, chaparral and open fields to streams, lakes and or meadows; essentially, anywhere insects can be found, though some bats do favor particular insects.

There are no confirmed sightings of any bat species in the watershed; however, suitable habitat exists (See Appendix D and 'Habitat Elements' discussion for suitable habitat descriptions). Special habitat needs, though, for the Survey and Manage species expect to be met through snag management, Riparian Reserves, and survey and manage management guidelines. The remaining four species of bats are also expected to be provided for through the above mentioned management.

NEOTROPICAL MIGRATORY BIRDS

Eighty-three (83) neotropical migratory birds (NTMBs) are suspected to occur within the watershed (see Appendix C). Examples include:

- riparian guild - Cooper's hawk, sharp-shinned hawk, yellow warbler, yellow-breasted chat
- open-shrub guild - green-tailed towhee, golden eagle, prairie falcon
- open-grass guild - killdeer
- late seral guild - brown creeper, flammulated owl, varied thrush

There are no known sightings of NTMB species within the Lower McCloud River Watershed, but suitable habitat exists throughout the watershed.

These species require breeding habitat and migration corridors. Because of alteration to breeding habitat and increased exposure to predation and parasitism many of these populations have undergone significant declines. Habitat preservation and restoration is the backbone of maintaining current populations of NTMBs. Following proper management of breeding habitat, exposure to predation and parasitism is expected to become reduced.

The general Forests standards and guidelines state that habitat is to be managed for NTMBs to maintain viable population levels. Management of Riparian Reserves, fragmented forested habitat, hardwoods, old-growth and late seral habitat, diverse seral stages, visual quality, protection buffers, snags, dispersal habitat, and special lands will help preserve breeding habitat for NTMBs. Deer herd management is also expected to improve the habitat of NTMBs as well as residents which are dependent upon shrub habitats. The creation of edges is beneficial to most of these species. Also of importance is the proximity of water and the size of shrub patches. A preliminary attempt at determining the size of patches needed was conducted (USDA, 1994), but only information about territory size was found. Deer management which maintains large 40+ acre patches of shrub habitat (mostly late seral) is expected to be most beneficial at this time.

GAME SPECIES

Black-tailed Deer

A management plan for the Lower McCloud Deer Herd was established in 1983 by the California Dept. of Fish and Game, Region I in cooperation with U.S. Forest Service, U.S. Bureau of Land Management and the U.S. Park Service. This plan indicates the population trends, suitable fawning habitat, and management for winter and summer range. Current information, which will supplement the existing management plan, was provided by CA Dept. of F&G (pers communication, D. Smith 2/97; CA Dept. Fish and Game, Wildlife Biologist)

The Lower McCloud River Watershed lies just north of the Shasta Lake deer herd. This herd contains resident and wintering Colombian black-tailed deer. The watershed also contains resident deer, but is noted as providing summer and transitional range. Though there is limited knowledge regarding the area because of access, a number of concerns exist for those resident and seasonal deer populations.

Concerns regarding habitat for deer include the loss of early seral habitat, the loss of herbaceous and young shrub layer in the understory, and the encroachment of hardwoods by conifers. The exclusion of fire has caused the habitat to shift from a mosaic of early seral habitat, to mostly late seral habitat. This shift encroaches upon herbaceous openings as well as limits the amount of foragable shrubs. Fire exclusion has also allowed the understory of forested conifer and oak habitats to mature, to be shaded out and to be replaced by shade tolerant species. Again forage, especially late summer forage important for resident deer, is eliminated with this change in vegetation. Lastly, fire suppression has also allowed hardwoods within mixed hardwood/conifer habitats to be overgrown and shaded out. This is suspected to occur once the conifers reach >60% canopy. The mast produced by these hardwoods is reduced or eliminated, removing another food source for deer and other game species such as elk and turkey.

Specific areas where these changes have occurred is unknown, though they are suspected to occur throughout the watershed. Changes can be determined by comparing the 1944 photos to current conditions (see vegetation discussion in Chapter 4). Other deer habitat analysis, such as hiding cover, fawning cover, and new brush within the chaparral community was not conducted as such analysis would require a more detailed database than LMP90, which provides no seral stage breakdown for chaparral or hardwoods.

Elk

There are scattered elk sightings within the watershed (pers communication, S. Self, 1997, Sierra-Pacific Industries, Wildlife Biologist; Smith and Murphy, 1973). Little, though, is known about the habitat's suitability for elk and the overall extent to which elk are using the watershed. Elk heavily use the adjacent Squaw Creek watershed. But the two watersheds have not been compared to determine the reason for the difference in use. Speculative reasons for limited elk use in the watershed include comparatively high road densities and high human activity (mainly timber harvest). Both these human uses tend to displace elk from preferred areas (Smith and Murphy, 1973). On the other hand, use in the watershed may be incidental or migratory as the sightings are few and elk traveled from Shasta lake to settle in just north of the watershed. But, without further information the assumption that suitable habitat exists within the watershed and that there is potential to improve and increase the suitable habitat, will be made.

Table 3-24: Other wildlife species of concern in the Lower McCloud River Watershed.

Species	**Status**				**Managed through:**				Sightings?
	S&M	FSC	CSC	CT	LS	RR	Deer	Snag	
long-legged myotis	●	●			●	●		●	No
fringed myotis	●	●			●	●		●	No
long-eared myotis	●	●			●	●		●	No
pallid bat	●		●		●	●	●	●	No
silvered-haired bat	●				●	●		●	No
tailed frog		●	●		●	●		●	No *
foothill yellow-legged frog		●	●		●	●		●	No **
Townsend's big-eared bat		●	●		●	●			No
Yuma myotis		●			●	●	●	●	No
wolverine		●		●	●	●		●	Yes ***
osprey			●			●		●	No
sharp-shinned hawk			●		●	●			No
Cooper's hawk			●		●	●			No
golden eagle			●		●	●			No
merlin			●		●	●			No
California quail			●			●	●		Yes
black swift			●			●			No
Vaux's swift			●			●		●	No
purple marten			●			●		●	No ****
yellow warbler			●			●			No
yellow-breasted chat			●			●			No

* Detections have occurred within the adjacent Squaw Creek, McCloud Arm, and Lower Sacramento Arm Watersheds. So, they may occur along the McCloud River and its major tributaries.

** Detections have occurred within the adjacent Squaw Creek, McCloud Arm, and Lower Sacramento Arm watersheds. So, they may occur along the McCloud River and it's major tributaries.

*** Unconfirmed wolverine scat and tracks found by the Nature Conservancy during two winters in Hawkins and Chatterdown areas 1980's. Sighted crossing road at Ah-Di-Na 1992 by a UC Berkeley intern. Detection also in Squaw Creek, 1981. (T. Hesseldenz 1997, pers. communication).

**** Sightings are recorded for Shasta Lake

Status:

- S&M Survey and Manage Species (LMP)
- FSC Federal species of concern (in most cases replaced category 1, 2 species)
- CSC California Species of Special Concern
- CT California Threatened

Managed through:

- LS Late-Successional Reserve guidelines
- RR Riparian Reserve guidelines
- Deer deer herd management guidelines
- Snag snag guidelines

PLANT SPECIES OF CONCERN

Ageratina shastensis - Shasta eupatorium (formerly Eupatorium shastense)
Shasta eupatorium occurs on limestone rock outcrops occasionally throughout the McCloud River Basin, and is not known anywhere else in the world. It has not been listed as a threatened or endangered species because there are no known threats to the species' existence at this time. Mining of limestone, which is not presently happening n the watershed, is the only source of potential threat known at this time.

Ten of the fourteen total documented populations of Shasta eupatorium occur in the watershed - all on limestone rock outcrops.

Arnica venosa - Veiny arnica
Veiny arnica is endemic to the Shasta-Trinity National Forests, and does not occur anywhere else. Nine of approximately fifty occurrences forest-wide occur within this watershed. Veiny arnica occurs in second-growth forests, usually on thin soils with northern exposures. Habitat attributes are difficult to define beyond this. The species may be impacted by timber harvest in its habitat, but seems to be holding on where it has been found in harvest units.

Lewisia cotyledon ssp. howellii - Howell's cliff-maids
All but one occurrence of Howell's cliff-maids on the Shasta-Trinity National Forests occur within the McCloud River Basin, with seven of the twelve occurrences found within the Lower McCloud River Watershed. This species is found only on rock outcrops, usually on rock faces in inaccessible areas, sometimes on road cutbanks. Threats to this species could potentially occur from new road construction through rock habitat, or from mining. Another threat to its viability could occur from botanical collecting, as there is a significant hobbyist trade in the genus Lewisia for rock garden enthusiasts and this is a particularly beautiful Lewisia with large pink flowers.

Neviusia cliftonii - Shasta snow-wreath
Shasta snow-wreath has not been found to date in the Lower McCloud River Watershed, but a known population occurs a mile south of the watershed at Ellery Creek. Suitable habitat for Shasta snow-wreath occurs in the Lower McCloud River Watershed, and it is assumed that this plant probably does occur there. Minimal surveying has been undertaken to locate the species in the watershed. Suitable habitat for the Shasta snow-wreath contains limestone substrate in cool, shaded, perennial stream canyons. Discovery of this shrub in 1991 set off an international flurry among the scientific community, as this was not only a new species, but a new genus of the Rose Family, and a significant new taxon related to an extinct Triassic period fossil. Its closest relative is the federally endangered Neviusia alabamensis, known from only two occurrences east of the Mississippi.

Raillardiopsis scabrida - rough or scabrid raillardelle
Rough raillardella is known from only one place on the Shasta-Trinity National Forests. That location is at Grizzly Peak in the northeast corner of the watershed. This species only occurs on rocky outcrops and talus at elevations above 6000 feet. There are no know threats to this rare taxon at this time. Construction of fire lookout towers, high-power transmission lines, or other construction on peaks could be a factor for this species' viability in the future.

NON-NATIVE PLANT SPECIES

Several non-native plant species have become established in the area around Ah-Di-Na Campground and some of these have been observed spreading into other parts of the watershed. These species are believed to have originated from the Ah-Di-Na homestead around the turn of the century.

Miscellaneous Fruit Trees

Fruit trees that were planted at the Ah-Di-Na homestead remain today. These trees are not invasive and are not considered to be a problem.

Robinia pseudoacacia - black locust

Black locust is a species that is particularly invasive and favors disturbed sites. Locust was planted at the Ah-Di-Na homestead about a hundred years ago and has had a major impact within and around Ah-Di-Na Campground. It has spread throughout the terrace at Ah-Di-Na and has invaded several meadow areas. It has replaced much of the riparian vegetation along the river in this area. Black locust is very sensitive to competition and is classed as very intolerant of shade (USDA, 1990). Locust is not expected to spread into conifer stands. Its occurrence in conifer stands around Ah-Di-Na is limited to road cuts where it takes advantage of the disturbed soil and large openings in the canopy cover.

Black locust has been observed at scattered locations along the entire length of the Lower McCloud River where it becomes established on gravel bars and river terraces. These plants are probably the result of seeds traveling downstream from Ah-Di-Na. As at Ah-Di-Na, locust along the lower river is replacing native riparian vegetation in some locations but is not expected to spread into adjacent conifer forests.

Rubus discolor - Himalayan berry
Rubus laciniatus - cut-leaved blackberry

These introduced non-native blackberries have become established in thickets in many locations in the Ah-Di-Na area and, if not checked, may contribute to permanent loss of fragile native riparian plant communities.

Centaurea solstitialis - yellow star-thistle

Yellow star-thistle has become established along the road leading into Ah-Di-Na Campground and at other well-used campgrounds in the watershed. This invasive plant has the ability to grow aggressively, preventing native plant species from competing for site occupancy. Over time, it may completely dominate these sites.

Human Uses

Heritage Resources
The McCloud River was occupied by Native American groups for at least 5000 years, and a number of prehistoric sites are located on the terraces along the river and along the major ridges. Prehistoric sites have been recorded on public lands including:

- McCloud River 8 sites
- Hawkins Creek 1 site
- Claiborne Creek 2 sites
- Chatterdown Creek 2 sites
- Horse Ridge 1 site
- Curl Ridge 2 sites

A number of other sites are known to be located on the Nature Conservancy, McCloud River Club, and Bollibokka Club lands. Two sites, Ah-Di-Na and Ash Camp have been archaeologically evaluated and determined eligible for the National Register of Historic Places. Known historic sites include the early 20th century habitation at Ah-Di-Na, which adjoins the campground and has been developed as an interpretive area for the visiting public, and a small campground dating at least as early as the 1940's which was associated with the trail system used by the Forest Service for fire patrol.

Although there are no tribal lands within the watershed area, Native Americans retain a strong interest in the area and wish to be consulted prior to any projects that may impact known heritage resources. The Pit River Tribe claims jurisdiction over the Ash Camp area and the Wintu Tribe of Shasta retains interest in the Ah-Di-Na area.

Whitewater Boating
Whitewater boating on the Lower McCloud River consists of rafting and kayaking. Rafting is practical for only a couple weeks each spring during heavier releases from McCloud Reservoir. Kayaks can operate during lower flows and can negotiate the river at any time during the year.

On June 30, 1982, Wilderness Adventures submitted an application to the Forest Service for a Commercial Use Permit to conduct commercial rafting operations on the Lower McCloud River. The application was later expanded to include operations on the Upper McCloud River and on Squaw Valley Creek. In the process of an extensive multi-year review by the Forest Service which involved the District Ranger's office, the Forest Supervisor's office, and the Regional Forester's office, the three streams were found to be unsuitable or inappropriate for commercial rafting. The District Ranger's office has reviewed the decisions and process and found the reasons for denial to still exist current to the current-day situation (CRMP, 6/1994).

Non-commercial boating (primarily kayaking) has been identified by the CRMP as an appropriate recreational use of the Lower McCloud River if conducted in a sensitive and proper manner. The CRMP has stressed the need for more education of the boating public to the issues of resources, ownership, and safety.

Property rights have been an issue for whitewater boating on the Lower McCloud River. Boaters putting in at the launch area below Ah-Di-Na Campground, quickly leave National Forest land and enter a 19 mile stretch of river through mostly private ownership. This 19 mile stretch crosses four corners of National Forest land totaling 1.7 miles. Three of these corners have minor river frontage of less than 1800 feet. One stretch of river continues for 11.6 miles entirely on private ownership. The ownership sequence along the Lower McCloud River is displayed in Table 3-25.

Table 3-25: Ownership sequence along the Lower McCloud River from McCloud Reservoir to Shasta Lake (CRMP, 10/1994).

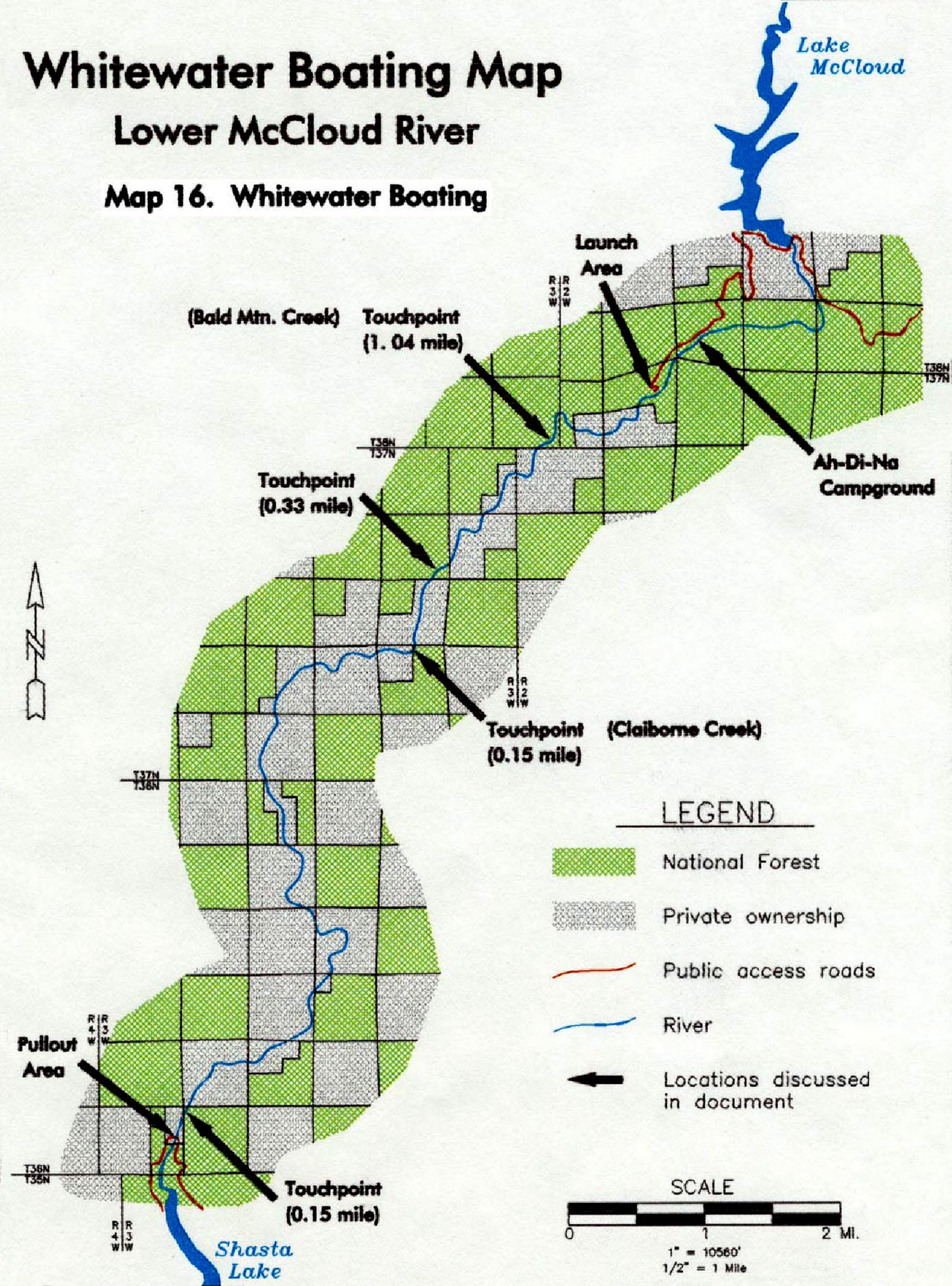
Legal Locations and Identifying Landmarks	Mileage Below McCloud Dam (miles)	Segment Ownership	Segment Length (miles)
McCloud Reservoir	0.00		
		The Hearst Corporation	0.66
	0.66		
Hawkins Ck./Ah-Di-Na		Forest Service	4.36
approx. Ladybug Creek	5.02		
		The Nature Conservancy	1.33
approx. Bald Mtn. Ck.	6.35		
T38N, R2W, Sec. 6		Forest Service	1.04
	7.39		
		The Nature Conservancy	2.89
	10.28		
T37N, R3W, Sec. 14		Forest Service	0.33
	10.61		
above Claiborne Creek		McCloud Fly Fishing Club	1.14
	11.75		
T37N, R3W, Sec. 26		Forest Service	0.15
	11.90		
Claiborne to Oak Cks.		McCloud Fly Fishing Club	2.53
	14.43		
Oak to Natawaket Cks.		Bolliboka Club	9.09
	23.52		
T36N, R3W, Sec. 32		Forest Service	0.15
	23.67		
T36N, R3W, Sec. 31		McCloud Fly Fishing Club	0.43
Shasta Lake	24.10		
		Total	24.10

Once boaters enter the river below Ah-Di-Na, there is no public access until the river reaches McCloud Bridge at Shasta Lake. The few roads along this stretch of river are mostly private access roads that are usually gated.

Whitewater Boating Map

Lower McCloud River

Map 16. Whitewater Boating



In addition to property rights, there is a concern about impacts at the four small parcels of National Forest land below Ah-Di-Na. These are the only places for boaters to pull out of the river on public land. Sanitation, litter, and fire risk are among the concerns at these sites. Access for maintenance and cleanup at these sites is difficult due to their remote locations.

Trails and Campgrounds
There are two National Forest campgrounds within the watershed.

- Ah-Di-Na Campground receives the heaviest use with an average annual use of approximately 6,100 visits or 12,200 visitor days. This is a fee campground with 17 campsites. Improvements include a water system, restrooms, cookstoves and a historic trail with interpretive signing.
- Ash Camp is an undeveloped campground with five sites and no fees. Minor improvements are occurring at Ash Camp at this time, including installation of a pit toilet.

In additional to the two existing campgrounds, there are plans to develop an additional campground along Hawkins Creek at the diversion pipe. This site would accommodate overflow from Ash Camp and be a replacement for the closure of Star City Creek to camping. The site is located along Hawkins Creek on a terrace of tailings from the Iron Canyon Diversion Tunnel. Development of camping facilities could include the restoration of vegetation on this terrace.

The Pacific Crest Trail crosses the northern part of the watershed and includes a major bridge crossing over the McCloud River at Ash Camp. Access points within the watershed are at Ah-Di-Na and Ash Camp. Other minor trails include:

- Tom Neal Trail (3W08)
- Tom Dow Trail(3W21)
- Tombstone Mountain Jeep Trail (4W04)
- Bald Mountain Jeep Trail (38N58)

Opportunities for additional trails have been identified within the Unroaded Non-Motorized Recreation management prescription (see Map 9 - Management Areas and Prescriptions).

Unroaded Recreation
The Shasta-Trinity LMP allocates a portion of the Lower McCloud River Watershed to Unroaded Non-Motorized Recreation (Prescription I). The LMP (pg. 4-45) states:

> "The purpose of this prescription is to provide for semi-primitive non-motorized recreation opportunities in unroaded areas outside existing Wilderness while maintaining predominantly natural-appearing areas with only subtle modifications."

During this analysis, two areas were identified where Prescription I boundaries could be moved to the edge of the viewshed:

- Boundary along east side of McCloud River south of Claiborne Creek could be moved upslope to the ridgetop.
- Boundary through Natawaket Creek drainage could be moved south to the ridgetop.

Transportation System

The Lower McCloud River Watershed has approximately 180 miles of road including:

- Arterial roads (FA-11 / Hawkins Creek Road) 8 miles
- Collector roads 77 miles
- Local Roads 95 miles

Roads in the watershed were mostly constructed in support of timber sale activities, dam and pipeline construction, and powerline construction and maintenance. Road construction is still occurring in conjunction with timber harvest activities on private timberland within the watershed (i.e., Hat Mountain area in 1996).

The heaviest use of the road system occurs in the spring/summer/fall season when public and commercial use is at its peak. The Hawkins Creek Road (FA-11) is a tie-through route between Big Bend and McCloud but is usually closed in winter due to snow. Lower elevation roads in the south end of the watershed, such as the Curl Ridge Road (35N18) and the Fender Ferry Road (34N17), are essentially open year-round.

Roads in this watershed access a variety of seasonal recreational uses including hunting, fishing, dispersed camping, and off-highway vehicle use.

Several private inholdings, such as the Bolliboka Club and the McCloud River Club, have restricted road access across National Forest system lands but are not open to public vehicle traffic.

Currently, right-of-way/cost share agreements exist with Sierra Pacific Industries on 50.5 miles (28%) of the road system within the watershed (Table 3-26).

Table 3-26: Roads involved in right-of-way/cost share agreements.

Road No.	Road Name	Distance (miles)		Road No.	Road Name	Distance (miles)
35N18	Curl Ridge	11.7		36N43	Satin Peak	2.0
35N18D	Curl Ridge	0.7		36N67	Bolliboka Ridge	4.0
35N18E	Curl Ridge	0.3		36N67A	Bolli	0.5
35N55	Forks Flat	5.7		36N77	Curl Loop	1.2
35N56	Chatterdown	8.8		36N79	Signal	0.75
35N56A	Chatterdown	0.3		36N79A	Signal	0.75
35N36B	Chatterdown	1.8		36N85	Sheepcamp	4.1
36N17	Nosoni	2.2		37N48	Van Sicklin	1.3
36N17A	Nos	1.0		37N86	McKenzie Mtn.	1.9
36N17B	Sonisicklin	1.5				

The road system also includes several low standard “flatcar” bridges. Examples are crossings over Caliborne and Chatterdown Creek. While they provide haul and tie-through routes on private timberland, they are not up to standard for Forest Service use and cost share agreements do not include these structures.

The checkerboard ownership pattern and co-op cost share agreements tend to limit road management options. A proposed land exchange is being examined in this watershed which would tend to consolidate National Forest land. Such a consolidation of land in the future could improve management options.

Current road density in the watershed is approximately 1.7 miles of road per square mile of land. While some physical road closure methods have been used in the past, results have been mixed. The remote nature of the area has resulted in low maintenance of gates and barricades and an increased risk of vandalism.

Chapter 4

Reference Conditions

The purpose of this chapter is to explain how ecological conditions have changed over time as a result of human influence and natural disturbances. A reference is developed for later comparison with the current conditions over the period that the system evolved and with key management objectives.

This chapter begins with a historic overview which summarizes the natural processes and land-use activities in the watershed. The remainder of the chapter follows the six core topics that have been presented previously.

The major headings in this chapter are:

- Historic Overview
- Physical Features
- Biological Features
- Human Uses

Discussions under the headings of physical features, biological features, and human uses are grouped into the following time periods:

- pre-1900
  This is a period before significant Anglo-American influences. The ecosystem was functioning under essentially natural conditions at this time.
- 1900-1945
  This is a period during which human influences began to affect natural processes in the watershed.
- 1945-present
  This is a period of major human influence on the watershed. It begins in 1945 with the completion of Shasta Dam

Historic Overview

This historic overview lists key dates and events related to the land-use activities and natural process in the watershed. A narrative history is also included in the appendix.

Land-Use Activities

Fire Suppression

Fire suppression in the Lower McCloud River Watershed began with establishment of the National Forest in 1905 and progressed through three eras:

- 1905-20 - horse/mule fire suppression
- 1920-45 - mechanized fire trucks
- 1945-present - aircraft, retardant planes, and helicopters

Each era represents increased effectiveness in suppressing fires.

Timber Harvest

Although some logging occurred on private land as early as 1958, timber harvest activities on National Forest land did not start until 1966. The first timber sales removed overstory trees in the Mica Gulch and Hawkins Creek areas. Regeneration harvest began in 1976 with the Hornet Sale. Timber sale history on National Forest land is summarized as follows:

Sale	Vol. (mmbf)	Sold	Closed
Mica Gulch	15.4	1966	1969
Hawkins	24.5	1972	1976
Hornet	4.3	1976	1981
Mica II	3.3	1978	1986
Deer-Mica	15.0	1984	1986
Ah Di Na	1.7	1984	1986
Horse Ridge	8.0	1986	1989
Beetle Dee.	16.6	1986	1992
Hawkins II	9.6	1987	1990
Satin Peak	4.6	1987	1989
Dee Fire Salvage	1.1	1990	1992
Total	104.1		

Road Construction

Access in the Lower McCloud River Watershed was fairly limited prior to 1966. Access into the area increased rapidly in the late 1960's with the development of road systems for timber sales. Significant events in the development of the transportation system in the watershed are as follows:

- 1902 - trail from Salt Creek
- 1914 - first wagon roads in place.
- 1916 - forest map shows trails on Curl Ridge, Claiborne Creek, Hawkins Creek and along the McCloud River
- 1916 - forest map shows an auto road to the McCloud River Club via Squaw Valley Creek.
- 1930's - CCCs construct Fender Ferry Road accessing south end of watershed.
- 1950's - road constructed to private land near Ah Di Na
- 1960's - Hawkins Creek Road constructed
- 1978 - Rare II temporarily stops development of unroaded areas on USFS
- 1980's - period of accelerated road building in support of timber harvest activities on both National Forest and private land.
- 1996 - latest road construction accesses private land in the Hat Mountain/North Fork Chatterdown Creek area.

Reservoirs/Diversion

- 1945 - construction of Shasta Dam is completed
  - passage of anadromous fish is blocked
  - wildlife migration is affected
- 1965 - construction of dam at Lake McCloud is completed
  - water is diverted to Iron Canyon Reservoir.
  - base flows and peak flows on the Lower McCloud River are affected.

Grazing

The extent of grazing in the watershed prior to 1900 is uncertain. As valley lands became more settled, grazing of sheep and cattle moved into the foothill and mountain areas. It is not know when grazing actually began in the Lower McCloud River Watershed.

Controlled grazing began in 1905 with establishment of the National Forest. Records for the period 1917-21 show three grazing allotments in the area. Grazing in the watershed ended by 1950.

Mining

Mining activity in the watershed has been minor. Gold mining was reported in the Hawkins Creek drainage in the 1850's. A copper mine was located southwest of Hat Mountain from 1896-1919.

Recreation

Recreation use of the watershed centers on the private clubs along the McCloud River. Significant dates are:

- 1896 - Central Pacific Railroad is granted odd-numbered sections along the river under the Pacific Railroad Acts of 1862 and 1864.
- 1896 - Ah-Di-Na is purchased from the Central Pacific Railroad by William R. Whittier and developed into a private sport-fishing and hunting resort.
- 1900 - McCloud River Club land is purchased from Central Pacific Railroad.
- 1921 - Bolliboka Club land is purchased from previous owners.
- 1958 - lands at Ah-Di-Na are purchased by the Hearst Corporation.
- 1965 - creation of Lake McCloud provides a recreational attraction in the area.
- 1965 - the Forest Service acquires lands at Ah-Di-Na from the Hearst Corporation and establishes a public campground and fishing access.
- 1974 - the McCloud River Club donates 2330 acres of their land to the Nature Conservancy which forms the McCloud River Preserve.
- 1975 - the Pacific Crest Trail is constructed.

Natural Processes

Wildfires

Reports of wildfires in the watershed are found in old records and newspaper accounts. Known major fires include:

- 1872 - 150,000 acre fire from North Fork of the Pit River into Chatterdown Creek.
- 1898 - another large fire similar to the 1872 burn.
- 1924 - a large fire reported in the Tombstone Mountain area.
- 1928 - Tombstone Mountain fire.
- 1933 - fire on High Mountain burned mostly brush.
- 1939 - 1,300 acre fire east of Bollibokka Club.
- 1944 - Hat Mountain Fire burned 4,160 acres of mostly brush and conifer reproduction.
- 1989 - Dee Fire on Beetle Butte.
- 1996 - Butcher Fire in Butcherknife Creek drainage.

Eruptions/Mudflows

Mount Shasta has erupted 13 times in the last 10,000 years. Repeated eruptions and mudflows affect water quality and channel morphology. The last major mudflow occurred on Mud Creek in 1924. Sediment from this mudflow entered the McCloud River and was observed entering San Francisco Bay.

Peak Flows

Peak flows greater than 20,000 cfs occur on the Lower McCloud River at approximately 10 year intervals. Flood events have been recorded in 1955, 1964, 1971, 1974, and 1997.

Erosion Processes

Mass wasting processes continue to erode the Klamath Mountains. Mass wasting features predominate the Lower McCloud River Watershed

Climate

Climate in the area is characterized by alternating colder/wetter periods and warmer/dryer periods. Climate fluctuations affect watershed erosion processes, peak flows, and fire regimes.

Klamath Mountain Uplift

The Klamath Mountains continue to be uplifted. This uplift process is continually being offset by the erosion process.

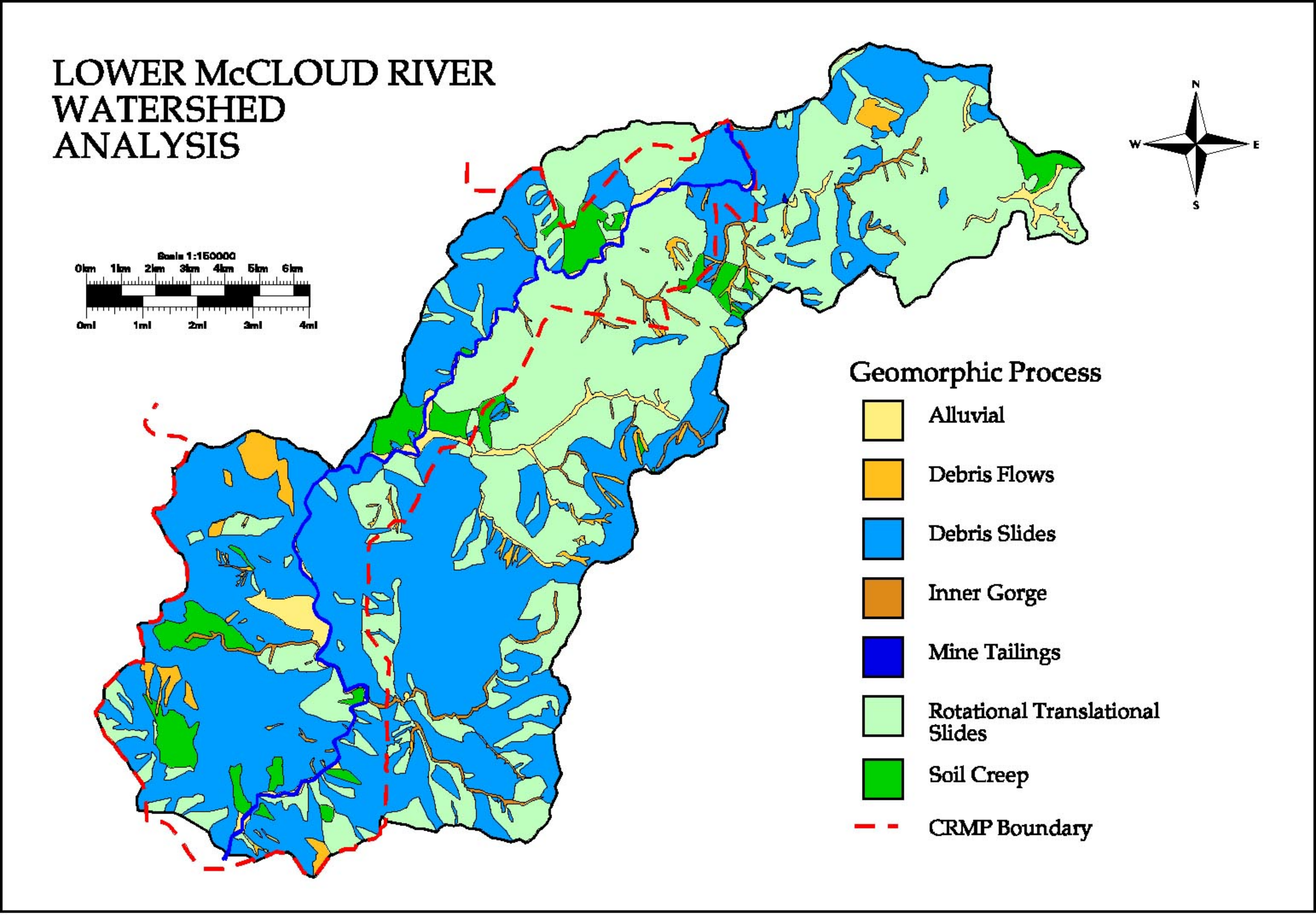
Physical Features

Geology, Geomorphology, and Erosion Processes

Pre-1900

The Lower McCloud River Watershed has been formed by natural processes occurring over time scales of hundreds of thousands or millions of years. The most recent period of mountain uplift began in the early to mid-Pleistocene, approximately 1.7-1.5 million years B.P., and continues today. During the past 150 years land-use activities occurring within the watershed have influenced the rates, frequency, magnitudes and areas of occurrence of natural processes. The interactions between natural processes and land-use activities are complex. Some land-use activities, such as road building and fire suppression, have significantly altered natural processes throughout the entire watershed while others have had little to no effect. Very little information is available concerning reference conditions for natural processes prior to European settlement. In order to understand how land-use activities affected natural processes it is necessary to identify the dominant natural processes that occurred in the watershed prior to European settlement and then determine the effects of land-use activities on each natural process.

The current topography of the Lower McCloud River Watershed has been created almost exclusively by a combination of tectonic uplift, mass wasting and fluvial and surface erosion processes. The influence of these processes has been continuous from the beginning of the Klamath Mountain uplift. The extensive role that mass wasting has played in forming the present day watershed is evident from the Geomorphic Features Map (Map 17). Mass wasting features occur over most of the watershed area. Common mass wasting features that are widespread throughout the watershed include debris slides and multiple rotational/translational landslides. Map 17 displays the current mass wasting features found in the watershed. The distribution of mass wasting features across the watershed has not changed appreciably as a result of land-use activities. Therefore, this



Map 17. Geomorphic Features

map is believed to reflect the approximate distribution of mass wasting features found in the watershed prior to European Settlement as well as current conditions.

The Klamath Mountains are still being uplifted; however, the rate of uplift has been offset by the continuing effects of erosion processes. Erosion rates in the watershed have varied considerably over time in response to long term changes in climatic patterns. The last major period of erosional activity occurred during the Pleistocene Epoch, 100,000 to 2 million years B.P. (before present). The climate during this period was wetter than it is today. Most of the slides depicted on the Geomorphic Features Map (Map 17) occurred during this epoch. Many of these slides were several million cubic yards in size and significantly altered the topography of the Lower McCloud Watershed during the Pleistocene.

During the Holocene Epoch (100,000 years B.P.), the climate has generally been drier than the Pleistocene. The decrease in landslide size during this epoch appears to reflect dryer conditions in the Lower McCloud Watershed. Landslides occurring during this period have been much smaller (~100,000 cubic yards) than those that occurred during the Pleistocene. The smaller slides may indicate a trend of decreasing mass wasting activity from the end of the Pleistocene to present.

In the past 200 years, mass wasting activity is believed to have been greatest following large catastrophic fires such as those that occurred in the late 1800s. Aerial photography from 1944 and historical information taken from regional newspapers in the early 1900s indicate that wildfires played a significant role in controlling vegetation patterns. The 1944 aerial photography indicates that much of the Lower McCloud River Watershed was covered in early seral vegetation as a result of frequent wildfires, some of which burned through the entire southern portion of the watershed on the late 1800s (see Vegetation section later in this chapter for more information). These large fires probably aggravated mass wasting processes during the following winters by removing vegetation and destroying root systems on burned hillslopes.

<u>1900-1945</u>

Between 1900 and 1945 land-use activities introduced by European settlers began to influence natural erosion processes in watershed. The earliest activities to occur in the watershed included fur trapping, mining and trail construction (see Historic Overview section for more information). These activities probably affected erosion processes; however, the extent and duration of these activities was so limited that their relative influence on the watershed during this time period is believed to have been insignificant.

Grazing activity occurring in the Chatterdown and Claiborne Creek sub-basins may have affected erosion processes. Direct impacts from cattle and sheep have not been documented; however, grazing activities occurring during the early 1900s probably affected erosion processes in areas where frequent burning occurred. Historical records indicate that many of the fires that occurred in the watershed were grazing related (<u>Cranfield, 1984</u>). Some of these fires were accidental while others probably occurred during efforts to improve forage. The influence of grazing activities on erosion processes ended with the exclusion of cattle and sheep from the watershed following the completion of Shasta Dam in 1945. No impacts from grazing are evident in the watershed today.

1945-present

Over the past 100 years fire suppression activities have decreased the size and frequency of fires in the watershed. Fire suppression occurring in watershed in the early 1900s was relatively ineffective due to access difficulties associated with the remoteness of the watershed. The employment of aircraft in 1945 greatly increased the effectiveness of fire suppression efforts. The reduction in fires has in turn reduced the amount of ground disturbed by wildfires. Effective fire suppression is believed to have reduced erosion and the size of landslides by reducing the amount of ground disturbed by wildfire. More research and monitoring effort are needed to determine if the relationship between fire suppression and decreased incidence of mass wasting activity is valid.

Road construction and timber harvest activities are not believed to have influenced erosion processes in the watershed until the mid-1960s. From approximately 1965 to present, timber harvest and road construction activities have affected erosion processes east of the McCloud River (see Ch. 3 for description of impacts). Actual mass wasting activity occurring as a result of timber harvest practices has been documented in the Deer Creek area of the Hawkins Creek sub-basin. Due to the lack of intensive surveys it is not known how many slides have occurred as a direct result of harvest activities. Surface erosion from poorly constructed roads, non-maintained roads and disturbed hillslopes has increased over the past 30 years. The lack of an observed increase in mass wasting activity may be partly due to the relatively brief period in which road construction and timber harvest activities have occurred in the watershed.

Table 4-1: Impacts of land-use activities on erosion processes.

Land-Use Activity	Impacts to Erosional Processes	Affected Area
Fire Suppression	Reduced erosion and frequency and size of landslides by reducing the amount of ground disturbed by wildfire.	Entire watershed.
Timber Harvest	Some incidences of increased mass wasting activity in Hawkins Creek area, possible impacts to other areas.	Hawkins, Claiborne and Chatterdown Creek sub-basins.
Road Construction	Increased surface erosion in heavily roaded areas.	Hawkins, Claiborne, Chatterdown sub-basins and areas west of McCloud River above Ah-Di-Na.
Reservoirs/Diversions	No impacts to hillslopes.	None.
Grazing	Impacts associated with burning of allotments to maintain range forage. Impacts to riparian areas that were heavily grazed (extent of impacts unknown).	Claiborne and Chatterdown Creek sub-basins.
Mining	Minimal to no effect.	Mining activity minimal in watershed. Small areas in vicinity of Hat Mountain were affected.
Recreation	No impacts.	None.

Hydrology

Pre-1900

Natural processes that controlled peak and base flows in the Lower McCloud River Watershed prior to European settlement have not changed from reference to current conditions. Peak and base flows within the watershed were controlled by the prevailing climate, or more specifically variations in annual precipitation. Variations in the amounts and distribution of vegetation within the watershed also affected peak and base flows. Wetter periods brought increased rainfall which reduced wildfire activity and stimulated vegetative growth. Increases in evapotranspiration probably partially offset increases in base flows during these wetter periods. Conversely, dryer periods resulted in lower flows that were offset by decreased evapotranspiration following catastrophic fires.

Changes in precipitation and evapotranspiration affected peak and base flows in tributary streams to the McCloud River but had a lesser effect on base flows in the river itself. Base flows to the McCloud River were largely regulated by groundwater inputs from Big Springs above the present day location of Lake McCloud. In his McCloud River Investigation conducted in 1938, Wales noted that discharge into the McCloud River from Big Springs was approximately 450 cubic feet per second or approximately half of the minimum flow recorded at the town of Baird (now beneath Shasta Lake) (Wales, 1938). Measurements made by the U.S. Geological Survey in August 1981 indicate that the discharge from Big Springs was 615 cfs, much larger than that estimated by Wales (Poeschel, et al., 1986). This constant supply of cold, clean water kept base flows high in the McCloud River during dryer periods prior to the creation of Lake McCloud.

The effects of groundwater flows from Big Springs on the McCloud River is best summarized by Mike Rode. The following paragraph is from Rode's 1990 report on the status of the Bull Trout in the McCloud River.

> "About 56 km (35 mi.) above Shasta Lake is Lower Falls which, prior to the construction of Shasta Dam, was a barrier to the upstream migration of anadromous fish. About 2.1 and 2.9 km (1.3 and 1.8 mi.), respectively, below Lower Falls, Muir (Little) and Big Springs increase the summer flow of the McCloud River from roughly 1 m^3/s (40 cfs) to about 23 m^3/s (800 cfs). About 0.8 km (0.5 mi.) above Wyntoon, a third spring source further augments river flows. This spring water inflow transforms the McCloud into a large, very clear, cold river with summer temperatures seldom exceeding 7.8 degrees Celsius (46 degrees Fahrenheit) until the river reaches McCloud Reservoir." (Rode, 1990)

1900-1945

Between 1900 and 1945 peak and base flows within the Lower McCloud River Watershed were not affected significantly by land-use activities. The scope of logging, road construction and mining activities was very limited and fire suppression activities were still only partially effective at controlling wildfires. Controlled burns undertaken by grazing permittees to enhance range forage may have affected water flows. Peak and base flows in the Chatterdown and Claiborne Creek sub-basins may have increased for short periods of time following fires set by the grazing permittees.

1945-present

Hydrologic conditions in the McCloud River Drainage were dramatically altered following the completion of Shasta Dam. Shasta Dam was the cornerstone of the Central Valley Project designed to provide irrigation water to farms, conserve winter runoff, maintain navigation on the Sacramento River and to reduce the threat of flooding in the Central Valley (Cranfield, 1984). Approximately 13 miles of the McCloud River below the Lower McCloud River Watershed was inundated during the creation of Shasta Lake.

Hydrologic conditions in the Lower McCloud River Watershed did not change significantly until the McCloud Dam was completed in 1965. The McCloud Dam was one component of the McCloud-Pit Project which was implemented for the purpose of hydroelectric power generation. Phase I of the project resulted in the creation of Lake McCloud and Iron Canyon Reservoirs and the construction of two large diversion tunnels (Lake McCloud to Iron Canyon and Iron Canyon to Pit 5 Power House). Monthly base flows in the McCloud River below Lake McCloud decreased by approximately 1000 cfs as a result of the diversion project (Fig. 2). Phase II of the project was never completed but would have drastically altered hydrologic conditions in the remainder of the McCloud River between Lake McCloud and Shasta Lake. While the Pit River Hydroelectric Project decreased base flows in the McCloud River it should be noted that none of the other tributaries to the McCloud River were affected by the project.

Table 4-2: Impacts of land-use activities on hydrologic processes.

Land-Use Activity	Impacts to Hydrologic Processes	Affected Area
Fire Suppression	Affects runoff and water yield due to increased vegetative cover and increased evapotranspiration. Undetermined effect on peak and base flows (both should decrease).	Entire watershed.
Timber Harvest	Increases runoff due to influence over vegetation and evapotranspiration.	Hawkins, Claiborne and Chatterdown Creek sub-basins.
Road Construction	Increased peak flows during winter rains when road system intercepts groundwater flow. Affects timing of flood peaks by altering the pathways and rates of water movement through the channel network.	Hawkins, Claiborne, Chatterdown sub-basins and areas west of McCloud River above Ah-Di-Na.
Reservoirs/Diversions	Large decrease in base flows to the McCloud River from Lake McCloud.	McCloud River from Lake McCloud to Shasta Lake.
Grazing	Possible increases in base and peak flows following burning to enhance range forage.	Chatterdown and Claiborne Creek sub-basins.
Mining	No impacts.	None.
Recreation	No impacts	None.

Beginning in 1945 the effectiveness in fire suppression increased and the natural fire regime in the watershed was altered. No data on the impacts of increased vegetation cover on evapotranspiration and water yield is available during this period; however, it is likely that water yield decreased as a result of increased evapotranspiration throughout the watershed. These decreases were probably offset in some areas by timber harvest activities which were observed to increase water yield in disturbed drainages (see Ch. 3).

Beginning in the mid-1960s timber harvest and road construction began to influence hydrologic processes in the watershed east of the McCloud River by increasing water yields from disturbed drainages. Increases in water yield were limited mainly to Hawkins, Claiborne and Chatterdown Creek sub-basins. The cause and effect relationship between timber harvest and water yield was verified in the Nature Conservancy Water Quality Study (see Ch. 3). Increases in water yield in Bones Gulch and Ladybug Creek were limited to the first year following timber harvest and wildfire disturbance. Increases in water yield from timber harvest activities were probably partially offset by increased evapotranspiration in areas where wildfire activity was suppressed.

Stream Channel Morphologies

<u>Pre-1900</u>

Channel morphologies in the Lower McCloud River have been formed primarily by fluvial erosion processes and mass wasting activity. Prior to European settlement channel morphologies were controlled by peak flows and hillslope erosion processes. Frequent fires and mass wasting activity affected channel development and influenced channel stability. Swales, colluvial, bedrock and cascade channels located in upland areas that were burned frequently probably exhibited unstable characteristics as a result of the high sediment inputs and the lack of large woody debris needed for channel stabilization. These upland channel types probably hosted aquatic and terrestrial plant and wildlife species adapted to frequently burned, early seral habitats rather than those adapted to the forested riparian areas found throughout the watershed today.

The channel morphologies of step-pool and pool-riffle channels like Hawkins, Claiborne and Chatterdown Creeks were probably similar to those found in the watershed today. Because impacts from burning appear to have affected midslopes and ridgetops more than inner gorge areas it is believed that the larger channel types such as step-pool and pool-riffle channels probably were not impacted appreciably by wildfires or mass wasting activity. Gravel and fine sediment probably accumulated in step-pool and pool-riffle channels following large wildfires and floods, however the sediment deposited during these events was probably flushed from the channel network during smaller bankfull flows occurring over the following years. Large woody debris probably played a significant role in controlling the morphologies of smaller step-pool channels; however, most large wood was probably flushed through the larger step-pool and pool-riffle channels.

<u>1900-1945</u>

Little information is available concerning the effects of land-use activities on channel morphologies in the Lower McCloud River Watershed between 1900 and 1945. Stream channel disturbance was very limited due to the limited level of human use that occurred in watershed during this period. Some stream channels may have been impacted by land-use activities such as road construction and mining; however, these impacts were probably insignificant due to the small area in which they occurred. Stream channels and riparian areas were probably impacted by grazing activities in the Chatterdown and Claiborne Creek sub-basins; however, the degree to which grazing activities affected stream channels and riparian areas is unknown. Today no signs of long-term stream channel degradation from grazing are visible in the Claiborne and Chatterdown Creek sub-basins.

<u>1945-present</u>

Some land-use activities occurring over the past 47 years have affected the morphology and stability of stream channels in the watershed. Perhaps the most widespread impacts to stream channels have occurred as a result of the successful exclusion of fire from areas that burned frequently prior to the onset of effective fire suppression techniques. A comparison of 1944, 1975 and 1995 aerial photos (see discussion on Vegetation in this chapter) shows that early to mid seral stands have developed into mid to late seral stands largely due to the exclusion of fire. The effects of this vegetative conversion on channel morphology are not readily apparent; however, the trend to older, mature stands has reduced sediment inputs to upland and cascade channels.

The exclusion of fire affected channel stabilities indirectly by influencing vegetation in close proximity to streams. The shift in vegetation from younger to older stands is believed to have affected upland and cascade channels in several ways. The establishment of mid to late seral vegetation has resulted in reduced soil erosion. The delivery of sediment to upland stream channels has decreased with increased vegetative cover. The potential for coarse woody debris recruitment to upland channel types located near the ridgetops and cascade channel types located on the midslopes has also increased. Increased levels of woody debris recruitment will eventually lead to changes in the morphologies and stability of colluvial, bedrock and cascade channel types. Fire suppression activities are also believed to have influenced channel stability by increasing evapotranspiration and lowering runoff peaks throughout the watershed.

Timber harvest and associated road construction activities did not begin to impact channel morphologies in the Lower McCloud River Watershed until the early 1970s. Impacts from these activities occurred mainly in the Hawkins, Claiborne and Chatterdown Creek drainages. Impacts were greatest in upland channels located within close proximity to ridgetops. Step-pool and cascade channel types were also impacted in areas where roads were constructed within stream inner gorges. Impacts were generally limited to channels located within or below clearcut areas rather than areas where selective cuts had occurred. The impacts associated with timber harvest activities were relatively small and were mainly limited to increased sedimentation in upland channels.

Roads impacted the morphology of upland channels throughout the watershed. Impacts were generally concentrated at stream crossings and in areas where roads were constructed within or adjacent to stream inner gorges and on unstable hillslopes. Impacts to step-pool and pool-riffle channels were mostly in the form of increased sediment inputs which led to increased deposition in pools and loss of fish habitat. Unlike the impacts from timber harvest activities which were of short duration, impacts from roads were chronic, especially on road systems that were not maintained. Common impacts to upland stream channels from roads included channel aggradation above plugged or partially plugged culverts, channel degradation below stream crossings, and gullying along poorly drained road systems.

Table 4-3: Impacts of land-use activities on stream channel morphologies.

Land-Use Activity	Impacts to Channel Morphology	Affected Area
Fire Suppression	Potential for increased large woody debris inputs to stream channels located in watersheds where fire suppression has been effective. Possible increased channel stability due to reduction in mass wasting activity.	Swale, colluvial, bedrock and cascade channel types would show most significant changes in stability and woody debris concentrations. Overall decreases in sediment inputs to all channel types.
Timber Harvest	Some impacts to upland channel types in Little Meadows. Some impacts to swales, colluvial and bedrock channels located in close proximity to or within harvest units.	Hawkins, Claiborne and Chatterdown Creek sub-basins. Impacts are restricted to areas where harvest activities have occurred. Impacts greatest in and below clear cuts.
Road Construction	Impacts to smaller bedrock, colluvial and upland channel types. Impacts to larger channel types occur in areas where roads parallel stream channels in steep inner gorges.	Hawkins, Claiborne, Chatterdown sub-basins and areas west of McCloud River above Ah-Di-Na.
Reservoirs/Diversions	Loss of fine sediment and bedload inputs to McCloud River from McCloud Dam to Hawkins Creek confluence. Lower summer base flows have decreased size of active channel and affected riparian vegetation. Aggradation of bedload at Shasta Lake.	McCloud River from Lake McCloud to Shasta Lake.
Grazing	Impacts to riparian areas from early 1900-1949. Bank erosion and overgrazing of riparian areas may have occurred.	Chatterdown Creek sub-basin, and to a lesser extent, Claiborne Creek sub-basin.
Mining	Minimal impacts associated with early placer mining attempts during mid-1800s.	No impacts from any mining activities have been documented.
Recreation	No impacts.	None

Reservoirs and diversions have affected channel morphologies in the McCloud River below the McCloud Dam. Due to the lack of pre-reservoir data, no measurable impacts were noted; however, changes in channel habitat types have occurred. The quantity of spawning gravels and cobbles in the McCloud River has decreased below the dam. It is likely that channel aggradation also occurred in the McCloud River Arm of Shasta Lake; however, channel aggradation in the Lower McCloud River Watershed did not occur because Shasta Lake was not full during the majority of peak flow events. Overall the influence of the diversion on channel morphologies only appears to affect a small reach of the McCloud River below the dam. None of the tributaries to the McCloud River in the watershed are impacted by the Pit River Hydroelectric Project.

Water Quality

Pre-1900

With the exception of the McCloud River, reference conditions for water quality in the Lower McCloud River Watershed are believed to be similar to current conditions, with the greatest changes taking place over the last 50 years. The quality of water in the streams tributary to the McCloud River has always been very good. Natural processes that affected water quality in the tributary streams prior to European settlement included climate, fire, peak flows, mass wasting activity and possibly volcanic eruptions from Mount Shasta. Impacts to water quality only occurred for short periods of time during winter high flows when concentrations of suspended sediments increased. Water quality in all of the tributary streams was probably excellent between high flows and during the summer and fall when base flow conditions prevailed.

The quality in the McCloud River, while very good, was affected by natural processes originating in the Upper McCloud River basin that were not present in the Lower McCloud Watershed. These processes caused water quality in the McCloud River to differ significantly from that of the tributary streams. Levels of suspended sediments in the McCloud River were higher than in the tributary streams due to the influence of Mud Creek. Mud Creek and Squaw Valley Creek are the only perennial streams draining Mount Shasta that actually flow perennially into the McCloud River. Numerous debris flows occurring at approximately 75 year intervals significantly elevated concentrations of suspended sediments in the river.

Water temperature in the McCloud River was greatly influenced by Big Springs due to the large volume of groundwater that entered the river at this location. The water temperature at Big Springs is approximately 7 degrees Celsius. The low water temperatures kept the McCloud River very cold and also controlled the distribution and types of aquatic species found along the lower river.

1900-1945

Little to no information concerning the effects of land-use activities on water quality in tributaries to the McCloud River is available for the early 1900s. Historical accounts of the watershed from Wales indicate that the quality of water in the tributaries was very good during this period (Wales, 1938). Water quality was probably impacted by mining and grazing activities, however the extent of these impacts are unknown. No other land-use activities have significantly influenced water quality in the Lower McCloud Watershed (see Table 4-4).

The large debris flows originating on Mount Shasta during the mid-1920s impacted water quality in the McCloud River. The largest debris flows from Mud Creek occurred during the mid-1920s. During the largest of these events in 1924 it was estimated that approximately 10,000,000 cubic yards of glacial debris were deposited in a ten mile stretch of Mud Creek and an unknown amount of this material entered the McCloud River (Wales, 1938). During the peak of the debris flow it is estimated that the solid content of sediment in the McCloud River was approximately 68 percent (Cranfield, 1984). The large quantities of sediment deposited and suspended in the river significantly degraded habitat for aquatic species that lived in and along the river. During the height of the flows much of river bed was covered by a layer of fine sediment which degraded the quality of spawning gravels. The poor clarity of the water during the flows also hindered the ability of fish to feed on aquatic insects (Cranfield, 1984).

A total of nine debris flow events have occurred in Mud Creek from 1900 to 1985 (Blodgett et al., 1996). In the interim periods between these flows, water quality in the McCloud River was much improved; however, it should be noted that the concentrations of suspended sediments in the river from Mud Creek were still high. Concentrations of suspended sediments were diluted by the large quantities of water that entered the river at Big Springs upstream of the Mud Creek confluence.

1945-Present

Water quality in the tributaries to the McCloud River was affected by the increased amount of land-use activity that occurred throughout the eastern half of the watershed. The majority of impacts were associated with increased instream sedimentation in areas where timber harvest and road building activities occurred. Impacts to water quality from timber harvest and road construction were mostly non-apparent while these activities were taking place unless the activities occurred in close proximity to perennial streams. Impacts from these activities did not manifest themselves until the following winter during winter runoff events. Impacts from timber harvest appeared to be relatively short lived and mostly in the form of increased hillslope erosion and turbidity during winter runoff events. The McCloud River Water Quality Monitoring Project showed that increased levels of turbidity did occur in drainages that were impacted by timber harvest activities and wildfires. The amount of sediment originating from disturbed areas decreased within 1-5 years of harvest activity. Impacts to the water quality from the road system were more chronic and ultimately appear to be more significant than those of timber harvesting.

Fire suppression activities actually operated to decreased fine sediment inputs to streams and improve water quality over the last 50 years. The suppression of wildfire throughout the watershed resulted in reduced amounts of hillslope erosion and increased hillslope stabilization. Increased canopy cover over upland stream channels also influence water quality throughout the watershed by lowering water temperatures.

Water quality in the McCloud River was altered following the completion of Lake McCloud and the onset of water diversion from the McCloud River for the Pit River Hydroelectric project. Prior to the construction of Lake McCloud, streamflow in the McCloud River had higher levels of turbidity due to the influence of Mud Creek. Turbidity levels in the McCloud River decreased when sediments from Mud Creek were cut off from the lower river by Lake McCloud. The decreased concentration of fine sediments in the lower river improved water quality accept during short periods in the fall when reservoir levels in Lake McCloud were low. Lower water levels in Lake McCloud affect the concentration of sediments at the outflow and occasionally result in the transfer of sediment laden runoff downstream. Turbidity levels below the dam have also been observed to increase following large runoff events as sediment settles in Lake McCloud.

Table 4-4: Impacts of land-use activities on water quality.

Land-Use Activity	Impacts to Water Quality	Affected Area
Fire Suppression	Improved water quality as a result of more canopy cover, decreased stream temperatures, increased channel stability, decreased sedimentation.	Entire watershed, however changes in vegetation have been greatest in southern tributaries to the McCloud River including Chatterdown Creek.
Timber Harvest	Increased turbidity immediately following harvest activities.	Hawkins, Claiborne and Chatterdown Creek sub-basins.
Road Construction	Increased turbidity during winter storms, increased sedimentation resulting from surface runoff from roads.	Hawkins, Claiborne, Chatterdown sub-basins and areas west of McCloud River above Ah-Di-Na.
Reservoirs/Diversions	Decreased turbidity in McCloud River following completion of McCloud Dam due to loss of sediments from Mud Creek. Increased levels of turbidity for short periods in spring and fall in response to reservoir drawdown and Mud Creek inflows. Increased water temperatures in the McCloud River	McCloud River from McCloud Reservoir to Shasta Lake.
Grazing	Increased sedimentation, bank erosion in overgrazed riparian areas. Increased erosion from burning activities.	Chatterdown Creek sub-basin, and to a lesser extent Claiborne Creek sub-basin.
Mining	Minimal to no effect. Water quality was probably disturbed during placer mining activities in the mid-1800s but no data is available to confirm this.	Mining activity minimal in watershed. Small areas in vicinity of Hat Mountain were affected.
Recreation	No Impacts	None

The effect of Lake McCloud on water temperature in the lower river was also significant and opposite of what one would expect. Normally, reservoirs actually create lower downstream water temperatures. Water temperatures in the McCloud River, prior to the completion of Lake McCloud, were much colder than those found in the tributary streams due to the influence of Big Springs. The temperature of water emanating from Big Springs is approximately 44-45 degrees Fahrenheit. Temperature data collected on the McCloud River above Hawkins Creek in 1996 indicate that the water temperature of the river remained above 50 degrees Fahrenheit throughout the summer and fall. The higher water temperatures have influenced the distributions and types of aquatic species found throughout the lower river (see Fisheries).

Biological Features

Vegetation

Overview

Large ecosystems maintained by surface fire, such as ponderosa pine and drier mixed conifer types, are a result of primary and secondary succession. These regimes contain persistent successional plant species that generally are shade tolerant and have developed adaptations to survive fire and maintain a constant or fluctuating population in response to disturbance. In the absence of fire beyond the normal return interval, these fire adapted species are replaced by late-successional species that are predominantly shade tolerant, thus the development of fuel ladders that alter fire behavior.

Fire exclusion, coupled with other impacts, have altered the current fire regime from a short interval, low intensity regime to one of moderate to high intensity at infrequent intervals. It appears that natural fire regimes may have been intact in the early 1800s with fire intervals at 5-30 years supported by lightning cause and perhaps Native American influence. We now have, on the average, a 17-36 year fire return interval with extended periods of 70 years without significant fire disturbance.

Summary of fire history in the Lower McCloud River Watershed:

Period covered	Total acres burned	Acres burned per decade
1872 - 1920	40,000 ac.	8,000 ac./decade
1921 - 1945	16,000 ac.	6,400 ac./decade
1946 - 1995	1,000 ac.	20 ac./decade

While it is evident that total burned acres has diminished in the previous eight decades, it is also apparent that fuels models within the watershed are in transition to mimic models typical of the mid 1800s. It was the combination of these fuels, as well as diminished suppression technology, that resulted in large burned areas. While fire suppression technology has developed, little effort has been made to alter developing critical fuel models.

The transition of fuel models from the mid 1800s to the present was analyzed using 1944 aerial photography, as well as current stand data, to verify fuel model changes over time. This analysis appears to indicate that historic fuel model conditions which fostered large wildfires are developing.

Fuel Model transition over time:

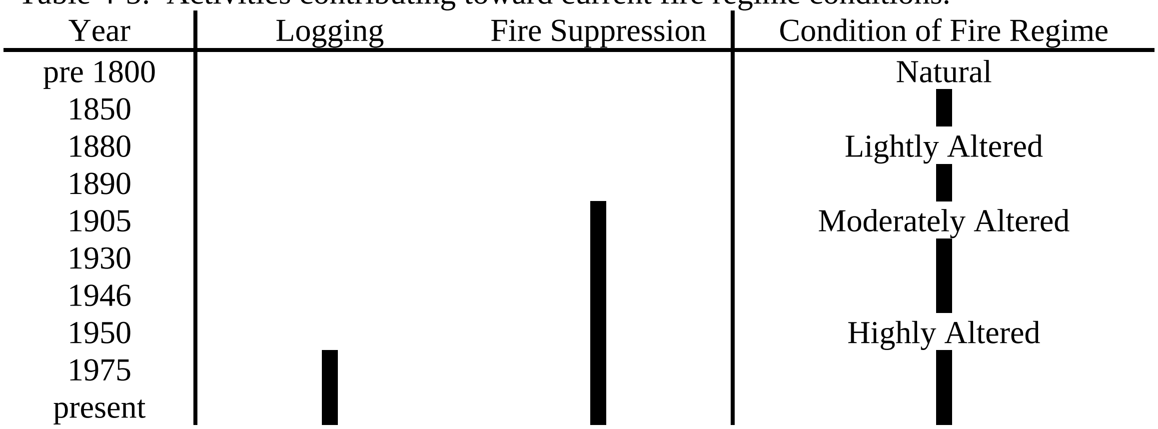
	1870 1900 1920 1944 1975 1995
Stratum*	4N/G------>2P---------------------->3P/2G------------------>4G
Fuel model	9/10------->5----------------------->9/5---------------------->10/5
Stratum*	3P/S------->BR-->HW
Fuel model	9/8--------->4--->6/4
Fire frequency	frequent--->infrequent--->
Fire intensity	low-------->mod./high------------->high---------------------->

*BR=brush, HW=hardwoods, other stratum codes are explained on page 3-12.

Fuel Model key:

Fuel Model	Description	Expected fire behavior	Suppression tactic
Model 10	conifer, heavy fuel	6 ft. flame ht.	indirect, dozers
Model 9	conifer, moderate fuel	4 ft. flame ht.	direct hand line
Model 8	conifer, light fuel	2 ft. flame ht.	direct hand line
Model 6	hardwoods, brush	9 ft. flame ht.	serious spotting
Model 5	brush, < 2 ft. high	4 ft. flame ht.	direct hand line
Model 4	brush, > 2 ft. high	22 ft. flame ht.	major spotting

Table 4-5: Activities contributing toward current fire regime conditions.



Pre-1900

Mixed conifer forests contain a variety of vegetation species that have a variety of responses to disturbance from fire. Such forest types make up one of the more complex regimes to describe a natural fire response. Native Americans and lightning were both sources of fire disturbance in mixed conifer and ponderosa pine forests. Native Americans burned such forests regularly as indicated from recorded accounts (Lewis, 1973). Research on fire modeling based on long term climatic data, including lightning frequency, suggests that much of early fire history can be explained by lightning occurrence alone (Van Wagtendonk, 1972). Anecdotal information recorded in 1934 notes a conversation with an old-timer that lived in the Mount Shasta region since 1852 who stated that “he never knew of Indians firing the country off because they already had plenty of game to hunt” (Shrader, 1995). It appears likely that Native American influence as an ignition source ended by the late 1800’s.

Presettlement fire histories in mixed conifer forests show a pattern of lengthening of fire return intervals with increasing elevation. The intensity of these fires was generally low due to fire frequency that kept residual fuel loading down and eliminated vertical fuel ladders and were more limited to surface fires. Typical return fire intervals for this fire regime before human disturbance was likely at 8-30 years depending on geographical features.

The pre-settlement pattern of vegetation within the watershed appears to have been formed by fairly frequent fires, which periodically burned off chaparral covered ridges and hillslopes, leaving large timber essentially confined to canyon bottoms or moist north slope areas.

Large fires are know to have occurred in the watershed in 1872 and 1898. The 1998 fire appears to have burned a major part of the watershed.

<u>1900-1945</u>
Human influences have affected the natural disturbance patterns, thus altering the fire regime. What was once a short return interval, low intensity regime has developed into one of moderate to high intensity at infrequent intervals. Fire return intervals have been calculated using dendrochronology in a similar watershed with much the same regime characteristics which shows the current return interval at 17-36 years. This is verified by recorded fire history that shows the last significant fires occurred within this settlement period between the years of 1872 and 1920. Many of the human caused fires were possibly from grazing activities.

With the advent of a highly structured suppression influence starting in the early 1900's we can now see very long intervals between fires that are generally large and stand replacement events.

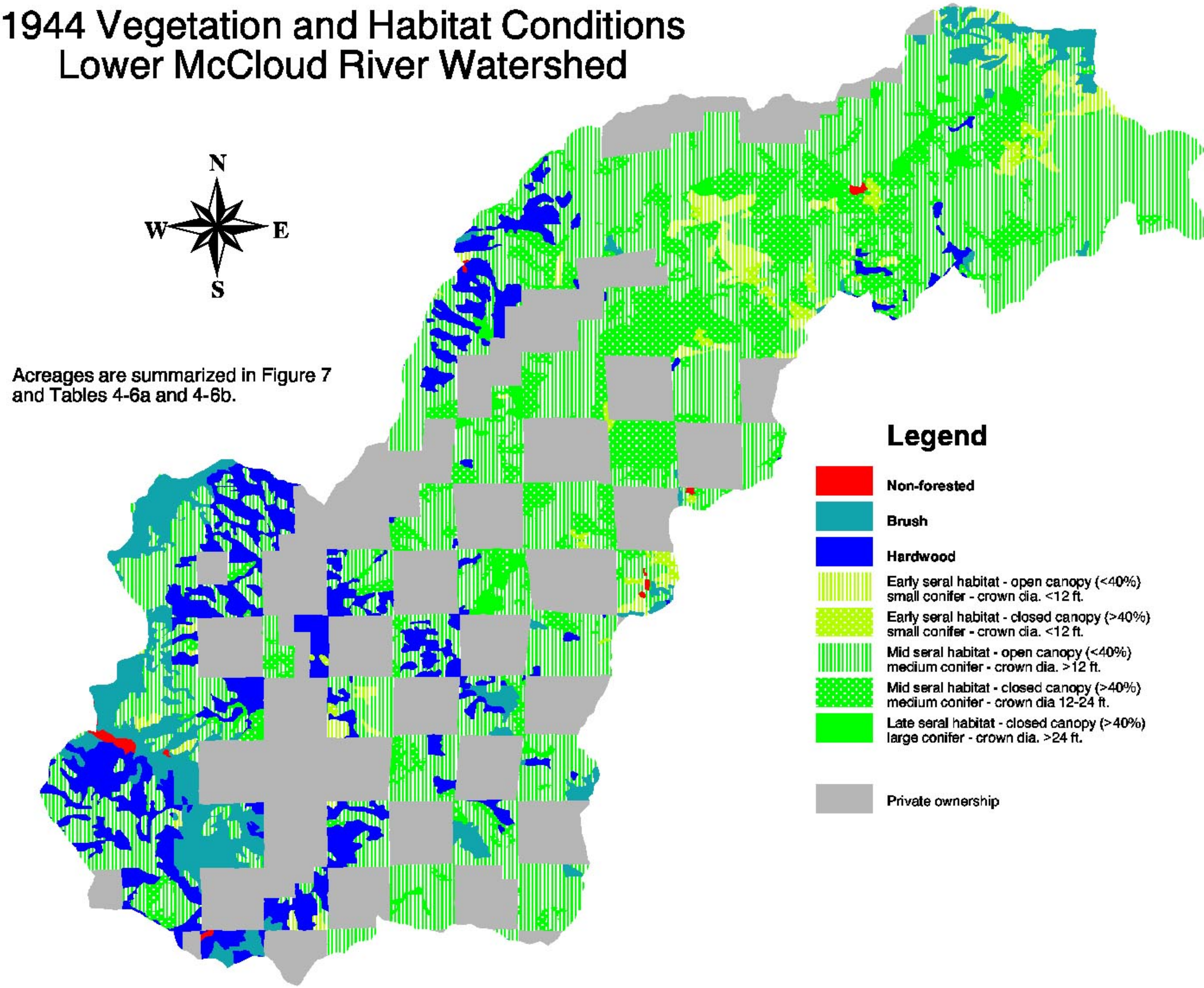
<u>1945-present</u>
The 50 year period from 1944 to 1995 shows a dramatic development of vegetation in the watershed. Tree size, crown cover, and stand structures increased rapidly during this period. Late seral habitat increased from 2% to 35% of the entire watershed (Table 4-6a) and from 3% to 47% within the LSR portion of the watershed (Table 4-6b). This rapid development of vegetation is attributed to high soil productivity, high rainfall, and fire exclusion. Land allocations have tended to exclude less productive ground from the LSR; therefore, the above tables show a faster development of late seral conditions within the LSR portion of the watershed than in the entire watershed.

The development of vegetation and habitat conditions in the Lower McCloud River Watershed was determined by observations from aerial photographs. The following sets of aerial photographs were used:

- 1944 - earliest available photo flight
- 1975 - photo flight used for Geographic Information System (GIS) database
- 1995 - most recent photo flight

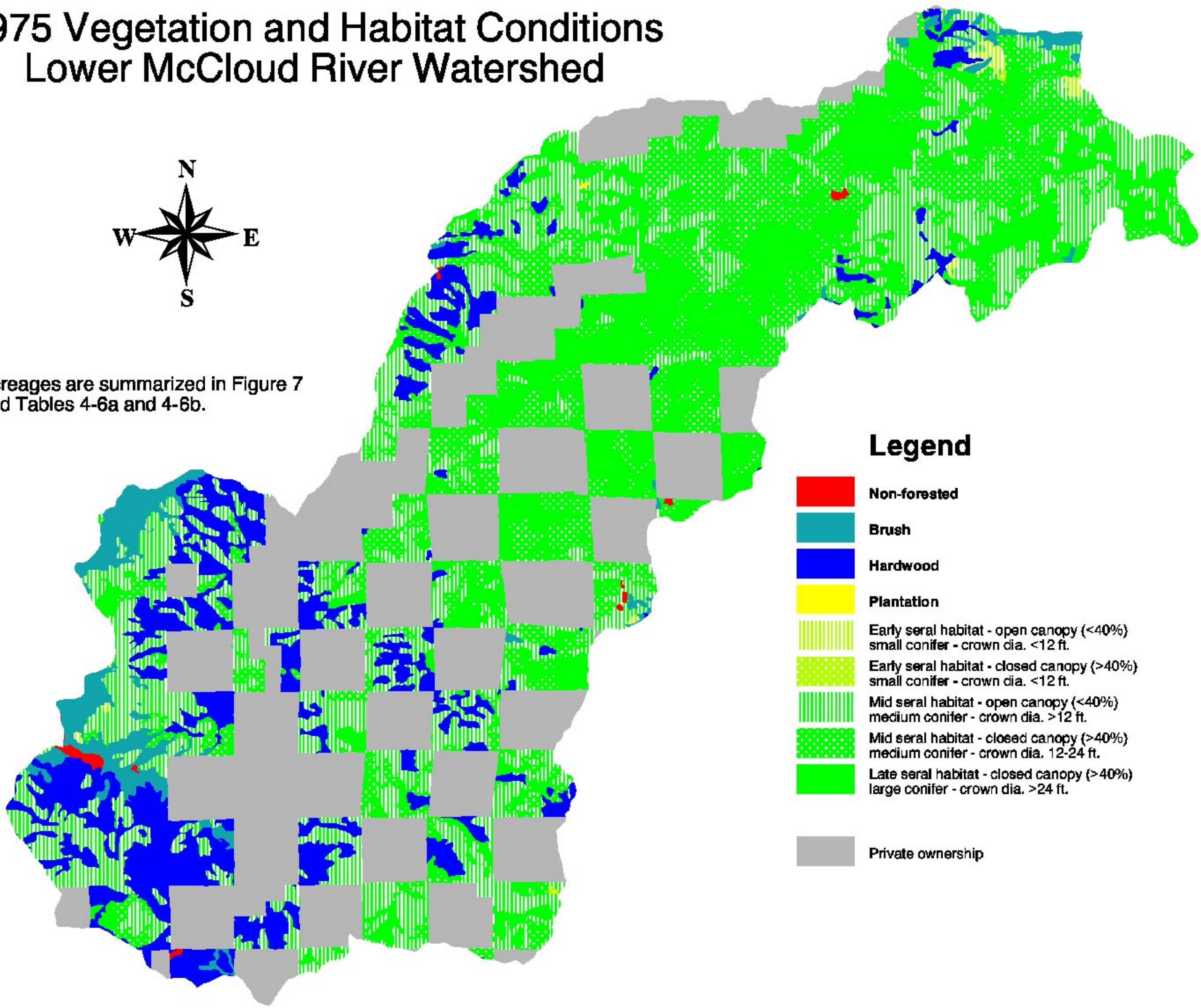
Results of these observations are displayed in the following tables, charts and maps.

1944 Vegetation and Habitat Conditions
Lower McCloud River Watershed

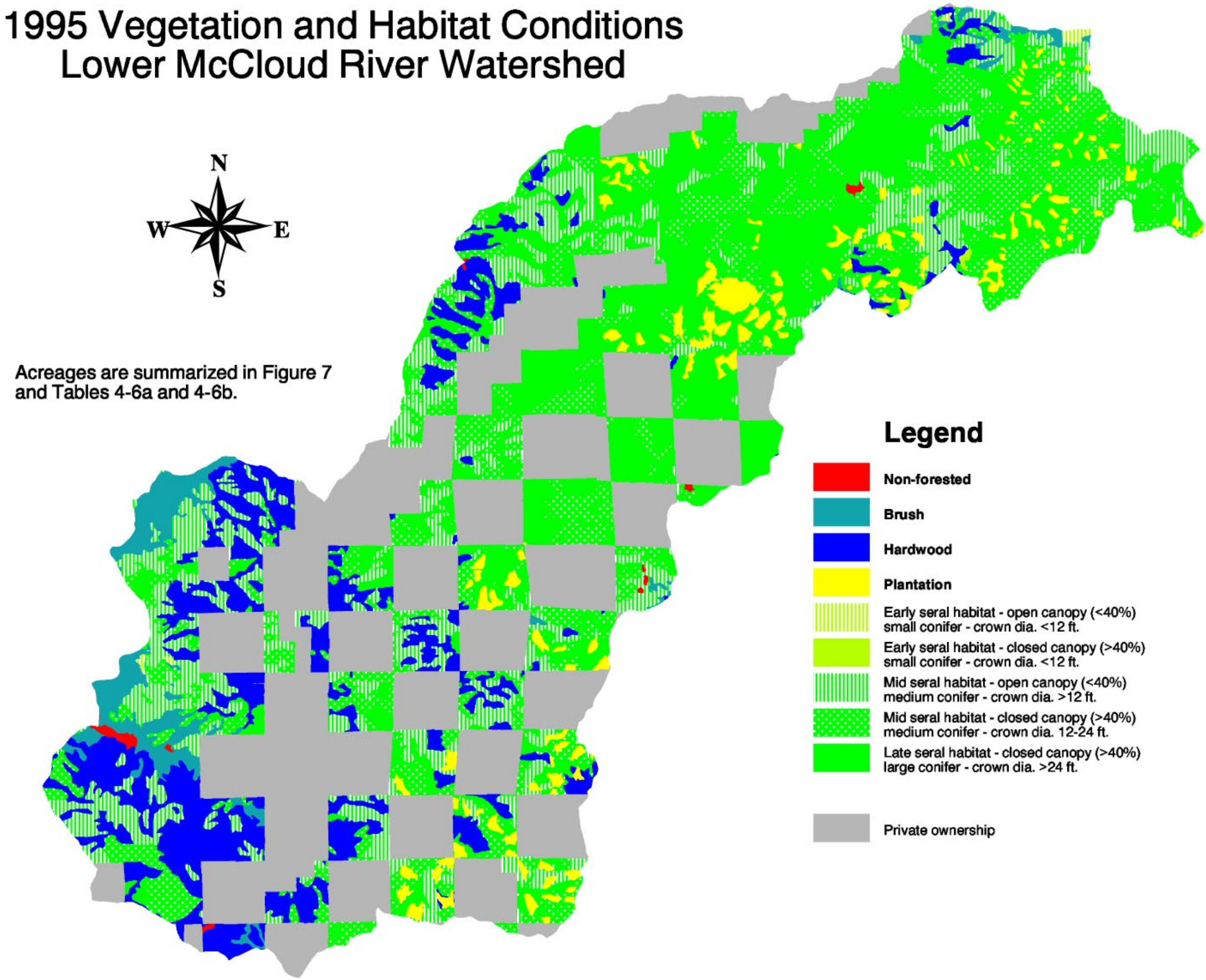


Map 18a. 1944 Vegetation and Habitat Conditions

1975 Vegetation and Habitat Conditions
Lower McCloud River Watershed



Map 18b. 1975 Vegetation and Habitat Conditions



Map 18c. 1995 Vegetation and Habitat Conditions

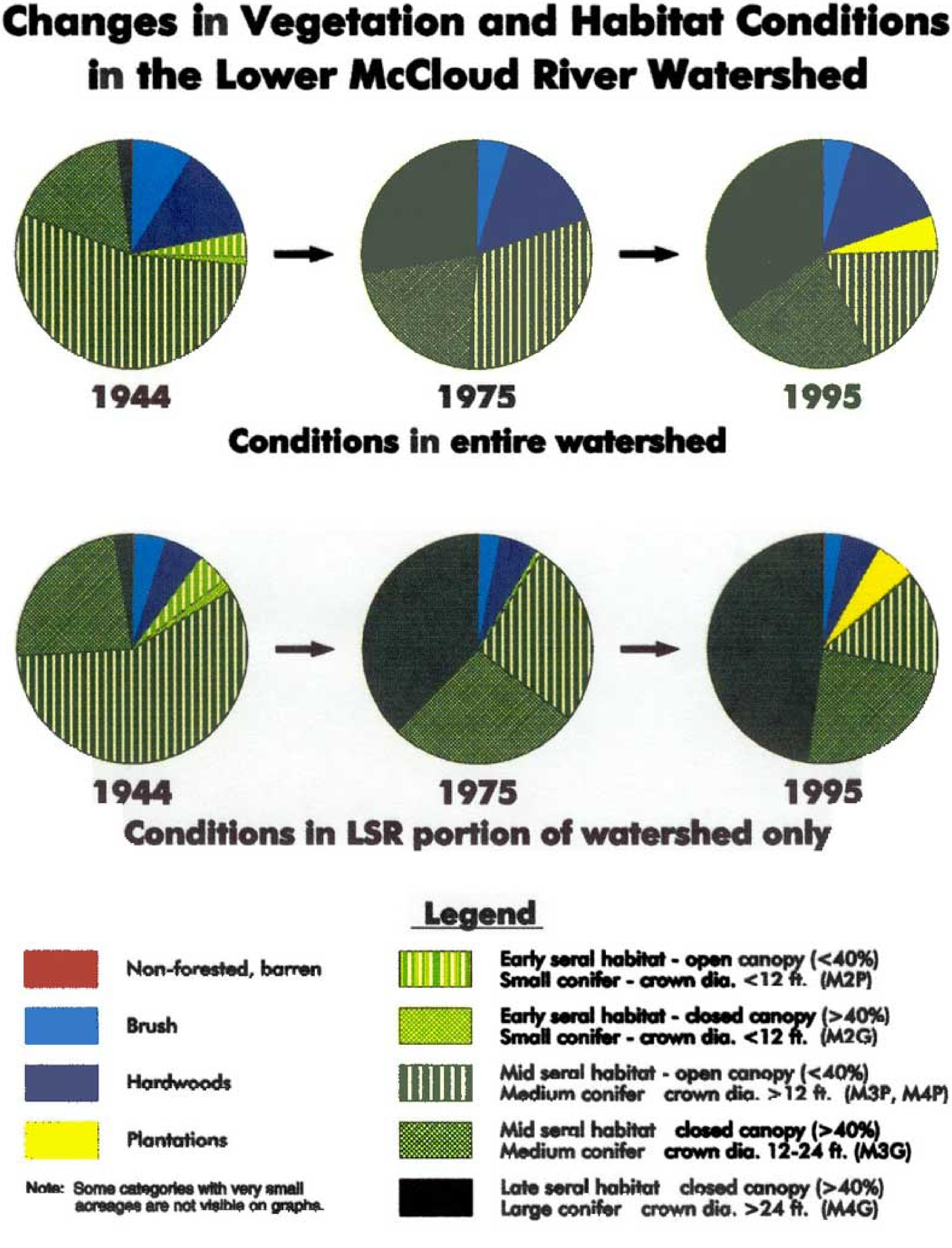


Figure 7. Changes in vegetation and habitat conditions in the Lower McCloud River Watershed over the last fifty years.

Table 4-6a: Vegetation and habitat development for the entire Lower McCloud River Watershed from 1944 to 1995.

		Acres			Percent		
Seral Stage	**Strata**	**1944**	**1975**	**1995**	**1944**	**1975**	**1995**
Non-forested	NF	128	128	128	0.3	0.3	0.3
Brush	SX	3833	1963	1857	8.5	4.4	4.1
Hardwood	HCO,HNC	5863	6879	6847	13.0	15.2	15.2
Early seral - plantation	XX1	0	0	2184	0.0	0.0	4.8
Early seral - open canopy (<40%)	M2P	1563	210	84	3.5	0.5	0.2
Early seral - closed canopy (>40%)	M2G	509	17	26	1.1	0.0	0.1
Mid seral - open canopy (<40%)	M3P,M4P,NC	24517	14079	8397	54.3	31.2	18.6
Mid seral - closed canopy (>40%)	M3G	7772	9583	10022	17.2	21.2	22.2
Late seral - closed canopy (>40%)	M4G	936	12262	15576	2.1	27.2	34.5
Totals		45120	45120	45120	100.0	100.0	100.0

Table 4-6b: Vegetation and habitat development within the LSR portion of the Lower McCloud River Watershed from 1944 to 1995.

		Acres			Percent		
Seral Stage	**Strata**	**1944**	**1975**	**1995**	**1944**	**1975**	**1995**
Non-forested	NF	48	48	48	0.2	0.2	0.2
Brush	SX	1314	883	788	4.6	3.1	2.7
Hardwood	HCO,HNC	1553	1533	1533	5.4	5.3	5.3
Early seral - plantation	XX1	0	0	1545	0.0	0.0	5.4
Early seral - open canopy (<40%)	M2P	1292	190	58	4.5	0.7	0.2
Early seral - closed canopy (>40%)	M2G	452	9	26	1.6	0.0	0.1
Mid seral - open canopy (<40%)	M3P,M4P,NC	16576	7489	4231	57.8	26.1	14.8
Mid seral - closed canopy (>40%)	M3G	6697	7727	6756	23.4	27.0	23.6
Late seral - closed canopy (>40%)	M4G	739	10793	13685	2.6	37.6	47.4
Totals		28672	28672	28672	100.0	100.0	100.0

Vegetation conditions observed in 1944 photos are consistent with conditions that would be expected on a landscape recovering from fires 50 years ago. Upper slopes had a scattered conifer overstory over a brush and sapling understory. Stringers of larger trees and heavier stocking were observed along major streams and draws. These conditions are believed to be the result of the large fires documented in newspaper accounts in 1872 and 1898.

The 1944 aerial photography was also used to track the development of current late successional stands over the last 50 years. Table 4-7 describes the 1944 condition of stands that had developed into late seral conditions in 1995. This table shows that mid seral open canopy conditions (M3P, M4P) in 1944 were the major source of current late successional habitat. Approximately 55% of the acreage of current late successional stands (M4G) developed from such conditions. The table also shows that mid seral closed canopy conditions (M3G) in 1944 were also significant as the source of approximately 38% of the acreage of current late successional stands.

Table 4-7: The 1944 condition of current (1995) late successional stands.

1944 condition of current late successional stands	**Strata**	Entire Watershed		LSR Portion of Watershed only	
		acres	%	acres	%
Early seral - open canopy (<40%)	M2P	114	0.7	113	0.8
Early seral - closed canopy (>40%)	M2G	148	0.9	124	0.9
Mid seral - open canopy (<40%)	M3P,M4P,NC	8631	55.4	7468	54.6
Mid seral - closed canopy (>40%)	M3G	5833	37.5	5304	38.8
Late seral - closed canopy (>40%)	M4G	850	5.5	676	4.9
Totals (1995 late seral stands)		15576	100.0	13685	100.0

In addition to providing the greatest acreage of current late successional conditions, mid seral open canopy stands (M3P, M4P) in 1944 also developed the best characteristics for late successional habitat 50 years later. Mid seral open canopy stands in 1944 had a scattered overstory of mature trees over an understory of brush and conifer saplings. Over the next several decades, these stands developed into multi-layered conifer stands with scattered large overstory trees over a pole and young sawtimber stand. The brush layer declined as canopy cover increased. Stands that developed from mid seral closed canopy conditions (M3G) showed less development of vertical stand structure. M3G stands developed at a slower rate due to higher levels of competition and less dominance by individual tress. The result was the development of single-layered stands with little vertical structure.

Species and Habitat

Overview

There were three documents which discuss historical wildlife population estimates, densities, distribution or presence within the Lower McCloud River Watershed. One document, “A Land-use History of the McCloud River Region, California”, contained brief statements about the species present prior to the 1900s (Cranfield, 1984). The other documents “The Shasta Lake Elk Herd” (Smith & Murphy, 1980) and “A Habitat Management Plan for the Shasta Lake Elk Herd” (Dunaway, 1964) and its addenda, primarily discuss elk population levels and distribution from 1911 to 1980 with some mention of other game species. For other wildlife not mentioned in the documents, their use of the watershed and population trends is projected based on the habitat regime, known European influences on the watershed, and wildlife sighting records from 1971 to 1995.

Prior to settlement in the mid 1800's, the transportation system consisted of trails associated with hunting, fishing, trading, and other activities of the native inhabitants. Some early explorers and trappers passed through this watershed in the early 1800's (Cranfield, 1984).

Many wildlife species that we are familiar with today were present at this time. Species that formed large herds (deer, elk), were far roaming (grizzly bear, black bear, wolves, wolverine), were restricted to special habitats (cavity nesters, bats) may have been in greater numbers due to large expanses of habitat, or the absence of the land use practices of the Europeans who were to follow. In contrast, late-successional species may have been less abundant due to a more open native landscape (Cranfield, 1984 and Dunaway, 1964).

In the late 1800's livestock grazing, and homesteading began to change the native landscape. Wildlife species populations considered threats were extirpated, such as the grizzly bear and wolf (Cranfield, 1984). The elk were also extirpated, possibly due to overhunting as occurred with elk in the Trinity Alps (Cranfield, 1984). Of these extirpated species, only the elk made a comeback after reintroduction in 1911. For other species, habitat changes most likely affected their historical populations and distributions. The major contributor to the change in habitat was fire suppression. Fire suppression practices caused a decrease in populations of deer and other species which utilize early seral habitats (Smith & Murphy, 1980). Conversely, fire suppression most likely expanded the population and distribution of many species which utilized late-successional patches found in the watershed (e.g., Northern spotted owl, Northern flying squirrel). Increased human activity through construction of roads and harvesting, most likely contributed to a movement out of the watershed or decline in habitat use for some species (deer, elk) due to disturbance and exposure (Smith & Murphy, 1980). Species that may have proliferated in the human altered environments are expected to be more common today than before European settlement (e.g., late-successional species, coyote, raccoons).

Old Growth/Late-Seral Habitat

Pre-1900

Late-successional habitat was closely associated with the major tributaries to the McCloud River (1944 aerial photos). The remaining landscape consisted of open forested habitats (<60% canopy closure) with early seral shrub or herbaceous understories, hardwood/conifer, oak woodland and chaparral habitats. Because of the open nature of most of the landscape, late successional species would have been restricted to the stringers and adjacent forested stands.

1900-1945

Settlement along the McCloud River and fire suppression began the habitat changes in old growth that we see today. Very small quantities of timber were likely harvested as a result of settlement, rather than marketing, as the watershed was not as accessible as surrounding forested land. As fire suppression became more efficient less of the land was maintained in an early seral or open forested stage. Consequently, the distribution and population levels of late successional species slowly increased. A more dramatic increase occurred between 1945 and the present.

1945-present

As mentioned in the vegetative section, late successional habitat increased dramatically between 1945 and the present. Late-successional species responded to this habitat increase and are now found throughout the northern portion of the watershed. Though fire suppression improved some stands, other stands may have become less suitable for wildlife because of increased dead/down loads, dense, single species understories, and the shading out of shade intolerant species. Excessive buildup of dead/down wood on the forest floor could inhibit visibility and accessibility of prey species for avian predators like the goshawk and spotted owl. Dense understory regeneration by shade tolerant species would obstruct movement of avian predators and decrease the overall species composition. Increased canopy closure could have led to shading out of oaks and other shade intolerant species existing in the understory. Removal of these species would eliminate structural diversity as well as forage, such as mast and herbaceous vegetation, important to many wildlife species.

With the introduction of timber harvest in 1966, some of this late-successional habitat was fragmented, mostly in the easternmost section of the watershed by the Forest Service and in the southern section by private timber companies. Some clearcut areas could have mimicked natural openings of early seral habitat utilized by predatory species, but at the cost of fragmentation. Harvest units were much larger than natural openings and different in overall composition. This fragmentation would have impacted late-successional species occurring there, but the extent, whether positive or negative, has not been documented as no surveys occurred before harvest activities. Despite the lack of surveys, the entire northern section of the watershed has been recognized as having exceptional late-successional habitat, especially for the Northern spotted owl, and has hence been included as part of the LSR. Other late-successional habitat occurs outside the LSR, mainly along stream courses. Some of these habitat areas have become connected, habitat-wise, to the LSR.

Early-Mid Seral and Oak Woodland Habitats

Pre-1900

Within the open chaparral and oak woodlands, deer foraged, small mammals created burrows and harvested seeds (rabbits, ground squirrels), and other open habitat/early seral dependent species thrived (California quail, green-tailed towhee, lizards). Chaparral, grew mostly in the southern half of the watershed with limited distribution elsewhere. This habitat supported many wildlife species (green towhee, pallid bat, deer). Naturally occurring fires would have maintained forage in the form of herbaceous vegetation found amongst the chaparral and open forest understories. As the chaparral recovered, sprouting chaparral provided succulent vegetation. In undisturbed areas, mature chaparral produced-berries and dense cover.

Oak woodlands, also primarily found in the southern half of the watershed, supported hardwood dependent species (gray squirrel, band-tailed pigeon). In these habitats, the influence of Native Americans on the habitat was considered beneficial to wildlife, such as seasonal lighting of wildfires. Wildfires, both naturally and artificially started, usually burned cool and kept the hardwood understory relatively open, stimulated acorn production and vegetative growth, and maintained shrublands in a mosaic of seral conditions.

1900-1945

Few changes occurred during this time as settlement was primarily in the north and fire suppression efforts were still developing.

1945-present

As natural fires were suppressed, chaparral underwent 'maturation'. Browsers were negatively affected as the chaparral became unpalatable and new growth became out of reach. Also, as the chaparral became decadent it provided less habitat for small to medium mammals, as branches near ground level matured or died. The accessibility for aerial foragers (golden eagle, great-homed owl) was reduced as less ground was exposed. Other species, though, which feed on berries or use shrubs as cover (bear, birds, deer) benefited from the maturing chaparral.

Within the oak woodlands fire suppression reduced the amount of browse available in the understory in the form of either mast, herbaceous growth or early seral shrubs. Understory growth, which would mature or affect changes in species composition in the absence of fire, could have reduced the amount of ground water available to the mature acorn producing oaks, and hence, quite possible the production of acorns. Herbaceous growth may have also been hindered since understory growth of shrubs and oak seedlings, usually tempered by frequent fire, would outcompete the herbaceous plants. Then, as with chaparral, shrub species in the understory would mature and become unpalatable to browsing species.

Elk population declines, along with knowledge of their habitat needs, support the belief that chaparral and oak woodland habitat changes affected the wildlife utilizing them. At one time the landscape supported wide roaming elk populations substantially larger than the current population (Cranfield, 1984). In one area along Squaw Valley Creek, Indians 'came upon an elk trail that looked "as if a saw-log had been drawn repeatedly through the snow" and he figured at least 1000 elk had passed through. The Indians then had taken over 100 cows for the winter' (Cranfield, 1984). By 1972 the landscape was believed to support on average, only 484 elk (Dunaway, 1964 and addenda; Smith & Murphy, 1980).

Despite the use of the watershed for grazing, the significant difference in what the landscape was able to support historically and then after 1911 was attributed to the overall habitat composition of the area. Overall, the area was very different from traditional Rocky Mountain elk habitat (the introduced subspecies). The amount and distribution of grasslands and herbaceous growth, of which there was little and sparsely distributed, contributed most to this difference (Smith and Murphy, 1980). Because habitat needs of elk have been known to be similar despite geographical differences, the habitat limitations could have also affected the native subspecies of elk if they were still in existence. But would the change in the habitat in the watershed be that large of an impact on the elk herd if it still existed?

The degree to which the Lower McCloud River Watershed was utilized by the historical elk population is unknown. Documentation of the introduced Rocky Mountain herd has indicated low use, especially compared to the Squaw Creek and Pit River drainages (Smith & Murphy, 1980).

Besides habitat, road density has also been identified as having contributed to displacement of elk. The watershed has been a checkerboard of National Forest and private ownership. Harvest and building of roads occurred within both ownerships, but mostly within private land. With the increase of roads over the years, so to the increase in movement out of the areas by elk and other disturbance sensitive species.

Very little information exists regarding deer populations within the watershed, but they are expected to follow the same use and decline as that of elk.

Aquatic Ecosystems - Aquatic and Riparian Dependent Wildlife Species

Pre-1900

Very little information has been documented regarding the condition and extent of aquatic and riparian habitats. No information was documented for associated wildlife species. Based on information compiled by Cranfield (1984), stream systems were healthy enough to continue to support large and consistent salmon runs despite periodic mud flows into the McCloud River. Other aquatic associated species, then, most likely recovered from the mud flows as tributaries probably served as reserves which would repopulate the river. As with the river, the riparian habitats and tributaries most likely underwent periodic changes, with associated wildlife species fully adapted to these changes. Which associated aquatic and riparian wildlife species had adapted to these changes, then remained within the system after the 1900s has not been speculated upon.

1900-1945

Species that were restricted to aquatic or riparian habitats (amphibians, willow flycatcher) may have been reduced in number or become less widespread due to habitat that was changed by cattle grazing and settlements along the river.

The results of European settlement altered aquatic and riparian habitats for the short term through the introduction of cattle grazing in the 1800s. Cattle grazing occurred unregulated throughout the watershed. Though nothing was built for cattle within the watershed, the east and southern portion of the watershed was 'deteriorating' as a result of grazing (Cranfield, 1984). The deterioration could have referred to direct impacts on the riparian habitat or to indirect impacts, such as laying bare upland herbaceous habitat. Riparian habitat that was grazed reduced suitable nesting habitat for many neotropical migratory bird species. Likewise, aquatic amphibians dependent upon emergent vegetation for reproduction and cover were impacted by grazing. In addition, cattle most likely competed with other grazers and browsers which were already being impacted by reduced forage habitat in the uplands. The north and western portion of the watershed received less use as many natural deterrents made grazing difficult to impossible. By 1907 the Forest Service began reducing the number of cattle grazing on the National Forest lands. With the reduction in cattle, introduction of grazing regulations and periodic resting of the habitat it is expected that aquatic and riparian species populations declined less quickly or stabilized. Then, with the construction of Shasta Dam in the 40's, grazing was ended and riparian habitats continued to recover.

Settlement in the watershed in the early 1900's impacted riparian habitat for the long term. This conversion of riparian habitat to buildings and landscape has occurred in isolated areas mainly along the McCloud River. With the exception of the introduction of black locust in the riparian habitat along the McCloud river, the overall impact of settlement on aquatic and riparian species has been suspected to be minimal based on the size and extent of the riparian and aquatic system in the watershed.

1945-present

Much of the damage to riparian habitat, meadows and springs occurred in the early part of the century and it is possible that existing wildlife populations have adapted, maintained 1940's population levels, or were locally extirpated. After the 1940's other impacts to riparian and aquatic populations occurred in the form of timber harvest and road construction. Construction of the McCloud Dam in the 1960's may not have significantly changed riparian habitat and therefore associated species, despite the lower water levels. Riparian and aquatic wildlife species may have benefited from fire suppression as channels were stabilized and riparian vegetation protected.

In the 1970s and 80s timber harvest temporarily devastated the vegetation along a few stream channels in the northeastern portion of the watershed. The effect on wildlife associated species was not documented, but was most likely negative. Since the harvest, these streams have undergone a slow recovery. Preharvest conditions most likely have not been reached. Elsewhere in the watershed, riparian associated species have been minimally impacted because of the limited amount and location of most timber harvest which occurred in the watershed on National Forest lands. Aquatic associated species, though, may have undergone a more significant impact where roads construction as occurred.

Roads impacted associated wildlife species where changes in the stream habitat occurred through the dissection of the stream, the direct or indirect input of debris into the stream and the increased flows and stream scouring. Where culverts were impassable, movement patterns of aquatic associated wildlife species were disrupted and made more difficult. Debris input into streams, such as siltation certainly would have negatively impacted stream dwelling wildlife which require oxygenated, rocky streams (e.g. Pacific salamander, tailed frog). The filling in of pools would also affect a number of aquatic wildlife which use pools as escape cover or for foraging. The changes in the stream channel through scouring could have been beneficial in that sediments were removed and pools formed. Negative impacts would include initial damage to existing populations. Overall, road impacts have been restricted to a few sub-basins.

Fire suppression increased riparian vegetation along streams. With less fire burning through riparian habitat the vegetation was able to expand and stabilize. This change was beneficial to many riparian associated species as it expanded their distribution. Within streams, those aquatic associated species which favored cool water also benefited from the denser, more expansive riparian habitat. Others, which require some open areas along streams for sunning, were negatively impacted. Where these changes have occurred, though, has not been documented.

Aquatic Ecosystems - Fisheries

Pre-1900

Prior to 1900, the native fish assemblage within the Lower McCloud River was largely intact and was used by the local Native Americans as an important source of food. Early white settlers began to inhabit the area in the late 1800s. These early settlers also used the fish as an important food source. Large runs of chinook salmon and steelhead ascended the river during this time and provided an important source of protein for Native Americans and settlers alike. Coho salmon were probably also present in the river, but in much smaller numbers. Records that specifically mention fish or fishing are very general in nature, but they do mention a large "trout" caught on a regular basis. This was likely the rainbow trout which was common. Bull trout were also present in the river, but information about this species in very limited. Moyle (1976) states that the rainbow trout, as well as the Sacramento sucker and Sacramento squawfish, were important food sources to the Native Americans and early pioneers. Hardhead minnow, which can become quite large, were also used as a food source. The sucker, squawfish, and hardhead minnow were common river inhabitants. Other fish species believed to occur in the river during this time were speckled dace and riffle sculpins. These fish probably were not important dietary staples.

Stream processes during this time were functioning to provide excellent fish habitat. Bedload movement and large woody debris were in balance with channel functions and most likely provided an abundance of deep pools and runs. Under these conditions large fish would have been common. Early use had little impact on the river and surrounding watershed, or on local fish populations as fishing, logging, and grazing were small in scope and were associated primarily with homesteading and Native American use. Large fires appear to have occurred on a regular basis within the basin. They were part of the basin ecology and due to their recurrent nature, they most likely helped maintain channel processes through the contribution of large woody material.

The hatchery at Baird on the Lower McCloud River was relatively small compared to today's standards. This early hatchery served as a salmon egg-taking station and had little impact on the native fish community during this time.

<u>1900-1945</u>

Changes to the fishery and aquatic habitat began taking place after the late 1800s and early 1900s. These changes were associated with the Baird hatchery, grazing, mining and recreation. Unlike the Sacramento River canyon, timber harvest was not a significant activity in the McCloud Basin until much later. In 1922 mud flows from Mud Creek into the upper McCloud River resulted in extreme turbidity levels downstream. This reportedly occurred several times since then and had resulted in high turbidity levels throughout the summers for a number of years. The effects of this elevated turbidity and deposition of fine silts would have resulted in some pool filling and a reduction in benthic invertebrate productivity. The effects on fish are unknown, but it in suspected that native fish were adapted to this condition.

The increased human activity in the area brought with it an increase in fires. Several large fires burned significant portions of the watershed destroying timber and other vegetation. The effects of fire during this time are not documented, but most likely included some adverse effects on the upper stream reaches. The effects of those early fires on the river corridor were probably minimal, if not of some benefit, as they resulted in the recruitment of large woody debris. Mining for copper is known to have taken place within the southern portion of the watershed. The effects of copper mining upon the aquatic environment can be quite devastating, but the effects associated with this mining have not been documented and remain unknown. Grazing was a significant activity, particularly on the east side of the drainage. Burning in support of grazing was common and served to compound other impacts associated with grazing. Those effects would have included the loss of riparian vegetation, increased sedimentation, lose of bank stability, and changes in water quality. Most of this would have occurred in the upper tributaries, but most likely had some effect on the river habitat also.

Recreation, probably more than any other single activity, had the greatest impact on the river. The McCloud River Club, Ah-Di-Na Club and the Bolliboka Club had a major influence on the conservation of the fishery and the preservation of habitat within the river.

In order to protect their recreational interests, these clubs took an active part in the area's management and have been successful in maintaining an excellent river fishery.

The hatchery at Baird, which was originally built to take salmon eggs, now began rearing salmon and trout for stocking into local waters. This brought about the introduction of exotic fish species which would have interacted with the local native fish populations. The effects of this introduction would have included increased competition, predation, and introduced diseases. The introduction of brook trout would have lead to hybridization with the bull trout. Due to the very cold water, the introduced brown trout were not yet a significant threat to the bull trout. Due to difficult access to much of this area, stocking was most likely infrequent except for the area adjacent to the hatchery.

<u>1945-present</u>
The completion of Shasta Dam in 1945 brought the runs of salmon and steelhead to a halt. The dam effectively blocked access to approximately 110 miles of spawning habitat. The elimination of the anadromous fish runs changed the ecology of the area by removing an important food source, by altering fish community structure, and by genetically "isolating" the rainbow trout as steelhead no longer had assess to the upper river. The dam brought about a simplification of the fish community structure as it eliminated several anadromous populations from the McCloud River.

The completion of the dam and the creation of Shasta Lake brought about the development of a warmwater lake fisheries which has adversely affected native fish populations even more. From the lake, spotted and smallmouth bass have moved into the river and prey on young native fish species and compete with the older ones. It is probable that other fish such as channel catfish also move into the river to feed. Like the bass, adult channel cats are highly predaceous on other fish. Brown trout, which had already been introduced, now moved up into the river from the lake to spawn which served to further increase competition and predation.

Grazing activities ended during this time frame, primarily as a result of the dam and the crash of the wool market. Mining has stopped being a significant activity for the past two decades.

The completion of the McCloud Reservoir Dam in 1965 had a profound effect on the lower river by increasing water temperatures and lowering base flows. This had an adverse effect on native trout populations, in particular the bull trout. The warmer water favored the introduced brown trout which until the completion of the dam, did not do well. The increased competition, the warmer temperatures and the loss of access to spawning habitat upstream of the dam are the probable causes for the extirpation of the bull trout from the McCloud River. Hybridization with the introduced brook trout may have also contributed to the decline of the bull trout. The last confirmed sighting of a bull trout was in 1975. Numerous attempts to located this species since that time have failed. Stocking was stopped in 1976 when the Lower McCloud River McCloud River Preserve was declared a wild trout stream. In 1997 the California Department of Fish and Game and the California State Fish and Game Commission declared the bull trout extinct in California.

The McCloud Dam did have one positive effect. The dam improved turbidity levels by stopping much of the sediment that flowed out of Mud Creek. The reduced turbidity would have greatly enhanced fishing. The reduced flow during the summer would have also improved fishing conditions.

Though some timber harvest took place on private lands in the 1950s, timber harvest on federal lands within the basin did not begin until the early 1970s. The effects of this activity are generally restricted to the tributary streams where the harvest has taken place. So far, the impacts of harvest activities appear to have had little effect on the river. The fishing clubs on the river, along with the Nature Conservancy, have been politically active in protecting their interests and as such land management activities have been implemented with their concerns in mind.

Habitat Elements (snags, dead/down, outcrops, caves, mines, buildings)

Pre-1900

Natural habitat elements within the watershed include snags, dead/down wood, caves and limestone outcrops. Though no historical documentation occurs for the densities of snags and dead/down, the densities most likely were less than current natural densities as the forested habitat was more open canopied due to wider spacing of trees. Within areas where denser spacing occurred, like the stream channels, the snag and dead/down wood densities most likely were similar to current densities in similar habitats.

The condition of existing caves and rock outcrops has been unknown, therefore their historical condition could not be assessed. The current condition versus historical condition has mainly focused on the vegetational characteristics associated with the cave or rock outcrops. Vegetational characteristics were considered important because a cave opening covered by vegetation would have reduced air temperature within the cave as well as reduced airflow. Vegetation on rock outcrops would also reduce the air temperature in the fissures as well as provide a more protected environment for wildlife.

1900-1945

With the influx of Europeans and their working of the land, changes in the density of snags and dead/down material occurred, caves and rock outcrops may have been altered, and mines and buildings were constructed. With the increased density of forested habitats, the density of snags and dead/down material would have also increased, though the wildlife species composition may have changed.

Caves and limestone outcroppings have not changed in their overall composition. The vegetation around these structures may have changed as a result of European settlement, namely fire suppression. Vegetation growth would have increased around cave and possibly changed the caves internal environment. Exploration of caves is not expected to have altered the caves from an environmental standpoint as the cave locations and use has been closely monitored by the Forest Service in conjunction with local spelunking groups.

In the 1920s copper mining explorations occurred around Hat Mountain and the Pine Flat areas. These resulted in several adits being constructed of various lengths. Mining activity ceased by the late 1920s and no other copper claims have been established since then. Claims for other rock material have occurred but these resulted, if when prospected, in surface mining activity.

Buildings have been constructed since the first settlement was established in the 1800's (Cranfield, 1984). Their distribution was widespread, even along the river, as privacy and difficulty of terrain limited the amount of settlement possible. Most buildings have since deteriorated or were demolished. Those which persisted on the Hearst property, at the Ah-Di-Na Campground, or on other private land along the McCloud River, may have provided bat habitat.

1945-present
As the land was harvested, snag dependent species habitat was reduced. Snag retention within these areas varied over time, with only the later years (post 1980's) retaining snags for wildlife use. Recruitment trees for snags were also eliminated and have continued to be. Thus, those areas harvested since the 1970s wouldn't be expected to provide snags to benefit most snag dependent species even by the year 2050. The loss of the later seral stages, especially in the easternmost section of the watershed and the replacement of these to younger, smaller trees, effected the amount of recruitment of large diameter snags and down logs, necessary for sustaining historical populations of snag and dead/down dependent species such as black bear, fisher and pileated woodpecker.

Since the 1940s caves continued to be explored and buildings inhabited. Therefore, there has probably been very few changes in impacts to these areas and associated wildlife.

Table 4-8: Impacts of land-use activities over time to habitat and wildlife.

Land-Use Activity	Old Growth/Late Seral	Early Seral/Oak Woodlands	Aquatic & Riparian	Habitat Elements
Fire Suppression	Increased habitat distribution to uplands. Increased associated wildlife population distribution and size. Decrease in movement and accessibility of prey in understory.	Maturation of chaparral causing unpalatable forage. Deceased success for aerial foragers and herbaceous forage for browsers. Increased patches of mature chaparral for use as cover. Possible decrease in oak regeneration and acorn production.	Increased riparian habitat along tributaries and distribution of associated species. Decreased open areas and sunning locations for reptiles (turtles).	Increased vegetative densities around caves and limestone outcroppings. Increased dead/down and snag densities with increase in forest densities.
Timber Harvest	Fragmented easternmost and southern sections of watershed. Overall, impacts minimal to associated species.	Created openings for establishment by brush and chaparral.	Degradation of streams and vegetation in easternmost part of watershed. Slow recovery.	Reduction in snags and large dead/down recruitment within harvested areas.
Road Construction	Impact not analyzed, expected to be minimal.	Displaced species sensitive to disturbance (elk).	Restricted movement along stream channels for some species. Negative impacts to stream habitat.	not applicable
Reservoirs/Diversions	not applicable	not applicable	Removed cyclic disturbance to associated species from mud flows. Minimal impact to riparian vegetation.	not applicable
Grazing	not applicable	Competition with native species for herbaceous forage.	Early century damage to streams and aquatic vegetation. Negative impacts to associated species. Some recovery expected.	not applicable
Mining	not applicable	not applicable	not applicable	Possible development of bat habitat.
Recreation	Removal of some habitat.	Early extirpation of elk and later reintroduction.	Introduction of black locust causing change in species composition. Impact to wildlife unknown. Removal of riparian habitat in areas of settlement in early 1900s.	Exploration of caves leading to discovery, but minimal disturbance. Buildings possibly creating bat habitat.

Human Uses

Heritage Resources

pre-1900

Terraces which line the McCloud River contain abundant evidence of Native American use, dating 5000 years or more into the past. At least three different ethno-linguistic groups of Native Americans are known to have used the Lower McCloud River Watershed area in the years prior to the coming of Anglo-Americans:

- Okwanuchu
- Wintu
- Achumawi

The Okwanuchu may have been the earliest inhabitants of the McCloud River. Within the last 1000 years or so, the Wintu and Achumawi groups began encroaching on the Okwanuchu territory. Both groups may have been attracted by the particularly rich anadromous fisheries on the McCloud. These groups intermarried with the Okwanuchu, who eventually ceased to exist as a separate group. This new culture developed a much more intensive fishing-based economy than had been present before. Permanent, year-round villages were established, and fish and acorns collected in abundance and stored for year-round use. Names and details of 32 Native American villages on the McCloud River within the analysis area, collected in the 1880's are believed to reflect the time period just prior to 1850.

Anglo-American intrusion into the watershed probably occurred about 1830. Fur trappers and miners were among the first to enter the area. There is no record of successful homesteading within the watershed during this time period.

As valley lands became settled, grazing of sheep and cattle moved into the hills and mountains. It is unknown, however, if grazing occurred within the watershed prior to 1900.

1900-1945

This period is characterized by the development of sport-fishing clubs along the McCloud River.

In 1896, the Central Pacific Railroad was granted lands along the McCloud River under the Pacific Railroad Acts of 1862 and 1864.

In 1896, Ah-Di-Na was purchased from the Central Pacific Railroad by William R. Whittier to develop into a private sort-fishing and hunting resort. It also operated as a self-sufficient ranch for many years.

In 1900, the McCloud River Club land was acquired from the Central Pacific Railroad by George W. Scott and William M. VanArsdale who founded the fly fishing club.

In 1921, The Bolliboka Club land was purchased from owners who presumably obtained railroad land in the early 1900's.

Although there was extensive copper mining in the adjacent Squaw Creek and Sacramento River drainages during the early 20th century, very little actually occurred within the

There was apparently at least one copper mine within the watershed near Hat Mountain.

The Shasta National Forest was established in 1905. Early Forest maps show the development of trails, phonelines, and fire lookouts. Pack trails are shown on Curl Ridge, Claiborne Creek Hawkins Creek, and along the McCloud River. An auto road connected the McCloud River Club via Squaw Valley Creek.

With establishment of the National Forest, the watershed area was divided into three range allotments:

- McCloud Allotment - generally the Claiborne Creek and several smaller adjacent drainages
- North Fork Allotment - generally the Chatterdown Creek drainage and over into Squaw Creek
- High Mountain Allotment - west side of McCloud River

<u>1945-present</u>
This period includes several events that had major impacts on the watershed.

In 1945, construction of Shasta Dam was completed and Shasta Lake formed. This blocked the annual upriver migrations of anadromous fish as well as blocking animal migrations such as deer. The inundation of the lake also hastened the end of stock grazing within the watershed as it made access more difficult.

Lands at Ah-Di-Na were purchased by the Hearst Corporation and road construction and logging began in 1958. The Forest Service acquired lands at Ah-Di-Na from the Hearst Corporation in 1965 and shortly afterward established a public campground.

In 1965, the McCloud Dam was constructed and water was diverted to hydroelectric plants on the Pit River. The diversion of water drastically altered base flows in the river below the dam. The McCloud Reservoir provided a recreational attraction as well as access to the area.

The period from 1966 to 1992 saw considerable timber harvest in the watershed with 104 million board feet removed. Timber harvest was accompanied by extensive development of road systems through much of the area.

In 1974, the McCloud River Club donated 2330 acres of land to the Nature Conservancy, which formed the McCloud River Preserve.

Whitewater Boating

pre-1900 & 1900-1945

There was no know whitewater boating on the McCloud River during these periods.

1945-present

Whitewater boating on the Lower McCloud River began during this period. The earliest documented rafting of the river appears to be several trips in 1982 (CRMP, 6/1994).

Trails and Campgrounds

pre-1900

Recreation use of the McCloud River began as early as the 1870's. The sport fishing potential of the McCloud River was recognized during this period and a fishing resort was established at "Horseshoe Bend" (now Hearst) on the upper river, thus introducing wealthy sportsmen to the river.

This period saw development of the private ownership pattern along the river and the establishment of private sport-fishing clubs. In 1896, Central Pacific Railroad acquired land along the McCloud River under the Pacific Railroad Acts of 1862 and 1864. Ah-Di-Na was purchased from Central Pacific Railroad by William R. Whittier in 1896 and developed into a private sport-fishing and hunting resort. The McCloud River Club land was purchased from Central Pacific Railroad in 1900 by George W. Scott and William M. VanArsdale who founded the fly fishing club.

There was essentially no development of recreational facilities on National Forest land during this period.

1900-1945

The private sport-fishing clubs along the river continued to develop during this period. The Bolliboka Club lands were purchased in 1921. Recreation use was still minimal on National Forest land.

1945-present

Lands at Ah-Di-Na were purchased by the Hearst Corporation and road construction and logging began in 1958. These activities provided road access to Ah-Di-Na.

Construction of McCloud Dam and creation of the reservoir in 1965 provided a recreational attraction as well as access to the area. Logging on National Forest land in the watershed began in 1966 and further increased access into the area.

In 1965, the Forest Service acquired lands at Ah-Di-Na from the Hearst Corporation and shortly afterward established a public campground, providing public fishing access o the river.

With the creation of McCloud Reservoir, the Forest Service began developing recreational facilities. On the east side of McCloud Reservoir, the Star City "Campground" evolved from a day-use only requirement imposed by deed restriction into an overnight campground receiving high usage. In 1996, Star City was closed to overnight camping to comply with the deed restrictions. This resulted in a shortage of camping facilities in the McCloud Reservoir and Lower McCloud River area.

With the closure of the Star City site to overnight camping, increased pressure was placed on Ash Camp. Overflow from Ash Camp has been accommodated on the large flat created by tunnel tailings where the diversion pipe crosses Hawkins Creek. This location is still undeveloped and lacking in large shrubs and trees.

In 1975, the Pacific Crest Trail was constructed through the area and passed through Grizzly Peak, Ash Camp, and Ah-Di-Na.

Unroaded Non-motorized Recreation (Prescription I)

pre-1900 & 1900-1945

The area designated as Unroaded Non-motorized Recreation (see Map 8) remained essentially unroaded during these periods. The only road through the area followed the McCloud River and accessed the Bolliboka Club (see Map 6).

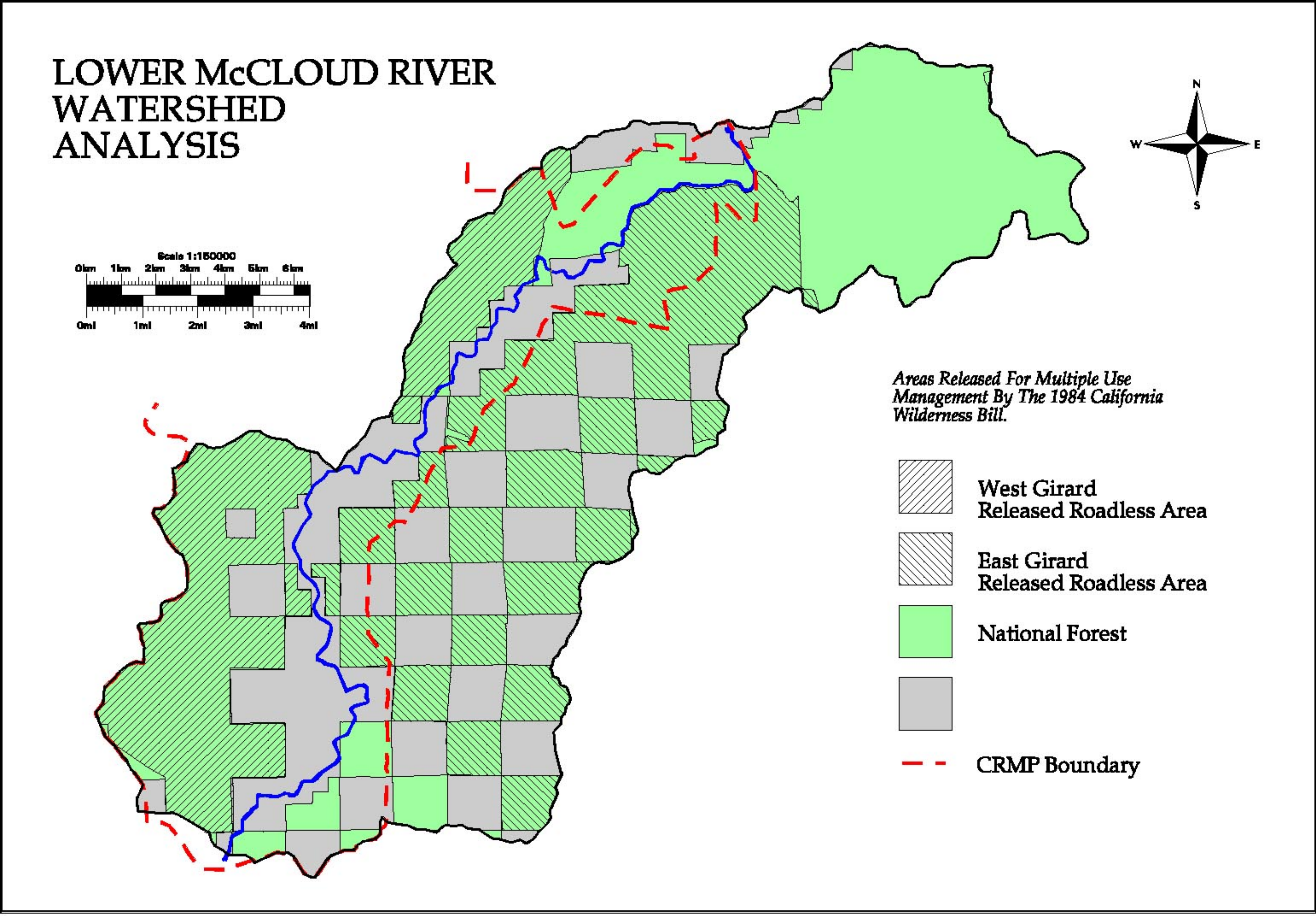
1945-present

The area continued to remain essentially unroaded during this period.

In the late 1970's, the majority of the Lower McCloud River Watershed was identified during the Roadless Area Review and Evaluation (RARE II) process as potential new wilderness. RARE II established the West Girard and East Girard Roadless Areas (Map 19). The effect of RARE II was to temporarily delay road building in the watershed until roadless areas suitable for wilderness designation were identified.

The 1984 California Wilderness Act (PL 98-425) stated that those roadless areas not designated as either wilderness or further planning be managed for multiple use purposes and that they be reviewed again for wilderness when the Forest Plan is revised. The West Girard and East Girard Roadless Areas were among those areas released to be managed for multiple-uses other than wilderness.

By the time that the California Wilderness Act released the West Girard and East Girard Roadless Areas, the Forest Plan was being developed. Unofficial direction was that management activities would not conflict with proposals in the draft Forest Plan. Because the area was being proposed for an unroaded, non-motorized theme - and because there were few timber harvest opportunities - roads were not built in the area. Some roads accessing private timberlands were constructed in the last decade.



Map 19. Released Roadless Area

Chapter 5

Interpretation

The purpose of this chapter is to compare existing and reference conditions of specific ecosystem elements and to explain significant differences, similarities, or trends and their causes. The interaction of physical, biological, and social processes is identified. The capability of the system to achieve key management plan objectives is also evaluated.

This chapter is organized by addressing the issues and core topics listed in Chapter 2. Additional topics that emerged during the analysis are included in this section.

Issues addressed in this chapter are:

- Catastrophic Wildfire
- River Use
- Road Impacts
- Late-Successional Reserves

Core topics addressed in this chapter are:

- Erosion Processes
- Hydrology
- Stream Channel
- Water Quality
- Vegetation
- Species and Habitats
- Human Uses

Additional miscellaneous topics that emerged during this analysis are:

- Non-native Plants
- Land Allocation Adjustment

Applicable key questions and core questions are restated at the beginning of each section and are used to guide the analysis.

- Key questions are taken from Chapter 2 - Issues and Key Questions.
- Core questions are taken from the *Federal Guide for Watershed Analysis*.

Catastrophic Wildfire

Key Questions (from Chapter 2):

- Under current management, what are the future trends for fire in the watershed?
- What is the desired role of fire in the watershed?
- How can fire be incorporated as an ecological process?

Present Condition:

- Fire regime has shifted toward moderate to high intensity fires and long return intervals.
- Crown bulk density (CBD) is 0.19 kg/m^3 in mature conifer stands. Approximately 70% of stands in the watershed exceed a safe threshold CBD of 0.10 kg/m^3.
- Areas of past regeneration harvest have transitioned into brush fuel models with higher fire hazard.
- The potential for catastrophic wildfire places the following resources at risk:
  - late-successional conditions
  - water quality
  - slope stability
  - recreational and aesthetic values
  - timber resources

Causal Mechanism(s):

- fire exclusion
- high site productivity
- past timber harvest

Trends:

- Understory densities will continue to develop vertical fuel ladders.
- High surface fuel loads will remain on private land.
- There will be a continuing trend towards more stand replacing fires.

Influences and Relationships:

- catastrophic wildfire increases slope instability, mass wasting potential, and hillslope erosion.
- catastrophic wildfire affects streams by increasing peak flows, increasing sediment load in the upland channel network, and increasing the pH of streams.
- catastrophic wildfire affects wildlife habitat by reducing late seral habitats and destroying important habitat components (snags, dead & down wood)..
- catastrophic wildfire affects riparian areas by removing riparian vegetation which is critical to maintaining cooler water temperatures, increasing stream biotic potential, and maintaining bank stability.
- catastrophic wildfire affects riparian areas by removing both large woody debris and the source of future large woody debris.

Influences and Relationships (cont.):

- when stream channels are destabilized by catastrophic wildfire, riffles tend to elongate resulting in a loss of pools and deep water habitat.
- catastrophic wildfire has negative impacts on recreational and aesthetic values.
- catastrophic wildfire results in loss of timber value on both National Forest and adjacent private land.
- catastrophic wildfire can result in economic and aesthetic losses for adjacent landowners.

Conclusions:

- There is a need to provide continued fire suppression in the watershed.
- There is a need to create compatible fuel profiles.
- There is a need to reduce surface fuel loads.
- Treatments should be prioritized according to slope, aspect and topographic position.

River Use

Key Questions (from Chapter 2):

- What uses, laws, policies, and actions are compatible with downstream property owners?
- How can recreational opportunities be provided for river users?
- Are existing land allocations consistent with current land uses? (see page 5-13)

Present Condition:

- Trespass on private land is a problem due to the small amount of public land along the river below Ah-Di-Na.
- The arrangement of existing parcels of public land along the river below Ah-Di-Na does not provide pull-out points in desirable locations.
- The lower river is remote and there are few opportunities to leave the river in case of emergency or when boaters find the river too challenging.
- There is concern that the limited amount of public land along the lower river cannot withstand the impacts of heavy boating use.
- The Forest Service has determined that the river is unsuitable or inappropriate for commercial rafting.

Causal Mechanism(s):

- land ownership patterns (amount and arrangement of public land)
- technical development of equipment for whitewater boating
- popularity of whitewater boating

Trends:

- River use is expected to increase as the popularity of whitewater boating increases.
- Trespass is likely to continue, especially along long river stretches with no public land.

Influences and Relationships:

- river flows affect the quality of whitewater boating.
- land ownership patterns affect the quality of the whitewater boating experience.

Conclusions:

- A more desirable arrangement of public land along the river could reduce the likelihood of trespass on private land.
- Pull-out locations on public land need to be managed to accommodate camping by whitewater boaters including sanitation, litter, and reduction of fire hazard.

Road Impacts

Key Questions (from Chapter 2):

- What roads in the watershed are necessary to provide access for private landowners?
- What are the future trends in road use, needs, and management?
- What is the appropriate transportation system for the watershed that would be consistent with the land allocations described in the Forest Plan?

Present Condition:

High road densities in some parts of the watershed are having detrimental effects on hillslope erosion and runoff and on the quality of late-successional habitat.

A possible future land exchange is being considered in the watershed which could transfer some existing private land to the National Forest. Most of this land would go into the LSR land allocation and the needs for the existing transportation system could change.

Causal Mechanism(s):

- Timber harvest
- Access to utilities (powerline, PG&E facilities)
- Land ownership pattern (access to private land)
- Road design and construction

Trends:

- Administratively Withdrawn and LSR land allocations will have very little new road construction due to current management direction.
- Road densities in the LSR are expected to drop as unneeded roads are removed from the transportation system.
- On Matrix land, major arterial roads are in place but additional collector and local roads will be needed to access some timber stands.

Influences and Relationships:

- roads increase hillslope erosion and gullying, peak flows, and sediment delivery and transport into colluvial and bedrock channels.
- poorly designed road crossings can result in aggradation of stream channels and can hinder the dispersal of aquatic wildlife along streams.
- roads represent a loss of landbase for providing late seral habitats.
- roads are a source of disturbance to wildlife during breeding seasons.
- roads provide access for fire suppression and fuel management activities.
- some roads provide access to adjacent private land.
- low standard roads are a recreation opportunity for off-highway vehicle users.

Conclusions:

- There is a need to maintain reasonable road access to private landowners.
- Road densities should be minimized in LSR, Administratively Withdrawn, and Riparian Reserve land allocations.
- An adequate road system is desirable in the LSR to provide access for fire suppression, long-term fuel management, and other management activities.
- Road closure plans should discourage streamside road systems and favor ridgetop systems.

Late-Successional Reserves

Key Questions (from Chapter 2):

- What is the role of this watershed in the functioning of the LSR?
- What is the trend for development of late-successional habitat in the watershed?
- What can be done to maintain and develop late-successional habitat in the watershed?

Present Condition:

- The Lower McCloud River Watershed is the largest contributor of late-successional habitat and contains most known owl activity centers in LSR RC-335.
- Most of the late-successional habitat within the watershed is located in the LSR.
- Late-successional habitat (M3G & M4G) accounts for 71% of the LSR portion of the watershed.
- Fragmentation within the LSR portion of the watershed comes from two sources:
- natural processes - soil and geologic conditions on Grizzly Peak and Bald Mountain.
- land-use activities - regeneration harvest and fire salvage.
- Fragmentation is a concern for dispersal outside the watershed.
- There is a risk of loosing large areas of late-successional habitat within the LSR to catastrophic wildfire.

Causal Mechanism(s):

- fire exclusion
- past timber harvest
- site productivity

Trends:

- An additional 2000 acres of M3P stands on high site are expected to develop into late-successional habitat within the LSR portion of the watershed within the next 50 years.
- Acres of plantation in the LSR portion of the watershed are expected to develop into late-successional habitat in the next 60-80 years.
- Dispersal conditions are expected to improve in the eastern portion of the watershed and remain generally unchanged in the western portion.
- There will be a continued risk of loss to wildfire within the LSR as fuel loads increase.

Influences and Relationships:

- the ability of the watershed to support large amounts of late-successional habitat is influenced by high site productivity and high precipitation.
- fire exclusion has allowed large acreages of late-successional habitat to develop.
- catastrophic wildfire is a potential threat for losing large acreages of late-successional habitat.
- forest stand history has allowed the development of favorable stand structures.
- LSRs encourage development of vegetation conditions that improve slope stability and reduce hillslope erosion.

Influences and Relationships (cont.):

- LSRs encourage development of vegetation conditions that reduce peak flows.
- LSRs provide greater crown cover that reduces water temperatures.
- LSRs provide an ample source for the long-term recruitment of large woody debris in Riparian Reserves.
- LSRs emphasize management for late-successional conditions which can lead to a deficit of early seral stages.
- management for late-successional conditions tends to develop high fuel loads and fuel ladders.
- LSRs are generally compatible with recreational uses.

Conclusions:

- Fragmentation is not inhibiting the functioning of this LSR.
- Dispersal in the LSR will be provided by current and developing late-successional habitat.
- Fragmentation from private land and wildfire occurs but is not considered a problem in the watershed.
- There is a need to reduce fire hazard in the watershed

Erosion Processes

Core Questions (from WA Guide):

- What are the natural and human causes of changes between historical and current erosion processes in the watershed?
- What are the influences and relationships between erosion processes and other ecosystem processes (e.g., vegetation, woody debris recruitment)?

Present Condition:

- Dormant and active mass wasting features are present in the watershed.
- Erosion of fine sediments is occurring in heavily roaded areas.

Causal Mechanism(s):

- Fire suppression activities have decreased the number of acres burned in the watershed. The decrease in ground disturbance by wildfire is believed to have led to decreased soil erosion and mass wasting activity.
- Road systems provide additional sediment sources to streams.
- The climate has been generally drier over the past several decades resulting in a reduced risk of mass wasting activity.

Trends:

- Fire suppression has reduced the potential for hillslope erosion and mass wasting activity.
- Current short term trends in hillslope stability and mass wasting activity could be reversed in the event of stand replacing wildfires.
- Erosion of fine sediments continues to increase with additional road construction and lack of maintenance.
- The short time period over which mass wasting processes have been studied and land-use activities have occurred (<50 years) precludes predictions of long term trends in mass wasting processes.

Influences and Relationships:

- Catastrophic wildfire could destroy the soil organic layer resulting in increased slope instability.
- Catastrophic wildfire increases the potential for mass wasting and hillslope erosion.
- Roads increase hillslope erosion and gullying by disrupting drainage patterns.
- LSRs encourage development of vegetation conditions that improve slope stability and reduce hillslope erosion.
- Peak flow events increase the hillslope erosion process.
- Hillslope erosion processes influence water quality.
- Hillslope erosion can deliver large volumes of sediment to the upland channel network.
- Sediment loads from erosion processes can result in a loss of spawning habitat.

Conclusions

- No definitive conclusion can be made regarding the effects of land-use activities on mass wasting processes due to the short time period (<50 years) during which land-use activities have occurred in the watershed. Longer time periods and more intensive studies will be necessary to determine how land-use activities affect mass wasting processes.
- There is a need to reduce surface erosion from roads.
- There is a need to develop a transportation plan that is compatible with Late Successional and Riparian Reserve objectives and meets the access needs of private land owners.

Hydrology

Core Questions (from WA Guide):

- What are the natural and human causes of change between historical and current hydrologic conditions?
- What are the influences and relationships between hydrologic processes and other ecosystem processes (e.g., sediment delivery, fish migration)?

Present Condition:

- Peak and baseflows in tributaries to the McCloud River are not believed to have changed appreciably from reference to current conditions.
- Baseflows and peak flows occurring at less than 5-10 year intervals in the McCloud River have been reduced due to water diversions from Lake McCloud.

Causal Mechanism(s):

- Diversion of water from Lake McCloud to Iron Canyon Reservoir.

Trends:

- Trends in base and peak flows are static.
- The occurrence of catastrophic fire could increase base and peak flows.

Influences and Relationships:

- Peak flows are affected by catastrophic wildfire, high road densities, and timber
- harvest activities.
- LSRs encourage development of vegetation conditions that reduce peak flows.
- Peak flow events result in increased hillslope erosion.
- Reduced baseflows have resulted in decreased flow depths and wetted channel widths in the McCloud River.
- Peak flows are important to the downstream transport of gravel and large woody material.
- Higher flows improve the quality of whitewater boating in the McCloud River.
- Lower baseflows in the McCloud River improve the quality of fishing by providing better conditions for wading.
- Decreased water releases and reservoir impoundment have resulted in higher water temperatures downstream of McCloud Dam.
- Lower peak or bankfull flows have resulted in increased sedimentation in the reach of the McCloud River below the McCloud Dam to Hawkins Creek.

Conclusion:

- Peak and base flows in tributaries to the McCloud River are functioning within the range of natural variability.
- There is a need to assess the current minimum releases from the McCloud Dam and to determine if they are adequate for downstream beneficial uses.

Stream Channel

Core Questions (from WA Guide):

- What are the natural and human causes of change between historical and current channel conditions?
- What are the influences and relationships between channel conditions and other ecosystem processes in the watershed (e.g., in channel habitat for fish and other aquatic species, water quality)?

Present Condition:

- The stability of upland stream channel types has increased in areas where fire has been effectively suppressed.
- Upland channels have been impacted by increases in fine sediments in heavily roaded areas.
- Larger streams have been impacted by sediment sources from roads located within and adjacent to inner gorges.

Causal Mechanism(s):

- Fire suppression.
- Roads.
- Timber harvest.

Trends:

- The stability of upland channels continues to increase in areas where fire has been excluded.
- Roads continue to be chronic sediment sources to streams. Sediment delivery to streams is not increasing except in areas where road construction is ongoing.

Influences and Relationships:

- Hillslope erosion following catastrophic wildfire can deliver large volumes of sediment to the upland channel network.
- Catastrophic wildfire destroys large woody debris in riparian areas and removes the source of future large woody debris.
- When stream channels are destabilized by catastrophic wildfire, riffles tend to elongate resulting in a loss of pools and deep water habitat.
- Catastrophic wildfire removes riparian vegetation which is critical to bank stability.
- Increased sediment loads following large wildfires results in a loss of spawning habitat.
- Road building increases sediment delivery and transport into colluvial and bedrock channels.
- Poorly designed road crossings can result in aggradation of stream channels.
- LSRs encourage development of vegetation conditions that improve slope and bank stability.
- LSRs provide an ample source for the long-term recruitment of large woody debris in Riparian Reserves.

Influences and Relationships (cont.):

- Reduced baseflows have resulted in decreased flow depths and wetted channel widths in the McCloud River.
- The stream channel characteristics of the McCloud River can affect the quality of whitewater boating.
- The formation and maintenance of habitat features, such as deep pools and runs are, critical to the production of large and mature trout.

Conclusion:

- Fire suppression has decreased sediment inputs and increased channel stability in areas where fire has been excluded.
- Upland channel types have been impacted by roads. There is a need to develop a monitoring plan to determine how roads are impacting cascade, step-pool and pool-riffle channel types.
- There is a need to manage for the accumulation of fuels in areas where fire has been excluded. Fire must be reintroduced in the watershed in order to prevent the continued build up of fuels in fire prone areas and to reduce the risk of catastrophic fires.

Water Quality

Core Questions (from WA Guide):

- What are the natural and human causes of change between historical and current water quality conditions?
- What are the influences and relationships between water quality and other ecosystem processes in the watershed (e.g., mass wasting, fish habitat, stream reach vulnerability)?

Present Condition:

- Mean summer water temperatures in the McCloud River above Shasta Lake have increased by 5.5 degrees Celsius from pre-reservoir temperatures (Rode, 1990).
- Turbidity levels in the McCloud River are lower than pre-reservoir conditions.
- With the exception of Ladybug and Bald Mountain Creeks, little to no water quality data is available for tributaries to the McCloud River.

Causal Mechanism(s):

- Lake McCloud Dam.
- Iron Canyon Diversion.

Trends:

- There is a risk of increased sedimentation should catastrophic fire occur.

Influences and Relationships:

(Water quality impacts are also displayed on Table 3-5.)

- Hillslope erosion following catastrophic wildfire can deliver large volumes of sediment to the upland channel network.
- Large fires result in the formation of ash which can increase the pH of streams.
- Catastrophic wildfire removes riparian vegetation which is critical to maintaining cooler water temperatures.
- Increased sediment loads following large wildfires results in a loss of spawning habitat.
- Road building increases sediment delivery and transport into colluvial and bedrock channels.
- Timber harvest can increase sedimentation and reduce canopy cover over streams.
- LSRs and Riparian Reserves provide greater crown cover that reduces water temperatures.
- Water quality affects aquatic and riparian dependent wildlife species and fisheries.

Conclusion:

- Summer water temperatures have increased in the McCloud River and turbidity levels have decreased from reference to current conditions.
- More water quality data is needed to assess water quality conditions in tributaries to the McCloud River.

Vegetation

Core Questions (from WA Guide):

- What are the natural and human causes of change between historical and current vegetation conditions?
- What are the influences and relationships between vegetation and seral patterns and other ecosystem processes in the watershed (e.g., hydrologic maturity, channel stability, shade disturbance, species movements, soil and erosion processes)?

Present Condition:

Aggressive fire suppression over the past century, coupled with highly productive soils and high precipitation, has resulted in:

- 35% of the watershed being in the late seral stage.
- a shift towards more shade tolerant tree species.
- development of an understory of shade tolerant tree species.

The loss of early seral habitat through fire exclusion and natural succession has been partially offset by the establishment of plantations.

Causal Mechanism(s):

- Fire exclusion
- Timber harvest
- Site productivity
- High precipitation

Trends:

- early seral/chaparral habitat - acreage will continue to be adequate
- hardwood forest habitat - probably fairly stable for the near future but then declining.
- late seral stages - acreage is expected to continue to increase

Influences and Relationships:

- there is a potential for losing large acreages of late-successional forest to catastrophic wildfire.
- catastrophic wildfire removes riparian vegetation which is critical to maintaining cooler water temperatures, increasing stream biotic potential, and maintaining bank stability.
- high site productivity and high precipitation make the watershed suitable for supporting large acreages of late-successional forest.
- fire exclusion has allowed large acreages of late-successional forest to develop.
- forest stand history has allowed the development of multi-layered stand structures.
- the LSR land allocation emphasizes the development of late-successional forest in the watershed rather than early seral stages.

Influences and Relationships (cont.):

- LSRs encourage development of vegetation conditions that improve slope stability and reduce hillslope erosion.
- LSRs encourage development of vegetation conditions that reduce peak flows.
- LSRs and Riparian Reserves provide greater crown cover that reduces water temperatures.

Conclusion:

The vegetation condition in the watershed influences wildlife habitat, fuel loads and structure, slope stability

Species and Habitats

Core Questions (from WA Guide):

- What are the natural and human causes of change between historical and current species distribution and habitat quality for species of concern in the watershed?
- What are the influences and relationships of species and their habitats with other ecosystem processes in the watershed?

Present Condition:

- Old growth requirements (15% minimum) are met and exceeded in this watershed.
- Adequate well-distributed habitat exists for the northern spotted owl and other old-growth and forest interior dependent species.
- Shasta salamander habitat is present within the watershed but its extent is unknown.
- Deer and elk distribution and extent of use is unknown for the watershed.
- Deer and elk forage is limited - oak and chaparral habitat is in poor condition.
- Peregrine falcon activity has been observed in the watershed, but no eyries have been identified.
- Snags and dead & down material appear to meet minimum levels.
- Bat habitat has been identified at several locations, but presence is unknown.
- Knowledge of riparian associated species in the watershed is limited compared to survey effort in adjacent watersheds.
- Inventory in the south part of the watershed is limited.
- Upland channels damaged by timber harvest activities are recovering.
- Populations of sensitive plants are known to occur throughout the watershed.
- Unexplored habitat for several sensitive plants occurs throughout the watershed.
- Inventories of survey and manage late-successional associated fungi, lichens, bryophytes, and vascular plants have not been accomplished to date.
- macroinvertebrate diversity and biotic condition was monitored in Lady Bug Creek for the period 1985-88 but does not include impacts of the Dee Fire (1989).

Causal Mechanism(s):

- fire exclusion
- lack of survey
- limited accessibility
- past timber harvest

Trends:

- old growth habitat has been increasing in the watershed for the last fifty years and is expected to continue increasing.
- the condition of oak and chaparral habitat for elk and deer will continue to deteriorate.

Influences and Relationships:

- catastrophic wildfire results in habitat loss.
- catastrophic wildfire destroys important habitat components (snags, dead & down wood).
- catastrophic wildfire destroys large woody debris in riparian areas and removes the source of future large woody debris.
- when stream channels are destabilized by catastrophic wildfire, riffles tend to elongate resulting in a loss of pools and deep water habitat.
- increased sediment loads following large wildfires results in a loss of spawning habitat.
- roads represent a loss of landbase for providing late seral habitats.
- roads are a source of disturbance to wildlife during breeding seasons.
- high site productivity and high precipitation make the watershed suitable for supporting large amounts of late-successional habitat.
- fire exclusion has allowed large acreages of late-successional habitat to develop.
- there is a potential for losing large acreages of late-successional habitat to catastrophic wildfire.
- forest stand history has allowed the development of favorable stand structures.
- LSRs encourage development of vegetation conditions that improve slope stability and reduce hillslope erosion.
- LSRs encourage development of vegetation conditions that reduce peak flows.
- LSRs provide greater crown cover that reduces water temperatures.
- LSRs provide an ample source for the long-term recruitment of large woody debris in Riparian Reserves.
- management for late-successional conditions tends to develop high fuel loads and fuel ladders.

Conclusion:

- Old growth needs in the watershed are being met by the LSR and Riparian Reserves.
- Snags and dead & down levels appear adequate at this time.
- Early seral habitat:
  - chaparral - there is a need to develop a mosaic of age classes.
  - grass/forbs - there is a need to develop the grass/forb layer in oak and conifer types.
- Survey and inventory needs in the watershed include:
  - aquatic
  - peregrine falcon
  - bats
  - Shasta salamander
  - deer and elk
  - sensitive plants
  - old-growth associated vascular plants, lichens, fungi, and bryophytes.
  - an opportunity exists to expand on previous macroinvertebrate monitoring in Bald Mountain and Lady Bug Creek (Mangum, 1985-88).

Human Uses

Other human use topics are discussed separately in the following locations:

- River Use - page 5-3
- Land Allocation Adjustment - page 5-13

Core Questions (from WA Guide):

- What are the causes of change between historical and current human uses?
- What are the influences and relationships between human uses and other ecosystem processes in the watershed?

Present Condition:

- The closure of the Star City day-use site to overnight camping had created overflow at Ash Camp. Ash Camp overflow is currently being accommodated on the terrace where the diversion tunnel crosses Hawkins Creek.
- Opportunities for additional trails have been identified within the Unroaded Non-Motorized Recreation management prescription.

Causal Mechanism(s):

- creation of McCloud Reservoir as a recreational attraction
- improved road access in the northeast portion of the watershed.
- closing of Star City day-use site to overnight camping

Trends:

- recreation use in the northeast portion of the watershed is expected to increase as area population increases.
- use of the Unroaded Non-Motorized Recreation Area is expected to remain unchanged due to lack of trail access.

Influences and Relationships:

- catastrophic wildfire has negative impacts on recreational and aesthetic values.
- catastrophic wildfire results in loss of timber value on both National Forest and adjacent private land.
- catastrophic wildfire can result in both economic and aesthetic losses for adjacent landowners.
- some roads provide access to adjacent private land.
- low standard roads are a recreation opportunity for off-highway vehicle users.
- river and channel characteristics affect the quality of whitewater boating.
- lower baseflows improve the quality of fishing by providing better conditions for wading.

Conclusion:

- There is a need to provide additional camping sites in the northeast portion of the watershed consistent with objectives of the LSR.
- The Unroaded Non-motorized Recreation Area (Prescription I) is currently underutilized due to a lack of trails. Opportunities exist to develop a trail system in this area.

Non-native Plants

Core Questions (from WA Guide):

- What are the natural and human causes of change between historical and current species distribution for species of concern in the watershed?
- What are the influences and relationships of species and their habitats with other ecosystem processes in the watershed?

Present Condition:

- Black locust and Himalaya berry are established at Ah-Di-Na and have displaced native vegetation.
- Black locust has been observed at scattered locations along the McCloud River from Ah-Di-Na to Shasta Lake.
- Black locust is not advancing into conifer stands.
- Yellow star-thistle is competing aggressively against native vegetation and leaves allelopathic compounds in the soil which prevents germination of other plants.

Causal Mechanism(s):

- establishment of homestead at Ah-Di-Na.
- downstream transport of black locust seed along McCloud River
- disturbance including road cuts and fills, campground, natural stream scour.
- relative intolerance of black locust to shade.

Trends:

- Black locust is expected to continue colonizing additional sites along river terraces between Ah-Di-Na and Shasta Lake.
- Existing native riparian vegetation along the Lower McCloud River is likely to be displaced wherever black locust becomes established.
- Yellow star-thistle is likely to continue spreading along roads wherever there is disturbed soil.

Influences and Relationships:

Removal of non-native vegetation may have temporary impacts around recreation sites, such as Ah-Di-Na Campground, until native vegetation recovers.

Conclusion:

- Black locust is likely to continue displacing native riparian vegetation along the Lower McCloud River but is not expected to have major impacts in conifer stands.
- Yellow star-thistle is likely to continue to displace native vegetation and infest disturbed areas in the watershed.

Land Allocation Adjustment

Key Question (from Chapter 2):

- Are existing land allocations consistent with current land uses? (taken from the River Use issue on page 2-3)

Present Condition:

The boundaries of Prescription I (Unroaded Non-Motorized Recreation management prescription) do not follow "viewshed" boundaries. Downstream from Claiborne Creek, the Matrix land allocation is near the bottom of the McCloud River canyon and is generally within a quarter mile of the river. In one location (Section 10, T36N, R2W) the Matrix land allocation is actually at the river's edge.

The prescription boundary through the Nawtawaket Creek drainage does not follow any topographic features or "viewshed" boundaries.

Adjacent landowners have expressed concern that expansion of The Unroaded Non-Motorized Recreation area has the potential to restrict access to their lands in the future.

Causal Mechanism(s):

- Land allocations as designated in the Northwest Forest Plan and the LMP

Trends:

No change from the existing condition would occur unless modifications are made to land allocation and management prescription boundaries.

Influences and Relationships:

Land allocation adjustments that discourage or restrict future road building have the potential to impact adjacent land owners.

Conclusion:

An opportunity exists to improve the recreation experience in the Unroaded Non-Motorized Recreation prescription.

Adjacent landowners need to be involved during public scoping at the NEPA level for any actions that would impacts access to their properties.

Chapter 6

Recommendations

The purpose of this chapter is to bring the results of the previous steps to conclusion, focusing on management recommendations that are responsive to watershed processes identified in the analysis. Monitoring activities are identified that are responsive to the issues and key questions. Data gaps and limitations of the analysis are also documented.

This chapter is organized by focusing on needs and opportunities identified in the “Conclusions” sections at the end of each item in Chapter 5.

Recommendations included in this chapter are:

- Fuels Management
- Riparian Reserves
- River Use
- Road Management
- Wood Products
- Recreation Opportunities
- Research Needs
- Control/Eradication of Non-native Plants
- Land Allocation Adjustment
- Survey, Inventory, Monitor

Fuels Management

Present Condition:

- There is a need to provide continued fire suppression in the watershed.
- There is a need to create compatible fuel profiles.
- There is a need to reduce surface fuel loads.
- There is a need to reduce fire hazard in the watershed.
- Dispersal in the LSR will be provided by late-successional habitat.
- Fragmentation is not inhibiting the functioning of this LSR.
- Fragmentation from private land and wildfire occurs but is not considered a problem in the watershed.
- Mass wasting activity has decreased in the watershed due to the effectiveness of fire suppression activities.
- The current condition for mass wasting activity should remain static providing that catastrophic fires do not occur in the watershed.

Recommendations:

Implement a cooperative long range fuel management program with adjacent landowners focused on critical hazard and risk elements identified in the watershed. The majority of this program would consist of prescribed burning; however, stand thinning and mechanical fuels treatment would be used where topography and access are favorable and where such treatments are consistent with current management direction (see Table 6-2). This program would be implemented in four phases as follows (also see Map 20):

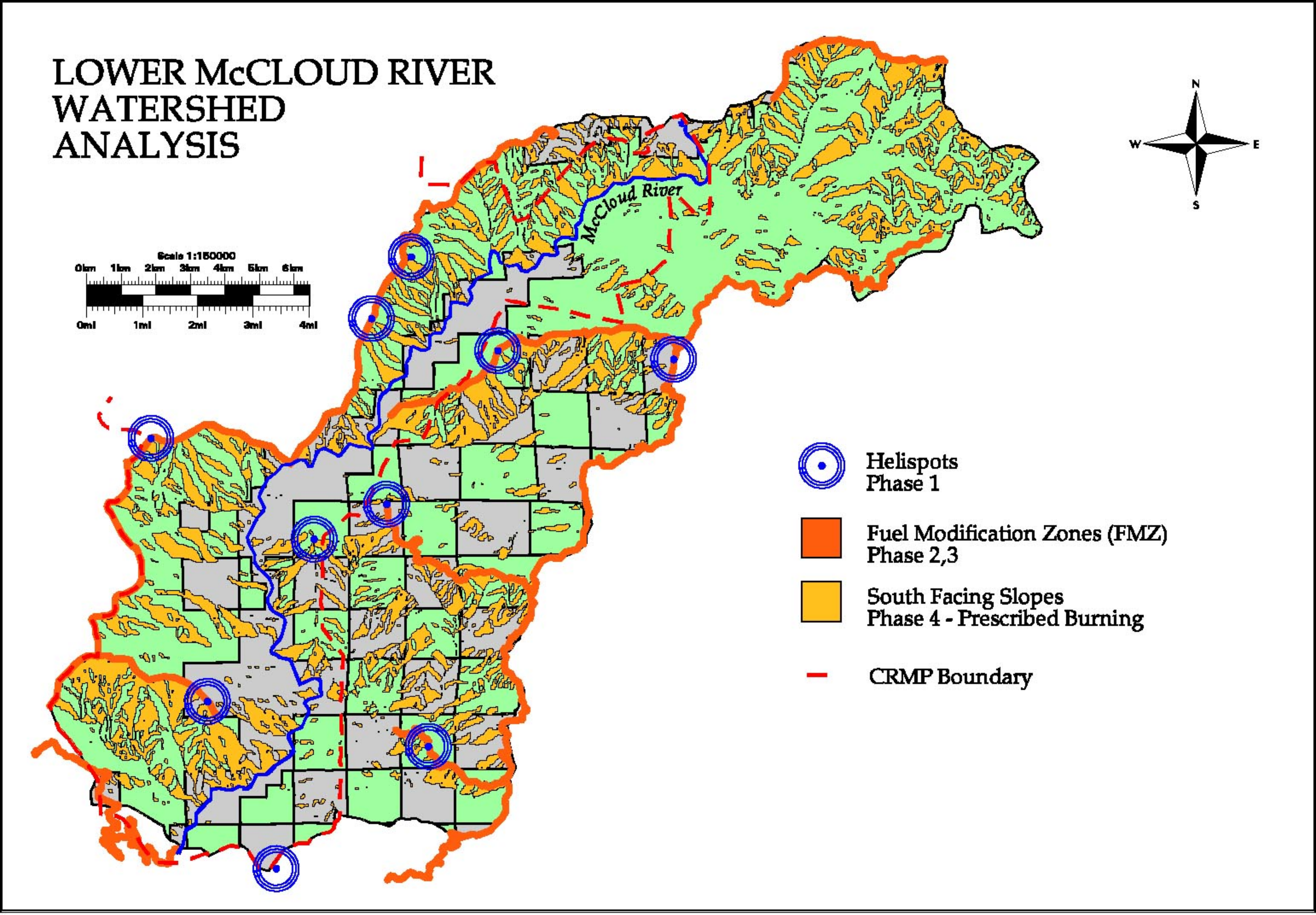
- **Phase 1 - Establishment of pre-suppression features.**

  This phase will establish pre-suppression features to enhance future suppression tactical decision. Some features will need to be in place before a prescribed burn program is implemented. These features may include helispots, water sources, and re-establishing access to specific existing 4-wheel drive roads that are critical for access during fire suppression.
- **Phase 2 - Establishment of Fuel Management Zone (FMZ)**

  This phase will establish an initial complex of approximately 61 miles of FMZs along key ridgelines and roads. Total FMZ width for this phase will be 300 ft. (150 ft. on each side of the ridge) for a total of approximately 2200 acres within the watershed. This zone will serve as initial anchor points for a large prescribed burn program, as well as enhancement of future suppression efforts.
- **Phase 3 - Expansion of FMZ down south facing slopes.**

  This phase will extend the FMZ an additional 700 ft. down south slopes where the highest probability of ignition currently exists. Total FMZ width will be 1000 ft. for a total of approximately 4900 acres within the watershed.
- **Phase 4 - Expansion of prescribed burning to other critical areas.**

  This phase will focus prescribed fire efforts on landscape features that pose the greatest hazard and risk potential beyond the FMZ. This phase may include south aspects that expand the FMZ, critical areas outside the FMZ, and protection of structural property within the watershed.



Map 20. Fuel Treatment Areas

Table 6-1 summarizes the distribution of acres on both National Forest and adjacent ownership if the recommended fuel management program is fully implemented. The acres shown in the table are based on topographic features, aspect, and hazard and risk. They are included to display the relative area of land that would be treated at each phase and do not necessarily indicate the actual acres that would be treated. Actual acres are expected to vary at the project design stage and would be displayed in environmental documentation at that time.

Table 6-1: Summary of recommended fuel management program showing the approximate acreage on both National Forest and adjacent ownership at each phase.

	National Forest		Other Ownership		Total
	acres [1/]	%	acres [1/]	%	acres [1/]
Phase 1	-	-	-	-	-
Phase 2	1146	52.9	1022	47.1	2168
Phase 3	3519	72.1	1361	27.9	4881
Phase 4	12554	71.5	5002	28.5	17556
Total	17219	70.0	7385	30.0	24604

[1/] acres are approximate and are only intended to show the distribution of ownership and the relative amount of area treated at each phase rather than the actual acres.

Prescribed Burning

Prescribed burning would be the main activity in the fuel management program and would be implemented during Phases 2, 3, and 4. Most burning would occur in Phases 3 and 4 as treatment moves to steeper slopes that are not suitable for other methods.

Prescribed burning is an acceptable management activity within all land allocations and mangement prescriptions (see Table 6-2).

Stand Thinning/Mechanical Fuel Treatment

Stand thinning and mechanical fuel treatments (machine piling, etc.) would be used as alternatives to burning where slopes are suitable (generally <40%) and there is existing road access. Thinning would focus on reducing understory vegetation and retaining larger trees that form the overstory canopy. Such activities would occur mainly in Phase 2 where treatments are focused on ridgetop areas and then decline as the program moves into Phases 3 and 4 where treatments tend to occur on steeper slopes.

Stand thinning and mechanical fuel treatments should promote acceptable fuel profiles that reduce the risk of catastrophic fire. When possible, surface fuels should be kept below 15.0 tons/acre and stand densities below 10.0 kg/m^3 of crown bulk density.

Thinning may occur within Riparian Reserves if measures are included to minimize disturbance to ground cover and vegetation. However, mechanical fuel treatments are not considered appropriate due to the amount of ground disturbance.

Stand thinning and mechanical fuel treatments are permitted activities within the Unroaded Non-Motorize Recreation Area (LMP 4-45 & 4-46) but are constrained by restrictions on new road construction. Helicopter removal is a permissible option that can be evaluated further in an environmental assessment.

Table 6-2: Compatibility of various fuel management activities with current management direction for the major land allocations and management prescriptions.

	Land Allocation or Management Prescription			
Activity	**Late-Successional Reserve**	**Riparian Reserve**	**Unroaded Non-Motorized Recreation**	**Matrix**
Prescribed Burning	Permitted when aimed at reducing risk. (LMP 4-37 & 4-43)	Permitted when it contributes to attainment of ACS objectives. (LMP 4-57)	Permitted. (LMP 4-45)	Permitted or emphasized. (LMP 4-64 thru 4-67)
Stand Thinning	Permitted when aimed at reducing risk and when beneficial to the development of late-successional forest conditions. (LMP 4-37 & 4-43)	Permitted when needed to attain ACS objectives. (LMP 4-54)	Mechanical / manual vegetation treatment methods are permit-ted but opportunities are very limited due to restrictions on road access. (LMP 4-45 & 4-46)	Permitted or emphasized. (LMP 4-64 thru 4-67)
Mechanical Fuel Treatment (machine pile, etc.)	Permitted when aimed at reducing risk. (LMP 4-37 & 4-43)	Not considered appropriate due to disturbance of ground cover and vegetation.	Mechanical / manual vegetation treatment methods are permit-ted but opportunities are very limited due to restrictions on road access. (LMP 4-45 & 4-46)	Permitted or emphasized. (LMP 4-64 thru 4-67)
Road Building.	Permitted when benefits exceed cost of habitat impairment. (LMP 4-39 & 4-43)	Permitted when designed to meet ACS objectives. (LMP 4-54)	Not permitted. (LMP 4-45)	Permitted or emphasized. (LMP 4-64 thru 4-67)

Treatment Priorities

Although the fuels management recommendations are proposed as part of a long range program that covers several large watersheds, there is a need to focus, at least initially, on areas of highest resource values and highest resource risk. Areas identified as being high priority for treatment are:

- areas that provide protection for large amounts of old growth and late-successional habitat (see Maps 12 & 18c).
- areas of high fire hazard and risk (see Map 15).

Based on these priorities, initial treatments would focus on the north portion of the watershed; however, other areas of lower priority may be treated when needed to fit into the overall fuel management strategy for the watershed.

Rationale/Objective:

- Protect existing watershed resources (especially the LSR) from stand replacement wildfire events through enhanced suppression and prescribed fire opportunities.
- Reduce stand replacement fire behavior by reducing surface fuels and stand densities to acceptable levels.
- Create and maintain acceptable fuel profiles within the watershed that are characteristic of its natural fire regime.

Riparian Reserves

Present Condition:
- Riparian Reserves occupy 38.6% of the Lower McCloud River Watershed.
- Riparian Reserves in the watershed are generally considered to be functioning properly at this time.
- Catastrophic wildfire could have long-term negative impacts on Riparian Reserves.
- There is an increasing risk of catastrophic wildfire in the watershed.

Recommendations:
- Management activities in the watershed should implement standards and guidelines and minimum Riparian Reserve widths as described in LMP 4-53 through 4-58.
- Riparian Reserves should not be excluded from prescribed burning when necessary to meet fuel management objectives. However, fire intensity within Riparian Reserves needs to be low with an objective of reducing ground fuels and removing fuel ladders in the understory while still retaining large woody debris and large trees that will provide a continuous supply of large woody debris in the future. Generally, fire should be allowed to back into riparian areas.
- Proposed management activities in the watershed will require additional investigation at the project level to identify "unstable and potentially unstable areas" (LMP 4-54). Map 11 identifies areas of high geologic hazard, but field verification is necessary to establish the actual limits of unstable areas on a site specific basis.
- Pursue geologic investigations and monitoring programs to determine how land-use activities influence mass wasting processes.
- There is no anticipated need to remove trees from within Riparian Reserves through timber harvest.

Rationale/Objective:
- With 38.6% of the Lower McCloud River Watershed designated as Riparian Reserves, adequate protection against catastrophic wildfire cannot be provided if fuels within these reserves are excluded from treatment.
- The condition of Riparian Reserves following controlled burning is preferable to the conditions that would occur following catastrophic wildfire, including:
    - more residual large woody material.
    - more residual duff and ground litter.
    - retention of most larger vegetation for shade, slope stability, and the long-term recruitment of large woody material.
- The objective of fuel treatment in Riparian Reserves is to reduce ground fuel and fuel ladders while still maintaining the effectiveness of the area in providing large woody debris for the long term.
- Ecosystem analysis at the watershed level is not adequate to determine the extent of unstable areas on a site specific level.

River Use

Present Condition:

- Trespass on private land is a problem due to the limited amount of public land along the river below Ah-Di-Na.
- The arrangement of existing parcels of public land along the river below Ah-Di-Na does not provide pull-out points for whitewater boaters in desirable locations.
- The lower river is remote and there are few opportunities to leave the river in case of emergency or when boaters find the river too challenging.
- There is concern that the limited amount of public land along the lower river cannot withstand the impacts of heavy boating use.
- The Forest Service has determined that the river is unsuitable or inappropriate for commercial rafting.

Recommendations:

- Maintain current policy of not permitting commercial rafting.
- Investigate the possibility of a two or three party land exchange with the objective of providing more desirable pull-out points and camping sites on public land for whitewater boaters. Criteria for evaluating the suitability of new pull-out points should include:
    - desirable features for camping (flat ground, etc.)
    - spaced at desirable distances along the river.
    - nearby road access for occasional maintenance work such as litter cleanup and fuel reduction.
    - sites located away from developed areas on private ownership.

Rationale/Objective:

- Relocation of public land along the Lower McCloud River by land exchange can:
    - provide more evenly spaced intervals between pull-out points.
    - provide better quality camp sites (terrain, shade, etc.).
    - provide land access for cleanup and fuel reduction work.
    - improve conditions for adjacent landowners by locating camp sites away from developed areas on their land.

Road Management

Present Condition:

- The existing road system in the LSR portion of the watershed was designed to provide access for timber harvest. Management direction has changed to providing for late-successional habitat and the need for roads has shifted to protection and maintenance of the LSR.
- A checkerboard land ownership pattern occurs over much of the watershed. The Forest must provide reasonable access to adjacent landowners and must respect existing right-of-way and cost share agreements.
- A land exchange has been proposed in the LSR portion of the watershed which could change the need to keep some roads in the transportation system in the future.

Recommendations:

Road management recommendations are presented in two phases:

Phase 1 - could be implemented immediately without land exchange.
This phase maintains access to adjacent private land and respects current right-of-way and cost share agreements.

Phase 2 - would be implemented only if the proposed land exchange occurs.
This phase closes additional roads that would not be needed for access to private land or constrained by right-of-way or cost share agreements.

Phase 1

- Late-Successional Reserve
  - General Recommendations:
    - reduce roads to those needed for fire protection and management of the LSR (mostly fuels treatments).
    - favor the retention of ridgetop and upper slope roads over roads in drainages and Riparian Reserves.
    - roads that provide access to private land or are included in rights-of-way and cost share agreements will remain open.
    - roads needed for powerline access near Grizzly Peak will remain open.
    - ridgetop and upper slope roads will be left in place but closed by gates or barricades.
    - roads in drainages and Riparian Reserves will be obliterated.
  - Specific Recommendations:
    - maintain Curl Ridge and Bald Mountain jeep trails for fire access.
    - construct and maintain jeep trails for fire access along selected Fuel Management Zones (FMZs) as described in recommendations for fuel management (see page 6-2 and Map 19).
    - Roads to be kept open within the LSR:

FA 11	Hawkins Creek
39N06	Stouts Meadow
38N53	Ah-Di-Na
38N53A	Ah-Di-Na Campground Loop
38N36	Bald Mountain Jeep Trail

37N48	Van Sicklin
35N18	Curl Ridge
38N59	Little Meadows
37N95	Claiborne Creek

- <u>Matrix</u>
  - General Recommendations:
    - maintain a transportation system that will provide adequate access for timber harvest and other management activities as well as fire suppression..
    - reduce surplus roads, especially those in drainages and Riparian Reserves.
    - roads that provide access to private land or are included in rights-of-way and cost share agreements will remain open.
    - surplus roads on ridgetops and upper slopes will be left in place but closed by gates or barricades.
    - surplus roads in drainages and Riparian Reserves will be obliterated.
  - Specific Recommendations:
    - maintain Curl Ridge and Bald Mountain jeep trails for fire access.
    - construct and maintain jeep trails for fire access along selected Fuel Management Zones (FMZs) as described in recommendations for fuel management (see page 6-2 and Map 19).
    - Roads to be kept open within the LSR:

38N17	Fenders Ferry
35N55	Horse Ridge
36N43	Satin Peak
36N45	(Stain Peak vicinity)
37N86	McKenzie Mountain

- <u>Administratively Withdrawn Areas</u> (Unroaded Non-Motorized Recreation)
  - No new road construction or jeep trails are proposed within the Unroaded Non-Motorized Recreation Area.

Phase 2

- <u>Late-Successional Reserve</u>
  - General Recommendations:
    - after land exchange, close additional roads that are no longer constrained by right-of-way and cost share agreements and not needed for management of the LSR.
    - reduce roads to those needed for fire protection and management of the LSR (mostly fuels treatments).
    - favor the retention of ridgetop and upper slope roads over roads in drainages and Riparian Reserves.
    - ridgetop and upper slope roads will be left in place but closed by gates or barricades.
    - roads in drainages and Riparian Reserves will be obliterated.
  - Specific Recommendations:
- Remove the portion of 35N18 along Claiborne Creek in Section 19 & 20, T37N, R3W and the existing bridge across Claiborne Creek in Sec. 25, T37N, R4W.

- Matrix
  - General Recommendations:
    - after land exchange, close additional roads that are no longer constrained by right-of-way and cost share agreements and not needed for management of National Forest land.
    - maintain a transportation system that will provide adequate access for timber harvest and other management activities as well as fire suppression..
    - reduce surplus roads, especially those in drainages and Riparian Reserves.
    - roads identified as surplus to management needs in ridgetop areas and upper slopes will be left in place but closed by gates or barricades.
    - roads identified for closure in drainages and Riparian Reserves will be obliterated.
- Administratively Withdrawn Areas (Unroaded Non-Motorized Recreation)
  - No new road construction or jeep trails are proposed within the Unroaded Non-Motorized Recreation Area.

Rationale/Objective:

- Curl Ridge and Bald Mountain jeep trails are located along key ridgelines for fire suppression. The Curl Ridge jeep trail is becoming overgrown with brush and needs clearing and maintenance.
- Jeep trails along FMZs provide access during wildfire and for maintenance of the FMZ.
- LSR objectives favor the location of ridgetop and upper slope roads that provide access during wildfires and for maintenance of FMZs.
- LSR objectives discourage roads in drainages and along Riparian Reserves where late-successional and old growth forest stands tend to occur.

Wood Products

Present Condition:

- Habitat on Matrix land in the south end of the watershed has been fragmented by recent clearcuts.
- Conifer stands of commercial size on Matrix land are limited. Few opportunities currently exist for additional regeneration harvest due to the amount and arrangement of recent clearcuts.

Recommendations:

Matrix

- Defer regeneration harvest (green tree retention) on Matrix land for ten years.
- Limit timber harvest to thinning, sanitation and salvage.

Late-Successional Reserve

- Wood products (sawlogs and chips) may be removed as by-products of stand thinnings and fuel treatments described on page 6-3.
- The removal of wood products from thinnings should be limited to areas within FMZs on slopes less than 45% and accessed by existing roads.

Rationale/Objective:

- Deferring regeneration harvest will allow existing plantations to develop and reduce the effects of further fragmentation on Matrix land.
- The recovery of wood products from stand treatments within the LSR is an appropriate method of removing excess woody material from the site provided that other resource needs have been met. The removal of such material can reduce the volume of fuel prior to prescribed burning.

Recreation Opportunities

Present Condition:

- There is a need for additional campsites in the area around Ash Camp.
- The Unroaded Non-Motorized Recreation area (Prescription I) is underutilized.

Recommendations:

- Evaluate the development of an additional campground along Hawkins Creek at the diversion tunnel.
- Pursue opportunities to develop hiking trails within Prescription I.
- Make ridgetop jeep trails in all land allocations except prescription I available for OHV use wherever such use is compatible with other resource values and management objectives.

Rationale/Objective:

- Development of trails is consistent with the LMP and provides additional recreation opportunities in the area..
- Trails also provide foot access for fire suppression.
- There is a demand for increased OHV opportunities on the Forest. Ridgetop jeep trails tend to occur on areas of low productivity and away from areas that support late-successional and old growth stands. OHV use in this watershed is considered to be compatible with LSR objectives.

Research Needs

Present Condition:

- The McCloud-Pit Project is scheduled for relicensing within the next decade.
- The effects of regulated releases and altered sediment regimes on biological and physical processes in the lower river are poorly understood.
- The current minimum release of 40 cfs below McCloud Dam is approximately 3-4 percent of pre-reservoir base flows.
- Water temperatures in the McCloud River below the dam average 10 degrees F higher than historic levels.
- Gravel recruitment is no longer occurring in the McCloud River between McCloud Dam and Hawkins Creek.
- The cumulative impacts of land-use activities in disturbed drainages such as Hawkins, Claiborne and Chatterdown Creeks are poorly understood. Water quality data for the McCloud River tributaries is scarce.

Recommendations:

- Pursue biological and hydrological investigations in cooperation with McCloud River CRMP. Some of the potential research topics include:
  - Determine sediment budget in the Lower McCloud River Watershed.
  - Determine gravel distribution in the McCloud River between McCloud Dam and Shasta Lake. Evaluate effects of peak flows and regulated releases on gravel distribution. Determine if McCloud River tributaries such as Hawkins, Squaw Valley and Claiborne Creeks are effective in replenishing gravel to the McCloud River.
  - Determine peak flow effects on channel morphology (pool depths, pool-riffle distributions, bankfull and active channel widths).
  - Evaluate the effects of turbidity to fisheries and aquatic resources below McCloud Dam. Determine how reservoir aging will affect suspended sediment and turbidity levels in the McCloud River.
- Develop a monitoring program for disturbed and undisturbed drainages to assess cumulative impacts to the aquatic environment from land-use activities. Examples of parameters to be monitored include: Water quality (temperature, dissolved oxygen, suspended sediment, turbidity, pH, conductivity); biological (macroinvertebrates, fisheries and vegetation surveys, spawning gravel condition); and morphological (pool depths, pool-riffle distribution, sediment sources, channel stability).
- Follow up on McCloud River Water Quality Monitoring Project with additional monitoring including water temperature data collection and surveys for macroinvertebrates and channel stability in Bald Mountain and Ladybug Creeks.

Rationale/Objective:

- The McCloud-Pit Hydroelectric Projects is scheduled for relicensing within the next decade. Recent relicensing direction for Region 5 has indicated that the Forest Service has often failed to participate fully in the relicensing process. The Forest Service often fails to organize early enough to request all of the studies it can or should from the licensee (<u>Region 5 Hydropower Relicensing, 1997</u>). Direction for the Shasta-Trinity

National Forests states that the agency must consider the following topics during the relicensing process.

- "Give priority emphasis to in-stream flows and habitat conditions that maintain or restore riparian resources, favorable channel conditions, and fish passage. During relicensing emphasize in-stream flows and habitat conditions that maintain or restore riparian resources and channel integrity" (R5 Hydropower Relicensing, 1997).
- "Locate new support facilities outside riparian reserves. For existing facilities inside Riparian Reserves, provide recommendations to FERC (Federal Energy Regulatory Commission) that ensure Aquatic Conservation Strategy objectives are met. Where objectives cannot be met, recommend that support facilities be relocated" (R5 Hydropower Relicensing, 1997).

- The opportunity exists to develop baseline data for trends that will be useful during relicensing. Changes in channel form (pool depth, pool-riffle distribution) are difficult to assess over short time periods (i.e. less than 5 years). Beginning research now will provide information over longer time periods that may be useful in establishing trends.
- Wild and bull trout habitat needs and beneficial uses associated with the wild trout fishery were not used as a criteria for determining minimum releases from McCloud Dam during Federal and State licensing of the McCloud-Pit River Project in the early 1960s. Protection of wild trout was not considered due to the low level of recreational fishing that occurred in the Lower McCloud Watershed.
- Cumulative watershed effects from land-use activities in disturbed drainages are poorly understood. Programs that monitor cumulative impacts need to be developed in order to reduce subjectivity and increase scientific credibility.

Control/Eradication of Non-native Plants

Present Condition:

- Black locust, Himalayan berry, and cut-leaved blackberry have displaced local native vegetation at Ah-Di-Na.
- Black locust has colonized several sites downstream along the river.
- Yellow star-thistle is becoming established along roadsides leading into the watershed and at other disturbed sites.

Recommendations:

- Develop a weed management plan for the watershed.
- The priority area to treat is Ah-Di-Na Campground and vicinity.
- This plan should include an implementation schedule to curtail further invasions of exotic plants in the watershed.
- Investigate opportunities to utilize larger black locust stems for furniture or woodworking stock.

Rationale/Objective:

- Black locust, Himalayan and cut-leaved blackberry, yellow star-thistle, and other exotic pest plants have the potential to eventually displace large areas of native riparian vegetation.
- Black locust appears to have value to local woodworkers and could be offered as a special forest product. Because of its small size, locust stems could be removed from the site with minimal disturbance. Utilization of such material is preferable to disposal.

Land Allocation Adjustment

Present Condition:

- Boundaries of the Unroaded Non-Motorized Recreation area (Prescription I) do not follow viewshed boundaries along the McCloud River south of Hat Mountain and in the Nawtawaket Creek drainage. Management activities on adjacent Matrix land could affect the semi-primitive and natural-appearing character of the area.
- Adjacent landowners have expressed concern that expansion of The Unroaded Non-Motorized Recreation area has the potential to restrict access to their lands in the future.

Recommendations:

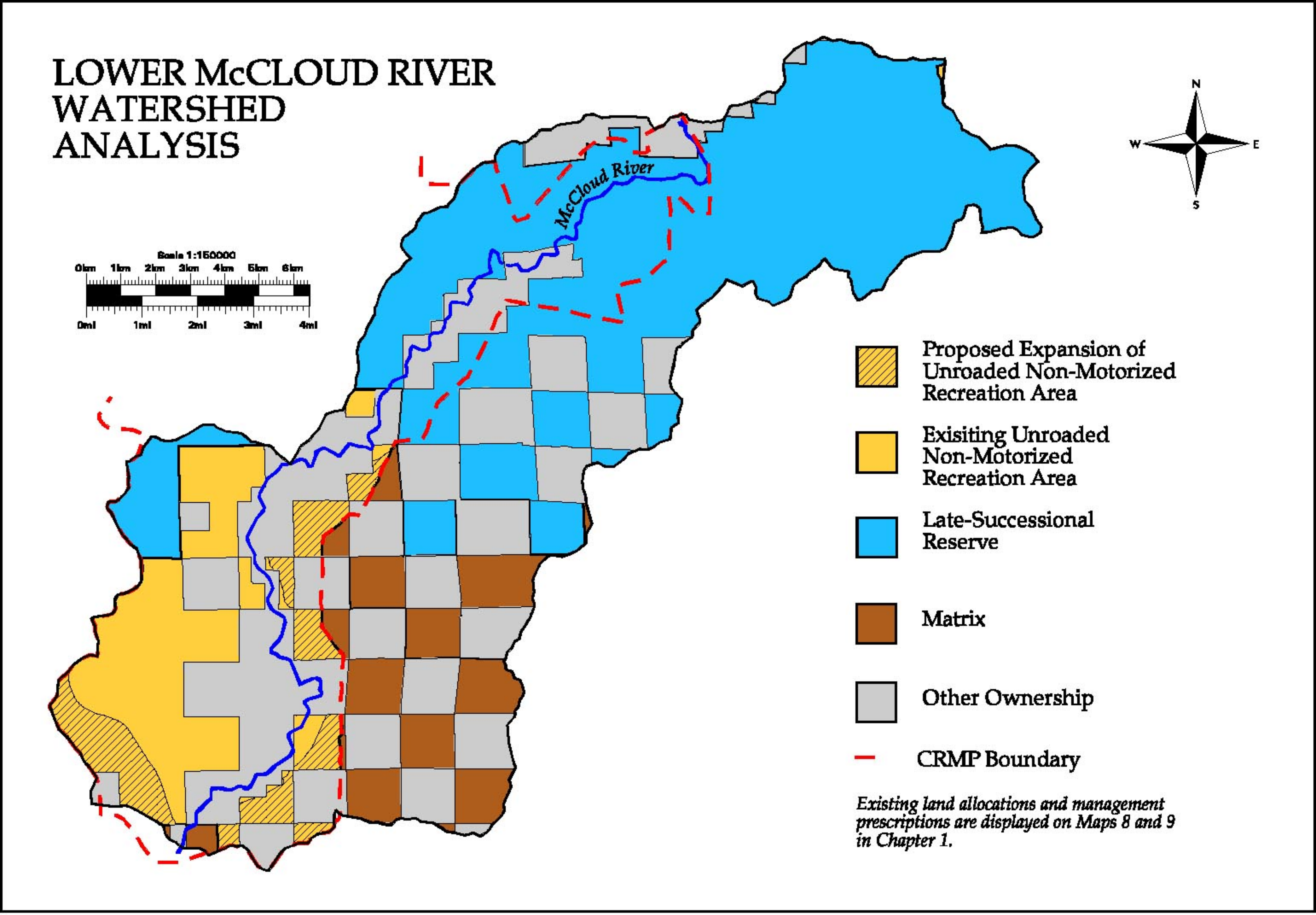
- Adjust land allocation boundaries in two locations as follows (see Map. 21):
- South of Hat Mountain

  Move the Prescription I boundary east from along the McCloud River to the top of the ridge running south from Hat Mountain.
- Nawtawaket Creek drainage

  Move the Prescription I boundary southwest from the bottom of Natawaket Creek drainage to the top of the ridgetop.
- Include all adjacent landowners in public scoping for proposals involving adjustments in National Forest land allocations.

Rationale/Objective:

- The above recommendations will ensure a semi-primitive and natural appearing character within the viewshed of the Unroaded Non-Motorized Recreation area. Current land allocation permits timber harvest, road building, and other high impact activities within this viewshed.
- This recommendation will not have a significant impact on timber outputs because:
  - timber resources in these areas are sparse and scattered.
  - site productivity is low in these areas.
  - slopes are steep.
  - much of this area is on unstable or potentially unstable slopes.
  - access is difficult.
- Land allocation adjustments that discourage or restrict future road building have the potential to impact adjacent landowners by restricting access to their land. Adjacent landowners need to be involved at the NEPA level.



Map 21. Proposed Adjustment To Land Allocation

Survey, Inventory, Monitor

Present Condition:
There is a large component of suitable habitat for late-successional associated wildlife, vascular plants, fungi, bryophytes, and lichens which has not been surveyed to date.

Recommendations:
- Confirm peregrine falcon eyrie locations.
- Shasta salamander - survey and inventory in general
- Aquatic wildlife -more intensive survey and inventory
- Determine traditional use pattern of deer and elk.
- Monitor snags and dead/down wood levels.
- Identify and assess populations of late-successional associated species of vascular plants, fungi, bryophytes, and lichens.
- Determine the extent and viability of the following sensitive plants that are known to occur in the watershed:
    - Shasta snow-wreath
    - Shasta euatory
    - rough raillardella
    - Howell's cliffmaids
    - veiny arnica
- Determine the presence, extent and viability of the following sensitive plants that potentially occur in the watershed:
    - Eastwood's fritillary
    - English peak greenbriar
    - northern clarkia

Rationale/Objective:
The above recommendations are intended to meet required survey and inventory needs for future projects and to fill in information gaps prior to future management decisions. There has been little survey and inventory information collected in the past in those parts of the watershed that have had little active management.

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Appendix A

Possible Management Practices

Lower McCloud River Watershed Analysis
Possible Management Practices

	WA Recommendation	Possible Management Practices	Required Documentation	Linkages	Scheduling
1.	Fuel Management - Phase 1 (pre-suppression features)	Construct helispots, water sources, fire access roads.	EA; LSRA	Would precede #2a; Possible inclusion with #2b and #5.	
2.	Fuel Management - Phases 2,3,4 (fuel treatment)				
	a. Prescribed burning	Prescribed burning	EA; LSRA	Follows #1.	After completion of Phase 1.
	b. Stand thinning	Timber sale	EA; LSRA	Possible link to #2c, #4, #5.	
	c. Mechanical fuel treatment	Machine piling	EA; LSRA	Possible link to #2b and #5. thru BD.	
3.	Relocate public land along river.	Small land exchange	EA/CE; exempt (LSRA)		
4.	Reduce road density	Road closure/obliteration	EA/CE; exempt (LSRA)	Possible link to #2b and #5. thru KV.	
5.	Timber harvest in Matrix	Timber sale	EA		
6.	Provide additional campgrounds	Campground construction.	EA/CE; exempt (LSRA)	Similar actions - #7	
7.	Develop additional trails	Trail construction.	EA/CE	Similar actions - #6	
8.	River research		CE; exempt (LSRA)	Similar actions - #11	Need adequate time to collect and analyze data prior to FERC relicensing.
9.	Control/eradicate non-native plants	Manual/chemical removal.	EA/CE; LSRA		
10.	Expand Prescription I	Land allocation adjustment	EA		
11.	Survey, Inventory, Monitor		CE; exempt (LSRA)	Similar action - #8	

EA - Environmental Assessment required
CE - Categorical Exclusion is probably adequate
EA/CE - Scope of the project will determine which documentation is appropriate.
LSRA - LSR Assessment required with REO review
exempt (LSRA) - LSR Assessment required but exempt from REO review

Proposed Projects

Project: Presuppression Features

Main Activities:

Development of pre-suppression features (WA pg. 6-2) that will be needed prior to implementation of a long-range prescribed burning program. Such features include:

- helispot construction
- development of water sources
- constuction of low standard access roads

Related Activities:

- timber sales - some activities (such as water source development) could occur as part of timber sales or other projects.
- road reconstruction (surfacing) on roads used for timber sale activities.
- road closures and obliteration that fall within project boundary.
- stream improvement activities that fall within project boundary.

Required Documentation: EA; BE; LSR Assessment (REO review required).

Scheduling: Prior to prescribed burning.

Funding: Possible funding through timber sale KV or BD funds.

LMP Consistency:

All activities in this project would be consistent with LMP direction. Road construction within the Unroaded Non-Motorized Recreation Area is not permitted for Forest Service generated activities (LMP 4-45).

WA Priorities:

Activities included in this project would need to be implemented prior to prescribed burning in any particular part of the watershed. Areas that provide protection for large amounts of old growth and late-successional habitat and areas of high fire hazard and risk have been identified as having the highest priority for treatment (WA page 6-3). Pre-suppression features related to areas identified as high priority for fuel treatment would likewise be regarded as having a high priority.

Proposed Projects (cont.)

Project: Prescribed Burning

Main Activities:

This activity would consist of a long-range prescribed burning program in the watershed.

Related Activities:

This project is similar to prescribed burning projects recommended in adjacent watersheds. Opportunities exist to combine or coordinate projects in adjacent watersheds to create more effective and economical projects.

Pre-suppression features discussed on the previous page would need to be in place prior to the implementation of prescribed burning.

Required Documentation: EA; BE; LSR Assessment.

Scheduling: After necessary pre-suppression features are in place.

Funding:

Appropriated - although some burning could be funded through KV or BD funds generated through timber sales.

LMP Consistency: All activities in this project would be consistent with LMP direction.

WA Priorities:

Areas that provide protection for large amounts of old growth and late-successional habitat and areas of high fire hazard and risk have been identified as having the highest priority for treatment (WA page 6-3).

Proposed Projects (cont.)

Project: Timber Sale

Main Activities:

This activity would consist of a timber sale (or several timber sales) that would implement the following recommendations:

- stand thinning as part of Phases 2-4 of fuel management (WA pg. 6-3).
- timber harvest on matrix land (WA pg. 6-10).

Related Activities:

Timber sales can provide a source of funding (KV, BD, purchaser credit) for other management activities. Such activities include:

- pre-suppression features such as helispots, water sources.
- roads.
- prescribed burning.
- mechanical fuel treatments.
- recreation developments.

Required Documentation: EA; BE; LSR Assessment (for thinning within the LSR).

Scheduling:

Funding:

Thinning, slash treatments, and road maintenance would be covered by the timber sale. Recreation KV funds could fund some recreation developments. Road closures and obliteration and any stream improvement projects that occur within or adjacent to a timber sale could be covered by KV funding.

LMP Consistency:

Recommendations in the Watershed Analysis include the possibility of mechanical treatments and helicopter removal within the Unroaded Non-Motorized Recreation Area. Such activities appear to be permissible in the LMP but wording and intent is unclear. Such activities should be evaluated in an environmental assessment at the project design stage.

WA Priorities:

Proposed Projects (cont.)

Project: Fuel Treatment

Main Activities: Machine piling - mostly on gentle slopes and where there is existing road access. Helicopter removal is a possibility to be evaluated in an EA.

Related Activities: Timber sale

Required Documentation: EA/CE; BE; LSR Assessment (for treatments within the LSR).

Scheduling:

Funding: Timber sale BD funds

LMP Consistency:

WA Priorities:

Proposed Projects (cont.)

Project: Land Exchange

Main Activities:

This would involve a small land exchange between the USFS and landowners along the McCloud River for the purpose of providing landing areas along the river for whitewater boaters in better locations than are currently available. Whitewater boaters would benefit by having landing points on better terrain and having landing points distributed more evenly. Land owners would benefit by having areas of public use moved further away from their facilities.

Related Activities: none identified

Required Documentation: EA; BE. The best opportunities for such a proposal are outside the LSR; therefore, an LSR Assessment is not anticipated.

Scheduling:

Funding: unknown

LMP Consistency: This activity would be consistent with the LMP.

WA Priorities:

Proposed Projects (cont.)

Project: Road Closure/Obliteration

Main Activities:
This activity would consist of road closures and obliteration as described on WA pg. 6-7.

Related Activities:
Some roads could be closed or obliterated through timber sale activities. Timber sales would also provide a source of funding.

Scheduling:

Funding: Appropriated; although some funding could come from KV money generated by timber sales.

LMP Consistency: This activity would be consistent with the LMP.

WA Priorities:

Proposed Projects (cont.)

Project: Campground Development

Main Activities: Development of an additional campground along Hawkins Creek , and possible other locations.

Related Activities:

Required Documentation: EA; BE; LSR Assessment but exempt from REO review.

Scheduling:

Funding: Appropriated; although some funding could come from recreation KV money generated by timber sales.

LMP Consistency:
New development proposals in LSRs that address public needs or provide significant public benefits, such as recreation sites, are approved on a case-by-case basis and may be approved when adverse effects can be minimized and mitigated (LMP 4-39).

WA Priorities:

Proposed Projects (cont.)

Project: Trail Development

Main Activities:

Development of additional hiking trails, mostly within the Unroaded Non-Motorized Recreation area.

Related Activities:

Required Documentation: EA; BE; LSR Assessment but exempt from REO review.

Scheduling:

Funding: unknown

LMP Consistency:

Trail construction is an emphasized management practice in the Unroaded Non-Motorized Recreation area (LMP 4-45).

WA Priorities:

Proposed Projects (cont.)

Project: Control/Eradicate Non-Native Plants

Main Activities:

Development and implementation of a weed management plan. This plan would be most effective as a cooperative project with adjacent landowners.

Related Activities: none

Required Documentation: EA; BE; LSR Assessment but exempt from REO review.

Scheduling:

Funding: **A**pproriated funds; grants; Cantara funds.

Black locust could possibly removed as a commercial product (firewood, furniture stock, etc.) which could eliminate or reduce costs.

LMP Consistency:

Direction for Late-Succesional Reserves in the LMP states:

> "Evaluate impacts of non-native species currently existing within reserves, and develop plans and recommendations for eliminating or controlling non-native species that are inconsistent with LSR objectives" (LMP 4-41).

WA Priorities: Ah-Di-Na has been identified as the priority area to treat.

Proposed Projects (cont.)

Project: Land Allocation Adjustment

Main Activities:

This activity would involve an amendment to the LMP. Boundaries to the Unroaded Non-Motorized Recreation area (Prescription I) would be adjusted in two locations as described on WA pg. 6-14.

This activity would only involve documentaion and issuance of a decision and would not involve any on-the-ground activity at this time.

Related Activities: none

Required Documentation: EA; BE

Scheduling:

Funding: unknown

LMP Consistency: This project would be recommending an amendment to the LMP

WA Priorities:

Proposed Projects (cont.)

Project: River Reasearch

Main Activities: Collect and analyze data in preparation for FERC relicensing.

Related Activities: Survey, inventory, and monitoring projects (see next page).

Required Documentation: CE

Scheduling: must be implemented soon to provide adequate time to collect and evaluate data prior to FERC relicensing.

Funding: appropriated money; grants; partnerships

LMP Consistency: All activities in this project would be consistent with LMP direction.

WA Priorities:

Proposed Projects (cont.)

Project: Survey, Inventory, Monitor

Main Activities:

Survey, inventory, and monioring with an emphasis on TES and S&M species and on those parts of the watershed that have not been surveyed in the past.

Related Activities: River research for FERC relicensing (see previous page).

Required Documentation: CE

Scheduling: prior to ground disturbing activities.

Funding: appropriated money; grants; partnerships

LMP Consistency: All activities in this project would be consistent with LMP direction.

WA Priorities:

Appendix B

Management Direction

Management direction for the Lower McCloud River Watershed is provided by the Shasta-Trinity National Forests Land and Resource Management Plan (LMP) which incorporates direction from the Record of Decision (ROD) for Amendments to Forest Service and Bureau of Land Management Planning Documents Within the Range of the Northern Spotted Owl.

Land Allocation

The ROD identifies four land allocations within the Lower McCloud River Watershed (see Map 8 in the Watershed Analysis):

- Late-Successional Reserve (LSR)

  Late-Successional Reserves are identified with an objective to protect and enhance conditions of late-successional and old-growth forest ecosystems, which serve as habitat for late-successional and old-growth forest related species including the northern spotted owl. Limited stand management is permitted, subject to review by the Regional Ecosystem Office (ROD A-4).
- Riparian Reserve (RR)

  Riparian Reserves provide an area along streams, wetlands, ponds, lakes, and unstable and potentially unstable areas where riparian-dependent resources receive primary emphasis. Riparian Reserves are important to the terrestrial ecosystem as well, serving, for example, as dispersal habitat for certain terrestrial species (ROD A-5).
- Administratively Withdrawn Areas

  Administratively Withdrawn Areas are identified in current Forest and District Plans or draft plan preferred alternatives and include recreation and visual areas, back country, and other areas where management emphasis precludes scheduled timber harvest (ROD A-4).
- Matrix

  The matrix consists of those federal lands outside the three categories of designated areas listed above (ROD A-5).

Management Prescriptions

Management Prescriptions apply a management theme to specific types of land. Within the general framework of the Forest Standards and Guidelines, they identify specific activities that are to be emphasized or permitted on that land and their associated standards and guidelines.

The LMP identifies eight Management Prescriptions in the Lower McCloud River Watershed area (see Map 9 in the Watershed Analysis):

- I Unroaded Non-Motorized Recreation
    - The purpose of this prescription is to provide for semi-primitive non-motorized recreation opportunities in unroaded areas outside existing Wildernesses while maintaining predominantly natural-appearing areas with only subtle modifications (LMP 4-45).
    - This prescription emphasizes special recreational and visual values, fisheries, and riparian resources (LMP 4-45).
    - This prescription applies to the Administratively Withdrawn Areas land allocation.
- III Roaded Recreation
    - The purpose of this prescription is to provide for an area where there are moderate evidences of the sights and sounds of humans (LMP 4-64).
    - This prescription emphasizes recreational opportunities associated with developed road systems and dispersed and developed campsites (LMP 4-64).
    - This prescription applies to the Matrix land allocation.
- VI Wildlife Habitat Management
    - The primary purpose of this prescription is to maintain and enhance big game, small game, upland bird game and non-game habitat (LMP 4-66).
    - While this prescription does not emphasize those wildlife species dependent on late seral stages, habitat favorable to these species will occur within this prescription (LMP 4-66).
    - This prescription applies to the Matrix land allocation.
- VII LSRs and Threatened, Endangered, and Selected Sensitive Species
    - The purpose of this prescription is to provide special management for LSRs and Threatened and Endangered species (LMP 4-43).
    - This prescription emphasizes retention and enhancement of sensitive plant species, old-growth vegetation, and hardwoods (LMP 4-43).
    - This prescription applies to the Late-Successional Reserve land allocation.
- VIII Commercial Wood Products Emphasis
    - The purpose of this prescription is to obtain optimum timber yield of wood fiber products from productive forest lands within the context of ecosystem management (LMP 4-67).
    - Timber stands will be managed to obtain optimum growth and yields using cultural practices which control competing vegetation, obtain stocking control, and minimize mortality (LMP 4-67).
    - This prescription applies to the Matrix land allocation.
- IX Riparian Management
    - The purpose of this prescription is to maintain or enhance riparian areas, wildlife and fisheries habitat, and water quality by emphasizing streamside and wetland management (LMP 4-59).
    - Multiple resource uses and activities will occur in support of, and to the extent that they do not adversely affect the maintenance of riparian area dependent resources (e.g., fish, wildlife, water quality) (LMP 4-59).
    - This prescription applies to the Riparian Reserve land allocation and is unmapped in the LMP.

- X Special Area Management
    - This prescription provides for protection and management of special interest areas and research natural areas (LMP 4-49).
    - Grizzly Peak is designated as a botanical Special Interest Area (LMP 4-125).
    - This prescription applies to the Administratively Withdrawn Areas land allocation.
- XI Heritage Resource Management
    - The primary theme of this prescription is to protect designated cultural resource values, interpret significant archaeological and historical values for the public, and encourage scientific research of these selected properties (LMP 4-50).
    - This area is unmapped and applies to all land allocations.

Management Areas

Supplemental management direction for specific units of land is provided in the LMP under Management Area Direction (LMP - Chapter 4 - Section G). A management area is a contiguous unit of land with separate, distinct management direction in response to localized issues and resource opportunities.

The LMP identifies three Management Areas in the Lower McCloud River Watershed area (see Map 9 in the Watershed Analysis). Supplemental management direction that applies to the Lower McCloud River Watershed is summarized as follows:

- National Recreation Area (NRA) - Shasta Unit (#8) (LMP-4-115)
    - Search for additional populations of Shasta snow-wreath. Avoid disturbance pending completion of a conservation strategy.
    - Construct no additional permanent roads on the Shasta Unit for timber harvest. Existing roads may be relocated to improve esthetics.
    - Administer the NRA according to specific direction provided in the Management Plan for the Shasta Unit.
    - Treat slash from timber harvest activities to meet adopted VQOs or fire hazard reduction objectives, whichever are the most restrictive standards. Natural fuel manipulation for fire hazard reduction will be done to maximize protection of forest investments and interface areas.
    - Plan no regulated timber harvest in the Shasta Unit. Unregulated harvest will occur to maintain a healthy, diverse, esthetic, residual stand.
    - Maintain or improve habitat for wildlife, including self-sustaining populations of ospreys, bald eagles, and Shasta salamanders. Improve habitat for harvest wildlife species.
- McCloud River (#10) (LMP-4-123)
    - Conduct a thematic study of the archaeological sites representing the Native American uses of the McCloud River. Emphasize sites that are being disturbed by dispersed recreation activities such as Ash Camp and Ah-Di-Na.
    - Interpret archaeological sites along the McCloud River in areas where visitors are already being directed.
    - Emphasize fuel management strategies that will reduce risk and hazard from wildfires adjacent to the California-Oregon Transmission Project (COPT) powerline corridor.

- To enhance forest health, develop a natural fire program to reinstate fire into the ecosystem.
- Cooperate with the DFG in developing a Wild Trout Management Plan for the Lower McCloud River.
- Where the opportunity arises, acquire public access along the McCloud River and Squaw Valley Creek.
- Continue to develop trail access to and along Squaw Valley Creek and the McCloud River.
- Emphasize the dispersed recreational use of the Tom Dow, Tom Neal, and the Pacific Crest Trail Systems.
- Complete trailheads at Squaw Valley Creek and Ash Camp.
- Evaluate whitewater boating opportunities.
- In cooperation with private landowners, PG&E, and the DFG manage the Upper and Lower McCloud River and Squaw Valley Creek under a Coordinated Resource Management Plan (CRMP) to protect the unique and outstandingly remarkable features of the river environment.
- Maintain or improve selected habitats for black bear, spotted owls, deer, elk, and turkey.

- Nosoni (#12) (LMP-4-131)
  - Cooperate with the DFG in developing a Wild Trout Management Plan for the Lower McCloud River.
  - Continue to work with the Nature Conservancy, the DFG, and the McCloud River Club to manage the recreation fishery in the McCloud River.
  - Reduce naturally occurring fuels to protect forest investments and interface areas from losses due to wildfire.
  - Provide low development and dispersed recreation facilities and emphasize hunting, fishing, and hiking opportunities.
  - Develop and implement a program to manage and use hardwoods for energy, fiber, and wildlife habitat.
  - Observe the following special management direction in the McCloud River corridor:

    Timber access:

    a. Minimize new road construction and attempt to locate new roads away from streamcourses.
    b. Minimize stream crossings.
    c. Design logging systems for maximum resource protection.
  - In cooperation with private landowners, PG&E, and the DFG manage the Upper and Lower McCloud River and Squaw Valley Creek under a Coordinated Resource Management Plan (CRMP) to protect the unique and outstandingly remarkable features of the river environment.
  - Maintain or improve selected habitats for deer, elk, turkey, bear, bald eagle, northern spotted owls, and Shasta salamander.
  - Continue to work with interest groups such as the Rocky Mountain Elk Foundation, Wild Turkey Federation, and Quail Unlimited to improve wildlife habitat.
  - During project level planning identify cultural and historical values. Manage significant sites under Management Prescription XI.

The above Supplemental Management Direction consists only of those excerpts from the LMP that apply to the Lower McCloud River Watershed . Refer to the LMP (Chapter 4 - Section G) for a complete list of supplemental management direction.

Coordinated Resource Management Plan

The McCloud River System has been determined eligible for possible inclusion in the National Wild and Scenic Rivers system. In lieu of recommending Wild and Scenic River designation, the Forest Service has taken the lead in working with adjacent private landowners and public agencies to develop a Coordinated Resource Management Plan (CRMP) for the corridor (LMP 2-6).

In July 1991, the McCloud River Coordinated Resource Management Plan (CRMP) was signed by principal landowners in the McCloud River Drainage and public agencies that administer programs in that area. The CRMP is intended to be an acceptable option to Wild and Scenic designation for the McCloud River.

Coordinated planning is a process designed to achieve compatibility between the uses being made of natural resources in a specified area. A CRMP sets forth the framework for activity planning within the CRMP boundary. This approach uses the best efforts and knowledge of everyone involved; private landowners and involved Federal, State, and local agencies.

Authority for State and Federal agencies to participate in coordinated planning is contained in existing statutes or delegations of authority. The Forest LMP contains Supplemental Management Direction to manage the Lower McCloud River under this CRMP (LMP 4-123).

The intent of the CRMP is to coordinate large-scale resource planning. The following excerpt from the CRMP describes its objectives:

> *The primary objective of the CRMP is to preserve the pristine quality of the river resources described within.*
>
> *The CRMP area includes significant recreation and visual resource values. Objectives for management are:*
>
>> *(a) maintenance of a predominately natural appearing area;*
>>
>> *(b) provision for public use consistent with wildlife and watershed protection and the rights of private landowners.*
>
> *The CRMP area includes significant vegetation resources. The objective for management is:*
>
>> *(a) vegetation use consistent with watershed, viewshed and fisheries values protection.*
>
> *Portions of the McCloud River have been designated by the Department of Fish and Game as wild trout waters under the California Wild Trout*

Program. The general fisheries management objectives of the Wild Trout Program are:

> *A. Maintenance of wild trout populations at levels necessary to provide satisfactory recreational angling opportunities.*
>
> *B. Maintenance and enhancement, where appropriate, of the habitat required for optimum wild trout production.*
>
> *C. Preservation of the natural character of the streamside environment.*

These objectives are appropriate for land management practices adopted pursuant to this management plan since they relate to the central issues of the McCloud watershed, including recreation management, timber management, wildlife management, watershed protection, and fisheries management.

If, for any reason, the terms of the CRMP are not followed and the Wild and Scenic River eligibility is threatened, the Forest Service will recommend the river for Federal Wild and Scenic designation (LMP 3-23).

Appendix C

Species List

List of Wildlife Species Possibly Occurring in the Lower McCloud River Watershed. Species Listed by Guild Association

HABITAT TYPES

MCN: Mixed Conifer
DFR: Douglas-fir
PPN: Ponderosa Pine
WFR: White Fir
VFH: Valley Foothill Hardwood
MCH: Mixed Chaparral
VRI: Valley Foothill Riparian
RIV: Riverine

GUILD(S)

AQFA: Fast water required, usually indicating streams or river
AQSL: Areas of slow water required, be they lacustrine or riverine habitat
AQUAT: Can use either the fast or slow water components
C/C: Cliff and caves
CHAP: Chaparral communities
DEAD/D: Dead and down material (logs, stumps, slash, litter, duff)
FOREST: Can use any forested habitat
HDWD: Hardwoods
LATE: Late seral stages (4a, 4b, 4c) and multi-layered
OPEN: Meadows, open areas, seral stages 1, 2, and 3a
OPEN-GRASS: Seral stage 1; mutually exclusive from OPEN-SHRUB
OPEN-SHRUB: All forested habitat types: openings, seral stages 2 and 3a
RIPAR: Associated with riparian vegetation
SNAGCAV: Tree cavity dependent species found in snags or live trees
T/R: Talus and rocks

WHRI Wildlife Habitat Relationship ID code

STATUS

S&M Survey and Management species listed in Appendix R of the Shasta-Trinity LMP, 1995
CSC CDF 'Species of Special Concern' (Special 8/94)
C2 Catagory 2 Candidate for listing by USFWS (Special 8/94)
CaE California State-listed Endangered (TES&P 1/95)
CaT California State-listed Threatened (TES&P 1/95)
FS Forest Service Sensitive (TES&P Animals of the Pacific Southwest Region 1/95)
FT Federally Listed Threatened (Endangered and Threatened Animals of Calif. 1/95)
FE Federally Listed Endangered (Endangered and Threatened Animals of Calif. 1/95)
FSC Federal Species of Concern

NT Neotropical Migratory Birds

Wildlife Species Possibly Occurring in the Lower McCloud River Watershed
and Associated with Habitat Types MCN, DFR, PPN, WFR, VFH, MCH, VRI, and RIV.
Species Listed by Guild Association.
Sparse to Dense Canopy (10-100%) and Seedling to Large Trees (5" to 40" DBH)

GUILD(S)	WHRI	COMMON NAME	STATUS	NT
AQFA	A004	PACIFIC GIANT SALAMANDER		
	A026	TAILED FROG	CSC, FSC	
	A043	FOOTHILL YELLOW-LEGGED FROG	C2,CSC, FSC	
	B373	AMERICAN DIPPER		
AQSL	A006	ROUGH-SKINNED NEWT		
	A032	WESTERN TOAD		
	A039	PACIFIC TREEFROG		
	A040	RED-LEGGED FROG	CSC, FT, FSC	
	A046	BULLFROG		
	B006	PIED-BILLED GREBE		
	B010	WESTERN GREBE / CLARK'S GREBE		
	B044	DOUBLE-BREASTED CORMORANT	CSC	
	B051	GREAT BLUE HERON		
	B052	GREAT EGRET		
	B076	WOOD DUCK		
	B077	GREEN-WINGED TEAL		
	B079	MALLARD		
	B080	NORTHERN PINTAIL		
	B094	LESSER SCAUP		
	B149	AMERICAN COOT		
	R004	NORTHWESTERN POND TURTLE	C2, CSC, FS	
AQUAT	B104	HOODED MERGANSER		
	B105	COMMON MERGANSER		
	B110	OSPREY	CSC	✓
	B113	BALD EAGLE	FT, CaE	
	B170	SPOTTED SANDPIPER		
	B293	BELTED KINGFISHER		✓
	B343	CLIFF SWALLOW		✓
	M112	BEAVER		
	M163	RIVER OTTER		
C/C	B108	TURKEY VULTURE		✓
	B126	GOLDEN EAGLE	CSC	✓
	B129	PEREGRINE FALCON	FE, CaE	✓
	B265	GREAT HORNED OWL		
	B279	BLACK SWIFT	CSC	✓
	B341	NORTHERN ROUGH-WINGED SWALLOW		✓
	B343	CLIFF SWALLOW		✓
	B344	BARN SWALLOW		✓
	M021	LITTLE BROWN MYOTIS		
	M023	YUMA MYOTIS	FSC	
	M025	LONG-EARED MYOTIS	S&M, FSC	
	M026	FRINGED MYOTIS	S&M, FSC	
	M027	LONG-LEGGED MYOTIS	S&M, FSC	
	M028	CALIFORNIA MYOTIS	C2, CSC	
	M032	BIG BROWN BAT		
	M037	TOWNSEND'S BIG-EARED BAT	C2, CSC	
	M038	PALLID BAT	CSC, S&M	
CHAP	B391	WRENTIT		
	B404	WATER PIPIT		✓
	B482	GREEN-TAILED TOWHEE		✓
	M038	PALLID BAT	CSC, S&M	
	M059	SONOMA CHIPMUNK		
	M119	BRUSH MOUSE		

GUILD(S)	WHRI	COMMON NAME	STATUS	NT
	M149	GRAY FOX		
	M181	MULE DEER		
	R023	SAGEBRUSH LIZARD		
	R053	CALIFORNIA WHIPSNAKE		
DEAD/D	A004	PACIFIC GIANT SALAMANDER		
	A012	ENSATINA		
	A014	CALIFORNIA SLENDER SALAMANDER		
	A021	CLOUDED SALAMANDER		
	M117	DEER MOUSE		
	M120	PINYON MOUSE		
	M151	BLACK BEAR		
	M155	PACIFIC FISHER	C2, CSC, FS	
	M157	LONG-TAILED WEASEL		
	R048	RINGNECK SNAKE		
	R049	SHARP-TAILED SNAKE		
	R058	COMMON KINGSNAKE		
	R059	CALIFORNIA MOUNTAIN KINGSNAKE		
FOREST	B127	AMERICAN KESTREL		✓
	B264	WESTERN SCREECH OWL		
	B267	NORTHERN PYGMY OWL		
	B279	BLACK SWIFT	CSC	✓
	B294	LEWIS' WOODPECKER		✓
	B300	WILLIAMSON'S SAPSUCKER		✓
	B307	NORTHERN FLICKER		✓
	M037	TOWNSEND'S BIG-EARED BAT		
HDWD	B052	GREAT EGRET		
	B116	COOPER'S HAWK	CSC	✓
	B251	BAND-TAILED PIGEON		✓
	B296	ACORN WOODPECKER		
	B303	DOWNY WOODPECKER		
	B326	ASH-THROATED WOODPECKER		✓
	B362	WHITE-BREASTED NUTHATCH		
	B417	HUTTON'S VIREO		
	B418	WARBLING VIREO		✓
	B547	HOUSE SPARROW		
	M077	WESTERN GRAY SQUIRREL		
	M176	WILD PIG		
LATE	B051	GREAT BLUE HERON		
	B117	NORTHERN GOSHAWK	CSC, FS, FSC	✓
	B134	BLUE GROUSE		
	B263	FLAMMULATED OWL		✓
	B270	NORTHERN SPOTTED OWL	FT	
	B304	HAIRY WOODPECKER		
	B305	WHITE-HEADED WOODPECKER		
	B308	PILEATED WOODPECKER		
	B309	OLIVE-SIDED FLYCATCHER		✓
	B317	HAMMONDS' FLYCATCHER		✓
	B346	STELLER'S JAY		
	B356	MOUNTAIN CHICKADEE		
	B357	CHESTNUT-BACKED CHICKADEE		
	B361	RED-BREASTED NUTHATCH		
	B363	PYGMY NUTHATCH		
	B364	BROWN CREEPER		✓
	B375	GOLDEN-CROWNED KINGLET		✓
	B390	VARIED THRUSH		✓
	B415	SOLITARY VIREO		✓
	B438	HERMIT WARBLER		✓
	B539	RED CROSSBILL		

GUILD(S)	WHRI	COMMON NAME	STATUS	NT
	B546	EVENING GROSBEAK		
	M012	TROWBRIDGE'S SHREW		
	M030	SILVER-HAIRED BAT	S&M	
	M034	HOARY BAT		
	M079	DOUGLAS' SQUIRREL		
	M080	NORTHERN FLYING SQUIRREL		
	M129	WESTERN RED-BACKED VOLE		
	M151	BLACK BEAR		
	M154	AMERICAN MARTEN	CSC, FS	
	M155	PACIFIC FISHER	C2, CSC, FS	
	M159	WOLVERINE	C2, CaT	
	M177	ELK		
OPEN	B108	TURKEY VULTURE		✓
	B126	GOLDEN EAGLE	CSC	✓
	B140	CALIFORNIA QUAIL	CSC	
	B141	MOUNTAIN QUAIL	C2	
	B264	WESTERN SCREECH OWL		
	B265	GREAT HORNED OWL		
	B267	NORTHERN PYGMY OWL		
	B276	COMMON NIGHTHAWK		✓
	B277	COMMON POORWILL		✓
	B279	BLACK SWIFT	CSC	✓
	B281	VAUX'S SWIFT	CSC	✓
	B307	NORTHERN FLICKER		✓
	B354	COMMON RAVEN		
	B366	ROCK WREN		✓
	B380	WESTERN BLUEBIRD		✓
	B381	MOUNTAIN BLUEBIRD		✓
	B489	CHIPPING SPARROW		✓
	B505	SONG SPARROW		✓
	B509	GOLDEN-CROWNED SPARROW		
	B512	DARK-EYED JUNCO		✓
	B524	BREWER'S BLACKBIRD		✓
	B538	HOUSE FINCH		
	B542	PINE SISKIN		✓
	B543	LESSER GOLDFINCH		✓
	M021	LITTLE BROWN MYOTIS		
	M025	LONG-EARED MYOTIS	S&M, FSC	
	M026	FRINGED MYOTIS	S&M, FSC	
	M028	CALIFORNIA MYOTIS	C2, CSC	
	M032	BIG BROWN BAT		
	M037	TOWNSEND'S BIG-EARED BAT		
	M049	SNOWSHOE HARE	CSC	
	M051	BLACK-TAILED HARE		
	M105	CALIFORNIA KANGAROO RAT		
	M142	HOUSE MOUSE		
	M145	PORCUPINE		
	M146	COYOTE		
	M151	BLACK BEAR		
	M156	ERMINE		
	M162	STRIPED SKUNK		
	M165	MOUNTAIN LION		
	M166	BOBCAT		
	M177	ELK		
	M181	MULE DEER		
	R004	NORTHWESTERN POND TURTLE		
	R022	WESTERN FENCE LIZARD		
	R042	NORTHERN ALLIGATOR LIZARD		

GUILD(S)	WHRI	COMMON NAME	STATUS	NT
	R048	RINGNECK SNAKE		
OPEN-GRASS	B123	RED-TAILED HAWK		✓
	B127	AMERICAN KESTREL		✓
	B158	KILLDEER		✓
	B199	COMMON SNIPE		
	B255	MOURNING DOVE		✓
	B262	COMMON BARN OWL		
	B333	WESTERN KINGBIRD		✓
	B341	NORTHERN ROUGH-WINGED SWALLOW		✓
	B344	BARN SWALLOW		✓
	B389	AMERICAN ROBIN		✓
	B404	WATER PIPIT		✓
	B411	EUROPEAN STARLING		
	B521	WESTERN MEADOWLARK		✓
	M018	BROAD-FOOTED MOLE		
	M072	CALIFORNIA GROUND SQUIRREL		
	M084	WESTERN POCKET GOPHER		
	M113	WESTERN HARVEST MOUSE		
	M133	MONTANE VOLE		
	M136	LONG-TAILED VOLE		
	M142	HOUSE MOUSE		
	R036	WESTERN SKINK		
	R051	RACER		
	R057	GOPHER SNAKE		
OPEN-SHRUB	B287	ANNA'S HUMMINGBIRD		✓
	B318	DUSKY FLYCATCHER		✓
	B326	ASH-THROATED FLYCATCHER		✓
	B360	BUSHTIT		
	B368	BEWICK'S WREN		
	B376	RUBY-CROWNED KINGLET		✓
	B377	BLUE-GRAY GNATCATCHER		✓
	B382	TOWNSEND'S SOLITAIRE		✓
	B407	CEDAR WAXWING		✓
	B425	ORANGE-CROWNED WARBLER		✓
	B426	NASHVILLE WARBLER		✓
	B435	YELLOW-RUMPED WARBLER		✓
	B436	BLACK-THROATED GRAY WARBLER		✓
	B471	WESTERN TANAGER		✓
	B477	LAZULI BUNTING		✓
	B483	RUFOUS-SIDED TOWHEE		✓
	B504	FOX SPARROW		✓
	B510	WHITE-CROWNED SPARROW		✓
	B536	PURPLE FINCH		✓
	M057	ALLEN'S CHIPMUNK		
	M075	GOLDEN-MANTLED GROUND SQUIRREL		
	M152	RINGTAIL		
	M161	WESTERN SPOTTED SKUNK		
	R039	WESTERN WHIPTAIL		
	R040	SOUTHERN ALLIGATOR LIZARD		
RIPAR	A026	TAILED FROG	CSC, FSC	
	A039	PACIFIC TREEFROG		
	A040	RED-LEGGED FROG	FT, CSC, FSC	
	A076	WOOD DUCK		
	B105	COMMON MERGANSER		
	B115	SHARP-SHINNED HAWK	CSC	✓
	B128	MERLIN	CSC	✓
	B129	PEREGRINE FALCON	FE, CaE	✓
	B138	TURKEY		

GUILD(S)	WHRI	COMMON NAME	STATUS	NT
	B255	MOURNING DOVE		✓
	B293	BELTED KINGFISHER		✓
	B299	RED-BREASTED SAPSUCKER		✓
	B303	DOWNY WOODPECKER		
	B311	WESTERN WOOD-PEWEE		✓
	B315	WILLOW FLYCATCHER	FS, SE	✓
	B320	WESTERN FLYCATCHER		✓
	B321	BLACK PHOEBE		
	B338	PURPLE MARTIN	CSC	✓
	B339	TREE SWALLOW		✓
	B340	VIOLET-GREEN SWALLOW		✓
	B369	HOUSE WREN		✓
	B370	WINTER WREN		
	B385	SWAINSON'S THRUSH		✓
	B386	HERMIT THRUSH		✓
	B430	YELLOW WARBLER	CSC	✓
	B460	MACGILLIVRAY'S WARBLER		✓
	B461	COMMON YELLOWTHROAT		✓
	B463	WILSON'S WARBLER		✓
	B467	YELLOW-BREASTED CHAT	CSC	✓
	B475	BLACK-HEADED GROSBEAK		✓
	B506	LINCOLN'S SPARROW		✓
	B528	BROWN-HEADED COWBIRD		✓
	B532	NORTHERN ORIOLE		✓
	M001	VIRGINIA OPOSSUM		
	M003	VAGRANT SHREW		
	M052	MOUNTAIN BEAVER		
	M112	BEAVER		
	M153	RACCOON		
	M158	MINK		
	M163	RIVER OTTER		
	R061	COMMON GARTER SNAKE		
	R062	WESTERN TERRESTRIAL GARTER SNAKE		
	R063	WESTERN AQUATIC GARTER SNAKE		
SNAGCAV	B076	WOOD DUCK		
	B105	COMMON MERGANSER		
	B110	OSPREY	CSC	✓
	B113	BALD EAGLE	FT, CaE	
	B127	AMERICAN KESTREL		✓
	B263	FLAMMULATED OWL		✓
	B264	WESTERN SCREECH OWL		
	B265	GREAT HORNED OWL		
	B267	NORTHERN PYGMY OWL		
	B270	NORTHERN SPOTTED OWL	FT	
	B274	NORTHERN SAW-WHET OWL		
	B281	VAUX'S SWIFT	CSC	✓
	B294	LEWIS' WOODPECKER		✓
	B296	ACORN WOODPECKER		
	B299	RED-BREASTED SAPSUCKER		✓
	B300	WILLIAMSON'S SAPSUCKER		✓
	B303	DOWNY WOODPECKER		
	B304	HAIRY WOODPECKER		
	B305	WHITE-HEADED WOODPECKER		
	B307	NORTHERN FLICKER		✓
	B308	PILEATED WOODPECKER		
	B326	ASH-THROATED FLYCATCHER		✓
	B338	PURPLE MARTIN	CSC	✓
	B339	TREE SWALLOW		✓

GUILD(S)	WHRI	COMMON NAME	STATUS	NT
	B340	VIOLET-GREEN SWALLOW		✓
	B356	MOUNTAIN CHICKADEE		
	B357	CHESTNUT-BACKED CHICKADEE		
	B358	PLAIN TITMOUSE		
	B361	RED-BREASTED NUTHATCH		
	B362	WHITE-BREASTED NUTHATCH		
	B363	PYGMY NUTHATCH		
	B364	BROWN CREEPER		✓
	B380	WESTERN BLUEBIRD		✓
	B381	MOUNTAIN BLUEBIRD		✓
	B411	EUROPEAN STARLING		
	M025	LONG-EARED MYOTIS	FSC, S&M	
	M027	LONG-LEGGED MYOTIS		
	M030	SILVER-HAIRED BAT		
	M077	WESTERN GRAY SQUIRREL		
	M079	DOUGLAS' SQUIRREL		
	M080	NORTHERN FLYING SQUIRREL		
	M155	PACIFIC FISHER	C2, CSC, FS	
T/R	B366	ROCK WREN		✓
	B367	CANYON WREN		
	M066	YELLOW-BELLIED MARMOT		
	R071	NIGHT SNAKE		
	R076	WESTERN RATTLESNAKE		

Appendix D

Wildlife Habitat Descriptions

Peregrine Falcon (Federally Endangered)

Peregrines have relatively strict nesting requirements: vertical cliff habitat with large potholes or ledges that are inaccessible to land predators and are preferentially located near habitat that has a high avian prey population. Peregrines are known to forage near and occasionally within forested habitat types; however, it is not considered a crucial habitat for any stage of their life history.

Northern Spotted owl (Federally Threatened)

Suitable nesting habitat is typically conifer or mixed conifer and hardwood forest, a total of 70% or greater crown closure with an overstory of 40% or more crown closure and large diameter tress, and two or more layered stands providing the remaining canopy closure. A multi-layered canopy that simultaneously provides cover while allowing for easy flying passage is preferred. Spotted owls nest in cavities that form in decadent or broken topped trees and snags. Their prey base of small mammals depends on the presence of snags and large down woody material.

Shasta Salamander (FS Sensitive, Survey & Manage Species, Fed Species of Concern, CA Threatened)

Suitable habitat for Shasta salamander is described as limestone caves or outcroppings which provide a cool, moist microclimate during the summer months, occurring below 3000 feet. They are most common where there is a light cover of oak among the limestones, though they do occur where digger pine-chaparral to sheltered canyons of Douglas-fir occur. These forested habitat also provide moist, cool microclimates, where salamanders can be found on the forest floor or under dead/down material. Salamanders are not known to use this type of habitat more than 50' from a limestone outcrop. Preferred habitat is usually found on north and east facing sides of outcrops below the 2000 foot elevation. (Bogener, D. and P. Brouha. 1979. Shasta Salamander (Hydromantes shastae), Shasta-Trinity National Forests: Comprehensive species management plan and a species status report. USFS-Shasta-Trinity National Forests. Unpublished, 35 pp.)

Northern Red-legged Frog (FS Sensitive, Fed Species of Concern)

This frog inhabits cool, deep, still to slow moving water such as lakes, ponds, ditches, or slow streams (Zeiner et al. 1990). Associated dense shrubby or emergent vegetation is required, and well vegetated terrestrial areas within the riparian corridor may provide important sheltering habitat during the winter (Davidson, 1994).

Northern Goshawk (FS Sensitive, Fed & CA Species of concern)

Suitable habitat for goshawks is described as late seral, dense coniferous, riparian or upland forests near early seral openings. Prey are medium to large birds or small mammals. According to the LMP, 'preferred' nest stand structure is 4b, 4c, and 5 conifer habitats with 60% of the nest stand containing a habitat mosaic with >60% canopy closure, 20% brush or small trees, and two or more 1/10 acre openings. The remaining 40% is dense mature forest with no openings and greater than 60% canopy closure. Forage stands also contain a 60% habitat mosaic with the remaining 40% having younger stands and openings.

Willow Flycatcher (FS Sensitive)

The willow flycatcher tend to nest in large clumps of willows separated by openings (Zeiner et al., 1990). Willow flycatchers have been detected in more linear willow habitat (some alder) along the main stem of the Trinity River; however, no nest sites were located (Wilson et al., 1992).

Pacific Fisher (FS Sensitive, Fed & Ca Species of Concern)

Suitable habitat for fishers consists of large areas of mature dense forest stands below 6000', with snags and canopy closure greater than fifty percent . Fishers use cavities in large trees, snags, logs (>30" DBH), rock areas and brush piles for cover and den sites. This species is largely carnivorous taking small mammals and birds. Riparian habitats are used as travel corridors and key habitat. Preferred road densities are <1 mi./mi.^{2}, with 1-2 mi./mi.^{2} acceptable for maintaining moderate habitat (LMP Appendix G).

American Marten (FS Sensitive, CA Species of Special Concern)

Suitable habitat consists of various mixed conifer forests types under 4000' elevation, with more than forty percent crown closure with large trees and snags. Martens use tree cavities, snags, stumps, logs, burrows, caves, and rocky crevices for cover and den sites. Habitat with limited human use is important. Small clearings, meadows, and riparian areas provide forage habitat. This species is mostly carnivorous taking small mammals and birds, but insects, fruit and fish are also consumed. See Pacific fisher for preferred road densities (LMP Appendix G).

Northwestern Pond Turtle (FS Sensitive, Fed species of Concern)

This species is found in a variety of habitat types associated with permanent or nearly permanent water (Holland, 1991; Zeiner, 1988). These turtles are often concentrated in low flow regions of rivers and creeks, such as side channels and backwater areas. They prefer creeks that have deep, still water and sunny banks. Hatchlings are small and require shallow edgewater areas with minimal currents. This species depends on basking to regulate their body temperature. Basking sites include logs and other woody material, rocks, emergent vegetation, overhanging vegetation that touches the water, and sloping banks. Studies conducted on the main stem of the Trinity River indicate this turtle prefers slow moving water (e.g., pools) where basking sites exist (Wilson et al., 1992).

Pallid Bat (Survey and Manage Species. CA Species of Concern)

This species is a year-round resident from low to high elevations. It selects a variety of day roosts including rock outcrops, mines, caves, hollow trees, buildings and bridges. Food items are primarily large ground-dwelling arthropods but also include large moths. Foraging occurs in and among vegetation as well as on the ground surface.

Long-eared Myotis (Survey and Manage Species, Fed Species of Concern)

This species is a year-round resident, primarily of the higher elevations associated with coniferous forests. The day roosts include hollow trees, under exfoliating bark; crevices in small rock outcrops; and occasionally in mines and caves. Nigh roosts show more variety but appear to favor caves and mines. Food items includes small beetles, flies and moths. Foraging occurs near vegetation and the ground.

Fringed Myotis (Survey and Manage Species, Fed Species of Concern)

This species is a year-round resident. Although found from low desert scrub to high elevation coniferous forest, it is primarily associated with middle elevation habitats. It uses mines, caves, trees, and buildings for day and night roosts. Its diet is composed primarily of beetles but includes a variety of other types of insects including moths.

Long-legged Myotis (Survey and Manage Species, Fed Species of Concern)

This species is a year-round resident primarily of the middle to high elevation forest habitats. It day roosts primarily in hollow trees, although it also uses rock crevices and mines. It feeds mostly on moths but will also eat beetles, flies, termites, and other small insects. Foraging occurs in open areas, often at canopy height.

Silver-haired Bat (Survey and Manage Species)

This species is primarily a resident of forested habitats. Winter roosts include hollow trees, rock crevices, mines and caves. Food items include a variety of insects but moths are the primary prey. Foraging occurs in or near wooded areas and along water courses.

Yuma Myotis (Fed Species of Concern)

No habitat description available

Tailed Frog (Fed & CA Species of Concern)

This species has been found in Shasta, Tehama, and Trinity counties. Suitable habitat is often referred to as mountain streams, but it is also found in steep walled valleys and coastal creeks. It is not associated with any particular plant species. In California, frog populations have been found in a variety of habitats including Sitka spruce, redwood, Douglas-fir and ponderosa pine forests as well as single populations in Yellow pine forest and Northern Coastal Shrub. Most known California Ascaphus populations are in areas with at least 40 inches of annual precipitation. However, farther north and east, Ascaphus can be found in areas with as little as 22 inches a year of precipitation.

Foothill Yellow-legged Frog (Fed & CA Species of Concern)

This species requires shallow, flowing water, apparently preferring small to moderate-sized streams with at least some cobble-sized substrate. They are infrequent or absent in habitats where introduced species are present (e.g., various fishes and bullfrogs).

Townsend's Big-eared Bat (Fed & CA Species of Concern)

This species is a year-round resident from low desert to high mountain habitats. It is a cavern dwelling species that uses mines, caves and buildings. It is one of the bat species most dependent on mines and caves in California. Food items are primarily small moths. Foraging occurs near vegetation and other surfaces, and prey is probably gleaned from these surfaces.

Snag Cavity Dwellers

General nest tree habitat requirements for primary excavator species are snags with signs of heart rot, firm sapwood, over 50% of the bark remaining (i.e., decay class 2 or 3), and 15" dbh or greater. Some species, like the pileated woodpecker, are able to excavate in firmer wood (decay class 1), whereas others, like the pygmy nuthatch, require softer wood (decay class 4). Forest habitat requirements vary from open canopy (western bluebird) to moderate and dense canopy habitat (house wren and flammulated owl). Snag density needs vary from 1.5 to 4.0 snags per acre, with the majority of snags in the 15-24" dbh size range. Species needing >24" dbh snags include marten, fisher, Northern spotted owl, pileated woodpecker and, on occasion, Northern goshawk. Recruitment required to maintain this snag density over time is approximately 3 green trees to one hard snag. Forage requirements are insect infested trees or logs, seeds, flying insects, terrestrial insects, or small mammals. Snags are also used by snag and non-snag dependent species for communication, courtship, food storage, thermal regulation, denning, cover, and perches.

Bark Cavity Dwellers

Some species nest or roost primarily under the bark, such as the brown creeper and long-legged bat. Only the snag tree requirements for bats are discussed here. Bats roost under the bark of snags, within snags, under wooden bridges, within caves, in tree foliage, and other similar areas. Suitable snags have been described as hollow snags or snags with peeling bark of 1" thickness or greater, located where it can be warmed by solar radiation, and standing 20+ feet tall. During the summer, bats may use a variety of roost sites, moving from one site to another depending on the time of day and temperature of the roost. Maternity roosts are very sensitive to disturbance during the summer months and hibernaculums during the winter. Eleven species of bats are suspected to occur within the watershed, with a few species not utilizing snags. No bat roost sites have been detected within the watershed. Formal surveys for bat roost sites have not been conducted and their snag requirements are unknown.

Dead/Down Dependent Species

General characteristics of the dead/down wood required by these species are medium to large (15" - 40"+) hollow or soft heartwood and sapwood with large sections of bark remaining. Bark helps to retain the moisture required by salamanders and warmth required by reptiles. Piles of small diameter dead/down wood (<10" dbh) provide cover and nesting sites for small mammals, birds and reptiles. If available, these small animals may also use shrubs for cover and duff for burrows. For small animals, approximately 25% of an area covered with small diameter dead/down wood (8" depth or greater) is recommended (Maser et al., 1979). Suitable amounts of medium to large diameter dead/down wood for foraging, varies by species from 10 tons/acre (fisher) to 15 tons/acre (black bear). Denning requirements are 20-40" dbh logs, with the number required per acre unknown.

Appendix E

History of the Lower McCloud River Watershed

Prepared by Elaine Sundahl, Archaeologist at Shasta Lake Ranger Station

Pre-1900: Terraces which line the McCloud River contain abundant evidence of Native American use, dating 5000 years or more into the past. At least three different ethno-linguistic groups of Native Americans are known to have used the Lower McCloud River Watershed area in the years prior to the coming of the Anglo-Americans. The Okwanuchu, linguistically related to the Shasta of the Shasta Valley, may have been the earliest inhabitants of the McCloud River. Developing an intimate knowledge of the land, they easily met all their physical needs from its varied resources. They practiced an annual pattern of traveling to the higher elevations of the McCloud River drainage in the summer, including trips to the Medicine Lake Highlands to obtain obsidian at the Grasshopper Flat or Lost Iron Wells obsidian source, and to the lower elevations in the winter. They left behind tangible evidence of their passing in obsidian spear points, net-weights, and grinding stones at such places as Ah-Di-Na and Ash Camp.

Within the last 1000 years or so, two other groups began encroaching on Okwanuchu territory. The Wintu moved northward up the McCloud River corridor and the Achumawi (Pit River people) advanced westward from their home on the middle Pit River. Both groups may have been attracted by the particularly rich anadromous fisheries on the McCloud River, which in turn were products of the constant cold water supply. These groups intermarried with the Okwanuchu who eventually ceased to exist as a separate group. This new culture developed a much more intensive fishing-based economy than had been present before. Permanent, year-round villages were established, and fish and acorns collected in abundance and stored for year-round use.

Names and details of 32 Native American villages on the McCloud within the watershed, collected in the 1880s, are believed to reflect the time period just prior to 1850. Those on the south are Wintu, and north of Claiborne Creek are Okwanuchu, Pit River, or a mixture of two or all three groups. A list of 67 Native American placenames recorded within the watershed area in the early 20th century includes 54 with Wintu names, 10 with Pit River names, and three places with names in both languages. No Okwanuchu placenames survived with the possible exception of Ah-Di-Na. Many of the placenames are translated into words for natural features, plants, and animals. References include limestone formations, riffles and eddies in the river, tributary creeks, salmon and suckers, bears, grizzlies, deerlicks, panthers, mountain quail, buzzards, fleas, 'black" manzanita, live oak, "sourbush", acorns, tobacco, and "red paint." Other names mention Indian villages and trails.

The latter part of the 19th century saw the earliest penetrations into the watershed area by Anglo-Americans, but numbers apparently were minimal and the effect to the environment slight. The earliest Anglo-Americans in the general area were fur trappers. In 1829, Hudson's Bay trapper Alexander McLeod "wintered" on the upper McCloud at or near Dead Horse Summit which was named for his ill-advised camp. The McCloud was first called the McLeod River after his expedition. Although numerous trappers from the Hudson's Bay base at Fort Vancouver trapped the Sacramento and Pit rivers between 1828 and 1840, when the fur trade declined, there is no record of any who traversed the length of the McCloud River.

Gold brought miners into the watershed area in the 1850s with some mining reported in the Hawkins Creek drainage. Legend has it that a miner named Hawkins and a group of other miners found a gold mine somewhere between Bartle and Ash Camp on the northwest foot of Grizzly Peak. They found so much gold that they buried some. Hawkins became greedy and killed the others. Hawkins Creek was supposedly named for this incident by Justin Sisson in 1882 while searching for the Lost Hawkins Mine.

Settlement followed, although all recorded settlement dating to the late 19th century was located to the north or south of the watershed. The river became known as the McCloud in the early 1850's, probably for Ross McCloud who explored the entire river in the 1850's and attempted to establish a pack trail through the area. He later abandoned this route in favor of the Sacramento River.

Although there was some economic and social interaction between the Native Americans and Anglo-Americans, conflicts began almost immediately with thievery and murders committed on both sides. Actual violence appears to have diminished in the 1870's.

The rich fisheries of the McCloud River were recognized nationally and in 1872 the first California fish hatchery was established by Livingston Stone at Baird for the U.S. Fish Commission for the purpose of collecting and shipping salmon eggs. Greens Creek Fish Hatchery, four miles above Baird, was also established in 1872 to collect trout eggs. The eggs were shipped throughout the country and the world (both hatchery locations are now inundated within Shasta Lake). The sport fishing potential of the McCloud was recognized at least as early as the 1870's. Justin Sisson, who had a hotel in Berryvale (later called Sisson and Mt. Shasta), had a fishing resort at the "Horseshoe Bend" (now Hearst) on the McCloud where he took his guests, including John Muir, thus introducing wealthy sportsmen to the McCloud.

Government Land Office (GLO) surveyors surveyed the lands within the analysis area between 1870 and 1882, making sections available for distribution in the form of homesteads, Indian allotments, and grants to schools and railroad companies. There is, however, no record of any successful homesteading within the watershed during this time period. Access was by foot trail, and trails followed both sides of the McCloud.

As valley lands became more settled, grazing of sheep and cattle were moved into the hills and mountains. It is unknown, however, if grazing was conducted within the analysis area prior to 1900.

1890-1945: The GLO surveys of the 1870's and 1880's made large tracts of federal land available for distribution. Sections 16 and 36 in each township were allotted to schools. The Homestead Act of 1862, under which a citizen could claim 160 acres of Federally-owned land, stimulated filing on lands in the McCloud River area but there in no record of patented homestead entries within the analysis area prior to the 1920's. A total of seven parcels of 80 and 160 acres in the Hamilton Bend area (T37N, R3W, Sec. 22, 26, and 28; now McCloud River Club) each were assigned as patented Indian trust lands in 1893.

In 1896 the Central Pacific Railroad (later known as the Southern Pacific) was granted all odd-numbered sections along the McCloud River under the Pacific Railroad Acts of 1862 and 1864. Patents were finalized in 1896, forming the basis for private ownership of alternate sections throughout most of the watershed area.

Ah-Di-Na was purchased from the Central Pacific Railroad by William R. Whittier in 1896 to develop into a private sport-fishing and hunting resort. It also operated as a self-sufficient ranch for many years. In 1900 the McCloud River Club land was acquired from the Central Pacific Railroad by George W. Scott and William M VanArsdale who founded the fly fishing club (Scott and VanArsdale originated the McCloud River Railroad and Lumber Company the same year). The nucleus of the Bollibokka Club lands was purchased in 1921 from previous owners who presumably obtained railroad land in the early 1900s. Although the large flats at Ah-Di-Na and the mouth of Claiborne Creek were developed and ranched, the overall effect to the watershed was minimal during this period.

Although there was extensive copper mining on Squaw Creek and the Sacramento River during the early 20th century, very little occurred in the McCloud drainage. Claims located on the north side of Hirz Mountain (T35N, R3W, Sections 5, 6, 7, and 8) were sporadically mined for iron ore between 1903 and 1944, and a nearby claim (Sections 7 and 8) was worked in 1957 to 1963 (now owned by the Southern Pacific Land Company). There apparently was at least one copper mine within the analysis area. The Keane copper mine was located about one mile southwest of Hat Mountain in Section 4, T36N, R3W, and contained seven adits 20' to 135' in length. A second reference, apparently to the same mine, gives the location as about four miles downriver of the McCloud River Club, "Abe Morgans place”, which became a copper mining camp.

The Shasta National Forest was established in 1905 with headquarters in Sisson (Mt. Shasta). With the exception of the Hawkins Creek drainage, the Lower McCloud River Watershed lay within the Squaw Creek District, which became the Redding District in 1938. Hawkins Creek was then, as later, part of the McCloud District. The Forest Service during its earliest years was primarily concerned with controlling grazing and the prevention of fires. A lookout station at Grizzly Peak is shown on the 1916 Forest map (the current lookout building was constructed in 1953 and is not considered historically significant). The lookout building at North Fork Mountain on Curl Ridge was constructed or reconstructed in 1935, probably by the CCCs (this building no longer exists). The 1916 map also shows a series of trails and a phone line called the Henderson Phone Line which traveled from McCloud and Squaw Valley Creek to cross the McCloud near Ash Camp and along Hawkins Creek to connect with Big Bend and points beyond. Pack trails are shown on Curl Ridge, Claiborne Creek, Hawkins Creek and along the McCloud. An auto road connected the McCloud River Club via Squaw Valley Creek.

With its formation, the Squaw Creek District assumed management of stock grazing on Forest Service lands. A grazing atlas stored on the Shasta Lake District contains a considerable amount of information on grazing as well as vegetation patterns for the years 1917 through 1921. The Lower McCloud River Watershed area during those years was divided into three allotments. The McCloud allotment included the Claiborne Creek drainage and several smaller drainages with a total of 7,667 acres of federal land and 10,219 acres of private land. This allotment had not previously been open to grazing because it was considered too rough. It was opened in 1918 because of the war and because the private sections had been open to sheep. The carrying capacity of the federal and private lands were each estimated at 3000 sheep and 200 head of cattle. Forage is described as consisting of "blue brush, short black oak, and other palatable brush such as bitter cherry, hazel, water maple and quite a lot of bunch grass on the ridges". Mountain lions, coyotes and bears were reported as quite numerous. Permittees in 1919 ran a total of 3700 sheep; in 1920, 1500 sheep are reported, and in 1921, 1400 sheep. Because the McCloud River Club controlled the mouth of Claiborne Creek, stock was driven in by way of Curl Ridge from DeLamar on Squaw Creek. Curl Ridge became known an the "cattle highway".

The North Fork allotment which included the drainage of Chatterdown Creek extended across Curl Ridge into Squaw Creek. Both sheep and cattle were grazed on this allotment. That portion of the District on the west side of the McCloud River was part of the High Mountain allotment, which apparently was administered by the Sacramento or Mt. Shasta District.

Between 1933 and 1940, the Civilian Conservation Corps (CCCs) established camps in the old fish hatchery at Baird, at Stouts Meadows, and just north of McCloud but none are recorded within the analysis area. The enrollees at McCloud devoted much of their time to working on the Mud Creek Dam and ditch.

1945-1965: The construction of Shasta Dam, begun in 1938 and completed in 1945, prevented the annual upriver migrations of anadromous fish as well as blocking animal migrations such as deer herds. The inundation of the lake also hastened the end of stock grazing within the watershed area as it made access much more difficult.

In addition to structures at Ah-Di-Na, the McCloud River Club and Bollibokka Club, the 1945 U.S.G.S. quadrangle shows structures at Ash Camp on the north side of Hawkins Creek, at Pine Flat on the east side of the river, "Wyatt" on the north side of the mouth of Chatterdown Creek, and "McAphee Flat", on the west side of the river just south of the mouth of Nawtawakit Creek (the latter three now all part of the Bollibokka Club Land Company). In 1945 all were connected by a system of trails along the river, generally on both banks. Numerous trails also connected to the ridge tops, and a "tractor way" followed the length of Curl Ridge.

In 1955 the newly organized Shasta-Trinity National Forests incorporated the Shasta National Forest, and the Redding District became the Shasta Lake District. District maps show many trails but very few roads into the Lower McCloud River Watershed; three exceptions were to the McCloud River Club by way of Squaw Valley Creek, to Grizzly Peak via Mushroom Rock and Star City Meadows, and upper Hawkins Creek via Smith Flat (now in Iron Canyon Reservoir).

The lands at Ah-Di-Na were purchased by the Hearst Corporation, and road construction and logging began in 1958.

1965-present: The past three decades have seen a manyfold increase of human use within the watershed area. Pacific Gas and Electric Company's construction of the McCloud Reservoir, which drastically changed the water levels of the river, provided a recreational attraction as well as access into the area. The purpose of the reservoir was to divert water to the Pit River hydroelectric plants by way of the Iron Canyon Reservoir.

The initiation of logging on public lands and the continuation of logging on private lands also increased access into the area. The Forest Service in 1965 acquired lands at Ah-Di-Na from the Hearst Corporation and shortly afterward established a public campground, providing public fishing access to the river. The 1966 Mica Gulch Timber Sale was the first timber sale on federal lands within the analysis area. In 1974, the McCloud River Club donated 2330 acres of their land to the Nature Conservancy, which formed the McCloud River Preserve, allowing limited public access.

In 1975, the Pacific Crest Trail was constructed through the watershed area via Ah-Di-Na and Ash Camp.