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Pacific Southwest Region

Headwaters Sacramento River Ecosystem Analysis

Mt. Shasta Ranger District
Shasta-Trinity National Forest

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Preface

The Record of Decision for Amendment 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 (herein called The President's Plan), describes four components including riparian reserves, key watersheds, watershed analysis and watershed restoration.

This report addresses those components with the exception of key watersheds, of which there are none in the Upper Sacramento River sub-basin. The outline of this report follows recommendations from Version 2.1 of the Ecosystems Analysis at the Watershed Scale Review Draft of March 1995.

To fully understand this analysis, the reader must be familiar with the above documents and the Land and Resource Management Plan for the Shasta-Trinity National Forests (herein called The Forest Plan).

Announcements were published in three local newspapers and two regional newspapers inviting public input to this analysis. Over seventy letters were sent to known interested people and organizations, inviting their participation and input. An Open House was held on April 18, 1995 where resource specialist on the Headwaters Team presented information on existing conditions and management direction for the Headwaters Watershed. No new information or issues were identified from public input to this analysis.

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The team would like to especially thank Don Haskins, Forest Geologist and member of the Forest Ecosystems Management Group, who was our team mentor.

Watershed Analysis Version History

Version 1 of the Headwaters of the Sacramento River Watershed Analysis was completed in August 1995 (8/29/95). Minor edits were made to Version 1 during January 2001 to create Version 2. The edits were almost exclusively grammar and syntax as well as fixing formatting problems. The reader is cautioned that all of the data and information found in Version 2 are based on 1995 WA methodologies, data and policy and that the content in this analysis has not been updated.

Steve Bachmann, Editor, Shasta-McCloud Management Unit

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Headwaters Sacramento River Ecosystem Analysis

Chapter 1 - Watershed Characterization

The Upper Sacramento River Sub-Basin

The Headwaters watershed is part of the Upper Sacramento Sub-Basin, which is part of the Sacramento River Basin. The latter drains a major portion of Northern California, with waters flowing into the Sacramento Delta and San Francisco Bay. The Upper Sacramento Sub-Basin is that portion of the basin above Shasta Dam that includes the Upper Sacramento River and its tributaries (See Vicinity Map). Some important characteristics of this sub-basin are:

- The terrain is generally steep and mountainous.
- The sub-basin is mostly forested with mixed conifer (ponderosa pine, Douglas-fir, red fir, white fir, & incense-cedar) as the predominant species.
- Interstate 5 and a main line railroad bisect the sub-basin.
- Prominent features include Shasta Dam, a portion of Shasta Lake and Mount Shasta, and Castle Crags.
- Land ownership is divided approximately 50/50 between private and Federal.
- Recreation use is high, especially in the National Recreation Area at Shasta Lake and along the I-5 corridor.
- The Castle Crags Wilderness and a portion of the Mt. Shasta Wilderness are located in the sub-basin.
- The incidence of man-caused fires is high along the I-5/railroad corridor.
- The Klamath, Weaverville, and McCloud mule deer herd utilize the sub-basin for winter and summer range.
- The sub-basin is within the Klamath province and the Shasta-McCloud Sub-province for Northern spotted owls.
- Five Late-Successional Reserves (LSR) and one Managed Late-Successional Area (MLSA) are within the sub-basin.
- The sub-basin supplies domestic water to several urban areas, including the City of Mt. Shasta, City of Dunsmuir and Castella.

Watershed Setting

The Headwaters Watershed drains generally mountainous terrain. The drainages that make up the watershed include the three upper branches of the Sacramento River (South, Middle, and North Forks), and Scott Camp, Castle Lake, Wagon, Ney Springs, and Stink Creeks. Lake Siskiyou is also located in the watershed. Some prominent characteristics of this watershed are:

- The watershed is located entirely within Siskiyou County, California.
- The terrain is steep and mountainous in the western 3/4 of the watershed.
- The terrain is gentle with large grasslands on the eastern 1/4 of the watershed.

- Urban and rural residential development is confined to the eastern 1/4 of the watershed.
- The watershed is mostly forested with ponderosa pine, sugar pine, incense-cedar, Douglas-fir, white fir, and red fir.
- Prominent features include Lake Siskiyou, Mt. Eddy, and a portion of the Castle Crags Wilderness.
- The only bald eagle nest site on the Mt. Shasta Ranger District is within the watershed.
- The only goshawk nest site for the Mt. Shasta Ranger District is within the watershed.
- The Klamath mule deer herd utilizes the watershed for winter and summer range.
- One Late-successional Reserve (LSR) and one Managed Late-successional Area (MLSA) are within the watershed.
- Ownership is approximately 25 percent private and 75 percent Federal.
- Private ownership is grouped in the eastern 1/4 of the watershed.
- Federal ownership is fairly consolidated in the western 3/4 of the watershed.
- Recreation use is high on both private and Federal lands.
- Seventeen alpine lakes and numerous wet meadows are found within the watershed.
- A portion of the Pacific Crest Trail traverses the western boundary of the watershed.

The watershed comprises approximately 65,000 acres of public and private lands (See Map 1). The eastern quarter of the watershed is predominantly in private ownership, comprised of mostly individual landowners and some county owned lands adjacent to Lake Siskiyou. The western three-quarters of the watershed are mostly public lands administered by the Mt. Shasta Ranger District, Shasta-Trinity National Forest.

The climate is temperate with an average annual precipitation of 40 to 60 inches. Approximately 80 percent of this precipitation occurs between October and May, mostly in the form of snow. The normal snowline is between 4,000 to 5,000 feet.

Watershed elevations range from a low of 3,200 feet on the Sacramento River below Lake Siskiyou to 9,000 feet at the summit of Mt. Eddy.

Relationship of Watershed to Sub-Basin

- The Headwaters Watershed makes up approximately 17 percent of the area of the sub-basin.
- Vegetation within the watershed is similar to that found in the basin.
- The terrain is similar to that of the basin with the exception of the large grasslands found mostly in the eastern 1/4 of the watershed.
- Recreation use is high for both the basin and the watershed.
- The nearest bald eagle nest site to the watershed is twenty miles away at Lake McCloud. The nearest bald eagle population within the sub-basin is at Shasta Lake, over 24 miles away.
- The Klamath deer herd winters and summers north of Dunsmuir and west of Interstate 5. The Klamath deer herd also travels west from the watershed into the Trinity River basin. The Weaverville deer herd is the only other deer herd suspected to interact with the Klamath deer herd.

Management Direction

The Land and Resource Management Plan for the Shasta-Trinity National Forests identifies eight Management Prescriptions in the Headwaters Watershed (See Map 2):

- I - Unroaded Non-motorized Recreation
- III - Roaded Recreation
- V - Wilderness Management
- VI - Wildlife Habitat Management
- VII - Threatened, Endangered and Selected Sensitive Species
- IX - Riparian Management
- X - Special Area Management
- XI - Heritage Resource Management

The Final Supplemental Environmental Impact Statement on Management of Habitat for Late-Successional and Old-Growth Forest Related Species within the Range of the Northern Spotted Owl (otherwise known as the President's Forest Plan) identifies six land allocations:

- Congressionally Reserved Areas, Prescription V above.
- Administratively Withdrawn Areas, Prescriptions I and X above.
- Late Successional Reserves, Prescription VII above.
- Managed Late Successional Reserves, Prescription VII above.
- Riparian Reserves, Prescription IX above.
- Matrix, Prescriptions III and VI above.

(Prescription XI above could be found in any of the above land allocations)

The Upper Sacramento Sub-Basin is within the Sacramento Northwest Province as designated in the Forest Plan.

Values and Uses

In the context of the Headwaters watershed, there are several significant values and uses:

Beneficial Values

- Ecological value includes healthy forest ecosystems and terrestrial and aquatic habitat for plant and animal species.
- Scenic quality associated with areas of high recreation use.
- Environmental values include water quality primarily for fish, wildlife, macroinvertebrates, and amphibians. Summer base flows are adequate to sustain fish, wildlife, and vegetation.
- Commodities include wood fiber, special forest products (fuelwood, Christmas trees, boughs, posts, poles), and common variety minerals (decorative rock).
- Rangeland forage for livestock grazing.
- Recreation including hiking, camping, fishing, hunting, horseback riding, and OHV use.

Chapter 2 - Key Questions and Discussion

Recreation

- What restoration and development standards are needed to ensure that recreation use is consistent with management of riparian dependent resources?
- Where can we provide for future recreational opportunities which best match area potential with demand?

Discussion - Recreation use within the Sacramento Headwaters Watershed Analysis area has been documented for over one hundred years. Recreation opportunities associated with alpine lakes and streams draw large numbers of visitors to the watershed.

As roads were developed, largely due to logging efforts, the watershed was opened up to an increasing number of people. Interstate 5 serves as the eastern border of the watershed and provides quick and easy access. Dispersed recreation sites may be found wherever a road passes by water.

Damage from vehicles associated with recreation use is increasing in sensitive riparian areas. These impacts must be addressed when planning future projects as well as managing existing use within the Sacramento Headwaters Watershed.

Existing National Forest campgrounds at Castle Lake, Gumboot, and Toad Lake are not full service facilities, and are often at full use capacity during the summer recreation season (See Map 3).

The public is showing an increased interest in the Headwaters Watershed for expanded recreation opportunities. Some examples include requests for winter off highway vehicle (OHV) staging facilities and trail systems and expanded mountain biking opportunities (single track). In addition to the requests for expanded opportunities, there is a need to upgrade existing facilities. Existing facilities were not designed for the numbers of visitors currently using the recreation sites. Types of use have changed and there is an increasing demand for facilities to accommodate motor homes, large groups, and amenities such as electricity and dump stations.

Forest Health

- What combination of planned activities (e.g. thinning, planting, prescribed fire) best achieve or maintain the desired mix of vegetation communities?
- Where are the priority treatment areas?

Discussion - This watershed contains a several populations of Port-Orford cedar that have not been infected with the root disease *Phytophthora lateralis*. This fungus is transmitted by water borne spores, and by movement of moist soil that contains the spores. Any type of vehicle or equipment that carries infested soil from another watershed and enters areas with Port-Orford cedar may introduce the disease to the watershed.

There has been a general species composition shift in many mixed conifer stands. More shade tolerant white fir now makes up a greater percentage of the stand composition. This is the result of historic logging that removed pine and Douglas fir from many stands, leaving less desirable fir and cedar. Fire suppression activities beginning in the 1940’s have also caused an increase in understory species and fuels. As a result of fire suppression, fuel ladders have developed that increase the risk of stand replacing wildland fires. White fir is the most fire intolerant mixed conifer type species in the watershed.

There has been a noticeable loss of large sugar pine and western white pine within the mixed conifer types in this watershed. These are usually individual trees and the loss is generally attributed to extended drought, high levels of vegetation, and fatal attacks by *Dendroctonus* bark beetles.

Overstocked stands of predominantly white fir (size density 2G and 3G) are in need of thinning to maintain the growth and vigor of these trees and reduce fuel build-up that could cause a stand replacing fire. Concern for these stands is greatest where slopes exceed 30 percent.

Many decadent shrublands that formed following historic wildland fires have not naturally regenerated to original conifer tree types. Some of these shrublands are now mature and overmature and are at risk to stand replacing fire. Areas of concern include the upper Deer Creek drainage and the area south of Lake Siskiyou.

In January of 1995, an approximately 120-acre stand of knobcone pine south of Lake Siskiyou was blown down during severe storm conditions. Most of this blowdown is on lands owned by Siskiyou County. Knobcone stands on National Forest System lands are also at risk to blowdown during future wind events.

Some understocked stands that resulted from past logging activities have not regenerated to previous stocking levels and species composition. This is a result of shrub competition and, in some areas, the presence of dwarf mistletoe.

Approximately 1,200 acres of pine plantation need maintenance to insure tree survival, increased vigor, and movement of species composition to a more natural mixed conifer type.

An urban interface is developing along the National Forest boundary within this watershed. Residential and commercial development is greatest in the areas adjoining Lake Siskiyou. This area shows a high incidence of wildland fires, most of which have been contained at small acreages due to prompt suppression action. As public use of this area increases and fuels build up, the risk of stand replacing wildland fires will continue to increase.

What types and amounts of forest products can be provided on a sustained basis?

Discussion - Under the President's Forest Plan for the Pacific Northwest forests, approximately 50 percent of the Headwaters Watershed is allocated to Matrix lands. These lands are expected to produce a majority of the PSQ (potential sale quantity) and provide other forest products through a variety of silvicultural treatments. The Forest Plan for the Shasta-Trinity National Forests further identifies a sustained level of forest products from suitable Matrix lands for Management Area 5. The Headwaters Watershed contains approximately 3/4 of the Matrix lands found within Management Area 5.

Special Plant and Animal Populations

- What additional measures are needed to ensure that grazing operations do not threaten the viability of threatened, endangered or candidate species?

Discussion - Species of special concern are defined as those listed under the Federal and State Endangered Species Act (including category 1 or 2 species), the California Department of Fish and Game's Species of Special Concern program, the US Forest Service Sensitive Species program, the Neotropical Migratory Birds (NTMB) program, the Record of Decision (survey and manage, 'protection buffers,' and other standards and guides), or as 'game' species.

There is one active grazing allotment in the Headwaters watershed (Bear Creek allotment).

A number of species of special concern are found within the allotment and are listed under their appropriate species category. The list indicates the species' listed status and degree of risk, whether inventories have occurred for the species, and if monitoring is occurring. The risks to a species were assessed based on the estimated and known (documented) effects from grazing to a species' population or

habitat. The level of risk (low, moderate, and high) is an assessment of the degree to which a species or its habitat is, or may be adversely affected.

Aquatic/Riparian Animal Species

Cattle have a greater adverse effect on riparian and wetland habitats because they tend to concentrate in these areas, particularly during the dry season. Effects to aquatic systems include effects to instream and riparian vegetation, stream banks, fish habitat and aquatic organisms. Improper grazing can reduce vigor and alter, reduce, or eliminate vegetation. This in turn can change plant species composition, lower water tables, and decrease canopy cover. Usually the narrower the riparian zone, the more easily this zone is altered.

Table 2-1: Aquatic/Riparian Animal Species.

STATUS	SPECIES	RISK	INVENTORIES	MONITORING
C2	Foothill Y-L Frog	High	Partial	None
C2	Cascades Frog	High	Partial	None
FS	N. Red-legged Frog	Unknown	None	None
FS	NW Pond Turtle	Unknown	Partial	None

C2 & C3 = Fish and Wildlife candidate species
FS = Forest Service sensitive species
ST = State of California Threatened and Endangered species

Terrestrial Animal Species

Cattle affect sensitive terrestrial species in many ways, especially when they rely on riparian habitat for all or a portion of their life cycle. If forage conditions are good or better, the effects due to livestock grazing are usually low for most terrestrial species. If forage conditions are poor, effects on terrestrial species are usually adverse. For a definition of 'good' and 'poor' condition standards see the Draft "Biological Evaluation for sensitive plant and animal species within grazing allotments on the Eddy/Alps zone of the Shasta-Trinity National Forests."

Table 2-2: Terrestrial Animal Species.

STATUS	SPECIES	RISK	INVENTORIES	MONITORING
C2	Trinity Alps Ground Beetle	High	Unknown	None
C2	Siskiyou Ground Beetle	High	Unknown	None
FS	Willow Flycatcher	High	Partial	None
C2	Townsend's big-eared Bat	High	Partial	None
C2	Northern Goshawk	Mod	Partial	None
C2	Fisher	Low	Partial	None
FS	Marten	Low	Partial	None
ST	Wolverine	Low	Partial	None
C2	Spotted Bat	Unknown	Partial	None

Plant Species

The effects from grazing on sensitive plant habitats may not be visible or readily noted on a day-to-day basis over the short term, but cumulative effects may build up and dramatically alter the structure and composition of a landscape over time. Riparian vegetation is especially sensitive to impacts from grazing, since livestock utilization is greatest in riparian areas. Direct effects result from herbivory, trampling, compaction, erosion, and from smothering by cattle droppings. Indirect effects to sensitive plants result

from compaction, introduction of non-native plant species, erosion of soil and stream banks, and reduction of available water in small lakes, vernal meadows and streams.

Table 2-3: Plant Species.

STATUS	SPECIES	RISK	INVENTORIES	MONITORING
C2	Showy Raillardella	High	Partial	Some
C2	Oregon Fireweed	High	Partial	None
FS	Siskiyou Fireweed	Mod	Partial	None
C2	SE Trinity Buckwheat	Mod	Partial	None
C3	Sht-Petaled Campion	Mod	Partial	None
C2	Scott Mountain Phacelia	Mod	Partial	Yes
FS	Salmon Mtn. Wakerobin	Mod	Partial	None
C2	Klamath Manzanita	Low	Partial	None
FS	Golden Draba	Low	Partial	None
C2	Mt. Eddy Draba	Low	Partial	None
FS	Mt. Eddy Buckwheat	Low	Partial	None
C3	Scott Mountain Bedstraw	Low	Partial	None
FS	Crested Potentilla	Unknown	Partial	None
C2	Wilkins' Harebell	Unknown	Partial	None
C2	Pickering's Ivesia	Unknown	Partial	None

The principal plant species of concern with regard to grazing in this watershed is showy raillardella, *Raillardella pringlei*. This species is a riparian obligate with a very limited worldwide distribution. One third of all its populations are within this particular watershed. Grazing affects showy raillardella populations through trampling, eating of leaves and flower heads and loss of habitat. Herbivory of the flower heads restricts the plant to vegetative reproduction. The effect of this imposed reproductive change on the species' viability is not known.

- How do we manage Late-Successional Reserves and Critical Habitat to maintain viable populations of old growth dependent species?

The Late Successional Reserves (LSRs) and Managed Late Successional Area (MLSA) in the watershed encompass approximately 8,500 acres of land. The Critical Habitat Area (CHU CA-7) surrounds both the LSR and the MLSA, and is approximately 16,500 acres. These habitats are found within the Klamath province, and the Shasta-McCloud Sub-province. The Klamath province, along with the adjacent Oregon Cascades to the north, comprise the stronghold of the remaining northern spotted owl populations and are considered to be of the utmost importance to recovery of the subspecies.

Low densities of owls are present in the Shasta-McCloud sub-province due largely to past logging practices and dry, naturally fragmented habitat. Low owl densities have raised a concern over restricted genetic interchange with the California subspecies. The Interagency Scientific Committee (ISC) was unable to designate 20+ pair Habitat Conservation Areas (HCAs) in the area due to a lack of contiguous federal ownership and because of natural and human-caused fragmentation of habitat. The area is vulnerable to wildfires and other environmental catastrophes, so it is particularly important to provide sufficient protection to buffer against catastrophic events.

Currently, CHU CA-7 has not met its intended goal of providing for five (5) spotted owl pairs. As of 1994, two spotted owl activity centers were located within the CHU. Until revoked, management for the CHU needs to continue so the intended prescription goal can be reached. In addition to providing for activity centers, the CHU was intended to be a link between surrounding CHUs as well as mitigation for the elimination of other critical habitat.

One spotted owl activity center (AC) is outside the LSR, MLSA and CHU. The activity center was surveyed before 1994 and is considered to be an unmapped LSR. Each unmapped LSR is 100 acres in

size. This activity center is important due to its capability to contribute future nesting pairs and provide for other old-growth dependant species.

Besides providing suitable habitat for spotted owls, late-successional reserves are intended to maintain a functional, interacting, late-successional, and old-growth forest ecosystem of which other old-growth related species are a part. Species likely to occur in the Sacramento Headwaters watershed and be highly associated with late seral and old growth habitat are listed below.

> Brown creeper, chestnut-backed chickadee, Douglas squirrel, golden-crowned kinglet, Hammond's flycatcher, hermit warbler, marten, Northern flying-squirrel, Northern goshawk, Northern spotted owl, Pacific fisher, pileated woodpecker, red-breasted nuthatch, red crossbill, silver-haired bat, varied thrush, Western red-backed vole, white-headed woodpecker, and bald eagle.

- What standards need to be considered on Matrix lands to respond to requirements of these special plant and animal populations?

Additional species requiring management in the LSRs, CHU and Matrix lands are those listed under the survey and manage standard and guides found in the Forest Plan and the President's Plan for the Pacific Northwest. Appendix R of the Forest Plan includes those old-growth dependent species known or suspected to occur on the Shasta-Trinity NF. The survey and manage standard & guide requires management of known sites of these species, field surveys prior to ground-disturbing activities, and/or general field surveys for these species. Survey requirements vary by species. Very little is known about the distribution, abundance and habitat needs of most of these species.

In the meantime, we know that the following survey and manage species are suspected to occur within or adjacent to the watershed: Long-eared bat, long-legged bat, fringed myotis, and silver-haired bat.

The following fungal species occur at Deadfall Meadows, just outside the Headwaters WA area: *Rhizopogon abietis, R. brunneiniger, R. evadens* var. *subalpinus, R. flavofibrillosus, Gautieria magnicellaris,* and *Gastrosuillus sp.* nov. Trappe 7516.

In addition to survey and manage species, management practices for Matrix include wildlife habitat management for State deer herd plans and other consumptive species, neotropical migratory birds, bats, and four cavity nesting species.

Water Quality

- What are the high priority restoration opportunities within the watershed? Why?
- What are the optimum transportation system needs for watershed management and public access?
- Are current activities and conditions within Riparian Reserves consistent with Aquatic Conservation Strategy (ACS)?

Discussion - The priority restoration opportunities are mostly related to roads. These include road crossings, culverts and through-cuts. Crossing and culvert problems include misplaced culverts, undersized culverts, and "shotgun" culverts. Many of the road systems have through-cut erosion problems. These are chronic problem areas where the fundamental road design leads to recurrent washout problems. These problems are not specific to any one area. They are widespread but not epidemic. Many of the specific sites are mapped in the Watershed Improvement Needs (WIN) inventory. This report is on file at the Mt. Shasta Ranger District.

Restoration of roads is pointless unless the roads are properly designed and maintained. Some of the roads were never actually designed but simply evolved from railroad grades or lower standards roads. Restoring or maintaining these roads is a losing battle. Such segments should be reconstructed or decommissioned.

The current transportation system in the Headwaters watershed reflects past and current uses. Timber harvest served as the catalyst for the development and maintenance of the transportation system. Recreational use increased along with the development of the road system over time. A reduction in timber harvesting has resulted in a dearth of funding for road maintenance. The optimum transportation system should be maintainable and provide for future management and recreation needs in the watershed. Future recreation and management needs should be identified in order to determine the size of the optimum transportation system. Roads that will not serve a function in the future transportation system should be decommissioned.

There are some areas in the watershed where current activities and/or conditions may not be consistent with ACS objectives. Riparian degradation may be occurring at some of the undeveloped campsites along the South Fork of the Sacramento River and around alpine lakes.

Grazing activities in upland meadows and existing road conditions may also be impacting riparian reserves. Cattle grazing is concentrated in and around mountain meadows. Grazing has resulted in some bank erosion and riparian vegetation removal. Cows tend to cluster in areas adjacent to the stream and create bare areas with high concentrations of manure. These areas are potential sources of sediment and pollution to streams.

Geologic instability mapping indicates that the vast majority of mass movement features are naturally occurring and are located in the North Fork and the Middle Fork of the Upper Sacramento. It is doubtful that these landslides could or should be remedied. Mass movement mapping indicates that there are man-caused mass movement features in and around the South Fork. These are active features that may present restoration opportunities.

Chapter 3 - Current Conditions

Recreation / Heritage Resource

(Reference Maps 3, 4, & 5)

Recreation is a predominant use of the Headwaters watershed. A paved two-lane road bisects the watershed along the South Fork drainage and crosses the divide at the southwestern edge. There are four developed campgrounds, one of which is privately operated on county-owned lands, with a full marina, restaurant and conference center. A new resort has opened just east of Lake Siskiyou and includes an eighteen-hole golf course, tennis courts, pro-shop, restaurant, bar, and rental cabins. Public traffic along this road, which leads directly into the watershed, is expected to increase.

Lake Siskiyou lies at the base of the watershed and carries the flow from the South, Middle and North Forks of the Sacramento River. It is one of the most heavily used lakes in Siskiyou County and is accessible year-round. Swimming, fishing, boating, windsurfing and sunbathing compete equally during the summer months and fishing is popular during the winter months when other lakes are inaccessible.

Castle Lake is an alpine lake that is accessible year-round by paved road. Approximately 50,000 people drive up the road annually to swim, fish, camp, boat, hike, picnic, ice skate, ski, snowmobile and snowshoe. The parking lot is also a trailhead into the Castle Crags Wilderness and the Pacific Crest Trail. The parking lot and lake use is at capacity on most days throughout the summer season, and on weekends during the winter. The six-unit campground just below the parking area is also filled to capacity most days during the summer season. This crowding has caused increases in illegal camping near the lakeshore and on the adjacent private property. No increase in lake pollution has been noted, but riparian vegetation surrounding the lake has been trampled and burned in campfires. There is an aging two-hole vault toilet at the parking lot. A similar one is located in the campground. Garbage is collected at both locations during the summer months and is usually overflowing.

The University of California at Davis currently holds a Special Use Permit for operation of a Limnological Laboratory at Castle Lake. This lab has operated for over thirty years and has collected a rare and valuable data baseline for the lake during this period. The permit is for a septic system and a wooden building that houses a chemical lab and living space. A small storage shed, generator building, dock and toilet facility are also included.

A second Special Use Permit authorizes the operation of the United Methodist Church Camp on Scott Camp Creek, about one mile northwest of Castle Lake, and two miles down the road. The camp is booked every weekend during the summer and is used for group gatherings. There are several buildings, including a lodge, caretaker cabin, bathhouse and generator shed. Hot running water, flush toilets, and showers are provided for campers who stay in tents or trailers. Both the Davis Lab and Methodist Camp are interested in development of their programs. A tentative plan has been proposed to use the abandoned nordic site between the two permit areas to accommodate users while moving impacts away from Castle Lake.

Other lakes in the watershed include Gumboot and Toad Lakes. Each of these lakes has a dispersed campground and experiences heavy recreational use over the summer season. The Gumboot Lake campground has no potable water, a vault toilet and no designated campsites. The Toad Lake campground is a walk-in facility with a vault toilet, no potable water and no designated campsites. The majority of the remaining lakes are located along the southern boundary of the watershed. Access to these lakes is achieved by either four-wheel drive vehicle or on foot. Past logging has created a good road system and the headwater areas are popular for hunting and camping.

Two main trail systems cross through the watershed (See Map 4). The Pacific Crest Trail enters from the south in the Castle Crags Wilderness and skirts the western edge of the watershed before leaving the

watershed near Mt. Eddy. A trailhead for the Pacific Crest Trail is located above Gumboot Lake. The historic Sisson Callahan National Recreation Trail also passes through the watershed, originating where the North Fork joins the South Fork of the Upper Sacramento River. The trail travels east to west, crossing the Pacific Crest Trail near Mt. Eddy. Hikers and horsemen use both trails during the summer months. There are also growing numbers of mountain bike users along the Pacific Crest Trail for lack of other well-maintained single-track trails in the area. Other popular trails include the Rainbow Ridge Jeep Trail, the Gray Rocks Lakes Trail and the Little Castle Lake Trail.

The abundance and accessibility of water creates a high amount of dispersed recreation use. Each road system has dispersed campsites wherever there is water close by. Concerns associated with dispersed recreation include escaped fires, water contamination from sanitation practices and impacts to riparian vegetation along the waters edge. Road maintenance is limited due to the lack of logging activity in the watershed.

An archery range with 42 targets is located near the South Fork road just above Lake Siskiyou (See Map 3). The permit includes several small parking lots, toilet facilities, registration area and practice range. Use has grown steadily over the past three seasons and other potential uses, such as trailheads for mountain bikes have been suggested. The local snowmobile club has also proposed using the parking lot in winter as a snowmobile park. Use would be up the South Fork road and into the high country along the divide.

The Sacramento Headwaters watershed contains a total of 55 archaeological sites: 14 historic and 41 prehistoric. A number of historic sites in the Deer Creek drainage are unrecorded. The prehistoric sites are mostly located along streams in the watershed. Prehistoric site densities average 2 per mile along the South Fork of the Sacramento, 3 per mile along Soapstone Creek, 8 sites along one mile of the Middle Fork of the Sacramento, and 4 along 1/2 mile of the North Fork of the Sacramento. Historic sites are dispersed throughout the watershed.

Thirty sites along the South Fork of the Sacramento, Castle Lake Creek, Fawn Creek and Soapstone Creek were monitored in 1994. Conditions indicate that almost 50% of the sites have been disturbed both before and after the sites were originally recorded in the late 1970's. The disturbance is mostly road and logging related (7 sites disturbed from road construction or maintenance, 6 sites from skid trail disturbance, and 2 sites from log landing disturbance). Five of these sites have also been used by recreationists (determined by campfire rings). Four sites along Soapstone Creek could not be relocated because of either heavy vegetation growth, erosion or road maintenance. Three prehistoric sites along Scott Camp Creek are eroding from natural causes.

The condition of sites in the Middle Fork and North Fork drainages and in Deer Creek is unknown.

Forest Health

Vegetation

(Reference Maps 6-13)

The National Forest System lands within this watershed are dominated by mixed conifer forests. Conifer tree species found are ponderosa/Jeffrey pine, white fir, Douglas fir, incense cedar, sugar pine, western white pine, red fir, and lodgepole pine. Port-Orford cedar is also found within the fringes of some perennial streams and wet meadow areas. The mix of these species varies with elevation, aspect and soil type.

The dominant size class of trees found in the mixed conifer forests is small to medium commercial size trees. These trees generally have crown diameters from twelve to twenty-four feet. They are considered

mature trees with diameters at breast height in the range of fourteen to thirty inches. Many of these mixed conifer stands are multi-storied and multi-aged (See Map 7).

A mixed conifer/oak forest occurs between 3,400 and 4,000 feet in elevation. This forest community covers approximately 16,000 acres or twenty-five percent of the watershed. Associated species include white fir, incense cedar, ponderosa pine and Douglas fir. California black oak is associated with many of these stands in varying densities. There are also some stands of pure California black oak. The understory of these stands has varying densities of shrublands consisting of green leaf manzanita, snowbrush, and white thorn. Approximately fifty percent of this type has an open stand density (10 to 39 percent canopy closure), fifteen percent has a moderate stand density (40 to 69 percent canopy closure), and five percent has a closed stand density (70 percent or greater canopy closure). Approximately fifteen percent of these lands are covered with seral shrubs and fifteen percent is wet meadows and lakes (Lake Siskiyou being the largest of these). These stands are dominated by mature size trees with crown diameters between 12 and 24 feet (Forest size class 3).

Between approximately 4,000 and 6,500 feet in elevation is a mixed conifer forest associated with white fir, ponderosa pine, incense cedar, Douglas fir and sugar pine. This forest community covers approximately 30, 000 acres or fifty-five percent of the watershed. Approximately fifty percent of this mixed conifer type has an open stand density, approximately thirty percent has a moderate stand density and approximately four percent has a closed stand density. Conifer tree plantations make up four percent of this community, planted mainly to ponderosa/Jeffery pine. Seral shrubs associated with this forest community are green leaf manzanita, huckleberry oak, and tan oak. Seral shrublands make up approximately twelve percent of this forest community. Also associated with this community are some stands of knobcone pine that originated as a result of previous wildland fires. The mixed conifer forests are dominated by mature size trees (crown diameters between 12 and 24 feet). Only about five percent of the forested lands are pole size trees (less than 12 foot crown diameter, Forest size class 2) and four percent are seedling and sapling size trees (Forest size class 1, mostly in plantations). Many of the mature mixed conifer stands are multi-storied and multi-aged. There is only one stand (115 acres) of larger mature size trees (Forest size class 4, greater than 24 foot crown diameter).

Between approximately 6,500 and 7,500 feet is a mixed conifer forest associated with red fir, Jeffery pine, lodgepole pine and western white pine. There are some small patches of pure red fir and some of pure lodgepole pine. This forest community covers approximately 13,000 acres or twenty percent of the watershed. Approximately sixty percent of the forested lands are of open stand density, fifteen percent of moderate stand density and less than five percent of closed stand density. Approximately fifteen percent of this community is seral shrub, mainly huckleberry oak and five percent is barren. These stands are also dominated by mature size trees with less than ten percent in the pole, seedling and sapling tree sizes.

Above 7,500 feet is a sparse density of alpine conifers including mountain hemlock and white bark pine. There is also be some brewer spruce, Picea Breweriana, within the Castle Crags Wilderness portion of this watershed.

Small populations of aquatic dependent species are found within the fringe of some perennial streams. Willows, alders and big leaf maple are found along the lower reaches of the Sacramento River tributaries above Lake Siskiyou. Port Orford cedar is also associated with these riparian species along the South and Middle Forks of the Upper Sacramento and several tributaries to the South Fork. Port Orford is the only one of these species that grows to a large enough size to be considered a commercial species. These species occur in small patches as individuals with no definable stand structure or composition (See Map 11).

Insects and Pathogens

Numerous insects and pathogens that feed on or attack vegetation have been observed within the Headwaters watershed. Most of these organisms are relatively host-specific. They cause mortality, top-

killing, dieback, defoliation or structural weakening of the plant. These effects can produce small openings, snags, down logs and defects. In general the native insects and pathogens present in the watershed cause small-scale disturbances; not catastrophic effects.

The more injurious insects include bark beetles (*Dendroctonus spp*.) of pines and Douglas fir; flatheaded borers (*Melanophila spp.*) of true firs, Douglas fir, and pines; and engraver beetles (*Scolytus spp.* and *Ips spp.*) of true firs, Douglas fir, and pines. These insects usually do not cause catastrophic damage in mixed conifer stands. Individual tree mortality and small group mortality is normally the end result of their attacks. Many of the bark beetles and borers successfully attack only trees that are of low vigor. Bark beetles are particularly well-adapted to exploit drought-stressed pines for breeding habitat. In densely stocked pine stands and plantations, an attack by Dendroctonus bark beetles may result in a group kill of dozens of trees.

Dwarf mistletoes (*Arceuthobium spp.*) are the most widespread and significant native pathogens in the watershed. Most of the Pinaceae species host at least one species of dwarf mistletoe. The most obvious species is Douglas fir dwarf mistletoe with its large witches' brooms. This species is common along the South Fork Sacramento River. These parasitic seed plants slowly increase on their host and cause a reduction in vigor that can accelerate tree mortality. They are most injurious in stands that have multiple layers and are single species or predominantly one species. In general dwarf mistletoe appears to have faster, more dramatic effects in pines than true firs, although high levels of dwarf mistletoe will eventually cause mortality in these latter species also.

Sugar pine needle cast (*Lophodermella arcuata*) has been observed in western white pine along Scott Camp Creek and the South Fork Sacramento River in 1992, 1993 and 1994. This fungus disease of the foliage is not usually observed on western white pine and it normally does not reoccur at significant levels over a several year period. The result of this repeated attack is a general crown thinning of the western white pine and, in concert with drought conditions, an increased susceptibility to mountain pine beetle attacks.

Numerous decay and canker causing fungi are also present. These organisms usually increase stand decadence by causing heart rot and branch and top mortality. The decay fungi may accelerate nutrient cycling by initiating the break down of woody material while trees are alive and standing. Most of the native canker causing fungi are facultative saprophytes and are weakly parasitic. Their parasitic capability increases when their host has a reduced ability to defend itself. This occurs when the host is under an external stress. The common stress-causing factors in Headwaters Watershed for most tree species include drought, poor site quality, overstocking and a shift toward shade tolerant species. This shift in species composition is a result of fire suppression and possibly higher precipitation levels. In addition, the more shade tolerant species seem to be more prone to canker fungi, particularly when under stress.

One non-native pathogen, *Cronartium ribicola*, which causes white pine blister rust is present in the Headwaters Watershed. The pathogen likely entered the area in the 1930s. It infects sugar pine, western white pine, whitebark pine, foxtail pine, and various species of *Ribes*. It has minimal effect on the *Ribes*, sometimes causing premature defoliation in the summer. It has a devastating effect on the pines, killing small trees within a few years to a few decades. Limited observations of the high elevation white pines around Mt. Eddy suggest that the rust has had limited effect on the trees so far. On larger trees, it does not have as significant an effect in many cases because of the limited number of infections and the location of the infections on the long limbs. In some situations, however, even large trees may be affected by the blister rust if enough limbs are killed and the tree becomes susceptible to successful insect attack. Observations indicate that trees in the 10-20 inch dbh (diameter at breast height) range are now showing signs of infection from the 1970s as tops and entire trees die. Regeneration of sugar pine is becoming increasingly difficult in California, especially in areas that are moist in the fall. Resistance to successful infection has been identified in sugar pine, but no resistant trees have currently been identified in this

watershed or the breeding zone it is in. Resistance has been identified in western white pine in other parts of the West, but this work is only in its early stages in California.

Fire and Fuels

Fire Frequency

Fire history for the Headwaters Watershed was obtained from findings recorded by Carl Skinner (PSW Redding) and through fire history data from the Shasta-Trinity NF. Fire history data was compiled from old fire reports dating back to the turn of the century, fire atlas maps on local districts and fire history maps in local museums. The data was derived from 15 sample sites within the watershed. The average time between fire starts is shown in Table 3-1.

Table 3-1: Average Time between Fire Starts (years).

	Year				
Site	**1911/PRES**	**1850/1910**	**1750/1849**	**1650/1749**	**<1649**
3C1	19.7	12.6	18.8	16.0	N/A
3C2	16.0	17.0	14.6	28.5	N/A
3C3	31.0	11.7	9.4	14.0	N/A
3C4	N/A	10.0	10.0	14.3	N/A
3C5	N/A	10.0	7.7	14.3	14.2
3B1	36.0	8.7	12.5	N/A	N/A
3B2	36.0	15.3	25.0	N/A	N/A
1A1	17.8	10.0	11.1	N/A	N/A
4A1	23.7	8.5	14.3	N/A	N/A
C	17.3	8.6	7.1	N/A	N/A
4D2	36.0	15.3	14.3	N/A	N/A
4D3	N/A	6.1	11.1	N/A	N/A
4D4	23.7	15.3	N/A	N/A	N/A
2D1	N/A	20.0	25.0	N/A	N/A
2E1	71.0	61.0	33.0	33.0	N/A
TOTAL	**328.2**	**230.1**	**213.9**	**120.1**	**14.2**
AVE.	**29.84**	**15.34**	**15.28**	**20.02**	**14.2**

The sample sites show a steady decline in large fire frequency from 1750 to the present within the watershed. Sample sites located between elevations of 3,750-5,700 feet tended to have fire return intervals that were consistent with the natural fire regime.

From 1911 to 1994 the Headwaters watershed and local surrounding areas had over 1,700 ignitions. Of these ignition sources 324 were initiated by lightning and the rest were human caused. Three large fires occurred in the watershed during this period.

1922 Fire (fire # 22578) burned 640 acres.

1924 Fire (fire # 24630) burned 2,100 acres.

1939 Fire (fire # 39677 Deer Creek fire) burned 17,410 acres.

The current potential for wildfire in the watershed was assessed using recent fire data from 1970-1994. This data was used to calculate the fire occurrence density rating, fire risk and fire hazard.

Fire Occurrence Density

The Headwaters Watershed has had 182 ignitions over the past 24 years (130 human caused and 52 lightning caused). This information was used to create a density map. The map depicts three areas

differentiated by the number of starts within low, moderate and high density zones and the number of acres in each zone.

Table 3-2: Fire Risk

DENSITY ZONE	NUMBER OF STARTS	NUMBER OF ACRES	FREQUENCY BETWEEN FIRES	RISK RATING
Low	4 fires	13,427	6.0 YEARS	0.13 LOW
Moderate	41 fires	16,906	.58 YEARS	1.00 HIGH
High	137 fires	23,667	.17 YEARS	2.38 HIGH

A risk map was created identifying low moderate and high risk areas. A hazard map was then created by correlating vegetation data with fuel types using the 90th percentile weather with Behave Fire (the weather was obtained from the months of June, July, August, and September). The 90th percentile weather is represented by the average temperature, average relative humidity, average 10-hour fuels and average wind over a given period of time. The risk/hazard class was then determined by coupling the hazard and risk information as shown in Table 3-3.

Table 3-3: Risk/Hazard Class

HAZARD CLASS		RISK CLASS		
		Low	**Medium**	**High**
A	Low	1	1	2
R	Medium	1	2	3
D	High	2	3	4

1 = low probability of an area being lost to wildfire.
2 = moderate probability of an area being lost to wildfire.
3 = high or very probable chance of losing entire area to wildfire.
4 = very high or quite probable that area will be lost to wildfire.

The Headwaters watershed has had large fire activity from 1750 to around 1900. After the turn of the century, fire suppression and forest management practices led to a build up of natural fuels and the encroachment of a less fire tolerant understory (white fir). The fire activity has increased as the area has become more populated. The lower east portion of the watershed is mostly private lands adjacent to forest lands. This has created an urban interface condition and has the largest fire density. The urban interface area has the highest potential loss to wildfire.

Special Plant and Animal Populations

(Reference Maps 14-17)

Plant Populations of Concern

Threatened, Endangered, Proposed, Candidate, & Sensitive plants

No federally listed or proposed plant species occur in this watershed. Most of the sensitive plants in the watershed are candidates for federal listing, either C1 or C2 categories. Several other candidates that are not on the Regional Forester's sensitive species list are found in the watershed. These have been proposed by this and other Forests for addition to the sensitive species list, and in the interim are treated as sensitive species by the Shasta-Trinity NF. One sensitive species in this watershed, *Eriogonum alpinum*, Trinity buckwheat, is listed by the State of California as Endangered.

Botanical diversity and endemism in the Headwaters watershed are as high or higher than any other watershed on the Shasta-Trinity National Forests. Twelve of the forty+ sensitive plants of the Shasta-Trinity are known to occur in this watershed, and there is suitable habitat for more. Intensive botanical surveys have been done for about 10% of the watershed. Three new plant species were discovered in the watershed in the last fifteen years.

Most of the rare plants in the watershed are geographically restricted to the Klamath Province, and many are further restricted to the Trinity Ultramafic sheet. The latter group are almost all serpentine substrate endemics of middle and upper elevations. Most are associated with rocky, open habitats that are affected to a small degree by recreation. A few are montane forest dwellers adapted to moderate periodic habitat disturbance. These species are affected by timber harvest, especially site preparation, road building and maintenance, and in a few places by recreation. One riparian-dependent rare plant, showy raillardella (*Raillardella pringlei*) is of principal concern in this watershed because of observed effects from cattle grazing.

TES plants of Riparian Habitats

Raillardella pringlei is endemic to the Trinity Ultramafic sheet in eastern Trinity and southern Siskiyou Counties. Habitat is limited to the immediate riparian zone associated with perennial streams and seeps, from 4,000 to 7,500 feet elevation. About one-third of all populations are within this watershed. Most suitable habitat has been surveyed for the plant.

Major populations of *Raillardella pringlei* at Fawn Creek, Toad Lake, Chipmunk Lake, and the upper reaches of the Middle Fork of the Sacramento are grazed annually by cattle in the Bear Creek allotment. Both the leaves and the flower heads are grazed. Local extinctions and population declines have been reported. Widespread grazing of flower heads prevents the plants from producing seed in many years. It is unknown what effect these grazing impacts have on the viability of the species. Showy raillardella has also sustained relatively minor impacts from recreational use of its riparian habitat; these impacts are likely to increase with increased recreational use of the watershed.

TES plants of Rocky Habitats

Rare plants of rocky habitats whose viability is significantly dependent on this watershed include *Eriogonum alpinum, Epilobium siskiyouense, Campanula shetleri,* and *Potentilla cristae.*

Eriogonum alpinum, Trinity buckwheat, is a Trinity Ultramafic sheet endemic; in fact over half of its populations are within this watershed. The plant is restricted to high-elevation, extremely serpentinized rock outcrops and talus. A few trails bisect populations, but for the most part this species is protected from impact by its remoteness.

Epilobium siskiyouense, Siskiyou fireweed, is also a Trinity sheet endemic of similar habitat to *Eriogonum alpinum,* often growing with it. About one-fourth of its populations are within this watershed.

Campanula shetleri, Castle Crags harebell, is limited to granodiorite cliffs of Castle Crags. It may be affected by rock climbers who use its cliff-crevice habitat for climbing, but there is no reliable information about the extent to which this is a real or just hypothetical problem for the species.

Potentilla cristae is a recently discovered species known from a few widely scattered localities in the Trinity, Scott, and Marble Mountains. Populations are documented from Cedar Basin and the headwaters of Wagon Creek in this watershed. Virtually all populations are in remote areas unlikely to be affected by human activity.

TES Plants of Forested Habitats

Three sensitive plants of forested habitats are likely to be affected by human activity in the watershed.

Arctostaphylos klamathensis, Klamath manzanita, is a Trinity Ultramafic sheet endemic of montane chaparral and openings in red fir forests, from about 5,500 to 6,500 feet in elevation. This species has been observed vigorously colonizing road cuts and logged forests. Most of its suitable habitat has not been surveyed for its presence, and it is similar enough to other manzanitas that the casual observer would not notice it. Six populations are currently documented, only one of which is in this watershed--this is the type locality (where it was first discovered) in Cedar Basin.

Cordylanthus tenuis ssp. *pallescens*, pallid bird's-beak, appears to be a relatively recent migrant into the watershed. In recent years the plant has been found along many roads in the watershed, mostly at lower elevations. Its natural habitat is in openings in mixed conifer forest on volcanic soils around the base of Black Butte. In the Headwaters watershed this rare subspecies appears to be hybridizing with a more common subspecies native to the watershed, *C. tenuis* ssp. *viscida*. A botanical survey specifically for this plant was done by the Shasta-Trinity NF in 1992-1993. Based on survey results, about 30% of all populations are in this watershed, but many are mixed populations with the related subspecies.

Phacelia dalesiana, Scott Mountain phacelia, is endemic to the Trinity Ultramafic sheet, where it grows in openings of montane mixed conifer forest at elevations from 5,300 to 7,000 feet. Most populations grow on nearly level ground. Experimental data from plots on the Shasta-Trinity NF indicate that infrequent, light to moderate soil disturbance and the creation of small canopy openings benefits the species by creating favorable microsites for seedling establishment, so long as part of the parent population is retained as a seed source. This species often is found in old skid trails and unmaintained roads. Heavy soil disturbance, such as site preparation of plantations by discing, destroys the plant. A thorough survey of suitable habitat was done in 1991 by the Shasta-Trinity NF and partners. Results indicate that about 10% of all populations of this species are within this watershed. Where the plant grows in popular recreation areas such as Toad Lake, foot traffic and vegetation removal cause local declines in phacelia numbers. If foot trails and campsites are rehabilitated, it is likely that the phacelia will recolonize if there is a nearby seed source.

Survey & Manage species: plants, lichens, & fungi

The President's Forest Plan includes standards and guidelines intended to protect and enhance habitat for certain late-successional and old-growth forest related species throughout the range of the Northern Spotted Owl. These species are listed in Table C-3 of Attachment A to the Record Of Decision (ROD); and they are commonly known as the "survey and manage" (or S&M) species. The subset of these species known or potentially occurring here on the Shasta-Trinity NF is published as appendix R of the Shasta-Trinity Forest Plan.

Four survey strategies apply to the survey and manage species. Each strategy has its own timetable for implementation:

Strategy 1 (manage known sites) applies to activities implemented in 1995. **Strategy 2** (survey prior to ground-disturbing activities and manage sites) is phased in for certain salamanders, red tree voles, and lynx for all projects implemented in 1997; for species in other groups, strategy 2 will apply to activities implemented in 1999. Survey protocols are currently being developed for these species. **Strategy 3** (conduct extensive surveys and manage sites) surveys must be underway by 1996, but standardized survey protocols are yet to be developed. **Strategy 4** (general regional surveys) will be initiated in 1996 and are to be completed by 2006.

One S&M vascular plant, *Cypripedium fasciculatum*, has been documented in the Headwaters watershed at one site near Castle Lake. Other occurrences of this species in the watershed are likely. Other S&M vascular plants possibly occurring in this watershed are *Allotropa virgata* (has been reported from Mt. Shasta), *Botrychium minganense* (within geographic range of species), *Botrychium montanum* (recently documented from Mt. Shasta), and *Cypripedium montanum* (documented from several places nearby).

Survey strategies 1 & 2 apply to all S&M vascular plants. Therefore, a management strategy must be developed for the known population of *Cypropedium fasciculatum* at Castle Lake prior to any future activity that may affect it. Project level surveys for these vascular plants must be part of National Environmental Policy Act (NEPA) documentation for any project that will be implemented in 1999.

Several S&M bryophytes are suspected to occur on the Shasta-Trinity NF, but none has been documented. Survey strategies 1-4 apply, depending on individual species. We have no known sites at present, so strategy 1 does not apply here (for the time being anyway). Project level surveys for these nonvascular plants must be part of NEPA documentation for any project that will be implemented in 1999.

Several S&M lichens are suspected to occur on the Shasta-Trinity NF, but none has been documented. Survey strategies 1-4 apply, depending on individual species. We have no known sites at present, so strategy 1 does not apply here (for the time being anyway). The majority of late-seral associated lichens are to be managed under survey strategy 4, which means that the surveys likely will be contracted at the regional or province level. Project level surveys for these species may not be needed unless known sites are discovered nearby.

A long list of S&M fungi are suspected to occur on the Shasta-Trinity NF. None has been documented within the Headwaters watershed. However, ten species of S&M fungi are documented from sites on Mt. Shasta or Deadfall Meadows; these should be considered likely residents of the Headwaters watershed. These are:

Deadfall Meadows
Gastrosuillus sp. nov. (Trappe #7516)
Gautieria magnicellaris
Rhizopogon abietis
Rhizopogon brunneiniger
Rhizopogon evadens var. *subalpinus*
Rhizopogon flavofibrillosus

Mt. Shasta
Arcangeliella lactarioides
Nivatogastrium nubigenum
Sedecula pulvinata
Thasterogaster pingue

In most cases survey strategies 1 and 3 apply. Extensive surveys rather than project level surveys are recommended by the President's Forest Plan, because the erratic production of fruiting bodies by these fungi makes it most efficient to do broad surveys during times of appropriate conditions. Sites identified during the surveys will be managed for the species in question. Project level surveys for one fungus species, *Bondarzewia montana*, are needed for NEPA documentation of projects implemented in 1999.

Noxious weeds & other exotic pest plants

Non-native plants in general have made few inroads into this watershed. At low elevations on private lands, pasture grasses and associated forage weeds are common, but this is in most cases intentional (that is, the pasture grasses and other plants were introduced on purpose). No noxious weed populations currently exist in the watershed. A few exotic grasses, sweet clover and other roadside weeds are established along the immediate roadside of the South Fork road, but have not spread into adjacent natural communities.

Animal Populations of Concern

Within the Sacramento Headwaters Watershed 10 amphibians, 111 birds, 59 mammals and 14 reptiles are associated with the habitat and elevations characteristic of the area. Species distribution and local knowledge contributed to this species list. Wildlife Habitat Relationships (WHR) habitat types found within the watershed include ponderosa pine, closed-cone pine (knobcone pine), red fir, mixed conifer (Douglas-fir, ponderosa pine), montane shrubland, montane riparian, riverine (SF Sacramento River and associated tributaries), and lacustrine (Siskiyou Lake and alpine lakes).

Documentation from sightings and nest locations and habitat/distribution models have indicated the existence of 34 species of special concern within the Sacramento Headwaters watershed. Species of special concern are defined as those listed under the Federal and State Endangered Species Act (including proposed, category 1 or 2), the California Dept. of Fish and Game "Species of Special Concern" program, the U.S. Forest Service Sensitive Species program, the Neotropical Migratory Birds (NTMB) program, the Record of Decision (survey and manage, 'protection buffers,' and other standards and guides), or as 'game' species. Each species or group of species has specific management guidelines designed to prevent the species from being listed or bring the species back to healthy population levels so delisting may occur. Species are also placed into one or more guilds which represent their habitat requirements. Guilds will be used to group the species of special concern for discussion purposes. The following discussions will describe the current condition for each species or group of species found within the Sacramento Headwaters Watershed.

Aquatic Guild

Management of Riparian Reserves is expected to provide for species listed in the aquatic guild. Possible conflicts with aquatic conservation strategy objectives effecting these aquatic species include cattle grazing in alpine meadows and riparian areas and fish stocking of alpine lakes.

Northern Red-legged Frog (Category 2, California Species of Special Concern)

No red-legged frog sightings have been recorded for the Sacramento Headwaters watershed, though the watershed falls within their known distribution.

Northern red-legged frogs have a historical distribution which is north of the California red-legged frog's range (Redding), west of the Cascade crest, and south of southern British Columbia. Suitable habitat for the Northern red-legged frog is defined as a water channel or pond with cool (< 25 degrees celsius), slow or still water, deep pools (70cm -92cm), emergent vegetation and free from non-native fish and bullfrogs. These bodies of water border or are in close proximity to dense riparian vegetation where escape and thermoregulation is possible.

Vegetation maps do not reflect the current riparian condition. Habitat typing has not occurred within the watershed. With the absence of riparian and aquatic habitat condition information, suitability of the watershed for red-legged frogs cannot be determined.

Cascades Frog (Category 2, CA Spp. Special Concern)

Cascades frogs are known to occur at most of the alpine lakes and along the major tributaries. In 1994, Gary Feelers conducted a study on cascades frogs from Gumboot Lake to 1/2 mile downstream and has documented an existing population. The condition of the population is unknown. Local fly-fisherman also reported cascade frogs along Gumboot Creek. Other locations identified include Toad Lake, Cedar Lake and Cliff Lake, the North fork of Deer Creek and Fawn Creek.

Suitable habitat for the cascades frog is defined as slow, permanent bodies of water surrounded by a moist forested habitat with herbaceous cover for thermoregulation and escape cover. Cascades frogs are strongly

tied to water. Apparently the headwaters of many tributaries are suitable for the cascades frog. How suitable other tributaries are is unknown without habitat typing or surveys.

Tailed Frog (CA Spp. Special Concern)

Tailed frogs have been identified at the headwaters of tributaries within the watershed. The watershed falls within their natural geographical and elevational (0-6,000') distribution.

Suitable habitat for tailed frogs is considered permanent, clear, cold (<15 degrees Celsius) water within a steep drainage, bordered by a dense, moist forest habitat. Riffles with small, clean cobble are important for larval stage stages.

Since habitat typing has not been accomplished for this watershed, the existence of other areas of suitable habitat cannot be determined.

Foothill yellow-legged Frog (CA Spp. Special Concern, Category 2)

Four sightings of yellow-legged frogs are recorded for Gumboot Lake, Fawn Creek and Ney Springs. Two of these sightings have been confirmed by herpetological experts. The watershed is within the yellow-legged frog's natural geographical and elevational distribution (0-7,500 feet).

Suitable habitat for yellow-legged frogs is a permanent, rocky bottomed body of water near moist, upland habitat. Water temperature requirements are unknown.

How suitable other lakes or tributaries are is unknown without habitat typing or surveys.

Bats

Eleven species of bats are suspected to occur within the watershed. Of special interest, the spotted bat, has been identified at Castle Lake. Ten of the species use caves, mines, or abandoned wooden bridges or buildings as wintering, maternity, and/or roost sites (collectively called roost sites). Bats are very sensitive to disturbance, especially the females when raising young, or the entire colony when hibernating. Disturbance by the public through the exploring of caves, buildings, or other areas inhabited by bats can lead to reduced reproductive success and increased mortality. Management guidelines in the Record of Decision suggest surveying and protecting potential roost sites and especially known roost sites.

Cavity Nesters

Three cavity nesting species are suspected to occur in the watershed. These cavity nesting species are the white-headed woodpecker, pygmy nuthatch, and flammulated owl. Forest observation records, breeding bird surveys, Christmas bird counts, and spotted owl surveys have confirmed their distribution in the Mt. Shasta Ranger District.

Bald Eagle (Federally Endangered)

Since 1989 only one pair of eagles has been recorded as nesting within the watershed. This nest site is located above Lake Siskiyou, about 6 miles west of Mt. Shasta City. It is on land administered by the USDA Forest Service, Mt. Shasta Ranger District. This is the only known nesting pair of eagles on the ranger district. The site is within the spotted owl Critical Habitat CA-7 and between the two LSR and Managed Late-successional Area (MLSA). The nest is located less than 900' from the Red Hill Road. The pair of eagles winters in the same area.

Young were first discovered in 1989, though the nest was thought to be built in 1987-88. Reproductive success has occurred in 1989, 1990 and 1994. The same nest tree, 'an overmature sugar pine,' has been used. In 1991 the nest was abandoned shortly after incubation, in 1992 incubation failed, and in 1993 the

nest appeared unused. In 1994, the nest blew out after the young had fledged. The most recent survey of May 1995, indicated that reconstruction of the nest was occurring. Both eagles were observed. Further surveying is required to determine the current reproductive status.

Suitable nesting habitat consists of a group of large diameter trees or snags, usually ponderosa pine, sugar pine or Douglas-fir, with well spaced large limbs. One of the group of trees must have an open crown to serve as a nest tree. Nests are generally within one mile of a permanent body of water containing an adequate prey base of fish and waterfowl. The eagles also require open, easily approached hunting perches along feeding areas. These may be large snags, broken topped trees or rock outcrops.

The nest site area for the Siskiyou Lake pair has large expanses of brush with mixed conifers and a few hardwoods in the understory. Sugar pine and ponderosa pine are the dominant conifers immediately around the nest area. Older or mature pines are uncommon in the area indicating a low recruitment for snags or alternate nest sites. Snag density is less than one per acre in the Lake Siskiyou area. Through management of the area for spotted owls, as indicated in the CHU and LSR guidelines, the condition of the stands for suitable nest and roost sites in the primary and secondary zones, is expected to increase.

Sightings of eagles at Lake Siskiyou and Castle Lake and past reproductive success indicate that these areas are suitable for foraging. Both lakes are stocked yearly with rainbow trout (12-15,000 lbs per year at 2-3 trout per pound in Siskiyou Lake and 10,000 fingerlings per year in Castle Lake). Castle Lake is considered to have an unsuccessful fishery and may contribute less fish to the eagle's diet than Lake Siskiyou. The South Fork of the Sacramento River is also used for foraging as detections are recorded along the river. Other areas used for foraging include Brown's Lake, Strawberry Valley, duck ponds, and local small swamps east of Siskiyou Lake. In the winter Hammond Reservoir and Lake Shastina (this lake is well outside of the 'maximum' foraging range and may be used by another pair) are also used by the pair. Though other lakes and creeks maintain fish populations, the use of them for foraging by this pair in the summer is unknown though considered minimal, as many of the lakes are over 2 miles away. The preferred foraging distance is 1/2 miles and the minimal distance is 1 mile.

Bald eagles have been sighted at alpine lakes, specifically Toad Lake, Porcupine Lake and Little Crater Lake (just north of watershed boundary). These lakes are stocked yearly with trout. The sightings occurred in the summer of 1994, over six air miles from the Siskiyou Lake nest site. Individual mature bald eagles were observed as well as two eagles performing aerial acrobatics. These sightings may indicate a very large home range for the existing pair or the existence of another home range.

Snags

Snag density requirements for species listed in the snag guild, are expected to be met through Late-Successional Reserve (LSR) silvicultural guidelines, Matrix snag retention and recruitment guidelines, and Administratively Withdrawn or Congressionally Reserved Areas. There is no current information on snag densities within the watershed.

Old Growth

Suitable (nesting, roosting, foraging) habitat requirements for old growth dependent species are expected to be provided through LSR, MLSA, Unmapped LSRs, and Matrix 'old-growth' retention guidelines. Suitable habitat in the watershed is extremely fragmented, existing in approximately three percent (3%) of the watershed (1,114 acres). The largest single patch of suitable, continuous owl nesting habitat is approximately 115 acres. Of the 1,114 acres, 335 is found in Matrix lands, 490 in the LSR, 110 in the MLSA, 125 in the Administratively Withdrawn Area and 64 in the Congressionally Withdrawn Area. The LSR and MLSA make up 8,552 acres or 21% of the watershed. In addition to suitable habitat another 74 percent of the watershed is forested and capable of becoming suitable habitat.

Dispersal habitat for these species is expected to be provided through these land allocations and through management of Riparian Reserves and the CHU. Based on dispersal analysis, the amount of dispersal habitat in the watershed is between 37% and 41% of capable forested lands. Within the watershed, 16,871 acres or 42% is within CHU CA-7. Forty-eight percent (48%) of the CHU lies outside the LSR and MLSA and is primarily prescription III. According to dispersal analysis, this area currently meets dispersal habitat requirements (>50%). Dispersal of wildlife within the watershed may be hindered by dense understories, habitat fragmentation, open shrublands, open forested habitats, and barren areas. Habitat fragmentation, urban development, and checkerboard ownership is expected to hinder dispersal of wildlife to larger suitable habitat reserves outside the watershed.

Table 3-4: The Percentage of Capable Lands which Meet Dispersal Habitat for each Quarter Township.

Quarter Township	Vestra 1990	Mt Shasta R.D. 1991-1992
40N05WA	46	---
40N05WB	27	---
40N05WC	16	27
40N05WD	42	65
39N05WA	41	60
39N05WB	14	23
39N05WC	38	30
39N05WD	25	---
39N04WB	63	71

Based on Vestra 1990, and Mt. Shasta R.D. 1991-1992

Northern Goshawk (FS Sensitive, CA Spp. Special concern, Category 2)

Only one goshawk nest, ST001 (Morgan) is recorded for the watershed. This is the only goshawk nest recorded for the Mount Shasta Ranger District. In 1992, a pair and young were verified. There is no indication the nest site has been surveyed since 1992. The nest site is located within LSR RC342 / CHU C-7. The nest site is located within 1/4 mile of spotted owl territory #001. A goshawk sighting was reported while surveying the spotted owl territory in 1990. Goshawks were again recorded in 1992 as a nesting pair. A brief discussion on the effects of the goshawks on the spotted owl nest is given in the spotted owl section. Incidental goshawk sightings are recorded along Castle Lake Creek and North Fork Deer Creek.

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 LMP 'preferred' habitat is 4b, 4c, conifer habitats with 60% overstory near water and openings (<1/4 mile). Forested habitat within the watershed would be classified as 'required.' This is considered an acceptable level for management.

Spotted Owl (Federally Threatened)

Three spotted owl activity centers are located within the Sacramento Headwaters watershed. Territory #001 is within the LSR and territory #005 in the MLSA. Both are within the CHU CA-7. The third territory (#018) is within prescription III - Roaded Natural Recreation, 2 - 3 miles from the LSR, MLSA and CHU, and is considered an Unmapped LSR. All territories have been surveyed within the last five years with the earliest surveyed in 1992 and the latest in 1994. Territory # 001 has reproductive status. The others have territorial single (005) or pair (018) status.

Table 3-5: Reproductive History of the Three Northern Spotted Owl Activity Centers within the Sacramento Headwaters Watershed.

Owl	Status	Status Verified	Young Verified
001	Pair	1976, 1991, 1983, 1986, 1989, 1990, 1991, 1992, 1993	1976, 1986, 1987, 1989, 1990, 1991
005	T.single	1986, 1987, 1988, 1989, 1990, 1992, 1993	no reproduction
018	Pair	1979-1980 (single), 1990 (single), 1992, 1993, 1994 (single)	no reproduction

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 trees, 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.

At the territory level (0.7 mile radius around activity center), all three territories are below the incidental take threshold (500 acres suitable habitat). At the home range level (1.3 mile radius), all three activity centers again have less than the incidental take threshold (1,336 acres).

Table 3-6: Amount of Suitable Habitat in Acres for each Activity Center within the Sacramento Headwaters Watershed.

Owl#	0.7 mile radius circle	1.3 mile radius circle
001	225	529
005	60	110
018	25	49

The nest site for activity center # 001 is a mature broken-top snag, 75 feet in height. The surrounding habitat has been described as ‘dense second growth’ and ‘a classic old growth forest.’ The area is timber typed as Douglas-fir 3 b/c. Average overstory canopy is 50% with trees averaging 90’ in height and 22” DBH. The average understory canopy is 70%, with a variety of tree species, 75’ in height. The nest site was discovered in 1989. Reproductive success occurred until 1991. The territory was last surveyed in 1993. The nest site is within 200 yards of an intermittent tributary and 1/4 mile from a goshawk nest site.

The goshawk nest site was discovered in 1992. Goshawks were recorded in the area as early as 1990. Whether the presence of the goshawk nest affected the reproduction of the spotted owls is unknown. Though goshawks are predators of spotted owls, other owl nest sites have been in close proximity to goshawk nest sites. In this case the goshawks may have been ‘clued’ into the presence of the owl nest when the surveyors agitated the adults or young, causing activity during the day, when the owls would be most vulnerable. Whether owls will return to the area is unknown, though a small portion of the habitat is still suitable.

From 1989 to 1994 approximately 85 percent of the watershed has been surveyed to protocol for calling routes, SOHAs and timber sales. From 1976 to 1989 District biologists or private individuals conducted unofficial surveys within 50% of the watershed. About 15 percent of the watershed has not been surveyed for spotted owls. These areas are in the eastern and the northwestern sections of the watershed. The unsurveyed areas include private lands (the eastern section), the unroaded non-motorized land allocation, and Mt. Eddy proposed Research Natural Area (RNA) land allocations (the northwestern section).

Table 3-7: Survey Areas and the Years Surveyed to Protocol and Not Surveyed to Protocol.

Survey Areas	Years to Protocol	Years not to Protocol
Chipmunk timber sale	1989, 1991, 1993, 1994	1992
Blue timber sale	1994	1993
Cedar timber sale	1993, 1994	1990
Fawn timber sale	1991, 1993, 1994	1992
Morgan timber sale	1989, 1990, 1991, 1993	1976, 1981-1987
Panther timber sale	1993, 1994	1990, 1992
Scott timber sale	1988, 1990, 1991	1985-1987, 1992
Soapstone timber sale	1990, 1991, 1994	1992
Stink timber sale	1992, 1993, 1994	---

California Wolverine (California Threatened, Category 2)

A 1985 sightings map for the Shasta-Trinity National Forest reported five wolverine sightings in the Sacramento Headwaters. These sightings are found near Cedar Lake, Lower Cliff Lake, the headwaters of South Fork of the Sacramento River, the headwaters of Soapstone Creek, and along Fawn Creek. On the same 1985 sightings map, 6,400 acres was identified as wolverine habitat. This identified habitat is within the proposed Cedar Basin Research Natural Area, and in Roaded Recreation. The boundary of the habitat area is: Seven Lakes Basin to the south, the South Fork of the Sacramento River to the north, Mumbo and Gumboot Lakes to the west and Upper Grey Rocks Lake to the east.

Preferred suitable habitat for wolverines is defined as late seral alpine conifer forests (4a-4c) with patches of open meadows for cover and forage and talus, hollow logs or snags for denning.

WHR habitat types found within the designated wolverine habitat include mature (3b-c) montane chaparral, 6-24” DBH, sparse to moderate canopy red fir and mixed conifer stands. Habitat in the watershed is expected to be limited to the alpine land stratification and is considered moderately suitable.

Species Which Use More Than One Guild

Game Species

Of the 194 species thought to occur in the watershed, 12 (16 percent) are game species. Some of these species include ruffed grouse, blue grouse, California quail, mountain quail, common snipe, band-tailed pigeon, mourning dove, snowshoe hare, black-tailed hare, grey squirrel, coyote, black bear, and mule deer. A majority are considered common species and are found, within their suitable habitat, throughout the watershed. Viability of these species are expected to be provided for by special management direction for riparian areas, downed logs, snags, old-growth species, green-tree retention, hardwood retention, seral stage diversity management, forest health and other management plans for special land allocations. In addition to these management directions are special land allocations and individual species management plans.

One area within the watershed is designated for wildlife habitat management. This area lies just north of the middle fork of the Sacramento River in section 28, on the south west border of LSR RC342, within CHU CA-7 and partially inside activity center #001’s 1.3 mile boundary.

A deer management plan for the Mt. Shasta Deer Herd is being revised by California Dept. of Fish and Game in Yreka, CA. This plan indicates the population size goals, protection and location of fawning areas, and management for winter and summer range. Fawning areas have not been identified for the watershed. Summer range occurs from within LSR RC342, east through Morgan Meadows, Mt. Eddy area and south along with western side of the watershed (alpine habitat) to soapstone gulch. Winter range overlaps with winter range in LSR RC342 then is found on the eastern side of the watershed around Deer

Creek, Siskiyou Lake and south east to the Cantara Loop. The rest of the watershed is considered transitional range. Deer populations within the watershed travel to these summer ranges and other located outside the watershed. Key habitat areas include wet meadows and open shrublands.

The band-tailed pigeon is also a neotropical migratory bird (NTMB). For this species, population index surveys indicate significantly declining populations over the last 15 years. Band-tailed pigeons are considered mature hardwood-conifer dependents. With the limited distribution of hardwoods within the watershed populations of band-tailed pigeons are also expected to be limited. No sightings of band-tailed pigeons have been reported.

Neotropical Migratory Birds (NTMB) (Watchable Wildlife Program - 'NatureWatch')

Approximately 76 NTMBs are suspected to occur within the watershed. Examples include Cooper's hawk, sharp-shinned hawk, yellow warbler, merlin, and yellow-breasted chat in the riparian guild, golden eagle in the cliff and cave guild, green-tailed towhee in the open-shrub guild and osprey in the aquatic guild. 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.

Because of past alteration in breeding habitat, current habitat preservation and restoration is the backbone of maintaining current populations of NTMBs. The general Forest standards and guidelines state that habitat is to be managed for neotropical migrant birds to maintain viable population levels. Management of Riparian Reserves, hardwoods, old-growth dependant species, diverse seral stages, visual quality, protection buffers, snags and special lands will help preserve breeding habitat for NTMBs. Following proper management of breeding habitat, exposure to predation and parasitism is expected to become significantly reduced.

Fisheries Populations

The headwaters of the Sacramento River has one reservoir and fifteen alpine lakes that contain fish, as well as approximately 66 miles of fish bearing streams. The reservoir has a surface area of 430 acres and sits at an elevation of 3,200 feet. The alpine lakes range from 50 acres to under an acre in size and from 5,600 feet to 6,480 feet in elevation. Siskiyou, Castle, Cliff and Toad are the largest lakes within the watershed. Anadromous fish are no longer found in the area since the completion of Shasta Dam on the Sacramento River. The current fish assemblage is composed of native and introduced resident fishes. For a list of fish bearing streams and lakes and the fish species contained, see Table 3-8.

The numerous lakes in the watershed are the destination of many recreationists as they provide scenery, solitude, and an opportunity to catch fish. Siskiyou lake is the focal point of fishing for many area anglers and is the most intensively managed fishery in the Headwaters as well the only lake with both warmwater and coldwater fish species. Bass and trout species are found in this lake and provide the dominant components of the catch. This lake or reservoir was created in 1968 with the completion of the Box Canyon Dam. The alpine lakes also receive a considerable amount of angler use. Angling pressure seems to be related to accessibility with Castle and Gumboot sustaining much of the alpine lake fishing pressure. Other alpine lakes that also receive a significant amount of angling pressure, though less accessible, are Toad, Cliff, Little Castle and Gray Rocks Lakes. These, as well other alpine lakes, are stocked with brook, brown and rainbow trout. The rainbow trout is the only stocked species native to the area.

The fish bearing streams range from moderate sized streams like the South Fork of the Sacramento River to small and relatively shallow streams like Fawn Creek. Fish habitat condition is highly variable, but in general, is considered fair. Habitat factors limiting to fish production appear to be a lack of deep pools, limited cover, and in some streams unstable or steep channels and excessive sediments. The stream

fishery is dominated by rainbow trout. These trout are stocked in the more popular streams because natural reproduction cannot keep pace with angler demands. In streams with relatively little angler use, natural production is enough to meet existing demands. In the lower reach of the South Fork of the Sacramento River the fish assemblage resembles that found in Lake Siskiyou. This assemblage also contains some native species such as Sacramento suckers, Sacramento squawfish and speckled dace. The South Fork receives a high degree of use because a road parallels most of this stream.

The current fisheries condition of the Headwaters Sacramento River can be characterized as a system that has been created, managed and maintained through the introductions and continued stocking of native and non-native fish species. Though warmwater fish populations are self sustaining, the trout populations in the lakes and many of the streams must be sustained artificially through annual stocking programs provided by the California Department of Fish and Game. The trout stocked locally are raised at the hatchery in Mt. Shasta and are needed to meet current fishing pressure.

Table 3-8: Present Fish Species Occurrence by Stream and Lake.

	Fish Species								
Stream/Lake	**RT**	**BNT**	**BKT**	**Bass**	**BNB**	**GNS**	**CRPE**	**BG**	**OTHER**
Castle Lk.	X		X						
Castle Lk. Cr.	X					X			
Chipmunk Lk	X		X						
Cliff Lks.	X		X						
Deer Cr.	X								
Fawn Cr.	X								
Grayrock Lks.			X						
Gumboot Lk.	X								
Heart Lk.			X						
Lk. Siskiyou	X	X	X	X	X	X	X	X	X
Lt. Castle Lk.	X		X						
Ney Spg. Cr.	X								
Porcupine Lk.	X								
Sac. R. M. Fk.	X								X
Sac. R. N. Fk.	X								X
Sac. R. S. Fk.	X		X						X
Sac. R. Upper	X	X							X
Scott Camp Cr.	X		X			X			
Scott Lk.	X								
Soapstone Cr.	X								
Stink Cr.	X								
Timber Lk.			X						
Toad Lk.	X		X						

Fish Species Codes:
***RT** = Rainbow trout, **BNT** = Brown trout, **BKT** = Brook trout, **Bass** = Largemouth, **GNS** = Green sunfish Smallmouth, **BNB** = Brown bullhead Spotted, **CRA** = Crappie, **BG** =Bluegill, **Other** = Sacramento sucker, Speckled dace, Sacramento squawfish, Riffle sculpin, Golden Shiner*

Water Quality

(Reference Maps 18-20)

Geology and Geomorphology

The Study Area lies within the Trinity ultramafic sheet. This is the easternmost ophiolite of the Klamath Mountains province and is the oldest and perhaps largest in the Pacific Coast region. It crops out from beneath the lower Paleozoic and younger strata of the eastern Klamath plate, forming the arcuate western

lip of the plate for a length of 160 km, and overlies the central metamorphic plate to the west. The fold axes tend to be parallel to the regional trend of the contact with the central metamorphic belt, and both compositional layering and foliation in the ultramafic rock are parallel to the contact. This situation may contribute to localized mass wasting.

The exposed lip of the ultramafic sheet ranges in thickness from a few meters to a kilometer or more, and at some places pinches out entirely. Eastward the sheet disappears beneath the Paleozoic strata.

The Trinity sheet consists mostly of tectonitic harzburgite and dunite, with gabbro, pyronxenite, diabase, and plagiogranite. This lithic association has led to consideration of the Trinity sheet as an ophiolite suite. Gabbroic rocks within the ophiolite have been dated at 439 million years. Both isotopic ages and structural relations to the Devonian metamorphic rocks are compatible with the idea that the Trinity ophiolite is early Paleozoic (probably Orodovician) in age, and that the ophiolite was the substratum on which early Paleozoic and younger strata of the eastern Klamath plate (to the east of I-5) were deposited.

This area was heavily glaciated during Pleistocene time. Glaciers carved cirques or concave erosional depressions on the upper slopes of nearly all peaks higher than 6,000 feet during the last glacial stages of this geologic time period, which ended about 10,000 years ago. Glaciation was more extensive during earlier Pleistocene time than later, and most peaks higher than 5,500 feet have evidence of cirques at least on the north-facing slopes. Because the older cirques may have been carved more than 100,000 years ago, the evidence of glacial origin is often modified or concealed by subsequent weathering and erosion which continues to the present age.

Because of high rainfall of a seasonal nature (40 to 70 inches)) and occasional extreme runoff during the winter and early spring, depositional glacial features, such as terminal moraines and glacial drift, have often been much modified or even totally removed by subsequent stream action. This is particularly true of the older glacial deposits. In areas where the gradient of the valley is steep, the typical U-shape of the glacial valley has in some instances been largely modified or destroyed by subsequent stream erosion. This is particularly true in the lower reaches of the subwatersheds.

The speed and effectiveness of glacial erosion is related to the gradient of the glacier, the thickness of the glacial ice, and most important, the textural fabric of the glaciated rock. Glacial erosion is largely effected in a lateral direction by a plucking action, in over-steepened portions of the glacier such as ice falls. This is accomplished most readily in a brittle, closely-jointed rock. Within the project area, the ultramafic rocks have yielded most readily to glacial plucking. Most of the long, glacially carved U-shaped valleys of The Eddys, along the crest of the Trinity Mountains, are carved from this rock. More massive greenstone, as on Gray Rocks, and massive granite, such as that common to much of Castle Crags, resisted erosion and these areas stand as topographic highs bordered by large U-shaped valleys deeply incised in adjacent peridotite and serpentinite.

Other features unique to mountain glaciation are also seen throughout the watershed. These include: cirques, aretes, tarns, and moraines. A “hanging valley” is evident in an unnamed tributary trough of the Middle Fork of the Sacramento which is headed by Toad Lake.

Mass wasting has played a dominant role in shaping the unique geomorphic features of the area. In addition to glacial processes mentioned, morphogenesis specific to periglacial and temperate climatic regimes are apparent (the former term referring to areas where frost action processes dominate).

Mass wasting processes can be particularly active in periglacial regions. The reasons include: soil freezing and thawing leading to accelerated rates of soil creep, and high water content in the active layer resulting from: (a) snow melt and the thawing of segregation ice during spring and summer; (b) impedance of drainage by seasonally frozen ground; and (c) low evaporation rates. These processes apparently were more active during Pleistocene time than at present.

The response of a given slope to such environmental conditions depends largely on its engineering properties and geometry. As already mentioned, the soil strength parameters of serpentine derived soils is inherently low. When soil has been sheared (as is the usual case in periglacial environments) soil strength is even less due to reduction in both cohesion and internal friction. Disruption of the colloidal bonds across the shear plane reduces cohesion, often to zero, while reorientation of the soil grains adjacent to the shear plane reduces their interlocking and lowers the friction along the shear surface. After a cohesive soil has been remolded its consistency can be changed at will by increasing or decreasing the moisture content. If the moisture content of a clay is gradually increased the clay passes from a solid state to a plastic state, and finally to a liquid state.

Conventional analysis of the soil mechanics of slope failures assumes failure along a slip surface, which in the case of a thawing active layer may be assumed to lie immediately above the interface between frozen and unfrozen soil. Although frozen soil may not be totally impermeable, permeabilities are several orders of magnitude less than equivalent unfrozen permeabilities, so that for practical purposes, the frozen soil may be considered impermeable. Melt water must therefore pond and seep laterally downslope. This situation poses mass wasting implications and planning considerations for wet meadow boggy areas.

These characteristics make the area uniquely vulnerable to impacts, making it even more imperative that the environmental dynamics be understood. Mass wasting active and dormant features so far identified within the area include: gelifluction, frost creep, frost heaving, nivation hollows, debris avalanches, debris slides and flows, and rotational landslides.

Gelifluction, frost creep, frost heaving, and nivation, where active, are very slow processes. Rates of movement for these are measured in mm/cm per year. Debris avalanches, slides and flows, along with rotational landslide movement rates are measured in meters per year or day.

Whether an active periglacial zone presently exists is yet to be determined through future field investigations. Active processes are in evidence within the temperate climatic zone. These take the form of debris avalanches, flows and rotational landslides. The former are especially in evidence along the steep cirque headwalls with the latter dominating the inner gorge zone of the major tributary streams.

A comparison of 1944 versus 1984 vintage aerial photography demonstrates these inner gorge landslides were initiated within the 40-years spanned by these photographs. It is yet to be determined if these are a consequence of human activity or from naturally occurring events. Future field work will determine this.

Further complicating this understanding will be determining the significance and effect of albedo, snow cover and vegetation to the thermal regime of slopes affected by mass wasting processes. Within these areas the depth of winter freezing limits the thickness of the active layer and hence the depth to which mass movement can take place. Photo analysis demonstrates a marked effect of topographic aspect as a factor in the amount and type of mass wasting features present in a given area.

Because the major tributary streams run eastward, half the major slopes along these courses face north and half face south. Previous research in similar locales has shown that the thickness of the active layer is closely related to vegetation cover (and this is related to drainage and soil surface temperatures). A covering of snow also has a considerable effect on the thermal regime because of the low thermal conductivity of snow. Since snow depths in winter not only affect soil freezing rates and depths but also greatly influence soil moisture conditions during the spring thaw, it must be concluded that the distribution of snow is a major factor in the distribution and rates of mass movements on slopes in an active periglacial zone. In this regard it must also be determined the effect that the removal of vegetation by fire or harvest have had upon affecting the amount of snow cover and the binding effect of plant roots.

The terrain within the Headwaters area was delineated on 1:60,000 aerial photos into general geomorphic types. These zones were defined to distinguish meaningful difference in morphogenisis. They represent and are a consequence of geologic type, climate, slope gradient and position, surface drainage and terrain

texture. These factors thus impart distinct and inherent characteristics of mass wasting for the defined landform units. These are listed in Table 3-9 along with their characteristics.

Table 3-9: Mass Wasting.

Areas	Delivery Characteristics	Mass Wasting Mechanisms	Processes
Glaciated Side Slopes	Glacially smoothed slopes; slightly to moderately dissected 70-150%	Debris slides rock falls	Translational processes assoc. with slides/ falls chemical/phys. weathering.
Periglacial Side Slopes	Hummucky valley floor glacial deposits & sideslopes; more dissection; 0-4%	Soil flow/ creep rotational/ trans. slides	Gelifluction trans. processes colluviation
Non-Glaciated mid-slopes	Slopes from 40 to 80%. channels steep and straight	Debris slides, avalanches;	Translational processes assoc. with debris slides.
Colluvial Hill and Footslopes	Slightly to moderately dissected uplands. 20-45%	Soil creep rain wash sheet flow	Colluviation

Soils

The Headwaters Analysis area was stratified into four major types of landforms, each with distinct associations of soils.

Non-Glaciated Areas: This segment of the analysis area is characterized by steep mountain sideslopes with a complex array of soils of varying depths and textures. Most are shallow to moderately deep and very stony. Soils in this area are classified as having a serpentinitic mineralogy. This reflects the balance of Calcium to Magnesium in the soils where highly serpentinized soils exhibit a Magnesium level that is toxic to most plants. These soils are essentially barren. Soils with a moderate serpentine effect are usually sparsely vegetated and support a limited number of plant species. Soils with a mild serpentine effect are somewhat sparsely vegetated and some plant species are excluded. Highly and moderately serpentinized soils are prone to landslides and surface erosion because of the unstable nature of the bedrock and because they are sparsely vegetated.

Glacial and Periglacial Areas: This segment of the analysis area is characterized by ridgetops, glacial cirque basins, scree slopes, and mountain meadows. The area is dominated by rock outcrops, shallow soils, and wetlands soils. Drainages usually contain deep deposits of extremely cobbly glacial outwash. This landscape segment includes Soapstone Basin which is characterized by mountain sideslopes and glacial outwash debris. The sideslopes are typified by moderately deep soils with stony substrata. Erosion hazards are generally low due to the gentle slopes and high proportion of rock outcrop.

Colluvial Areas: This segment of the analysis area is characterized by mountain sideslopes, colluvial hillslopes, and stream terraces. The soils are typified by moderately deep stony soils on sideslopes and deep, non-stony soils on colluvial slopes and terraces. Some isolated areas of moderately serpentinized soils also exist in this segment. The lowest areas feature wetlands and shallow ponds. This area encompasses urban and developed areas. The soils include wetlands and urbanized and disturbed area. Soils have a moderate to high erosion hazard on mountain sideslopes and colluvial slopes and a low hazard on foot slopes, terraces and floodplanes.

Hydrology

The Sacramento Headwaters watershed is a geologically young drainage system located in the eastern Klamath mountains. Stream channels in the watershed are continually adjusting to geologic processes that

are uplifting the Klamath Mountains. The watershed has a dendritic drainage network and is palmate at its lower end where the Sacramento River and its tributaries converge at Lake Siskiyou.

The watershed contains two distinct hydrologic areas. The western portion of the watershed, hereafter referred to as Headwaters, drains the eastern Klamath mountains. A much smaller portion of the watershed to the northeast drains alluvial soils derived from both Mount Shasta and the Klamath mountains. Stream channels in each of these areas respond differently to precipitation because of differences in their geology and soils.

The Headwaters area is composed of glacial cirques, deep U-shaped valleys and upland meadows. The channel network drains mostly forested land. Major tributaries to the Sacramento River include its South, Middle, and North forks, Scott Camp Creek, Ney Springs Creek, Stink Creek, Castle Lake Creek, and Deer Creek. These streams generally drain shallow, impermeable soils with low water storage capacities. Water stored within the soil profile provides baseflow to streams throughout the year. Precipitation that is not stored in the soil profile is released quickly as surface runoff. The quick response of the watershed to precipitation results in high flows during snowmelt and peak flows during large precipitation events. The limited soil water storage results in low base flows after snowmelt has ceased.

The alluvial soils located in the northeast corner of the watershed are drained by Cold and Wagon Creeks. This portion of the watershed is almost entirely located on private land. Cold Creek drains mostly agricultural land and urban developments and Wagon Creek drains both forest and agricultural lands. Both creeks are spring fed and deliver steady base flows to Lake Siskiyou throughout the year. The porous volcanic soils on the western slopes of Mount Shasta store large quantities of water which are released gradually throughout the summer. Flood peaks in Cold and Wagon Creeks are less than those of streams draining the Klamath Mountains because of the high infiltration capacity of these soils.

All of the streams discussed above drain into Lake Siskiyou with the exception of Ney Springs Creek and Stink Creek which enter the Sacramento River below Box Canyon Dam. Completed in 1969, the Box Canyon Dam was constructed to provide for downstream flood attenuation, fish and wildlife and increased recreational opportunities. It has a storage capacity of 26,000 acre feet and a water surface area of 430 acres (Dong and Tobin, 1973). The effect of Lake Siskiyou on downstream conditions on the Sacramento River has been to decrease sediment loads and water temperature immediately below Box Canyon Dam. Channel aggradation has occurred in channels draining into Lake Siskiyou due to the decreased gradient at the head of the reservoir.

Channel Morphology

Streams in the Headwaters watershed often begin as mountain lake outflows, spring outflows on hillslopes, and spring outflows at the edges of wet meadows. Spring fed wet meadows occur in or near the headwaters of all three forks of the Sacramento River.

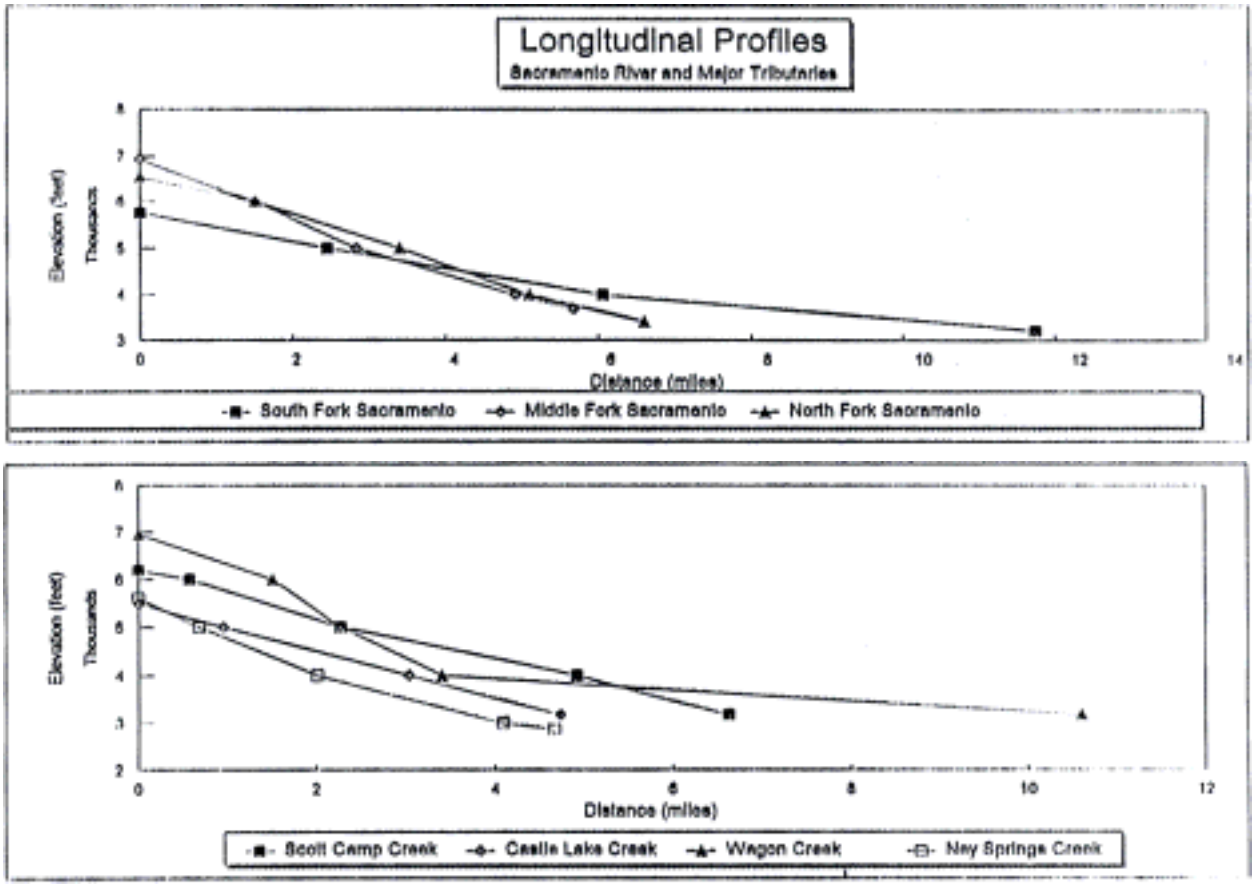
Two distinct types of wet meadows can be found in the watershed. Valley floor meadows occur in glacial cirques and valleys at elevations between 4,500-7,000 feet. Valley floor meadows are characterized by low gradient channels. They often contain a network of small feeder channels that transport water from the meadow perimeter to the valley floor. The soils in the meadows are impermeable and underlain by glacial till. Groundwater levels are very close to or at the surface of the meadows.

Hillslope wet meadows comprise the second type of meadow found in the watershed. These meadows occur at the same elevation as the valley floor meadows. These meadows contain numerous high gradient channels. Channels in hillslope wet meadows are more susceptible to disturbance than the low gradient channels in the valley floor meadows.

Below meadows and lakes, channel gradients increase and channel gorges begin to develop. Deep canyons cut by the larger streams occur at elevations of 3500-5500 feet. Channel gradients at these elevations range from 3-15 percent. Large amounts of sediment are transported through these canyons

during peak flows. The gradients of the Middle and North Forks of the Sacramento are similar to one another and steeper than the gradient of the South Fork (Figs. 3-1, 3-2 below).

Figure 3-1, 3-2: Longitudinal Profiles, Sacramento River and Major Tributaries.



The surrounding uplands in the canyons are generally steep and composed of soils that are moderately to highly susceptible to erosion. Mass wasting is an active process on these slopes and is especially prevalent on the central reaches of the Middle and North Forks of the Sacramento River. Mass wasting and landslides are the dominant mechanisms responsible for the delivery of hillslope material to stream channels. Impacts to water quality are greatest immediately following mass wasting events and during high flows.

The channel widths of the larger streams increase steadily between the upland reaches and Lake Siskiyou. The bankfull width of the South Fork of the Sacramento grows from approximately 40 feet wide above the Soapstone Creek confluence to 100 feet wide below the confluence. The bankfull channel between Soapstone Creek and the Middle Fork confluence is sparsely vegetated and composed mostly of large rocks, boulders and cobbles.

In the lower reaches of the watershed above Lake Siskiyou channel gradients decrease and the combined forks of the Sacramento River and Deer Creek merge to form a large floodplain greater than 300 feet wide along some reaches. The Sacramento River is braided along portions of this reach. Floodplain sediments are only mobilized during peak flow events. Riparian vegetation within the floodplain is mostly confined to narrow bands that run parallel to the active channels.

Water Quality

Water quality on public lands is managed to ensure compliance with the Federal Clean Water Act (CWA). The CWA directs Federal agencies to maintain water quality according to state and tribal water quality standards. It is the responsibility of the Forest Service to ensure that management activities do not adversely impact water quality within the National Forest.

The quality of water in the Sacramento River Headwaters watershed was examined by evaluating the water quality parameters of turbidity, temperature, chemistry and microbiology. Water quality data was obtained from Forest Service monitoring efforts (Deer Creek Study, 1971-76) and a water quality study conducted in the Lake Siskiyou area by the U.S. Geological Survey (Dong and Tobin, 1973). Some change in water quality may have occurred from the time that these studies were conducted, however these changes are not believed to have been significant.

Potential impacts to water quality from management activities include increased sediment and nutrient inputs and increased water temperatures. The water quality of streams draining the Klamath Mountains is expected to be better than that of Cold and Wagon Creeks. Water quality in the latter is affected by urban development and agricultural practices occurring in the lower portion of the watershed.

Turbidity

Turbidity levels are generally very low in the Headwaters watershed. Turbidity data collected on Deer Creek, Wagon Creek, and the North and South Forks of the Sacramento River indicate that turbidity levels ranged from 0.16-26 JTU (Jackson turbidity units) from June 1974 to April 1976 and averaged less than 0.5 JTU during this time period (Deer Creek Study, 1971-76). The highest turbidity levels were observed during high flow events when channel debris and fine sediments were mobilized and transported downstream. The increase in turbidity during high flows is largely caused by increased sediment contributions from hillslopes and roads. Hillslope erosion processes are particularly evident along portions of the Middle Fork of the Sacramento. Steep gradients (>5%) enable the channels to transport most of the finer sediments through the watershed to Lake Siskiyou.

Water Temperature

Water temperature data is available for the Sacramento River below Lake Siskiyou and several of the inflows to the lake. Management practices are not believed to have modified water temperature in Headwaters streams. Riparian buffers have protected forest canopies in and adjacent to stream corridors.

Timber harvesting activities have not occurred immediately adjacent to stream channels, however other processes may have affected water temperature in Headwaters streams. Water temperatures can be altered by changes in canopy cover. Removal of streamside vegetation from wildfires increases direct solar radiation to streams resulting in increased stream temperatures. Temperatures below Lake Siskiyou are affected by the reservoir and should not be extrapolated to inflows above the lake. For more information on water temperature see Dong and Tobin, 1973; Deer Creek Study, 1971-76; and USGS and Box Canyon Dam Stream Flow Records.

Water Chemistry and Microbiology

Concentrations of nitrogen and phosphorous were measured in several Headwaters streams in 1970-71 during a water quality study conducted by the U.S. Geological Survey (Dong and Tobin, 1973). Concentrations of nitrogen and phosphorous were found to be low in most of the tributaries to Lake Siskiyou and in the Sacramento River downstream of Lake Siskiyou. Water samples from the Sacramento River above Lake Siskiyou, Cold Creek and Wagon Creek were found to contain higher concentrations of

nitrogen and phosphorous. The higher concentrations of nitrogen and phosphorous in the latter were attributed to agricultural practices in the lower watershed.

The concentration of bacteria in streams is an important water quality indicator. High bacteria counts can generally be linked to large animal populations and poor sewage treatment (MacDonald, 1991). The U.S. Geological Survey measured total and fecal bacteria in streams in the Headwaters watershed in 1970-71. Water samples from Cold and Wagon Creeks were found to have higher total and fecal coliform bacteria counts than water samples from other Headwaters streams. Again, the higher counts reflected urban and agricultural use in the lower watershed (Dong and Tobin, 1973).

Peak Flows

Although they occur infrequently, peak flow events significantly impact the morphology of stream channels in the upper Sacramento River Headwaters. The cumulative impacts of management practices on channel morphology may not be made apparent until a peak flow occurs. Rain-on-snow events usually are responsible for the largest peak flows in the Headwaters watershed. Peak flows alter channel form through bank erosion, bedload transport, and scour-and-fill processes. Peak flows are believed to be the dominant control on channel form, however normal high flows also shape the morphology of stream channels in the upper Sacramento River headwaters.

Peak flows are capable of transporting large volumes of suspended sediment and bedload through the drainage network. Sediment is transported through high gradient reaches and deposited in low gradient depositional reaches. Progressively smaller fines are deposited along low gradient reaches as peak flows recede. Channel gradients in the upper Sacramento River headwaters are generally steep (>5%) along all of the streams draining the uplands of the watershed. The South Fork of the Sacramento has the lowest average gradient of 5 percent. The gradient decreases to 2-3 percent along the last 5 miles of South Fork above Lake Siskiyou (Figs. 3-1, 3-2). Large quantities of sediment are mobilized and deposited in the floodplain of this depositional reach during peak flows. The channel has aggraded along this reach in response to the decreased downstream gradient caused by the construction and filling of Lake Siskiyou.

Peak flows can significantly alter riparian areas through the destruction of riparian vegetation. Riparian vegetation is scoured and removed from stream banks along high gradient reaches while riparian vegetation along low gradient reaches is often buried by sediment. The potential for altering the riparian communities in the Headwaters watershed is greatest along the lower reaches of the South Fork of the Sacramento.

The drainage density of the channel network is an indicator in the ability of the watershed to transport water from its uplands to the watershed outlet. The drainage density for the upper Sacramento River Headwaters is only 1.2 mi/mi2, however this value reflects only the blue line streams on the U.S. Geological Survey topographic maps. The drainage network is undoubtedly larger and expands during large precipitation events. This expansion in turn increases the rate at which water is transported through the watershed resulting in an increase in peak flows. Sub-basin drainage densities range from 1.0 in the North Fork sub-watershed to 1.4 in the South Fork sub-watershed.

The watershed area between 4,000-6,000 feet is most susceptible to rain-on-snow events and consequently is believed to be the source area of the largest amount of runoff during peak flow events. Stream reaches within and below this elevation zone are most susceptible to physical alteration from peak flows.

Base Flows

Low flows in Headwaters streams usually occur in August and September. Discharge from the Sacramento River was recorded at a gaging station located three miles south of Mt. Shasta above Stink Creek from 1959-1987. The minimum flow measured before the construction of Box Canyon dam was 38

cfs or 0.42 cfs/m2 in 1964. In contrast to the flow at the gage, base flows from the watershed area above the Lake Siskiyou excluding Wagon Creek were calculated to be approximately 28 cfs. Although low flows in the Sacramento River are regulated by the Box Canyon Dam, flow comparisons between the Stink Creek gaging station and the Delta gaging station near Shasta Lake indicate that the overall effect of flow regulation from Box Canyon Dam on the lower Sacramento River is small.

Hydrologic Impacts from Disturbance

The current condition of the channel network in the upper Sacramento River Headwaters is a product of past mass wasting and peak flow events and the response of the watershed to disturbance. Management activities such as timber harvest, road construction and recreation use all impact the hydrology of the Headwaters watershed.

Timber Harvest

Timber harvest affects the flow regime primarily through the removal of vegetative cover. Hydrologic processes affected by timber harvest include interception, evapotranspiration, and the timing of snowmelt. Changes in these processes can alter the timing and amount of runoff. Timber harvest results in reduced interception and decreased evapotranspiration. A reduction in canopy cover allows precipitation to reach the ground quickly thereby increasing surface runoff. The reduction in evapotranspiration associated with the removal of vegetation increases soil moisture and increases the amount of water available for surface runoff. The overall effect of timber harvesting is to increase soil moisture resulting in higher base flows. The increased water yield that results from timber harvesting is gradually reduced as vegetation is restored.

Roads

Roads are a chronic source of sediment to streams in the Headwaters watershed. The watershed has a road density of approximately 2 mi/mi^2. Road densities range from approximately 1.5 in the North Fork sub-basin to approximately 2.7 in the Wagon Creek sub-basin. Roads increase surface runoff by capturing water that would normally have infiltrated into the soil and quickly routing surface runoff to the channel network. The road system acts as an extension of the channel network thereby increasing the transport efficiency of the watershed. Roads compact the soil and often interrupt subsurface flowpaths and this results in the return of groundwater flow to the surface. Where roadcuts are present subsurface flows are returned to the surface flow system. Roads may also supply additional sediment to streams during high flow events.

Roads in wet meadows can significantly alter hydrologic conditions by compacting the soil and blocking subsurface flow paths. Culverts enable return flows from the meadows to continue through the watershed but they also concentrate the flow which can result in gully formation below roads.

Grazing

The wet meadows located in the upland portions of the watershed have been impacted primarily by grazing and fire suppression. Fire suppression has resulted in the invasion of upland tree species into the wet meadow areas. Fire suppression in upland areas impacts the meadows by increasing vegetation that in turn decreases the amount of water available for runoff. The result is a lowering of the water table in the meadows. Grazing practices also impact the meadow systems by eroding stream banks, trampling riparian vegetation and increasing sediment and organic inputs to streams. Upland meadow restoration projects such as the Fawn Creek project have been undertaken to mitigate grazing impacts in meadows in the upper Sacramento River Headwaters.

Fire

Wildfires have the potential to significantly impact hydrologic processes in the watershed. Forest fires eradicate vegetation and reduce evapotranspiration. Depending on the severity of the fire, the impact of fire on water yield can be greater than that of timber harvest. The reduction in evapotranspiration increases soil moisture and makes more water available for runoff. If the fire removes all vegetation, base flows to intermittent and ephemeral streams can increase significantly. Changes in water yield are diminished as the vegetation recovers.

Wildfires destabilize hillslopes by removing vegetation and this can result in increased sediment transport to streams particularly during large runoff events. Fires also act to destabilize intermittent and ephemeral channels by burning woody material in the channels. The loss of woody material results in decreased channel grade control which decreases the ability of the channel to store sediment. Timber salvage activities further disturb the soil resulting in increased slope erosion and raising the potential for sediment transport to streams.

Transportation System

The Headwaters Watershed area has approximately 120 miles of current system road including 7.88 miles of arterial (40N26 South Fork), 24.77 miles of collector, and 87.46 miles of local road. Non-system roads on National Forest land probably account for another 30+ miles of low standard roads.

In addition there are approximately 19.6 miles of county road (including the Castle Lake, Lake Siskiyou, Old Stage, and W.A. Barr Roads) and roughly 30-40 additional miles of roads on private timberland and residential areas from the Ney Springs/Stink Creek area in the south to the Brown's Lake/Wyehka/Abrams Lake area to the north.

The rocky soil types, abundant surface water, and fairly steep topography of much of the area all contribute to some erosion and road maintenance problems; poor drainage and runoff control on some native surface roads has resulted in loss of "fines" and resultant "cobbly" surfaces.

The heaviest use of the road system is in the summer/fall season when public and commercial use is at its peak, although the Castle Lake Road is usually plowed in the winter for recreational use.

Following are brief descriptions of various road systems in this watershed:

40N26 South Fork

Because it forms a major transportation corridor between Mt. Shasta, Mumbo Basin, and parts west, and is located adjacent to the South Fork of the Sacramento River for much of its length, the most important Forest Service road facility to this watershed is the South Fork road, 40N26. This road originated as logging access, with the upper end, from the South Fork bridge (Sec.34, T40NR5W) to Mumbo Basin, built in the 1940's with "100 gallons of diesel and a quart of whiskey a day" for the power shovel and operator. There is still potential for logging/public traffic conflict along certain segments of this road including narrow segments, intersections and curves with poor sight distance, potential "overspeeding" stretches, etc. This is an increasingly popular route due to its paved surface; recent improvements on roads in the Mumbo Basin area have also opened up additional recreation opportunities.

Gray Rock, Soapstone, Devil's Gulch Road Systems

The 39N45 road is located on an old foot trail which originally was the only fire access between the South Fork and Whalan area to the south. Parts of this road system cross wet meadow areas and perennial streams with no drainage structures. There is one through-cut section that is an on-going erosion problem.

Castle Lake Road System

The Castle Lake Road was completed in 1920 by citizens of Sisson in response to a proposal by a film company to make a movie using Castle Lake as a backdrop. The road was named “Salisbury Pike” in honor of screen actor Monroe Salisbury, who originated the proposal. The road is maintained as an open facility year round and receives heavy winter use. The road is maintained under an easement to Siskiyou County. This is a paved, double lane road kept to standards for public traffic.

Scott Camp Ridge Road System

Most of this system also evolved for logging access in the 1920’s. Local newspaper accounts from 1940 talk about cedar being hauled from Scott Camp Creek for the Forest Service sign shop. Many roads are in poor condition and are overgrown, with little maintenance in recent years. Red Hill Road 40N43 provides an alternate timber haul route during tourist season to alleviate traffic conflicts on South Fork road. The lower 2.47 miles of this road was rocked under the Fawn/Chipmunk Timber Sale (1994).

Ney Springs/Stink Creek Road System

This road system originated as logging access, although there also was a resort located in this area that thrived in the 1920’s. The system has heavy maintenance needs in spots due to poor drainage and lack of attention. Private land in this area has been subject to recent re-entry for road building and timber harvest activities.

Bear Ridge/Fawn Creek/White Ridge Road Systems

Portions of the 39N21Y, 39N24Y, 40N42, 40N33, and 40N64 roads were reconstructed with the Fawn/Chipmunk Timber Sale in 1994, including spot rocking on 40N42 and 40N64. Some of these roads also had culvert installations and roadway ditch and dip improvements for better drainage. Expect recreation traffic to Toad and Porcupine Lake areas to increase dramatically as word of the improved road conditions gets out to the public.

Deer Creek Road System

The transportation system in the Deer Creek watershed was developed for both railroad and conventional logging practices. A railroad grade was constructed right up the bottom of the drainage, between 1896 and 1906. The railroad probably operated well into the 1920’s or 30’s. Rainbow Mill was located near the confluence of Deer Creek and the South Fork. This road system is fairly popular for hunters, woodcutters, campers and fishermen because it accesses the north shore of Lake Siskiyou via the North Shore Road (a county maintained road).

Road Right-of-Way and Cost Share Agreement

Currently a cost share agreement exist with Roseburg Lumber Co. on all or parts of the following roads in the watershed:

- 40N26 South Fork Road
- 40N33 White Ridge Road
- 40N43 Red Hill Road

Road Closures

Existing open road density in the Headwaters Watershed area is approximately 2 miles per section. In the past, road closure plans were developed by timber sales to eliminate roads surplus to the transportation system, or seasonally close them to protect road surfaces or wildlife. These included obliteration, earth

barricades, gates and guardrail barricades. These closures were implemented with varying degrees of success.

Trails

There are approximately 27 miles of existing trails within the Headwaters Watershed Analysis area including:

1. The Pacific Crest Trail (PCT), which follows the ridgeline around the west and southwest edge of the watershed for approximately 9 miles from White Ridge to the western boundary of the Castle Crags Wilderness. This is a popular section of trail as it has good access via the Gumboot trailhead on road 40N26.
2. The Gumboot Lake Trail which runs approximately 0.5 mile from the above trailhead on 40N26 down to Gumboot Lake.
3. The Castle Lake Trail, 4W02, extending approximately 4.4 miles from the end of the Castle Lake Road easterly towards Mt. Bradley.
4. The 5W08 Trail which runs from the Soapstone Gulch area for approximately 1 mile southwest to the top of the ridge (eventually tying into the Whalan Road). This apparently was originally a fire access trail.
5. The Gray Rock Lake Trail, which runs approximately 0.5 mile from the 39N41 road to Gray Rock Lake.
6. The Sisson-Callahan Trail, 5W04, which runs westerly for 7.2 miles from near Lake Siskiyou to the Siskiyou/Trinity County line.
7. The 2-mile 5W05 Trail between the Middle and North Fork drainages.
8. The 6W05 Trail from the North Fork drainage to Deadfall Lakes (1.7 mile).
9. The 6W25 Trail from 6W05 to the summit of Mt. Eddy (0.8 mile).

Chapter 4 - Reference Conditions

Recreation / Heritage Resource

Prehistoric

Dense concentrations of prehistoric sites along portions of the main watercourses provide evidence of prehistoric human activity in the watershed. Since no archaeological research has been done in the watershed, it is not known when in prehistory the area was being used. Sundahl (1994) suggests the sites are representative of an east-west travel route from Medicine Lake Highlands obsidian sources to points along the Trinity River and further to the coast. Alternately, the sites could represent seasonal use of valley dwellers for seasonal resource extraction activities such as fishing, hunting, and gathering during the spring, summer, and fall. At the end of the prehistoric era, an American Indian tribe called the Okwanuchu (related to the Shasta) was thought to have occupied the vicinity of Mt. Shasta (Dixon, 1905). Their tribal territory included the head of the Sacramento River as far down as Salt Creek. The members of this tribe were largely decimated by early malaria epidemics in the 1930's and the remainder may have assimilated with the surrounding tribes.

Early and Modern Historic - 1850-present

Historic activities in the watershed are mainly centered around early logging and recreation activities with some range activities represented as well. The source of the following information comes from both written documentation and archaeological sites in the watershed.

The first documented historic use of the watershed was a reported Indian battle which took place in the vicinity of Castle Lake in 1855 (Elliott 1993). An army patrol drove Indians (a mixture of Modoc and Trinity River Wintu) into the area where they camped in a meadow possibly between Castle Lake and Little Castle Lake. From this base camp the Indians began troubling the miners on the upper Sacramento River. In an attempt to retaliate, a vigilante group set out to attack the Modoc camp. It is not certain where the battle was fought but it was reported as the last battle fought with bows and arrows.

Less than 20 years later a mule and horse trail was built in the watershed and called the Sisson-Callahan trail. The trail was built in the 1870's (see site record) and was used as a pack route for supplies to the upper Trinity River mines and into Scott Valley. In the late 1880's another trail reached Castle Lake from Sisson. This is shown on an 1887 Siskiyou County map; the trail left the Sacramento River at the junction of Scott Camp Creek, followed Scott Camp Creek into section 7 (T39N, R4W) and turned north along Castle Lake Creek.

Recreational development first occurred in the watershed in 1889 on private land at Ney Springs (Township 40N, Range 4W, Section 32). A mineral bath resort was developed by Mr. and Mrs. John Ney. Guests would get off the train at Cantara in Section 34, Township 40 N, Range 4W. They would be met by a carriage and driven over a rough road to the resort approximately 1 mile distance (Frank 1981). On the 1916 Shasta National Forest Map a road is shown that travels east from Cantara through section 33 (T40N, R4W) and south into Ney Springs (see Historic Trail and Recreation Map). By 1940 a road was established into Ney Springs. The resort was closed in the 1940's.

In 1896 another part of the watershed was affected on a larger scale by logging operations. The Sisson Mill and Lumber company incorporated and operated a mill south of Sisson. A standard gauge steam logging railroad was built and a five mile track reached into timber areas east of the Sacramento River (Rippon 1992).

In 1899 this company moved their sawmill to the mouth of Deer Creek at Box Canyon in Section 24, T40N, R5W). Later that spring this mill was moved and a larger one built in Section 19, T40N, Range

4W. This mill called the Rainbow mill and camp included a shingle mill, store, post office, school, several homes, and a mess hall (Rippon 1988).

In 1900 the Sisson Mill and Lumber Company dissolved and became the Wood and Sheldon Lumber Company. Mr. Smith Jr. in 1908 reports that 6,000 acres out of 10,000 acres owned by Wood and Sheldon were already cut and burned. The burned portion was already covered with brush and Smith estimated that natural reforestation would be slow.

Besides the Deer Creek drainage, the area between the Middle Fork and North Fork Sacramento in sections 22 and 27, T 40N, R 5W was logged (Wood and Sheldon land holdings map and archaeological site records). The dates of this operation are uncertain; the Wood and Sheldon land holdings deed shows section 22 as part of their land holding. Archaeological records note a log chute in these sections (Vaughan 1982) and the Government Land Office plat of 1888 shows a line running in roughly the same location as the log chute.

In 1908 another Lumber Company - the Castle Lake Lumber and Box Company- logged in sections 14 and 18, T39N, R4W between Ney Springs Creek and Castle Lake Creek. This was a Shasta National Forest Timber sale (Schrader Photo File L-Castle Lake Lumber and Box Company 1-5). Private land was logged adjoining this sale, but which section is unclear. From section 14, 120 thousand fir and cedar, 115 thousand yellow pine, and 5,000 sugar pine was logged and brush was burned. It is also uncertain how the lumber was removed from the area. A 1963 Forest Service Recreation Management Plan for Castle Lake notes that the Scott Camp Creek drainage was logged in 1910 with Port-Orford cedar being the prime objective. This report may be referring to the above logging operations, or more extensive operations may have been conducted.

In 1914 (date uncertain) a partner of Wood and Sheldon by the name of Martin organized the Pioneer Box Company (Schrader 1948). The Sisson Headlight (April 5, 1917) announced that a new mill would be built and that the company plans to rebuild the railroad into Rainbow Canyon and up Deer Creek.

In 1925 the Pioneer Box Factory established a logging camp in section 7, T39N, R4W. This operation used logging trucks on the newly built Castle Lake road to remove lumber from the woods. A 1929 Mt. Shasta Herald article (11/28/29) notes that logging had been suspended in the vicinity of Castle Lake for the winter.

In 1930 the Forest Service acquired most of the cutover lands in the watershed in a land exchange with the Piedmont Land and Cattle Company who had acquired the land from the Mt. Shasta Pine Manufacturing Company earlier that year.

While the watershed was opened up for logging, it was also used for recreation and for range. Four cabins associated with range activities around 1900 have been recorded in the watershed near meadows. The Toad Lake Cabin was used by the Cattle Company of Callahan by 1900.

Use of the many lakes and rivers in the watershed for fishing and hunting was fairly common by 1900. Fisk Ward sometime after 1906 tells that he would go on horseback from Rainbow to Castle Lake, Gumboot, Picayune, Toad, or Cliff Lakes (Glidden 1948). The 1916 Shasta National Forest map shows established trails along the South Fork of the Sacramento to Gumboot Lake, along the North Fork of the Sacramento to Bear Creek Cabin and south to Toad Lake, from Gumboot to Picayune Lake, and along Picayune Creek. By 1920 an auto road to Castle Lake was constructed. In 1923, articles in the Mt. Shasta Herald promoted tourism on the Shasta National Forest. Trails along the South Fork and side trips to Picayune and Gumboot Lakes as well as the auto road to Castle Lake were promoted (Mt. Shasta Herald 6/21/23). Similarly, in 1931 the Shasta National Forest printed a brochure advertising good fishing, swimming and boating at Castle Lake and the Forest Service campground nearby. Most of the lakes in the watershed were stocked with trout from the State Fish hatchery in Mt. Shasta.

Forest Health

Vegetation

Within the Headwaters Watershed four vegetation communities were identified with distinct vegetation composition and historic conditions. These are the Alpine and Red Fir Zone, the Mixed Conifer Zone, the Mixed Conifer/Black Oak Zone and the Riparian Zone.

Within the Alpine/Red Fir Zone historic vegetation patterns and composition are similar to current conditions. Because this zone is high elevation and low site productivity, only a small portion has been harvested, all with some type of individual tree selection. Historic vegetation was dominated by mature (greater than 24 foot crown diameter) red fir with lesser amounts of western white pine and lodgepole pine. Scattered individual trees of whitebark pine could be found above timberline. Over 50 percent of these stand were of open stand density (10-39% canopy closure). Only about 20-30 percent of this zone supported moderate stand density forests (40 to 69% canopy closure) and less than 5 percent supported closed stand density forests (greater than 70% canopy closure). Seral shrublands and barren areas made up about 20 to 30 percent of this zone.

Within the Mixed Conifer Zone historic vegetation was dominated by mature and over mature (greater than 24 foot crown diameter and some trees greater than 40 foot crown diameter) stands of timber. Species mix was dominated by more fire resistant ponderosa /Jeffrey pine, cedar, and Douglas fir. Species mix varied with aspect and elevation. Approximately 20 to 30 percent of the forested lands supported open canopy stand densities, usually at the higher elevations and on south facing slopes. Approximately 30 percent of the forested lands supported moderate stand densities (40 to 69 % canopy closure) and 20 percent supported closed stand densities (70+ canopy closure). Approximately 20 percent of this zone was covered with seral shrublands.

Within the Mixed Conifer/Black Oak Zone historic vegetation was dominated by mature and overmature mixed conifers and black oak. Black oak made up from 10 to 30 percent of most mixed conifer stands. Approximately 10 to 20 % of the forested lands supported open canopy stand density, approximately 30 to 40% supported moderate stand densities and approximately 40 to 50% supported high stand densities. Less than 10% of the zone was seral shrublands.

Within the riparian zone historic vegetation is similar to current conditions. Scattered individual trees and clumps of aquatic dependent species were present along low gradient perennial streams. Typical of these species were willow, alder and big leaf maple. Port Orford cedar found within this zone had the same distribution at is currently found.

Fire and Fuels

Minimal studies of prehistoric fire occurrence have been conducted within the Headwaters of the Sacramento watershed. The fire history of the watershed has been recorded from 1650 to present based on fire scar analysis. Preliminary results from this unpublished study on the upper Sacramento showed a mean interval of approximately 19 years between fires intense enough to leave scars. Frequent, low-intensity ground fires were the common type of fire rather than stand-replacing, high-intensity fires.

By separating the study area into three time periods, Pre-settlement, Settlement, and Suppression or the present, we are able to determine the following mean fire intervals,

Pre-settlement: 1650/1849, 7.7-28.9 with a mean of 18.30 years.

Settlement: 1850/1900, 6.1-20.0 with a mean of 13.50 years.

Suppression: 1901/1994, 17.3-36.0 with a mean of 26.65 years.

Native American Use of Fire

A significant use of fire during the prehistoric era was Native American burning. Fire was the most significant management tool used by California Native Americans (Anderson 1993). There is evidence that almost every tribe in the western United States used fire to modify their environment (Lewis 1993). Human caused fires were probably a more significant factor than natural fires in influencing vegetation and the environment. Several purposes for burning by the Native Americans have been noted. These include fire management, maintenance of habitat diversity, favoring vegetation for food sources, and producing quality vegetation material for baskets and other implements.

There are several references in the literature to the use of burning for the purpose of fire management. Light surface fires in grasses were used to reduce encroachment by shrubs and conifers which eventually might act as fuel ladders, igniting tree canopies (Anderson 1993). Burning of needles and debris in general precluded excessive accumulations of fuels so that destructive wildfire conditions did not develop (Lewis 1993). Burning was rarely done during mid-summer and early fall when the forests were most vulnerable to catastrophic wildfire (Williams 1994).

Native Americans generally burned parts of the ecosystem in which they lived to promote a diversity of habitats, especially increasing the “edge effect,” which gave greater security and stability to the Native Americans lives. This use of fire was different from that of white settlers, who burned to create uniformity in ecosystems (Williams 1994).

Historic Fire Occurrence

Forest Service fire report records can be used to determine historic fire frequency. This data goes back to 1911 and includes the period up to 1994. Forest Service records document 182 fires within the Headwaters watershed (130 human caused and 52 caused by lightning) between 1911 and 1994. Additional fires adjacent to the watershed probably would have effected the watershed if suppression action had not been effective.

Table 4-1: The distribution of fires by size class.

Size Class	Acres	Number	Percent
A & B	0-9.9	180	98.9
C+	10+	2	1.1

Since the early 1900s, 37% of the watershed has been influenced by large fire activity. The largest fires recorded in the watershed occurred prior to 1970. There were 3 fires, the first fire in 1922 was 640 acres, the second fire in 1924 was 2,100 acres and the third fire in 1939 was 17,410 acres. Of these fires, the third fire in 1939 was lightning caused.

Wildland fire suppression became progressively more effective in the 1930’s with the Civilian Conservation Corps (CCC) and after World War II, with an increase in mechanized (bulldozer) and aerial strategies. This has resulted in significant increases in accumulated fuels (both living and dead) within forests of the Klamath Physiographic Province. Success in fire suppression has induced changes in forest cover and density which in turn have resulted in changes in fire frequencies and intensities. The conditions noted in this watershed have been occurring throughout the wildlands of the western United States, and have resulted in a change in the amount of area burned annually. Among the potential reasons for this trend is the increase in fire suppression technology and resources between 1916 and 1965, and the worsening of the fuel mosaic from 1950 to present (Agee 1993).

Fire suppression activities have changed the fire regime for the low elevation Ponderosa Pine and mixed conifer forests throughout the west (Agee 1993) and in this watershed, from one characterized by

frequent, light surface fires to one of crown fires or infrequent, severe surface fires. This change in fire return interval has also affected disturbance-dependant regimes like chaparral and glade ecosystems. Comparing prehistoric fire occurrence information with the information available during the historic, or fire suppression period shows that fewer acres of the watershed were burned annually during the fire suppression period. We can conclude that in this context, fire suppression has been successful. This success has resulted in changes in fuel loading and vegetation conditions. Average fire return intervals have changed from a 7.7 to 28.9 year interval with a mean of 18.3 years for the period before fire suppression to 17.3 to 36 year interval with a mean of 26.5 years between fires.

Special Plant and Animal Populations

Plant Populations of Concern

Threatened, Endangered, Proposed, & Sensitive plants

Distribution and abundance of rare plants in this watershed is governed by a combination of availability of suitable habitat, connectivity of habitat for dispersal and colonization, and losses of local populations from human impacts, climatic fluctuations and other environmental events such as floods, fires and diseases.

To a greater degree than in most watersheds, rare plants here are highly substrate specific. This means, for instance, that regardless of other favorable conditions, a serpentine endemic will not grow on granitic soils. Habitat connectivity in these circumstances is dependent on geologic and soil patterns. Suitable habitat may not be inhabited if it is isolated from occupied sites, and sites of local extinctions may not be recolonized for long periods of time, especially if intervening habitat has been altered in the meantime.

TES plants of riparian habitats

Prehistoric - Before 1850

Raillardella pringlei would have occupied virtually all suitable habitat within the geographic boundary of the Trinity Ultramafic sheet. That is, the plant would be in every drainage with ultramafic substrate and perennial water between 4,000 and 7,500 feet. The continuous nature of the riparian habitat would ensure efficient dispersal and recolonization in case of local scouring loss. Plentiful seed production and the plant’s adaptation for wind dispersed seed would ensure genetic mixing among drainages.

During drier years, late season fires would have occasionally burned over many montane meadows, killing invading tree seedlings and maintaining the wetland plant communities.

Early Historic - 1850 to 1940

Entry of logging and road-building activities into the watershed would have had minor effects on *Raillardella pringlei* and its montane riparian habitat, because most logging of this period was done at low to mid-elevations in the mixed conifer zone, lower in elevation than *Raillardella* inhabits.

The influx of large livestock herds around the turn of the century probably had a significant effect on *Raillardella* abundance and distribution in the watershed. Trampling and grazing of the foliage on a yearly basis for 40-50 years had unknown effects. Cropping of most flower heads (based on current observations) prevented seed reproduction of the species, and therefore greatly reduced gene flow between drainages. Current absence of *Raillardella* from several apparently suitable meadow systems in the watershed (notably Morgan Meadows) may be attributable to local extinctions caused by heavy grazing pressure; there is no way to know for certain.

During this period, late season fires would have continued to suppress tree invasion of montane meadows.

Modern Historic - 1940 to present

During this period logging and road-building expanded into the upper mixed-conifer and red fir zones. *Raillardella pringlei* populations and habitat were affected by roads built in and across riparian zones, and by local changes in meadow hydrology related to the logging of trees from meadow margins.

Grazing pressure from domestic livestock lessened, because of regulation by the federal government. Livestock numbers dropped to about one third of what they had been. *Raillardella* impacts lessened, populations probably stabilized, and local extinctions stopped. Loss of gene flow continues, however, because of chronic loss of flower heads to grazing cattle.

Fire suppression in the modern period has contributed to encroachment of trees into montane meadow systems. The encroaching trees, because they transpire large quantities of water from the wetland communities they have invaded, speed up succession of the meadow systems toward drier plant communities. Over time these changes mean that some habitat is no longer suitable for *Raillardella* and other wetland obligates. Many of the invading trees in meadows of this watershed were girdled to kill them in the 1980's. In the absence of fire, continued measures will be needed to eliminate tree seedlings in montane meadows if the meadows are to be maintained.

TES plants of rocky habitats

Prehistoric - Before 1850

Eriogonum alpinum and other inhabitants of rock outcrops and talus would have been little changed from their distributions today. While their distributions would have been ultimately limited by suitability of substrate, elevation and aspect (as they are currently), only a portion of suitable habitat would be occupied at any given time. Local extinctions caused by rock slides, severe weather events and other natural disturbances would be slowly recolonized.

Early Historic - 1850 to 1940

Building of trails such as the Sisson-Callahan trail and cattle trails through subalpine and alpine areas would have caused local losses of rare plants where trails went through these plant populations. Otherwise, settlement and development of the watershed had little effect on this group of high-elevation plants.

Modern Historic - 1940 to present

Expansion of road and trail systems in moderate and upper elevations of the watershed made alpine and subalpine habitats much more accessible to recreationists. There is now greater impact to the vegetation and rare plants from recreational foot traffic than from other sources. Still, most rare plants of upper elevation rocky areas are protected by their remoteness. Despite their natural rarity and geographic restriction, none of these species is seriously affected by human use of the watershed.

TES plants of forested habitats

Prehistoric - Before 1850

Arctostaphylos klamathensis and *Phacelia dalesiana* would have been dependent on natural disturbance events such as windthrow, fire and animal trails to create new habitat for colonization. These species

would have existed in a mosaic of forest seral stages, with new openings colonized by seeds from adjacent established populations.

Cordylanthus tenuis ssp. *pallescens* probably did not occur in the Headwaters watershed in prehistoric times. This subspecies was geographically restricted to the volcanic soils around the base of Mt. Shasta. Its near relative, *Cordylanthus tenuis* ssp. *viscidus*, is widespread in the Klamath and Cascade provinces.

Early Historic - 1850 to 1940

Entry of logging and road-building activities into the watershed would have had minor effects on *Phacelia dalesiana*, *Arctostaphylos klamathensis*, and their montane habitat, because most logging of this period was done at low to mid-elevations in the mixed conifer zone, lower in elevation than these species inhabit.

Cordylanthus tenuis ssp. *pallescens* appears to have migrated into the watershed with the building of roads, principally the South Fork Road. It is possible that seeds were carried in with the rock used for road building, since this species is currently known to grow at several local quarry sites near Mt. Shasta.

Modern Historic - 1940 to present

Logging and road-building in the modern period has had more effect on species in the red fir zone than earlier periods. *Phacelia dalesiana* occurs in many timber sales from this period in the watershed. The plant occupies old skid trails and spur roads, but is absent from areas disced for sale preparation. Not much is known about the distribution and abundance of *Arctostaphylos klamathensis*, since the plant was only recently discovered and named. There are no records from timber sale plant surveys on the Shasta-Trinity. Looking around the area one can see roadside populations of Klamath manzanita adjacent to closed-canopy red fir stands with virtually no understory. Given its positive response to disturbance one would conclude that the modern period has seen an increase in the abundance of this species, but this is not documented.

Fire suppression during the last fifty years has probably had a negative impact on both these rare species. Old phacelia populations are not able to reproduce in stands where there is a thick duff layer, because the tiny seedlings are not able to push through the duff. The phacelia reproduces best on bare soil between shrubs. Older plants will resprout after a cool ground fire; the effect of a stand-replacing fire on this plant are undocumented. Klamath manzanita does not have a burl and so does not resprout after fire, but apparently produces plentiful seedlings after a fire. It will not grow under a closed canopy.

Cordylanthus tenuis ssp. *pallescens* is much more abundant now in the watershed than in prehistoric times, when it may not have been there at all (although its near relative, *C. tenuis* ssp. *viscidus* is native to the watershed). This plant responds favorably to soil disturbance and is especially well-adapted to gravelly roadsides. It has colonized many roads around Lake Siskiyou, as well as the South Fork road and its tributaries. From the roadsides it has moved into adjacent forest and shrub communities.

Survey & Manage species: plants, lichens, & fungi

Prehistoric - Before 1850

Not much is known about these old-growth associated species. Old growth in the mixed conifer and mixed conifer/black oak zones was much more plentiful (see “vegetation” in Forest Health section of this chapter and chapter 5); this condition would have favored more widespread occurrence of old-growth associates. Frequent cool fires would have favored more open stands with less understory competition. Older trees are more likely than younger trees to be occupied by lichens and associated with hypogeous fungi.

Early Historic - 1850 to 1940

Reduction of old-growth habitat in the mixed conifer and mixed-conifer/black oak zones because of logging during this period would have reduced population numbers of survey & manage species present. Fragmentation of suitable habitat would have hampered pollination of old-growth dependent vascular plants, and would have reduced successful dispersal of seeds and spores to favorable sites for all of the species in this group.

Modern Historic - 1940 to present

Reduction and fragmentation of old-growth started in early historic period persists to the present.

One vascular plant in the survey and manage group - clustered lady's-slipper (*Cypripedium fasciculatum*) is thought by some botanists to be dependent on frequent cool ground fires for habitat maintenance. If this is true, then fire suppression of the last fifty years has been detrimental to this species, which is known to have occurred in the watershed near Castle Lake.

Noxious weeds & other exotic pest plants

Prehistoric - Before 1850

Virtually no non-native plants would have been present in the watershed, since "native" is generally defined as whatever was here before European settlement.

Early Historic - 1850 to 1940

Some exotic plants arrived in the watershed with livestock, and some were brought into the settled lower parts of the watershed as pasture plants or garden ornamentals. Pasture plants such as sweet clover migrated farther into the watershed along roads.

Modern Historic - 1940 to present

Roadside weeds continue to migrate along roadsides into the public portions of the watershed. Exotic weeds are noticeable along roads as far as the upper end of Lake Siskiyou. *Isatis tinctoria*, dyer's woad, has become a pest along W.A. Barr Road and could become a major nuisance on the cobbly floodplain above Lake Siskiyou. This weed has become well-established in similar habitat above Trinity Lake.

Exotic grasses such as wheatgrass and orchardgrass have been introduced into the watershed by the Forest Service for roadside stabilization purposes; these are well entrenched but show no signs of invading adjacent native plant communities.

Animal Populations of Concern

No historic records on wildlife population estimates, densities or distribution are known to exist for the Headwaters Watershed. Wildlife use and species composition population trends are projected based on the habitat regime, known European influences on the watershed, and wildlife sighting records from 1971 to 1995.

The distribution and abundance of fish and wildlife species in the Sacramento Headwaters Watershed is dependant on the habitat regime, human use of the area and for anadromous fish downstream use and condition. General information on the habitat regime of the watershed over time is known. Fisheries records exist largely because of the Sisson and Bard hatcheries. Though these records are often incomplete, there is enough information to provide a historic overview.

Prehistoric - Before 1850

Many wildlife species that we are familiar with today were present at this time. Other species present in other watersheds, but unknown to occur in the Headwaters because of limited historical references include elk and grizzly bear. Species that formed large herds (deer), were far roaming (bear, wolverine), or were restricted to special habitats (amphibians, willow flycatcher, cavity nesters) were in greater numbers due to large expanses of habitat that was unencumbered by fences, settlements, and the mosaic of land use practices of the Europeans who were to follow.

Prior to 1850, the native fish assemblage within the headwaters of the Sacramento River remained largely intact. Rainbow trout, Sacramento sucker, Sacramento squawfish, speckled dace and riffle sculpins were common resident stream inhabitants. The relative abundance and importance of these species is not known. Records that specifically mention fish and fishing are very general in nature, but they do mention large “trout” caught on a regular basis. Moyle (1976) states that the Sacramento sucker, rainbow trout and Sacramento squawfish were important food sources to the Native Americans and early pioneers. A report of the Department of Fish Culture (1916) indicates that during the 1800’s the high mountain lakes within the analysis area were devoid of fish. In fact, most of the lakes in Siskiyou and western Trinity counties did not contain fish.

Anadromous fish are thought to have occurred in the watershed as there were no known barriers to fish migration on the Sacramento River in the 1800s. Their actual presence has not been confirmed or denied, but it is believed that spring and fall run chinook and steelhead were found in the area (Rode, Pers.Comm, 1995). With respect to geologic time, anadromous fish occurrence may have been sporadic as evidence suggests that lava flows from Mt. Shasta may have periodically blocked the river (Jasso, Pers. Comm, 1995).

Early Historic - 1850 to 1940

Wildlife species populations requiring special habitats and those sought after for recreational or commercial use began declining with the increased settlement and recreation in the watershed and surrounding area. There are no known records indicating original populations sizes for wildlife species affected in the Headwaters watershed. Other species that have proliferated in the human altered environments are more common today than during this period (bullfrog, European starlings, coyote, raccoons). In 1896 the railroad opened up the watershed to timber harvest, cattle grazing and increased recreation. Due to timber harvest in the Deer Creek, Castle Creek, Ney Springs and North Fork Sacramento drainages, large stands of old growth were harvested and burned. Old growth dependant species populations declined with the fragmentation and elimination of their habitat on the lower slopes of the Headwaters. Aquatic wildlife species populations also declined as streams were damaged by sedimentation and logging practices. Cavity nesting species were also negatively affected when snags were harvested, removed or burned.

Shrubs were allowed to revegetate the once forested lands. Shrub dependant species populations (towhees, finches, skunk) increased with an increase in shrublands. Until the shrubland became decadent they provided forage for many wildlife species (deer, bear, birds) and habitat for small to medium mammals which are a prey base for aerial foragers (golden eagle, great-horned owl). Natural reforestation in these areas was estimated to be slow.

By the late 1800’s unregulated cattle grazing occurred throughout the watershed. Records for the North Fork Sacramento and Toad Lake drainages, part of the larger Bear Creek grazing area, indicated that over 1,500 cattle grazed this area. This pressure continued until the 1932 when the stocking rate was reduced to 700. The stocking rate remained fixed for the next 10 to 12 years. In the old Eddy Mountain allotment, which included Morgan Meadows, over 800 cattle were grazed until the 1930’s when the stocking rate was reduced to 475 (Gordon 1971). Records indicate the Eddy Mtn. grazing area (later an allotment) was

also used by horses and sheep (Dunaway 1967). The area was later considered not suitable for sheep and sheep grazing was discontinued (Dunaway 1967). Though grazing practices varied, the condition of meadows and riparian areas utilized by cattle began to decline. Meadows most impacted, based on 1940 records of meadow conditions in 1930's, were Gumboot, Salt Lick Creek, Fawn Creek, South Fork Sacramento and Morgan Meadows.

Aquatic amphibians dependant upon emergent vegetation for reproduction and cover were highly impacted and riparian dependant species were moderately impacted. High impact grazing would have reduced the habitat of many small mammals, reducing their populations, and hence a prey base for many raptors (golden eagle, sharp-shinned hawk). The extent of grazing on the small mammal and raptor populations was unknown, though expected to be dramatic at first. Cattle competed with local deer herds for forage and may have degraded important fawning areas, though the extent of their impact on deer populations was unknown.

Recreational use also negatively affected native fish and wildlife populations. Aquatic amphibians populations were again impacted when streams and alpine lakes were stocked with trout. Riparian dependant species (warblers, heron) were displaced when streamside habitats and meadows were used for camping. Populations of generalist wildlife species (i.e. crows, jays, raccoons) capable of scavenging and adapting to the presence of recreating humans increased. Game species (bear, deer, grouse), natural predators (bear, mountain lion) and furbearer populations (beaver, mink) declined as they were hunted and trapped. Other species sensitive to human disturbance, wide roaming, or considered a threat to humans and livestock (wolverine, mountain lion) were also negatively impacted.

The establishment of the hatchery at Bard on the McCloud River and the Sisson hatchery at the foot of Mt. Shasta signaled the beginning of fisheries management in northern California. These hatcheries were originally used to collect and hold salmon and steelhead eggs which were shipped nationwide (Fish & Game Commission, 1910). Later the emphasis was shifted to rearing of resident and anadromous salmonid species for stocking into local streams (Fish & Game Commission, 1914). The first recorded release into the headwaters of the Sacramento River occurred in 1911 with the release of an unspecified trout species. This was followed in 1913 with the released of salmon fry and then in 1914 with arctic grayling. The lakes in the watershed were first been stocked in the early 1920s (possibly earlier). Early records indicate that the lakes and streams in the area have been stocked with a variety of salmonid species to include lake trout, eastern brook trout, brown trout, rainbow trout, cutthroat trout and something called a black spotted trout. The 24th Biennial Report of the State of Calif., Fish and Game Commission (1916) reports the following fish species were stocked locally from fish raised at the Sisson (Mt. Shasta) hatchery:

Brown Trout: Wagon Creek, Box Canyon, Castle Creek

Rainbow Trout: Little Castle Creek

Brook Trout: Wagon Creek

Black Spotted Trout: Castle Creek, Wagon Creek, Eddy Lake, Little Castle Creek, Sacramento River

Modern Historic - 1940 to present

Some wildlife populations requiring special habitats and sought after for recreational or commercial use continued to decline and others stabilized. From 1940 to 1986 the watershed was once again harvested for timber. More old growth forests were harvested along with many second growth forests and converted to early/mid seral forests or decadent shrublands. With the loss of later seral stages and the replacement of these to younger, smaller trees, there will be less recruitment of large diameter snags and down logs necessary for species such as black bear, fisher and pileated woodpecker. Primary and secondary cavity nesters and denners, such as the white-headed woodpecker and western bluebird, may have likely been affected by the reduction in stand size. Eighteen percent of the bird species found on the forest use

cavities for nesting. In addition, this habitat and subsequent fragmentation of interior forest habitat negatively affects species such as the Northern spotted owl and Northern goshawk.

By 1947, the Forest Service began regulating cattle grazing on both Forest Service and Southern Pacific lands. There was an approximate 80% reduction in the number of cattle allowed to graze in the Headwaters (Showalter 1986, Gordon 1971, and Dunaway 1967). Until the late 1960's, all meadows within the watershed were grazed, through three allotments; North Fork Sacramento, East Fork Sacramento, and South Fork Sacramento. By 1974 only the Bear Creek allotment (the East Fork Sacramento allotment and west portion of North Fork Sacramento allotment) remained, comprising 45% of the Headwaters. With the reduction in cattle, introduction of grazing regulations, and periodic resting of the habitat, it is expected that aquatic and riparian dependant species populations declined less quickly or stabilized. Much of the damage to the meadows occurred in the early part of the century and it is possible that existing wildlife populations have adapted (cascades frog), maintaining 1940's population levels, or may have become locally extirpated (Northern red-legged frog). (Sightings indicate numerous cascade frog populations, limited foothill yellow-legged frog and tailed frog populations and no northern red-legged frog populations.)

As with grazing, aquatic amphibians populations may have been most impacted with initial stocking and less impacted by continued stocking. The creation of Siskiyou Lake and the stocking of numerous lakes and streams apparently had a positive affect on ospreys and bald eagles. With the introduction of a productive fishery in Siskiyou Lake, one osprey nest and one bald eagle nest have been established. Previous to 1987, bald eagles were not officially recorded as occurring in the watershed. Deer, though, did not benefit when winter forage was covered by the creation of the lake. Winter forage along the shorelines of the lake may not have helped mitigate the reduction of historical winter habitat along the Sacramento River. Hunting and trapping regulations also allowed populations of most game species to stabilize, though others also affected by impacts on their habitat (band-tailed pigeon, fisher) continued to decline.

The lack of fire in the ecosystem has caused ungrazed grasslands and shrubland to become decadent, and has increased fuel loadings and stocking densities in forested stands to occasionally unhealthy levels. For some species these fuel build ups are beneficial (woodrat and mice spp), providing microhabitats for cover, seed and berry production for forage, and overgrown vegetation for thermal or nesting cover. Though these fuel build-ups are beneficial, they may be increasing the populations beyond their natural population size. Other species which utilize open grasslands are not benefited when meadow size is reduced by encroachment of surrounding tree species. Browse species are negatively affected when shrublands becomes decadent or unpalatable and new growth is out of reach.

Chinook salmon and steelhead continued to run the upper Sacramento River until 1943 when Shasta Dam was completed. The completion of the dam affectively blocked access to approximately 110 miles of spawning habitat for salmon and steelhead, and an unknown amount of habitat for white sturgeon. Sturgeon probably did not inhabit the Headwaters area as they require large deep pools. Rode (Pers. Comm. 1995) stated that coho salmon may have occurred in the analysis area prior to the completion of Shasta Dam, but probably never was a common species.

In 1968, Box Canyon dam was completed and Siskiyou Lake was created. This lake was initially stocked with trout species, and in the early 1970s warmwater fish were introduced by the California Department of Fish and Game. Since 1970, Siskiyou Lake has been stocked with largemouth bass, smallmouth bass, spotted bass, green sunfish, brown bullhead, carp, and golden shiners. Brown trout, brook trout, and catchable rainbow trout are also still planted. Recently, grass carp have been illegally introduced into a local pond, but at this time are in no danger of escaping. Table 3-8 is a list of fish presently found within the Headwaters Watershed of the Sacramento River.

Presently, fisheries management is focused on habitat protection and the stocking of hatchery trout. Warmwater fish populations are self sustaining. Trout are planted in remote areas through the use of

aircraft, while the more accessible and popular streams and lakes are planted with catchables. Rainbow trout are the most common trout species planted.

Water Quality

The quality of water in the Sacramento River Headwaters has been influenced by a combination of natural processes and human activities. Natural processes and human activities have negatively impacted water quality in the past, however long term impacts to water quality were probably minimal. In general, water quality in the watershed has been very good. The following discussion focuses on natural processes and human activities occurring in the watershed and their influence on water quality.

Prehistoric - Before 1850

Little historic information is available concerning the quality of water in the Sacramento River Headwaters. Prior to European settlement (late 1800's) the water quality was largely governed by geologic processes and climate. These factors controlled reference conditions for water quality and continue to influence water quality in the Sacramento River Headwaters today.

The principle geologic factors affecting water quality were the uplift of the Klamath mountains and the Pleistocene glaciations with their attending glacial erosion and mass wasting processes. The Klamath mountains were uplifted rapidly during the Cenozoic era. The large glaciations that occurred during the Pleistocene and the smaller glaciations that occurred toward the end of this geologic time period played a significant role in shaping channel morphology. The glaciers carved cirques in upland areas and created deep U-shaped valleys in the lower reaches of the watershed. Features carved by the early glaciations of the Pleistocene were repeatedly modified by subsequent glaciations or hidden by erosion and mass wasting processes. The combination of rapid uplift and frequent glaciations created conditions favorable for instability in the watershed. These conditions were exacerbated by inherently unstable serpentinitic rocks found within the watershed.

Since the end of the last glaciation channel morphology has been controlled by a combination of mass wasting and fluvial processes. These processes influenced channel morphology by modifying glacial features. Fluvial processes eroded terminal moraines and other glacial depositional features while mass wasting processes resulted in the introduction of sediment to U-shaped valleys. Mass wasting deposits were further modified by subsequent fluvial processes. The continued interaction between mass wasting and fluvial processes formed the inner gorges presently found in the watershed. Inner gorges of this type are present in the lower reaches of the tributaries to the Sacramento River above Lake Siskiyou.

Most mass wasting events were triggered by high intensity precipitation events in which the majority of the precipitation fell as rain. The result was that peak flows and mass wasting often occurred simultaneously during individual precipitation events. Mass wasting processes served as the dominant mechanism by which hillslope material was transported to the channel network while peak flow events served as the dominant mechanism responsible for transporting and redistributing sediments along the channel network.

The recurrence of peak flows in the watershed is a function of climate. Because no climate records are available prior to the mid-1800's, it is difficult to determine the recurrence interval of pre-historic peak flows. If the climate did not change significantly from reference to current conditions then peak flows in the watershed would have occurred at approximately ten year intervals.

The spatial distribution of mass wasting events combined with the varying effects of peak flows and elevation has affected the development of riparian zones in the lower portions of the watershed. Inner gorge mass wasting at lower elevations inhibited the development of riparian zones by depositing hillslope materials in the inner gorges and inundating riparian vegetation. Peak flows inhibited the formation of riparian areas by scouring riparian vegetation in high gradient reaches and depositing

sediment in riparian areas in lower gradient reaches. The overall effect of peak flows has been to limit the occurrence of riparian vegetation at lower elevations in the watershed.

Wet meadows occurring at higher elevations in the watershed developed in glacial cirques and tarns. The effects of peak flows were dampened at higher elevations where the majority of precipitation fell as snow. The diminished influence of peak flows combined with the openness of streams in glacial cirques allowed wet meadow riparian areas to establish themselves at higher elevations in the watershed.

Mass wasting events combined with occasional lava flows from Mount Shasta resulted in the occasional blockage of the channel network. This affected channel morphology in the lower portions of the watershed by creating flow obstructions in the Sacramento River. The periodic obstruction of stream channels by lava flows and sediment probably resulted in short term channel aggradation until the channels downcut through the deposits.

The cumulative effects of rapid uplift, glaciations, mass wasting and variations in climate indicate that reference conditions for water quality were stable with respect to geologic time. It is hypothesized that water quality was adversely affected by mass wasting processes and large scale mobilization of sediment during peak flows but these impacts were of short duration. Peak flows and mass wasting impacted water quality by introducing large amounts of sediment to stream channels, however turbidity levels probably declined quickly following the disturbance.

Early Native Americans had some potential to impact water quality because most of the prehistoric sites were concentrated adjacent to or within riparian zones along the main tributaries of the Sacramento River. Occupation of the upper Headwaters area by Native Americans was probably seasonal in nature with almost all of the use occurring in the summer months. Native American impacts to water quality were probably small and have no influence on present day water quality.

Early and Modern Historic 1850 - Present

Land use in the upper Sacramento Headwaters changed dramatically following European settlement. In the late 1800's timber harvest, road construction, grazing, and recreation activities began to occur in the watershed. These uses influenced water quality independently and/or by interaction with natural mass wasting and peak flow processes.

Natural Disturbance

Because mass wasting is a dominant process, a specific inventory was conducted to further determine important factors which contribute to the process. Mass wasting was investigated using a time sequence analysis of aerial photographs of the entire watershed. Specifically this involved mapping on 1944 black and white, 1983 color infrared and 1980 color photography. The information on the measured change of mass wasting occurrence for landform types is tabulated in Table 4-2.

Table 4-2: Inventoried Mass Wasting Features (acres approx.) within Analysis Areas

Area	Total Acres	Landslide Acres (1980)	Percent Change (1944)
Glaciated Hill Slopes	21,248	990 (4%)	+0
Periglacial Side Slopes	6,835	83 (1%)	+18
Non-Glaciated Mid-Slopes	14,720	915 (6%)	+39
Colluvial Hill Slopes	23,040	515 (2%)	+15

Except for possibly along the South Fork of the Sacramento River, most mass wasting features were found to originate above tree line or be situated along stream courses without an apparent human catalyst.

Most features take the form of debris slides or avalanches. Climate as a consequence of elevation; runoff, and percent slope acting together are interpreted to be the primordial influencing factors in landslide generation. The factors of aspect, slope position, bedrock geology, and human activity follow in the order of influence.

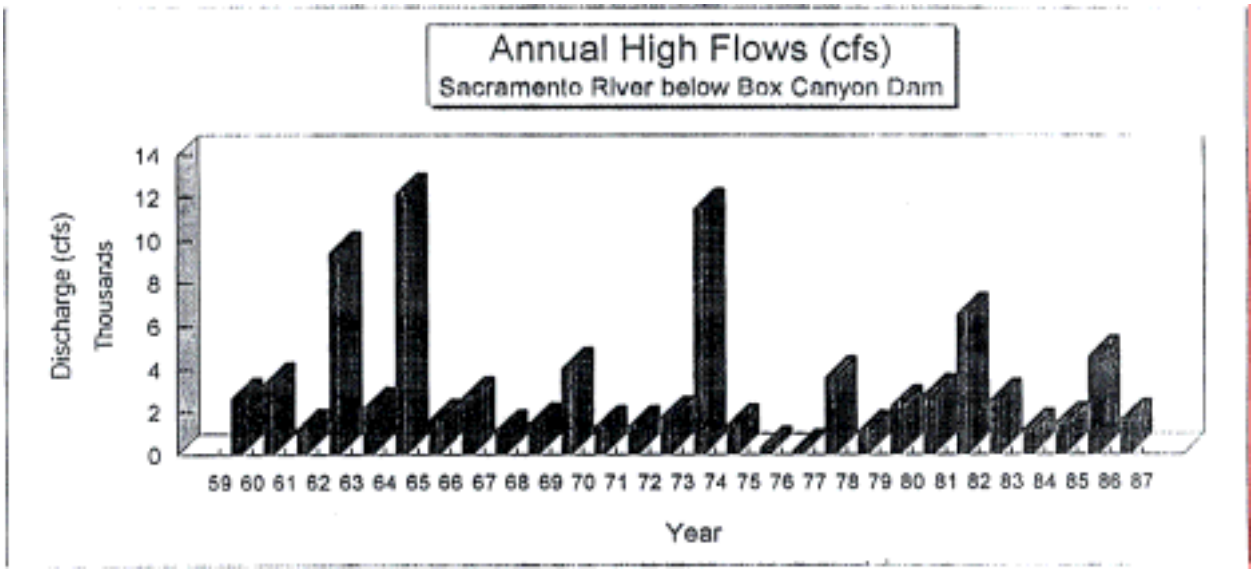
The high percentage increase in mass wasting within the non-glaciated mid-slope analysis area is interpreted to represent the effect of major storm runoff events such as occurred in the water years '62-63, 63-64', and 73-74'. This is also interpreted, to be why the glaciated zone did not show a percentage increase in mass wasting over the years.

Prime areas for watershed restoration efforts are 1,000 to 10,000 cubic yard landslides located along the South Fork of the Sacramento River. These may have been initiated by human activity. Future field study will determine how impacts from human disturbances influence mass wasting. Other landslides appear to be natural in occurrence and too large for practical stabilization.

The first Europeans to explore the upper Sacramento River testified to the effects of mass wasting and peak flows on channel morphology. Henry Eld, a member of the 1841 Wilkes Overland Expedition to California, was one of the first Europeans to observe these impacts in the Sacramento River Canyon. The physical appearance of the canyon in the Dunsmuir area prompted Eld to name the river "Destruction River" (Scanlon, 1968).

Abnormal precipitation events capable of altering channel morphology have occurred approximately every ten years in the watershed. Early accounts of peak flows on the Sacramento River indicate that large floods occurred in 1849, 1850, and 1862. From the mid-1800's to the present peak flows have occurred at approximately ten-year intervals. Ten year estimates were determined from inspection of historic gage records from a gaging station (located 0.1 mile upstream of Stink Creek (1959-1987) and discharge records at the Box Canyon Dam. Peak flow events with discharges of greater than 9,000 cfs were recorded in 1962, 1964, and 1974. The largest discharge recorded at the gaging station was 12,200 cfs during the 1964 flood. The 1962, 1964 and 1974 peak flows were 2-4 times greater than the annual high flows recorded from 1959-86 (Fig. 4-1). Flow regulation at Box Canyon dam may have modified annual high flows at the gaging station. Discharge from the largest peak flow events is believed to be representative of the normal discharge from the watershed because the storage capacity of the reservoir was exceeded during these events. No peak flow events exceeding 9,000 cfs occurred at Box Canyon Dam between 1975-1994. The largest flows measured at the dam during this period were 4,559 cfs on March 9-10, 1989, and 5,165 cfs on May 31, 1993.

Figure 4-1: Annual High Flows (cfs) – Sacramento River below Box Canyon Dam.



Human Activities

Timber harvest began in the Sacramento Headwaters watershed in the late 1800's. The pace of logging activities fluctuated in the watershed. Approximately 80 percent of the watershed had been logged by 1990. Logging peaked twice in the watershed; once in the early 1900's and again in the late 1970's. The effect of logging on water quality was probably variable over time. The removal of timber influenced stream flow by removing vegetation and increasing water yield. It is expected that contributions of sediment to streams were higher following disturbances from logging.

The construction of roads and railroads which accompanied timber harvest probably had the greatest impact to water quality. Early roads and railways were often constructed in and along stream corridors. One railroad grade, built between 1890 and 1906, was constructed up the center of the Deer Creek channel. The earliest roads were constructed in the 1920's. Road construction in the watershed peaked in the 1940's. The construction of roads resulted in significant impacts to water quality. Road erosion problems were inevitable because of the steep terrain, serpentinitic soils, natural instability and the abundant supply of surface runoff produced by large precipitation events.

Road impacts to water quality during the early 1900's were probably greater than present day impacts. Early roads were constructed without consideration of potential impacts to water quality. Hillslope detritus from road construction was often side cast directly into stream channels. Practices such as side casting resulted in the introduction of large quantities of bedload and fine sediments to stream channels. Early roads concentrated runoff during large precipitation events and this resulted in the scouring of fine sediments from road surfaces and the rapid delivery of water and sediments to stream channels. Water quality impacts were greatest immediately following road construction. Road construction practices improved over time resulting in reduced impacts to water quality. In many cases old road beds stabilized over time. Roads continue to be the greatest source of fine sediments to streams in the watershed. Additional restoration efforts will be necessary to further minimize impacts to water quality from roads.

Water quality in the upper Sacramento Headwaters was influenced to a lesser degree by grazing and mining. Mining activities were very limited in the watershed and are not believed to have had any appreciable effect on water quality. Livestock grazing was introduced to the upland riparian meadows in the late 1800's. Cattle grazing in upland wet meadows resulted in stream bank erosion and increased nutrient inputs to wet meadows. Restoration projects such as the one in Fawn Creek meadow were

initiated to improve bank stability and create fish habitat, thereby mitigating grazing impacts. It is important to note that grazing practices may not be solely responsible for impacts to channels in wet meadows. Natural disturbances such as peak flows produced from summer precipitation events may also be responsible for impacts to channels in wet meadows. For further information concerning grazing impacts to water quality see the discussions in Chapter 3 (Current Conditions: Hydrology) and sections addressing grazing impacts to Special Plant and Animal Populations.

Restoration activities in the watershed have also occurred in response to perceived channel damage from peak flows. In 1974 a January rain-on-snow event impacted the watershed by redistributing bedload and depositing large amounts of woody debris in the lower portions of the South, Middle, and North Forks of the Sacramento River and Deer Creek. A portion of the South Fork road was also destroyed during this event. The following summer a restoration project was undertaken in the lower portion of the watershed to mitigate peak flow impacts. Woody debris were removed from channel banks and the active channel along the South Fork and its tributaries. Heavy equipment was used to redistribute the bedload in the South Fork. Large amounts of bedload were relocated from the center of the channel to the channel banks to protect the banks from erosion. Along some portions of the floodplain, the South Fork channel was re-routed from the outer banks to the center of the floodplain (Caraway, 1975). Overall, the 1974 South Fork restoration resulted in significant modifications to the floodplain and channels of the South Fork of the Sacramento River.

Historically, fires impacted water quality by removing vegetation and contributing to hillslope instability. Hillslope destabilization resulted in increased sediment contributions to streams and vegetation removal increased water yield. Water quality impacts from fire were of short duration. Following World War II the practice of fire suppression began in the watershed. This had no direct impact to water quality, however fire suppression may have actually improved water quality in the short term by reducing sediment inputs to streams. Water quality was probably affected by the larger fires in the watershed, the largest of which was a 17,000 acre lightning fire which burned portions of the Deer Creek and South Fork drainages.

Prior to the 1900’s recreational use of the Sacramento River Headwaters was limited. Timber harvest and the construction of roads which accompanied harvest activities improved access to the watershed resulting in an increase in recreational activities. Alpine lakes and streams were opened up to fishing, camping, hunting and other recreational pursuits. The majority of recreational activities were concentrated around streams and lakes. Prehistoric sites along the South Fork of the Sacramento River that were originally used by Native Americans provided ideal locations for recreational activities. Impacts to water quality included poor sanitation practices and the removal of riparian vegetation at campsites located along streams and lakes. Impacts were greatest along the South Fork of the Sacramento River, and at Castle and Gumboot Lakes.

The construction of the Box Canyon Dam (completed in 1969) significantly affected processes controlling channel morphology and water quality. The reservoir completely cut off the supply of sediments and bedload to the Sacramento River immediately below the dam. Downstream water temperature regimes and flows were also affected by the reservoir. The effect of the reservoir upstream of the river was to block the traditional movement of bedload and suspended sediments thereby resulting in channel aggradation in tributaries to Lake Siskiyou. A portion of the bedload currently present in the South Fork of the Sacramento River can be attributed to channel aggradation.

Past impacts to water quality in the developed portion of the watershed west of Mt. Shasta City were much greater than in the upland areas. Water quality in the developed area has been significantly impacted by grazing and agricultural practices and other problems associated with urban development. The influence of these impacts on water quality has varied over the past one hundred years. Hydrologic features directly affected by these impacts included Cold and Wagon Creeks and Lake Siskiyou.

Chapter 5 - Interpretation

Recreation / Heritage Resource

Several factors contribute to the popularity of the Headwaters watershed for recreation use. The presence of easily accessible lakes and streams where the stocking of fish is done on a routine basis is a major attraction for this area. The close proximity to Interstate 5 and the national and international recognition of Mt. Shasta also contribute to high public use of the watershed. There are also trailheads for both the Pacific Crest and Sisson Callahan National Recreation Trails within the watershed.

Population increases for Shasta County and the Redding urban area continue at a rate of approximately three percent per year. Population increases for Siskiyou County are approximately one percent per year, although that rate is probably higher for the south part of the county. These two counties are where most of the local visiting public originate from.

Recreation visitors to the Mt. Shasta area, including the Headwaters Watershed, are increasing at a rate of approximately five percent per year. This figure is based on traffic counters on both the Castle Lake Road and the Everitt Memorial Highway on Mt. Shasta.

The local communities are moving from an economy based on the timber industry to one based on tourism. The local Chambers of Commerce (Cities of Mt. Shasta, Dunsmuir and Weed) have increased their publicity efforts to attract more visitors on a year-round basis. Private recreation developers, such as the Lake Siskiyou Campground and the Mt. Shasta Resort, continue to expand and attract more visitors to the area. Plans have been proposed for future residential and recreation development on private lands within the Headwaters Watershed.

The National Forest System lands within the watershed are allocated to management prescriptions that emphasize recreation use. Roaded Recreation and Unroaded, Non-Motorized Recreation are the main management prescriptions for this watershed. Portions of both Late Successional Reserves are also popular for dispersed recreation. The Methodist Church Camp, a permitted developed recreation facility, is located within the Scott Camp Creek Late Successional Reserve.

Meeting future demands for public recreation use of the Headwaters Watershed will require development on both private and public lands. Opportunities for development on public lands are greatest in the area around Lake Siskiyou (Siskiyou County and National Forest System lands) and adjoining the Castle Lake Road (private and National Forest System lands). Developed facilities should meet full-service standards that accommodate a variety of recreation users on a year-round basis. Dispersed recreation will continue to be associated with the alpine lakes and the South Fork of the Sacramento River.

The archaeological sites have changed dramatically from reference to current conditions. Erosion has occurred at sites from natural causes along Soapstone Creek. Timber related road construction, road maintenance, and increased recreation access has caused general site deterioration.

Forest Health

Vegetation

Alpine/Red fir Zone: A large part of this zone is within the Administratively Withdrawn Land Allocation under the Forest Plan. Management prescriptions are for Unroaded Non-Motorized Recreation and Special Management Areas (Special Interest Area and Research Natural Area). A portion of this zone is within the Congressionally Reserved Land Allocation (Wilderness Prescription). A portion of this zone is with the Matrix Land Allocation with a management prescription of Roaded Natural Recreation. Within the Roaded Natural Recreation Prescription is where most of the historic timber harvest has occurred.

Generally mature-large trees were removed on a selection basis leaving a stand of similar composition but with lower stand density. Most of these stands are regenerating naturally to original stand densities. Shrub competition has prevented some stands from regenerating naturally to original densities. Fire exclusion has encouraged increased shrub competition in this zone to a limited extent.

Mixed Conifer Zone: This zone has land allocations that include Congressionally Withdrawn (Wilderness Prescription), Late-Successional and Managed Late Successional Reserve (Threatened and Endangered and Sensitive Species Prescription), and Matrix (Wildlife Habitat Management and Roaded Natural Recreation Prescriptions). This zone has been greatly influenced by human actions that include timber harvest and the exclusion of naturally occurring wildland fires. Starting in the early 1900's private logging companies were removing virgin stands of ponderosa pine from much of the lower elevation drainages that were accessible with narrow gauge railroads. Early written descriptions of this activity indicate near clear-cut conditions following harvest, with no efforts to remove logging slash or reforest the areas. Some of these areas subsequently burned as a result of human caused fires. Many of these burned areas reverted to seral shrubland and knobcone pine. In 1905 a small portion of the watershed was reserved under Presidential Proclamation as National Forest System lands. It was not until 1930 that a major portion of the watershed came under federal ownership as a result of land exchanged with private timber companies. Timber Harvest on National Forest Lands began in the late 1950's and early 1960's. High risk selective tree removal was used during the 1960's and through the mid 1980's. Generally large diameter pine and Douglas fir were removed over large areas, causing a reduction in canopy closure and a shift in species composition to more shade tolerant white fir, normally found in the understory of these stands. Approximately 60 to 70 percent of the commercial forest lands within this zone were harvested under this treatment during this period. All harvest was using tractor yarding with associated skid trails and access roads. In 1985 silvicultural treatments started to include clearcutting. Approximately 600 acres of clear-cut have been created in the watershed, mostly planted to ponderosa/Jeffrey pine. Another 600 acres of plantations were created from seral shrubland clearing where no timber was harvested.

Also starting in the mid 1940's was a policy of aggressive wildland fire suppression by both the Forest Service and the California Department of Forestry. Since that time no large stand replacing fires have occurred within the watershed.

The result of these actions has been a reduction in the acres of moderate and dense canopy closure stands, a significant reduction in the old-growth forest age class, and a general species composition shift from pine and Douglas-fir to more shade tolerant species such as white fir. The density of some of the white fir stands has now reached levels that exceed the capability of the site to support the stand, and mortality has begun a natural thinning process. As vegetation growth and mortality in these dense stands continues to increase, the risk of a stand replacing wildland fire also increases, especially in areas where the incidence of fires is high.

Mixed Conifer/Black Oak Zone: This zone is almost entirely on non-Federal lands under the jurisdiction of the State of California and Siskiyou County. Zoning of these lands is mostly rural residential with a minimum lot size of 2.5 acres. There are also some agricultural lands and Timber Preserve lands within this zone. Residential development has been the primary influence on vegetation changes within this zone. The subdivision of large tracts of land into small, often minimum size parcels has progressed steadily over the last several decades. Clearing for home construction and access roads have fragmented many stands of trees and reduced the natural processes within the landscape. New subdivision developments are being proposed that will further impact the vegetation communities in the zone. This zone also has a large number of introduced plant species, due to residential development and associated landscaping.

Riparian Zone: Vegetation within this zone has been mostly impacted by human development, including roads and early railroad logging. Early trails and subsequent roads were located immediately adjacent to

major streams. Early logging railroad grades were sometimes built on the stream or crossed it at many locations. All the early railroad grades have been abandoned and most have reverted to natural vegetation.

The following table shows the percentage of land area in each density class for the first three community types prior to and following European settlement.

Table 5-1: Density Class Comparison - Historic to Present.

Canopy Density Class	Communities					
	Mixed Conifer/Oak		Mixed Conifer		Red Fir	
	Historic	Current	Historic	Current	Historic	Current
Open	10-20	50	20-30	50	>50	60
Moderate	30-40	15	30	30	20-30	15
Closed	40-50	5	20	4	5	5
Plantation	---	---	---	4	---	---
Shrubs	<10	15	20	12	20-30	15
Meadows/Lakes	15	15	---	---	---	---
Barren	---	---	---	---	5	5

Answers to Key Questions

- What combination of planned activities (thinning, planting, prescribed fire, etc.) best achieve or maintain the desired mix of vegetation communities? What are the priority treatment areas?

Most vegetation management activities will occur within the Matrix land allocation and Late Successional and Managed Late Successional Reserves. These land allocations are predominantly in the mixed conifer community. The objectives of vegetation management in Matrix lands is to maintain forest health and provide a sustained supply of forest products. Objectives within Late Successional and Managed Late Successional Reserves are to protect and enhance the conditions of late successional and old-growth forests.

Within the mixed conifer community, the stand composition objective is to increase the percentage of pine and Douglas-fir to be more representative of historic conditions. The actual percentage will vary with aspect and elevation. The age class diversity objective is to increase the percentage of late successional and old-growth forests to more represent historic levels. This objective is mandated by the allocation of Late Successional Reserves, Riparian Reserves and Congressionally Withdrawn Areas within the watershed.

Within the Alpine/Red fir zone, the objective is to ensure that forested lands within the Matrix allocation are maintained in a healthy condition, and can supply a sustainable output of forest products.

Priority silvicultural objectives and treatments are:

1. Ensure that existing plantations become established at required stocking levels and have a mix of species that represent natural stand composition. Treatments will include release, thinning and interplanting.
2. Ensure that stocking levels maintain forest health. In overstocked stands the treatment would be thinning and uneven-age management. In understocked stands the treatment would be site clearing and interplanting.
3. Restore previously forested lands that have converted to shrublands as a result of wildland fire or other natural disturbance. Treatment would be site clearing and planting.
4. Obtain a representative mix of conifer tree species in the mixed conifer zone. Treatments will be group selection and regeneration harvest and site clearing for natural and artificial reforestation.

- What types and amounts of forest products can be provided on a sustained basis?

The Shasta-Trinity National Forests Land and Resource Management Plan establishes a sustained harvest level for commercial forest lands, with a disaggregration by Management Area. Management Area 5, of which the Headwaters watershed is a part, has an estimated sustainable harvest level of twenty million board feet per decade. The estimated allocation of that output, based on the percentage of matrix lands, for the Headwaters watershed is twelve to fourteen million board feet per decade. Over the next decade, a high percentage of that output will be as biomass and small diameter sawlogs.

Table 5-2: Forest Health Conditions.

Existing Condition	Causal Mechanism	Future Trends
Less than 5% old growth within the watershed	Historic logging and stand replacing fire removed much of the old-growth component.	Allocation of Late-Successional and Riparian Reserves should create old-growth stands on approximately 20 percent of the watershed within the next century.
Overstocked stands that are susceptible to stand replacing fire and insect and disease attack.	Exclusion of wildland fire since aggressive suppression actions started in early to mid 1900's.	Continued aggressive suppression actions and development of overstocked conditions. Increasing potential for stand replacing fires.
Plantations dominated by ponderosa pine and not representative of adjoining mixed conifer type.	Reforestation following logging and shrubland conversions that used ponderosa pine as the preferred species.	Continued use of ponderosa pine as the dominant species in reforestation of shrublands.
Shrublands that have not advanced to early seral stage conifer forests.	Historic logging and stand replacing fires during both historic and prehistoric times.	Older shrublands continue to occupy sites that could support forested communities. Some development of conifer tree cover, mostly shade tolerant white fir. Increasing potential for stand replacing fires.
Build-up of natural fuels, both live and dead that exceed desired future conditions.	Exclusion of wildland fire since aggressive suppression actions started in early to mid 1900's.	Continued aggressive suppression actions and build-up of live and dead fuels. Increasing potential for stand replacing fires.

Special Plant and Animal Populations

Plant Populations of Concern

Threatened, Endangered, Proposed, & Sensitive Plants

This watershed includes a large number of rare plants, most of them associated with mid to upper elevation serpentine soils. Trends can be summarized by habitat group:

Riparian habitats. *Raillardella pringlei* and its riparian habitat has been damaged by livestock grazing; habitat effects have lessened since livestock use has decreased and logging operations avoid riparian zones. Viability of this species is still a concern since the effects on viability of continued cropping of flower heads are not known. Populations of *Phacelia dalesiana* at forest/meadow margins around mountain lakes have been reduced or nearly eliminated by recreational use.

Rocky habitats. Population numbers and habitat quantity have changed little since prehistoric times for the species that are high-elevation rock-dwellers.

Forest habitats. A few sensitive plants are forest dwellers, though none of these are old-growth associates. Changes in forest vegetation since prehistoric times because of logging and fire suppression

have had both positive and negative effects, but the net effect has been more or less neutral. Where *Phacelia dalesiana*, a forest-dweller, ventures into meadow margins it has been affected by recreational use (see "riparian habitats" above). Despite local effects and temporary reductions in numbers these species remain viable throughout their historic ranges. In fact, pallid bird's-beak has apparently expanded its geographic range since prehistoric times. Although its natural habitat is rapidly being converted to residential and urban uses in the towns of Mt. Shasta and Weed, it has survived and traveled along disturbed roadways.

Survey & Manage species: plants, lichens, & fungi

We have no records of survey and manage lichens or fungi from this watershed. One survey and manage vascular plant, clustered lady's slipper, was documented from the Castle Lake area several decades ago. Since these species are all assumed to be old-growth associates, the reduction and fragmentation of old growth forests in the watershed can be assumed to have caused a similar reduction and fragmentation of survey and manage species.

Noxious weeds & other exotic pest plants

Weeds are not a serious problem in Headwaters watershed at present. Sweet clover, Dyer's woad, and other exotics are creeping into the watershed via South Fork road. Dyer's woad has the potential to become a serious pest around Lake Siskiyou. Exotic grasses were planted along roadsides and have persisted, but are not spreading into native plant communities.

Table 5-3: Differences.

Condition	Causal Mechanism
Fragmented populations of *Raillardella pringlei*; lack of seed production	Past grazing practices, road building in riparian areas; grazing of flower heads by cattle.
Reduction of *Phacelia dalesiana* populations around mountain lakes	Recreational use of meadow margins around lakes--compaction, foot traffic, vegetation removal.
Entry of *Cordylanthus tenuis* ssp. *pallescens* into watershed	Construction of South Fork Road
Scarcity of old-growth dependent Survey & Manage plants, lichens, fungi	Logging, stand conversion, fire suppression (many Survey & Manage species were never there)
Entry of exotic pest plants (weeds) into watershed	Road construction & travel in watershed; deliberate planting for erosion control

Answers to Key Questions

- What additional measures are needed to ensure that grazing operations do not threaten the viability of threatened, endangered, or candidate species?

The viability of *Raillardella pringlei* is of concern. Since the plant is still present in the watershed, it clearly has some resilience to grazing. Since there are no never-grazed populations for comparison, we don't know what the long-term impact of grazing on this species has been. The principal unanswered question for this plant is whether chronic loss of flower heads to cattle grazing is affecting its long-term viability by preventing seed reproduction and gene flow among populations. A thorough survey of suitable habitat for the species is needed, and a study of the genetic variability among populations. Until the study is completed, an interim measure is desirable, to let each population in the watershed be ungrazed every third year at a minimum so that seeds can be produced and dispersed.

- How do we manage Late Successional Reserves and Critical Habitat to maintain viable populations of old growth dependent species?

The first step for survey and manage species is to conduct basic surveys to determine whether these species are present in the watershed. To date, only one survey and manage vascular plant, clustered lady's slipper, is known to be in the watershed. This species is apparently dependent on periodic underburning for habitat maintenance.

- What standards need to be considered on Matrix lands to respond to requirements of these special plant and animal populations?

Until we have survey information that will be amassed over time, the survey and manage standard and guide in the President's Forest Plan and our Forest Plan will be adequate - project-specific surveys for plants and certain lichens, and managing known sites. We will begin with relocating the lady's-slipper site near Castle Lake, and then developing management recommendations based on our observations and the Regional Ecosystems Office management guidelines.

Animal Populations of Concern

Table 5-4: Differences.

Condition	Causal Mechanism
Riparian and aquatic dependant species populations declined.	High grazing pressure in late 1800's on meadows, riparian vegetation, and aquatic vegetation. Creation of Siskiyou Lake, flooding lower slopes of Headwaters. Initial stocking of tributaries and alpine lakes.
Old growth, late-successional, and snag dependant species populations have declined.	Timber harvest and conversion to shrubland or early to mid seral forests, burning and removal of snags, reduction in late-successional forests for large snag recruitment.
Deer populations have fluctuated severely with a current downward trend.	Settlement of Europeans; meat market hunting, sport hunting, timber harvest, fire suppression, cattle grazing, European development on winter range, creation of Siskiyou Lake.
Bald eagle nest site established and summer sightings in alpine lakes.	Creation of Siskiyou Lake, stocking of tributaries and alpine lakes.
Shrub and dead/down dependant species populations increased.	Fire suppression, unmanaged regeneration on harvested forest lands.

Answers to Key Questions

- What additional measures are needed to ensure that grazing operations do not threaten the viability of threatened, endangered or candidate species?

Wildlife populations dependant upon emergent vegetation for nesting (northern red-legged frog, cascades frog) and streamside vegetation for cover (foothill yellow-legged frog, willow flycatcher, marten), and insects for food (tailed frog, Townsend's big-eared bat) are expected to be affected by current grazing practices, especially in areas of cattle concentration.

Populations of species effected by grazing practices are not expected to return to their historical levels. The continuation of current grazing practices, may further effect these populations negatively. Populations may stabilize, continue to stabilize or even increase with changes in grazing practices.

Cattle grazing is permitted within Riparian Reserves provided the effects are not adverse to riparian habitat and are consistent with the aquatic conservation strategy. Current management for willow flycatcher is to provide for population viability through the protection of habitat in the form of riparian habitat such as Riparian Reserves and wet meadows. For other listed species management goals are to maintain reach populations of T&E species and, if possible, increase existing viable populations of

sensitive species. Overall, management is intended to prevent any species from becoming a candidate for T&E status.

In the Headwaters Watershed, cattle grazing may not be consistent with aquatic conservation strategies 8 and 9 ('Maintain and restore…adequate summer and winter thermal regulation,' and 'maintain and restore well-distributed populations of…vertebrate riparian-dependent species') or with TES management goals.

- How do we manage Late-Successional Reserves and critical habitat to maintain viable populations of old growth dependent species?

Within the Headwaters watershed, late-successional forest (LS) and old-growth (OG) forest dependant species were identified as occurring below their historical distribution and population size. Protection of these habitats are important for the continued existence of these species in the Headwaters Watershed. These populations could increase with habitat protection and enhancement, but are not expected to return to their historical levels. Provisions for these species can be found in the Forest Plan.

Late-successional reserves (LSR), Managed Late-successional reserves (MLSR), unmapped LSRs, administratively withdrawn areas, and congressionally withdrawn areas, protect and manage for OG and LS forests. These reserved areas and land allocations are expected to provide habitat for the Pacific fisher, American marten, Northern goshawk, and nesting habitat for the Northern spotted owl. Critical habitat is intended to provide dispersal habitat and nesting habitat to at least five owl pairs. Habitat Capability Models provide other management guidelines for the marten, fisher, and goshawk. For goshawks, known goshawk nest sites are to be protected and a limited operating period will exist around active goshawk nest sites.

Spotted owl nest sites also have a limited operating period (LOP). In addition to a LOP, the Fish and Wildlife Service (F&WS) require 500 acres of suitable habitat within a .7 mile radius of the nest site and 1,336 acres within a 1.3 mile radius. Spotted owl activity centers outside of mapped LSRs are given 100 acres of 'unmapped LSR'. These areas are managed as LSRs. The area around the spotted owl 100-acre core should be managed to reduce natural disturbance and should be maintained for old-growth dependant species, even if deserted by the owl(s). These 100-acre cores should be mapped based on the best habitat around the nest site.

Current road densities in the reserved areas may exceed recommended road densities for goshawk, marten, and fisher (1-2 mi/mi2). Dispersal habitat for spotted owls is below the 50% requirement for consultation. All three spotted owl territories (0.7 mile radius) and home ranges (1.3 mile radius) contain less than 50%, and on average less than 10% of the required suitable habitat, resulting in 'incidental take' and consultation. Over 70 percent of the LSRs and CHU are potential habitat (capable of becoming suitable).

- What standards need to be considered on matrix lands to respond to requirements of species plant and wildlife species other than TES or candidate species?

Numerous land practices have occurred on Matrix lands affecting a variety of wildlife species. Grazing practices have affected species partially dependent on wet meadows for foraging and the rearing of young (deer and bear). Other species benefited when timber harvest converted forest habitat into open grass and shrubland (deer, shrub dependant species, aerial foragers, green-tailed towhee). Conversely, snag (tree-cavity), dead/down, and old growth dependant species declined with the removal of snags, down woody material, and trees (bats, northern flying squirrel, pileated woodpecker, western bluebird). In areas of fire suppression, snag and dead/down dependant species may benefit. The creation of Siskiyou Lake negatively impacted deer populations by removing a large areas of wintering range from use. Increased hunting pressures also negatively impacted deer populations. Bald eagle and osprey, though, benefited from the creation and stocking of Siskiyou Lake, as well as the stocking of other alpine lakes. Initially

introduced fish in the pristine lakes may have caused population declines in amphibians species populations.

Population levels of all the species impacted by past management practices and major land alterations are not expected to return to prehistoric levels. Management can help stabilize or even increase population levels. Because of late seral management emphasis in non-Matrix lands, the Matrix lands are important for maintaining seral stage diversity for multi-habitat species (deer, bear).

Deer and bear are partially dependent on the wet meadow systems in the Bear Creek allotment in July and August for rearing young (Showalter, 1985). In addition, the Dept. of Fish and Game voiced a concern for the amount of summer range available to deer, especially during the early summer. The Headwaters is within Management Area 5 (Parks-Eddy). Management area 5 places emphasis on hunting over the non-game aspects of fish and wildlife management. This area is also identified for maintaining or improving selected habitats for deer and bear. Areas of concern have been identified as 'upper meadows,' alpine meadows, and riparian areas (Showalter 1986 and Payton 1989). In response to the fawning and forage concerns, a cattle rotation system which left the upper meadows unused until mid-summer was implemented. The effectiveness of this rotation system is unknown.

Winter range is also in decline. It is important to maintain shrublands and other winter forage areas. Off-highway vehicles may contribute to disturbance of deer and bear on winter and summer ranges. Current literature suggests road densities of 1-2 miles/mi^2.

In fifth field watersheds 15% of the landscape (federal forest lands only) is to be managed for late-successional forests. Landscape areas where little late-successional forest persists should be managed to retain late-successional patches. Retention of these patches applies directly to Matrix lands in the Headwaters. Because of past timber harvest, less than 3% of the Headwaters contains late-successional forested areas. This amount is below historical levels and current management guidelines.

The Matrix lands are also to be managed for spotted owl/ late-successional dependent species dispersal habitat requirements. Riparian reserves and late-successional management will partially provide for dispersal habitat. In addition half of all regenerated stands over time will be 50-60 years old, which on average or better sites will result in stands of conifers that will provide for dispersal habitat. Currently, less than 40% of the watershed contains dispersal habitat (dispersal habitat = conifer stands with 13"+ DBH, 40%" canopy closure, black oak, mixed hardwoods, and Pacific madrone stands). This is below the F&WS 50% requirement. Any reduction in the amount of, or condition of dispersal habitat will require informal consultation.

Snag dependant species requirements are expected to be met through old-growth, late-successional forest management as well as snag guidelines for Matrix lands. In salvage areas, all standing live trees should be retained including those injured but expected to survive. Retain snags likely to persist until late-successional conditions are developed and the stand is producing snags (i.e. 80 yrs old). Snag densities in Matrix lands should provide for cavity nesters, secondary cavity nesters, and bark dwellers at the 40% population level, and white-headed woodpecker, pygmy nuthatch and flamulated owl at the 100% population level. Snag models developed for the forest are being reviewed and verified. Currently, the snag model predicts 0.9 snags/acre in Douglas-fir, 4.4 in ponderosa pine, 3.6 in mixed conifer (including white fir), 2.5 in lodgepole pine, juniper and closed-cone pine forests, and 1.0 in red fir forests. No snag over 20" DBH is to be marked for cutting. If snag requirements are not met, then snag harvest is not expected to take place. Bats also utilize snags, but densities required are not well known. Snag densities for the Headwaters is unknown, but are expected to be lower than recommended levels because of past timber harvest practices.

Bats are a survey and manage species. Riparian Reserves are expected to provide foraging habitat. Snag management will help maintain important roost, winter, and maternity sites. In Matrix lands caves, mines, and abandoned bridges should be protected, and surveys conducted to determine the presence of bats.

Currently no potential bat sites have been identified. For areas containing bats, timber harvest is prohibited within 250 feet of the site.

Bald eagle populations in the Headwaters watershed have apparently increased, with the first recorded sighting in 1986. Since that time one nest site and various summer sightings have been recorded. Management direction for the nest site includes a primary and secondary zone, noise reduction, limited operating period, line of site disturbance and maintenance of a forage resource. Rainbow Ridge, Lower Castle Creek, Lower Scott Camp Creek, and the ridges north of Castle Lake road have been identified as potential nesting sites. These areas are to be protected for future occupancy. Areas where bald eagles are sited during the summer and at a substantial distance from the known nest site, may indicate another nest site or important dispersal area. Any habitat improvement within the primary or secondary zone must follow Critical Habitat Unit guidelines for spotted owls.

Stocking is expected to continue in many of the alpine and lowland lakes and streams. This is compatible with the objectives of the Parks-Eddy management area. Yet stocking may not be compatible with the intent of the Forest management guidelines or the aquatic conservation strategy objectives.

Neotropical migrant birds and other non-consumptive species are expected to benefit from management of Riparian Reserves, snags, dead/down, late-successional forests, seral stage diversity and cattle grazing.

Fisheries

The trend for resident fisheries in the Headwaters of the Sacramento River is toward more intense management. The pristine nature that occurred long ago has been changed and can never be recaptured. Locally, recreational fishing has increased dramatically. This demand tends to be directed towards the more easily accessible areas such as Lake Siskiyou, Gumboot Lake, the South Fork of the Sacramento River and Castle Lake, but all lakes and streams (with fish) have experienced an increase in use. Some natural trout reproduction does take place, but is insufficient to sustain present user demand. As a result, fish stocking has become necessary. It is anticipated that as the number of people that engage in fishing increases, stocking allocation will also need to be increased, and that this increase will be largely in the form of catchable size trout.

Water Quality

The quality of water in the Sacramento River Headwaters has always been very good. Natural processes and human disturbance have interacted or worked independently to occasionally influence water quality. Impacts to water quality have been primarily in the form of increased bedload and suspended sediments. Sediment inputs to streams occur mainly during peak flow events. Roads provide a chronic source of sediments to streams. Grazing activities affect stream banks resulting in sediment contributions to wet meadow streams.

The majority of impacts to water quality from natural and human disturbances do not occur continuously. Instead these impacts often occur simultaneously during large precipitation events. Large precipitation events trigger peak flows and mass wasting processes. Impacts from human activities and fire may not be apparent until a peak flow occurs. Disturbed areas act as additional sediment sources during peak flow events. Thus the majority of the impacts to water quality and channel form are associated with large precipitation events and occur within very short time frames. Water quality and clarity recover quickly after these events. Conversely, adjustments to channel form from peak flows may never return to conditions prior to peak flows.

Catastrophic events account for the largest volume of sediment delivery to channels and sediment transport in the watershed. The majority of sediments transported during these events are derived from mass wasting processes and roads. Roads serve as source areas for sediments during peak flows and

smaller precipitation events. The chronic sedimentation problem from roads could be mitigated by restoration projects designed to reduce the amount of sediment created and transported by roads.

Water quality in the Headwaters watershed has changed very little from reference to current conditions, however there have been changes to physical features and processes that affect water quality and channel morphology. Similarities and differences between reference conditions and current conditions are identified on the following page and in Table 5-2. Similarities identify conditions and processes that have not changed significantly from reference conditions to current conditions. Differences identify disparities between reference and current conditions and the causal mechanisms responsible for changes in processes and physical features.

Similarities

Water quality and channel form are controlled primarily by mass wasting processes and peak flow events. Mass wasting processes continue to be the dominant mechanism responsible for sediment transport from hillslopes to the channel network. Peak flows provide the dominant means by which sediments and hillslope materials are redistributed throughout the channel network.

Natural mass movement processes are responsible for the majority of sediment transport in the watershed. The majority of mass movement has occurred in areas unaffected by timber harvest and road construction. In isolated instances road construction and timber harvest activities may have triggered some mass wasting along the South Fork and Middle Fork drainages. Roads continue to be chronic sources of sediments to streams.

The concentration of bedload in the majority of the channel network has not changed significantly from reference to current conditions (Lower South Fork is an exception). Roads are believed to have contributed some hillslope materials to stream channels, however these contributions are believed to be small when compared to the natural supply of bedload from upland areas. The natural geologic instability inherent in the watershed combined with the recurrent effects of peak flows will continue to supply colluvial material to the channel network.

Water quality with respect to stream temperature and turbidity is not believed to have changed significantly from reference conditions to current conditions. Early timber harvest activities may have affected water temperature however riparian buffers have protected the majority of streams from timber harvesting activities thereby preserving stream canopy cover.

Table 5-5: Differences.

Condition	Causal Mechanism
Riparian zones and stream channels have been impacted by land use activities.	Roads have been constructed within and adjacent to riparian reserves. Roads are chronic sources of sediment to streams. Grazing has affected bank stabilization in wet meadows. Recreation has impacted riparian reserves along streams and lakes.
Concentrations of woody material in the lower portions of the South, Middle and North Forks of the Sacramento River and Deer Creek may be below recommended levels. Fish habitat may be reduced along portions of streams with insufficient amounts of woody debris.	Restoration of the South Fork channel and its tributaries following peak flow events resulted in the removal of large quantities of woody debris. The removal of woody debris was necessary to eliminate barriers to fish migration and reduce bank erosion, however excessive amounts of woody material may have been removed from portions of the South, Middle and North Forks of the Sacramento River and Deer Creek.
The Sacramento River channel has been modified immediately downstream and upstream of Box Canyon Dam. The supply of sediment and bedload has been cut-off to areas downstream of the dam. Traditional bedload movement has been blocked by Lake Siskiyou resulting in channel aggradation along portions of the South Fork immediately above the reservoir. Restoration projects have altered the distribution of bedload in the South Fork upstream of Lake Siskiyou.	Box Canyon Dam. Channel restoration work along the South Fork following the 1974 peak flow.
Recreation use is increasing within the watershed. The majority of recreational activities occur within and adjacent to lakes and streams. It is likely that recreational use within riparian reserves will increase in the coming decades.	Population growth in Siskiyou County and surrounding vicinity. Increased numbers of people have fostered increased demand for recreation opportunities in the watershed. Increased access along streams and to lakes.
Changes in potential impacts to water quality have occurred in the developed portion of the watershed.	Urbanization and agricultural practices have affected the distribution of surface runoff and water quality within and around Mt. Shasta City.

The interaction of land use activities with natural processes was examined to identify areas in the watershed where processes were found to be operating outside their natural range of variability. These relationships were examined in Table 5-6. Potential restoration opportunities were identified for roads (1994 WIN Inventory), riparian reserves along Gumboot Lake, Castle Lake, and the South Fork of the Sacramento River, and stream channels with deficient amounts of woody debris in the lower elevations of the watershed. Restoration projects will be developed both to meet the needs of increased recreation activities along the South Fork of the Sacramento River, Castle Lake, and Gumboot Lake while simultaneously providing for resource protection in riparian zones.

Table 5-6: Qualitative Summary of Water Quality Effects.

Human Activities	Trends	Natural Process Interactions	Water Quality Effects	Potential Restoration Areas
Recreation	Increasing recreation use concentrated around and within riparian reserves.	Recreation activities may impact riparian vegetation in areas where recreational activities are concentrated.	May introduce contaminants to streams and lakes particularly in areas where recreational activities are concentrated.	Impacts from recreation use are believed to be greatest along Castle and Gumboot Lakes and at camping sites along the South Fork of the Sacramento River.
Roads	Continual expansion of road system over past century. Stabilization of older road systems over time.	Some interaction with mass wasting processes. Increased sediment transport and drainage network expansion during peak flow events.	Potential sediment source. May impact channel conditions in problem areas associated with culverts and stream crossings. Some impacts to slope stability.	Possible hillslope restoration opportunities along the South Fork. Isolated restoration opportunities identified in 1994 WIN Inventory. Possible road closures or conversion to trails in Soapstone Basin, Cedar Basin and Deer Creek.
Timber Harvest	Recent decrease in timber harvesting activities.	Some interaction with mass wasting processes.	Some introduction of sediment to streams. Increase in water yield following harvesting.	None identified.
Grazing	Decrease in grazing allotments and numbers of livestock in recent years.	May increase sediment loads to channels during peak flow events.	Increased nutrient inputs to streams. Bank destabilization resulting in channel migration, down cutting and sedimentation.	None identified. Past restoration projects have been undertaken at Fawn Creek and Gumboot Meadows.
Reservoir: Water Resources/ Restoration	Increased regulation of water resources over time.	Affects sediment transport, peak flows, and base flows.	Channel aggradation upstream of reservoir. Decrease in sediment loads downstream of reservoir. Modification of water temperature downstream of reservoir.	Possible introduction of woody debris to the South Fork of the Sacramento River and its tributaries. Large amounts of debris were removed following the 1974 peak flow.
Urban Development	Increasing urban development.	Increased runoff to creeks from paved surfaces.	Potential water quality impacts in developed areas associated with urbanization.	None identified.

Current Activities and the Aquatic Conservation Strategy

Activities currently occurring in Riparian Reserves include grazing, recreational activities, and roads. Timber harvest activities have occurred within Riparian Reserves in the past, however stream buffers/Riparian Reserves widths will regulate future harvesting activities in Riparian Reserves.

Some roads in the watershed are located within Riparian Reserves. Standards and guidelines for roads are to determine the influence of “each” road on the Aquatic Conservation Strategy objectives through watershed analysis. A complete road inventory is beyond the scope of this analysis, however isolated problem areas associated with roads have been identified in the 1994 WIN inventory (Lanspa, 1994).

Recreation facilities within Riparian Reserves occur adjacent to Gumboot Lake, Toad Lake and Castle Lake. Management direction encourages the development of additional recreational use. Existing facilities should be evaluated for restoration and/or relocation to reduce impacts within Riparian Reserves. Additional recreation sites should be developed to disperse recreational activities over a larger portion of the watershed.

Chapter 6 - Recommendations

Recreation / Heritage Resource

Table 6-1: Recommended Actions.

Project Opportunity	Objective	Priority Areas
Trailhead development for existing system trails including parking, sanitation facilities, and road access.	Accommodate existing public use while reducing impacts to water quality.	Sisson-Callahan NRT at the North Fork of the Sacramento River. Soapstone trail. Gray Rock Lakes trail.
Trail construction.	Accommodate existing public use.	Castle Lake loop trail
Provide full service developed campgrounds thru rehabilitation and/or relocation of existing facilities.	Accommodate existing public use and reduce impacts to water quality and riparian reserves.	Gumboot Lake campground. Castle Lake campground.
Provide day-use sites.	Accommodate existing public use and reduce impacts to water quality and riparian reserves.	Areas along the South Fork of the Sacramento River and Castle Lake.
Provide facilities for winter sports activities, i.e. snowmobiling, snowplay, and cross country skiing.	Accommodate existing public use.	Locations to be determined along the country road Castle Lake road.
Protect archaeological sites from continued recreation use by erecting barriers.	Protect archaeological sites from further disturbance.	The South Fork of the Sacramento River above Red Hill bridge.
Stabilize sites that are eroding along creek banks.	Protect archaeological sites from further disturbance.	
Develop interdisciplinary archaeology plan for archaeological sites.	To better understand the dynamic relationship between humans and the surrounding ecosystem over the last 8,000 years or so.	Along the South Fork, the Middle Fork, and the North Fork of the Sacramento River.

Table 6-2: Recommended Actions.

Project Opportunity	Objective	Priority Areas
Reduce overstocking by thinning and uneven aged management.	Improve forest health by increasing the growth and vigor of residual trees. Move more rapidly to mature and old-growth forests. Decrease the susceptibility of trees to insect and disease and reduce fuel ladders.	Stands with size densities 2G, 3G, and 3N. Consider those stands on 40% and greater slopes first.
Plantation release and interplanting.	Same as above plus creation of a more representative mixed conifer stand over time.	All plantations.
Convert shrublands to forested lands.	Increase the percentage of forested lands in the watershed. Create additional nesting, roosting, foraging and dispersal habitat for wildlife. Reduce live fuels.	Shrublands that are determined, through field investigation, to be capable of supporting a closed canopy forest.
Create a defensible fuels reduction zone.	Reduce the probability of large stand replacing fires spreading either from or to private lands.	Urban interface along the National Forest boundary at Deer Creek, Rainbow Ridge, and Lake Siskiyou. Also around high use recreation sites at the Methodist Camp and Lake Siskiyou.
Underburn.	Reduce natural fuels build-up and reintroduce fire as a natural disturbance process. Move species composition to more shade intolerant species.	In the mixed conifer community where prior thinning treatments have been done, and in meadows and grasslands.
Treat decadent shrublands by crushing or burning or both.	Reduce natural fuels build-up and create early seral habitat for wildlife.	Shrublands that will not support closed canopy forests.

Table 6-3: Inventory, Monitoring, and Research Needs.

Recommended Action	Objective
Complete timber type mapping of the watershed using most recent (1995) aerial photography.	Establish current conditions for stand size density and establish trends in natural stand development. Comparison of 1975 type mapping and 1944 aerial photography.
Complete a fuels inventory.	Establish baseline of existing fuel loading.
Establish continuous forest inventory plots and monitor these plots every ten years.	Establish growth trends and changes in stand composition and structure over time. Validate sustainable output of wood fiber.
Identify and screen rust resistant trees for sugar and western white pine within the watershed. Monitor existing trees of these species and increase the percentage of these species planted. Implement protection measures around identified resistant trees.	Maintain sugar and western white pine as a component of the mixed conifer forests in this watershed.
Monitoring of road closure effectiveness.	Identify road closure problems and establish a maintenance program for closure efforts.
Traffic counts.	Identify use patterns and trends.

Special Plant and Animal Populations

Plant Populations of Concern

Table 6-4: Recommended Actions.

Project Opportunity	Objective	Priority Areas
Redesign cattle grazing plans to allow periodic rest of *Raillardella pringlei* populations during reproductive season.	Allow showy raillardella to flower and produce seed at least 1 year out of each 3.	Fawn Creek, Toad Lake, other raillardella-inhabited meadow systems.
Remove trees encroaching on montane meadow systems.	Maintain hydrology of meadows to support wetland spp.	Montane meadows in watershed.
Cooperate with County Agricultural Dept. to reduce weed infestations at lower (east) end of watershed.	Prevent spread of undesirable weeds into natural areas of watershed.	W.A. Barr Rd., South Fork Road.
Interpret natural features of watershed (interp. brochure, nature trails).	Educate users to voluntarily reduce impacts to sensitive areas.	Gumboot & Toad Lakes, Mt. Eddy, Cedar Basin? (POC)

Table 6-5: Inventory, Monitoring, and Research Needs.

Recommended Action	Objective
Systematic survey of all suitable *Raillardella pringlei* habitat.	Identify restoration needs and opportunities, document distribution and abundance.
Genetic study of *Raillardella pringlei* populations.	Determine whether reproduction by seed is critical to species viability (and therefore adjustment of grazing practices necessary to species survival).
Survey for survey and manage fungi.	Determine whether survey and manage spp. found at Deadfall Meadows and on Mt. Shasta are also in Headwaters watershed.

Animal Populations of Concern

Table 6-6: Recommended Actions.

Project Opportunity	Objective	Priority Areas
Evaluate rangeland vegetation condition using ecological status and collect baseline information on riparian-dependant wildlife species identified as at high or moderate risk.	Once baseline information is collected grazing practices can be adjusted to eliminate impacts.	Wet Meadows within the Bear Creek Grazing Allotment.
Evaluate the effectiveness of the cattle rotational system.	In fawning and cubbing areas, the rotational system was developed so most of the allotment would not be used by cattle until mid-summer, minimizing the conflicts in some areas. Was this effective?	Fawning and cubbing areas within the Bear Creek Allotment; wet meadows and adjacent shrubland.
Close roads and create line-of-site barriers in areas where fawning and cubbing occur or road densities exceed habitat capability model guidelines.	To provide for better hunting conditions and to reduce illegal kill. Mitigate for disturbance in shrublands and other areas, used by deer and bear, that will be converted to late-seral stages. Provide areas of minimal disturbance for fawning and cubbing.	Areas containing wet meadows and other areas important to deer and bear for fawning and cubbing.
Provide for a mosaic of habitat for deer (40% cover and 60% foraging area) and bear as well as mature berry producing brushfields.	Mitigate for conversion of shrublands to late-seral forests.	Deer Creek Drainage. Rainbow Ridge area.
Identify and manipulate, as appropriate, decadent shrubfields on non-timber sites.	Mitigate for conversion of shrublands to late-seral forests.	Deer Creek Drainage, Rainbow Ridge, Toad Lake area.
Increase dispersal habitat in quarter townships currently not meeting 11-40.	Provide dispersal habitat throughout the watershed for wildlife. Fulfill Fish and Wildlife dispersal habitat requirement and eliminate need for informal consultation. Meet dispersal objective of CHU CA-7.	Quarter Townships: 40N05WB, 40N05WC, 39N05WB, 39N05WC, 39N05WD.
Protect suitable habitat, late-successional forest stands, and 100-acre unmapped LSR by using appropriate silvicultural treatments to reduce environmental hazards (i.e. fire, disease, insect infestation) around these special forest stands.	Meet Forest Plan LSR and Matrix objectives for old-growth dependant species	Activity Center #018, suitable habitat and old-growth forests within matrix lands and areas of high fire risk.
Retain snags in project areas as recommended by the snag model. For areas of surplus determine use of snag(s) by wildlife before marking for harvest, this includes under the bark. Consider maintaining additional snags for snag and dead/down recruitment. In areas where snags densities are less than the model follow Forest Plan guidelines for snag recruitment.	Meet objectives of Matrix standards and guidelines for cavity nesting species. Determine snags suitable for harvest when there is a snag surplus. Maintain those snags most often used and most important to wildlife.	Matrix lands where silvicultural treatments would involve removing snags or large dying trees or snag densities are below snag model recommendations.
Educate the public about the value of snags (Animal Inn) and the effects of unregulated wood cutting.	Reduce felling of snags for woodcutting and reduce illegal wood cutting. Improve public relations.	Headwaters watershed and District wide.

Table 6-7: Inventory, Monitoring and Research Needs.

Recommended Action	Objective
Evaluate value of alpine lakes to bald eagles and the possibility of another pair in the Headwaters watershed. Survey Toad Lake, Porcupine Lake, and Little Crater Lake.	Meet Pacific Bald Eagle Recovery Plan objective of identifying alternate nesting habitat and other areas important to eagles. Determine if another pair of bald eagles is present in the Headwaters watershed or if the current pair has an extended home range.
Identify road density and silvicultural treatments in suitable and potential habitat by following Forest Plan standards and guides as well as the best known scientific information for sensitive species; fisher, marten.	Reduce human disturbance to wildlife.
Identify and map migration corridors and holding areas, summer range concentration areas and fawning areas, in cooperation with Fish and Game.	Redistribution of cattle in these areas, and ability to monitor the use and condition of these areas (Showalter 1986).
Determine current snag densities in the Headwaters or specifically in matrix lands.	Establish an understanding of the current snag densities and whether they meet snag model recommendations.
Conduct bat surveys in suspected roost, maternity, or wintering sites, especially prior to ground disturbing activities in all land allocations.	Meet Forest Plan guidelines for Caves/bridges found within Matrix lands.
Evaluate habitat conditions within the current and potential nesting habitat.	Establish the need for any silvicultural treatments to improve the nest stand and/or reduce and potential hazards to the nest stand.
Research effects of stocking on amphibian populations in alpine lakes through literature review.	Establish baseline understanding of current stocking effects on amphibians populations within the Headwaters. Establish, if required, proper stocking procedures with Dept. of Fish and Game.
Survey alpine lakes for amphibian species composition. Monitor amphibians populations and stocking in stocked and unstocked alpine lakes.	To obtain baseline understanding of amphibian distribution and habitat use in the alpine lake system of the Headwaters. Establish areas where restoration can occur or stocking reduced (if stocking found to be detrimental to current populations).
Fish Population/Habitat Surveys.	Establish baseline of habitat suitability, fish production capability, and habitat improvement needs.

Water Quality

Table 6-8: Recommended Actions.

Project Opportunity	Objective	Priority Areas
Evaluate restoration and/or relocation of developed recreation facilities located in riparian reserves.	To meet the objectives of the Aquatic Conservation Strategy.	Developed sites at Castle and Gumboot Lakes.
Evaluation of restoration and/or relocation of dispersed recreation sites.	To meet the objectives of the Aquatic Conservation Strategy.	Sites along the South Fork of the Sacramento River.
Evaluation of road restoration recommendations from 1994 WIN Inventory.	To meet the objectives of the Aquatic Conservation Strategy.	As identified in the WIN inventory.
Evaluate decommissioning of roads.	To meet the objectives of the Aquatic Conservation Strategy. To improve wildlife habitat conditions. To reduce the risk of introducing *P.lateralis*.	Roads in Soapstone, Cedar Basin, and Deer Creek sub-watersheds.
Evaluate hillslope restoration associated with mass wasting and roads.	To meet the objectives of the Aquatic Conservation Strategy.	South and Middle Forks or the Sacramento River subwatershed.

Table 6-9: Inventory, Monitoring, and Research Needs.

Recommended Action	Objective
Stream Surveys	Comparison with previous stream surveys and establish baseline data for existence and function of course woody debris.

Chapter 7 - Initial Late Successional Reserve Assessments

The Headwaters watershed contains two Late Successional Reserves (Prescriptions VII). The Scott Camp Creek Managed Late Successional Area is approximately 1,960 acres and the Deer Creek Late Successional Reserve is approximately 5,440 acres. Both of these LSRs are entirely within the Headwaters watershed and all lands are under management of the U. S. Forest Service.

Recommendations from Chapter 6 of this analysis includes project opportunities within both of these Late Successional Reserves. This initial assessment identifies site specific project opportunities within these two land allocations.

The Scott Camp Creek Managed Late Successional Area contains a portion of the Port-Orford cedar population that occurs within this watershed. Protection of this species from the root disease Phytophthora lateralis is a concern both for this watershed and within the range of the species. To both reduce road density within the Managed Late Successional Area and reduce vehicle access to stands of Port-Orford cedar, it is recommended that approximately three miles of road be decommissioned and one mile of road be closed to public traffic. Road 39N40 should be closed with a gate at or near the LSR boundary. Road 39N46 should be decommissioned from the turn-off to the Methodist Camp southwest to its end. Nonsystem roads A, B and C as shown on the Scott Camp Creek LSR Map should be decommissioned. These actions will reduce the open road density within the LSR to approximately 0.3 miles per square mile.

To reduce the risk of an escaped wildland fire within the Scott Camp Creek LSR, it is recommended that a shaded fuel break be constructed around the perimeter of the Methodist Church Camp. Construction of this fuel break will require removal of understory brush and some sapling and pole size trees and pruning of larger size conifer trees. A strip approximately 100 feet wide would be treated around the camp permit area. The permit area covers approximately twelve acres and the fuel break would be approximately six acres, some of which would be within the permit area and some outside of it.

The Deer Creek Late Successional Reserve has approximately 400 acres of young pine plantations that either presently are in need of release from shrub competition or will need release with the next five years. Plantations established in 1985 and 1986 are in immediate need of release from shrub competition. These plantations were created by site conversion of shrublands, which typically require several release treatments to allow the trees to out compete shrubs. There are approximately 300 acres of these plantations in the Deer Creek Late Successional Reserve. There is also approximately 100 acres of plantations established in 1990 that will need one or more release treatments with the next five years. These plantations were the result of timber harvest where reforestation is require by law.

Also within the Deer Creek Late Successional Reserve are several roads that should be closed or relocated. Two sections of FR 40N27 need to be decommissioned and relocated to eliminate erosion problems caused by through-cuts and steep grades. These problem areas were identified in the Watershed Improvement Needs Inventory done in 1994. New road construction to replace the decommissioned sections, approximately 0.5 miles, would not remove any suitable Northern spotted owl habitat. Continued use of this road is needed for access to the Deer Creek area for emergencies, specifically wildland fire suppression. A non-system road that is within the riparian reserve for Deer Creek should be closed to vehicle traffic. This road is actually a historic railroad grade and closure needs to be coordinated with the District archaeologists. Currently there are approximately 2.3 miles of open road per square mile within the Deer Creek Late Successional Reserve.

In addition to the above project opportunities, both of these Late Successional Reserves have possible vegetation management opportunities for fuels reductions and forest health. Both Late Successional Reserves have shrublands that have the potential for conversion to mixed conifer forests. These project

opportunities will require site specific investigation through the environmental assessment process and review by the Regional Ecosystems Office. Currently the District does not have the staff available to complete these investigations and prepare the necessary prescriptions.

Based on review of information provided in the watershed analysis, it is further recommended that the Deer Creek Late Successional Reserve be designated a Managed Late Successional Area. This subwatershed has a history of catastrophic wildland fires. Approximately 1/3 of the subwatershed is shrubland and knobcone pine, a direct result of stand replacing events that are predicted to reoccur. Fuel loading in these shrublands and some of the denser mixed conifer stands have created areas of both high risk and hazard for escaped wildland fires. Public use in this area is also increasing, due to its proximity to Lake Siskiyou, thereby further increasing the risk of escaped fires. Over 400 acres of existing plantations and opportunities to create additional site conversions will require intensive vegetation management within this area for sometime into the future. This Late Successional Reserve exhibits the characteristics that appear to warrant consideration of this proposed land allocation.

Appendix A - Headwaters Maps

Maps available in a separate package.

Map List

Map A - Vicinity Map

Map 1 - Base Map

Map 2 - Management Prescriptions

Map 3 - Recreation/Land Use

Map 4 - System Trails

Map 5 - Visual Quality Objectives

Map 6 - Vegetation Types

Map 7 - Conifer Tree Size

Map 8 - Vegetation Density

Map 9 - Plantations by Year Planted

Map 10 - Partial Harvest by Year

Map 11 - Port-Orford Cedar Locations

Map 12 - Fire Occurrence

Map 13 - Historic Escaped Fire Boundaries & Year

Map 14 - Wildlife Observations

Map 15 - Sensitive Plant Locations

Map 16 - Lakes and Streams

Map 17 - Wet Meadows

Map 18 - Geomorphology

Map 19 - Possible Landslide Areas

Map 20 - System Roads

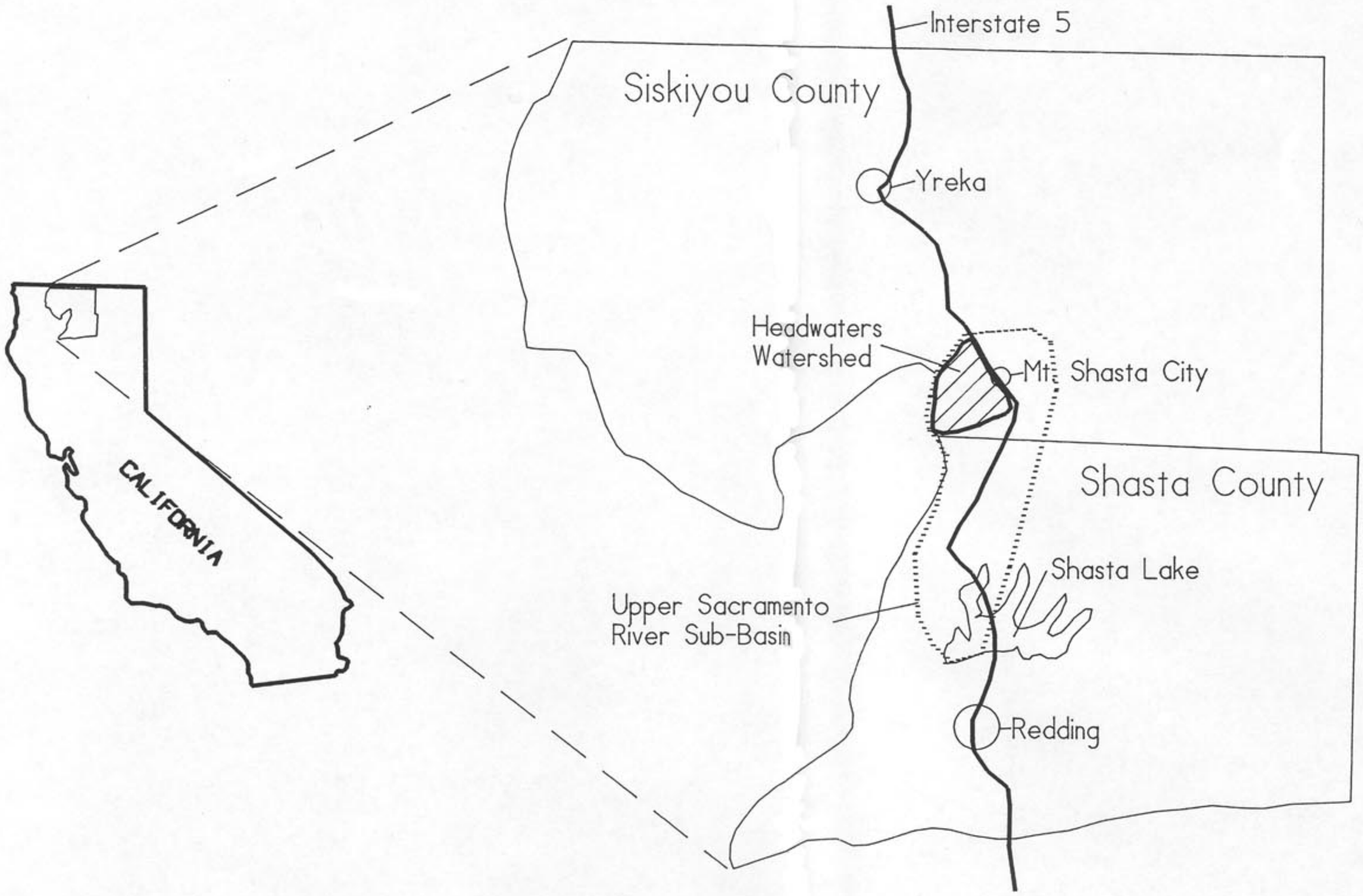
Map 21 - Deer Creek Late-Successional Reserve

Map 22 - Scott Camp Creek Managed Late-Successional Area

HEADWATERS SACRAMENTO RIVER VICINITY MAP

Map A

Date: 6/95



HEADWATERS SACRAMENTO RIVER

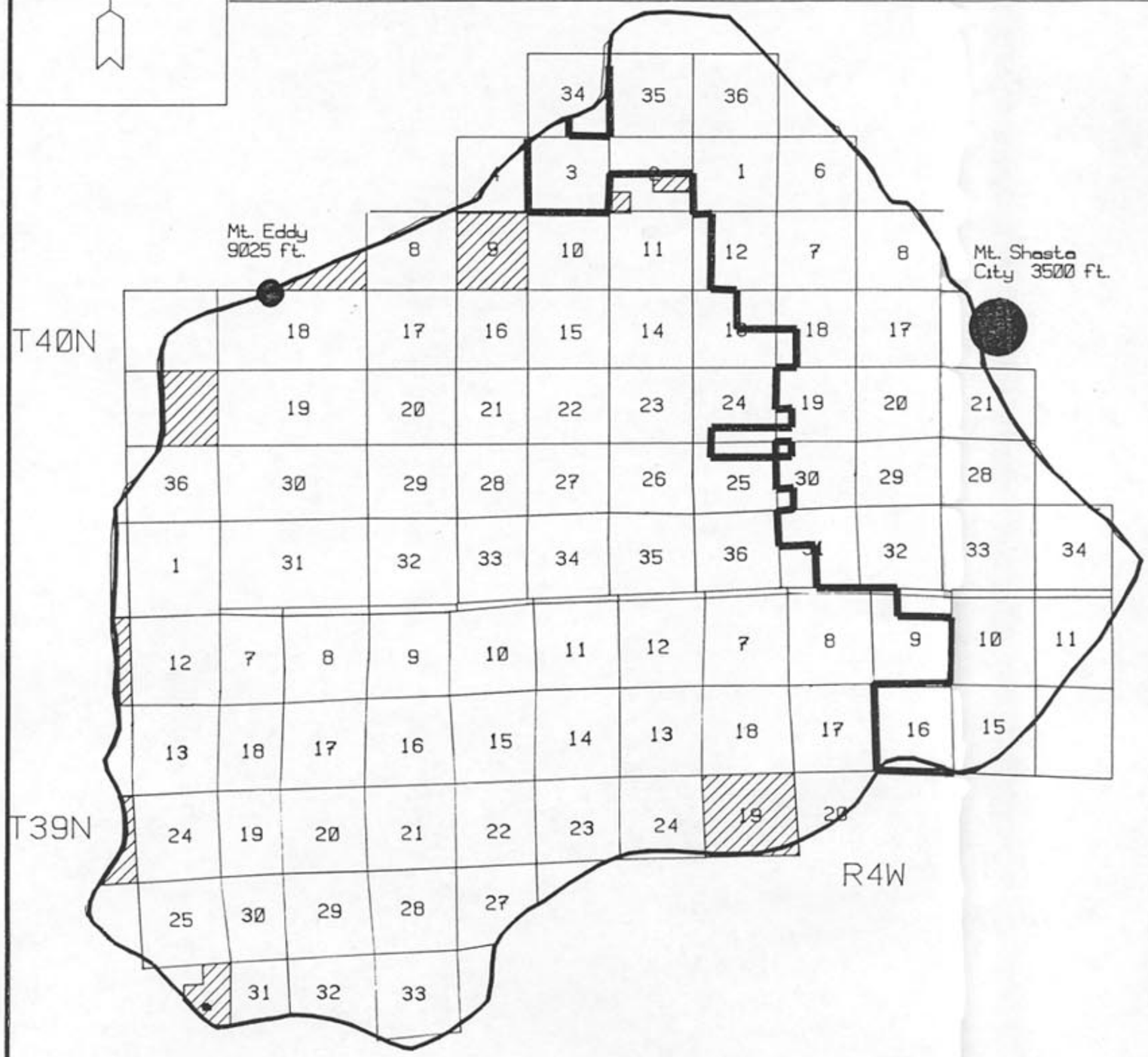
MT. SHASTA RANGER DISTRICT, SHASTA-TRINITY N.F.'S

Map # 1

Date: 6/95

1 2 3 Miles

Mapscale



LEGEND

Base Map

N.F. BOUNDARY

PRIVATE LAND

HEADWATERS SACRAMENTO RIVER

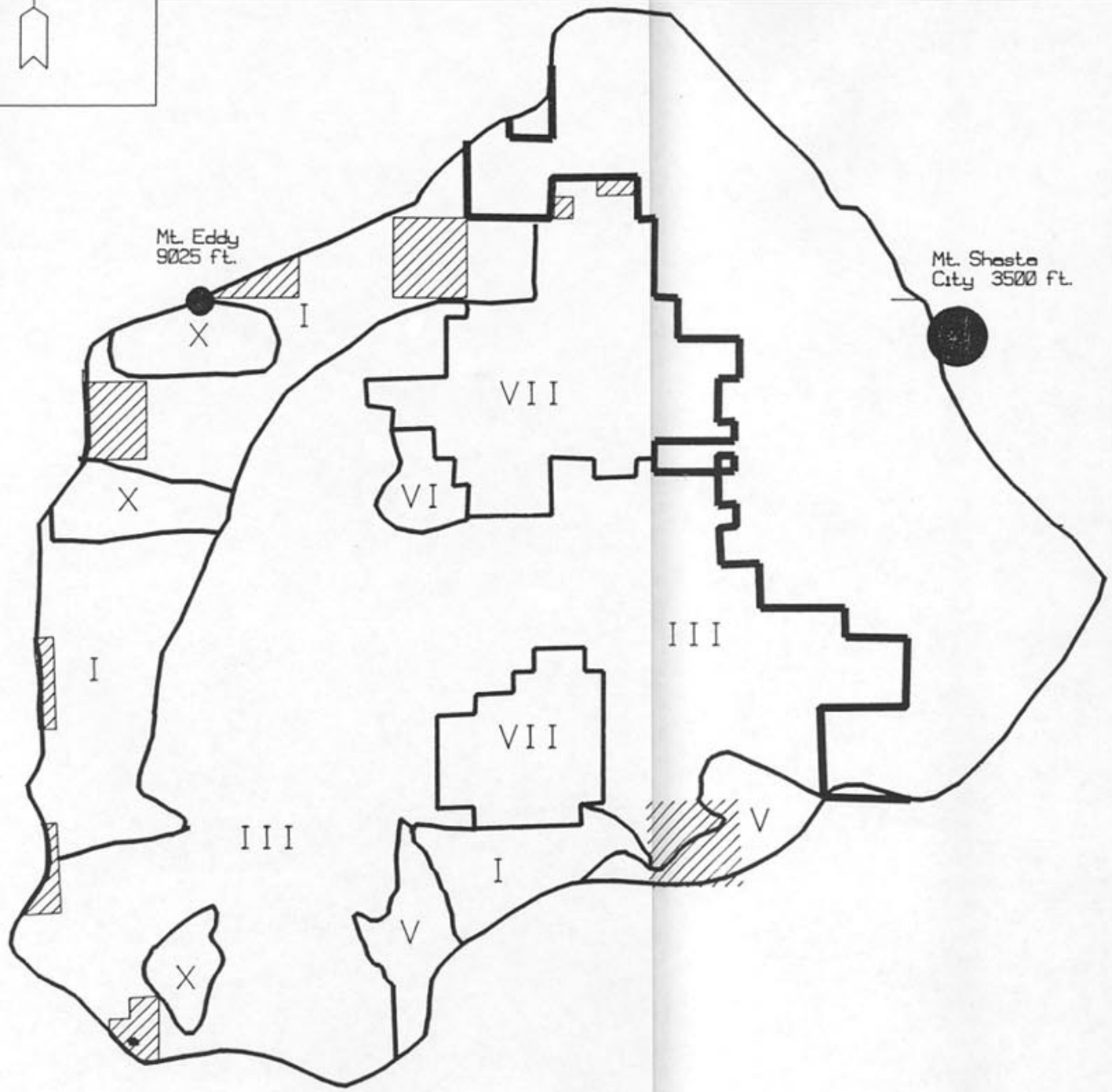
MT. SHASTA RANGER DISTRICT, SHASTA-TRINITY N.F.'S

Map # 2

Date: 6/95

1 2 3 Miles

Mapscale



LEGEND

MANAGEMENT PRESCRIPTIONS

I. Unroaded Non-Motorized Recreation

III. Roaded Recreation

V. Wilderness Management

VI. Wildlife Habitat Management

VII. T & E Species Management

IX. Riparian Management (not shown)

X. Research Natural Area

N.F. BOUNDARY

PRIVATE LAND

HEADWATERS SACRAMENTO RIVER

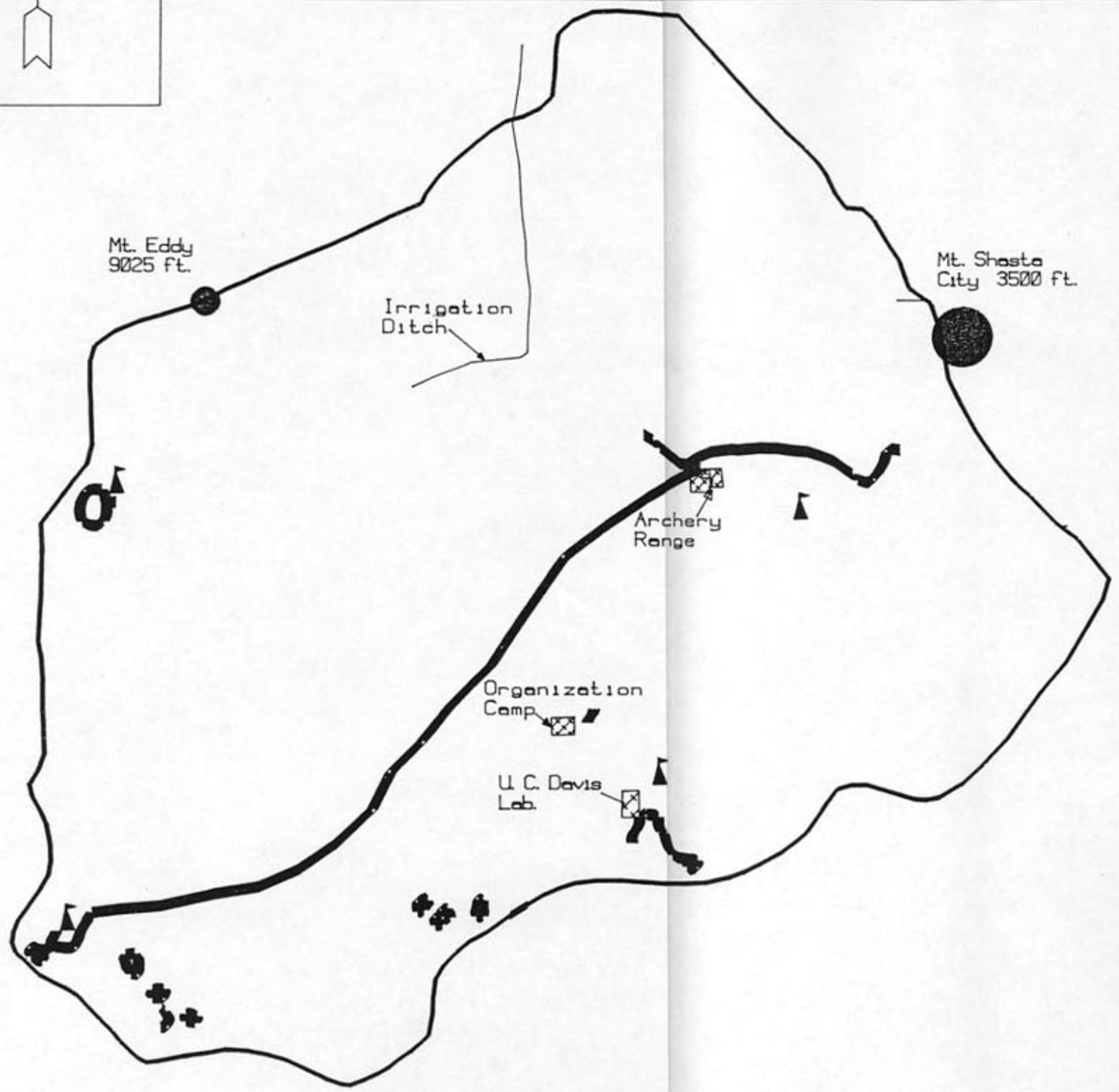
MT. SHASTA RANGER DISTRICT, SHASTA-TRINITY N.F.'S

Map # 3

Date: 6/95

1 2 3 Miles

Mapscale



LEGEND

Recreation/Land Use

- Developed Campground
- Dispersed Recreation
- Special Use Area

HEADWATERS SACRAMENTO RIVER

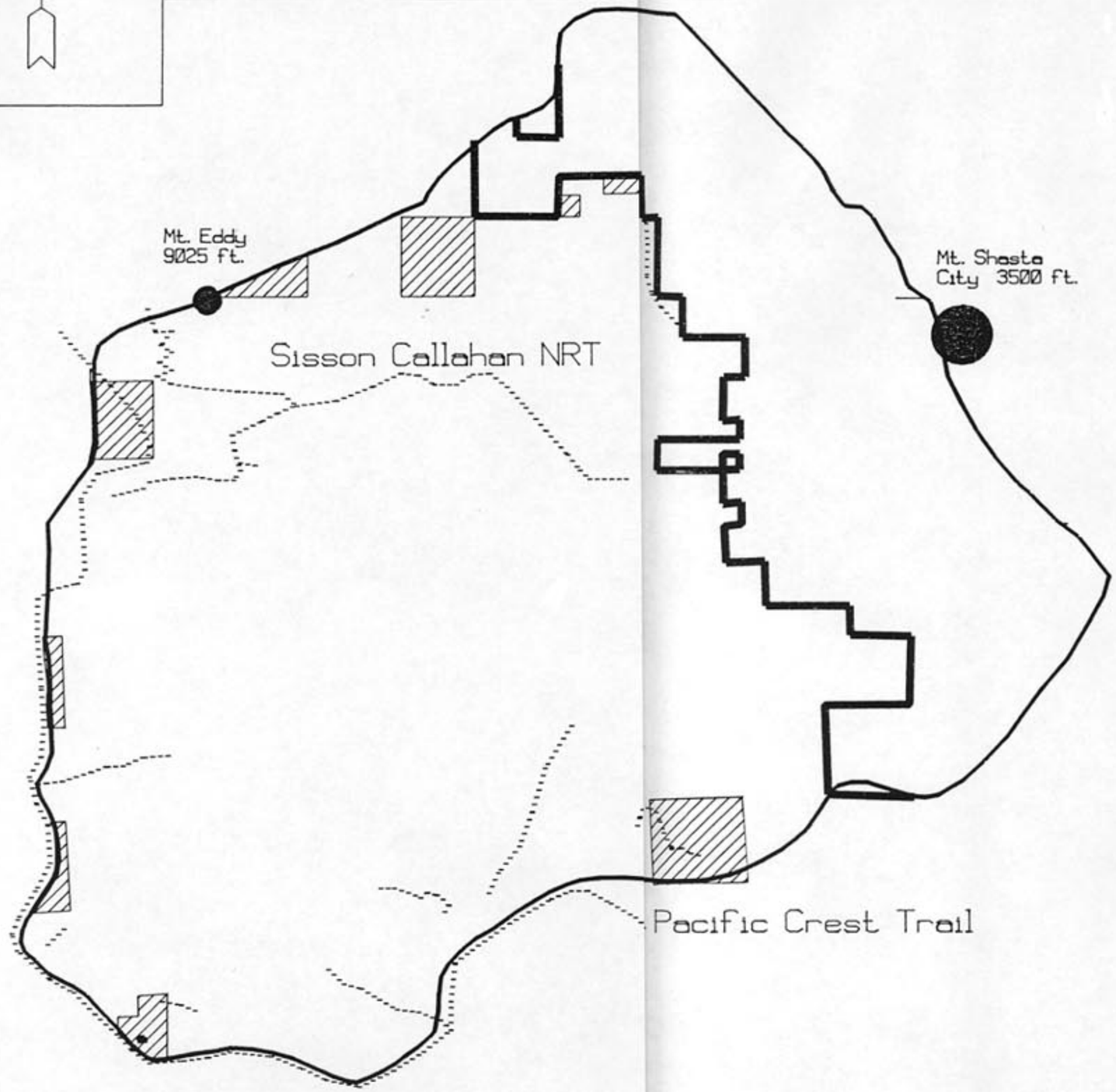
MT. SHASTA RANGER DISTRICT, SHASTA-TRINITY N.F.'S

Map # 4

Date: 6/95

1 2 3 Miles

Mapscale



LEGEND

System Trails ----------

N.F. BOUNDARY

PRIVATE LAND

HEADWATERS SACRAMENTO RIVER

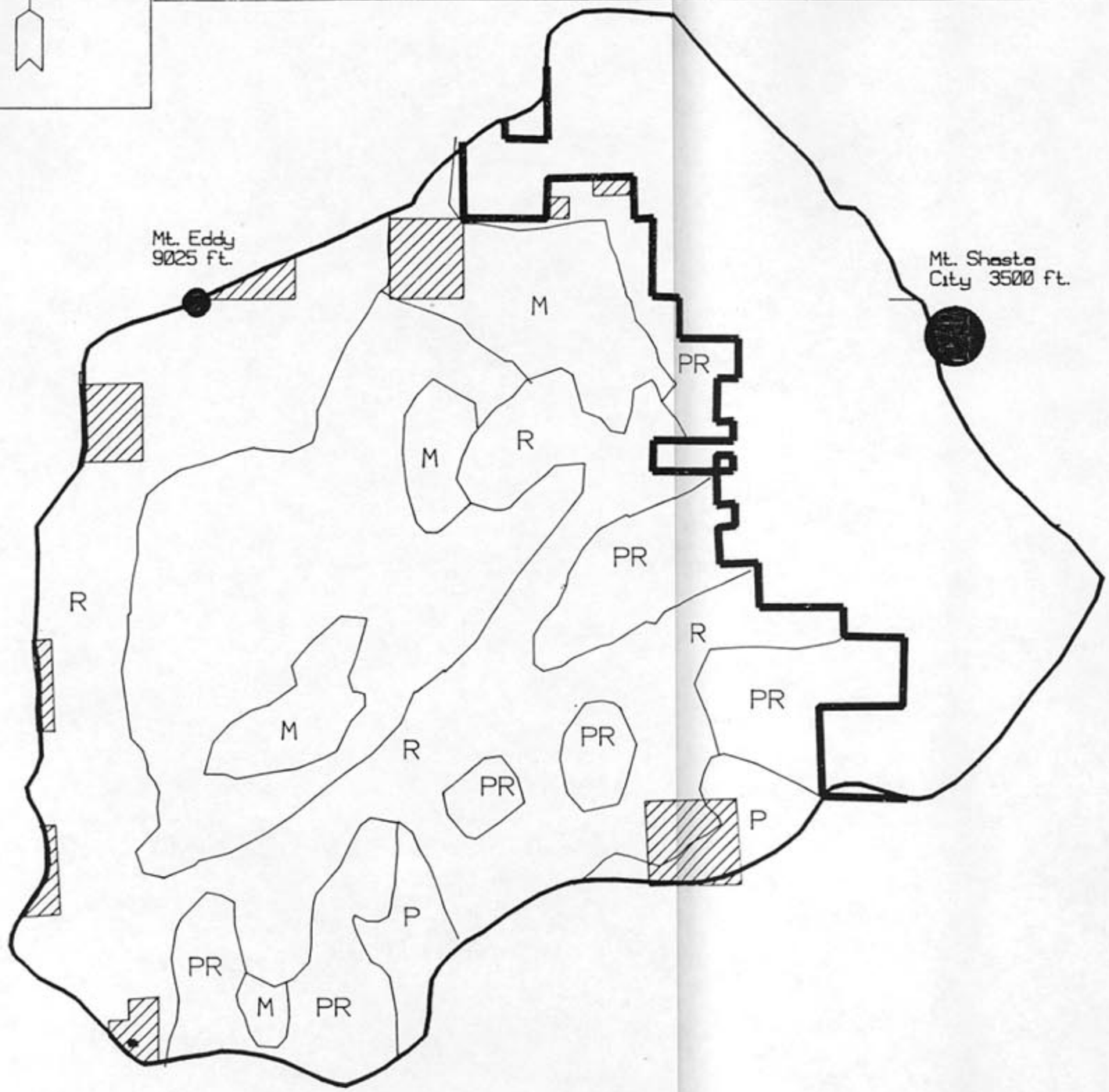
MT. SHASTA RANGER DISTRICT, SHASTA-TRINITY N.F.'S

Map # 5

Date: 6/95

1 2 3 Miles

Mapscale



LEGEND

VISUAL QUALITY OBJECTIVES

P PRESERVATION

R RETENTION

PR PARTIAL RETENTION

M MODIFICATION

N.F. BOUNDARY

PRIVATE LAND

HEADWATERS SACRAMENTO RIVER

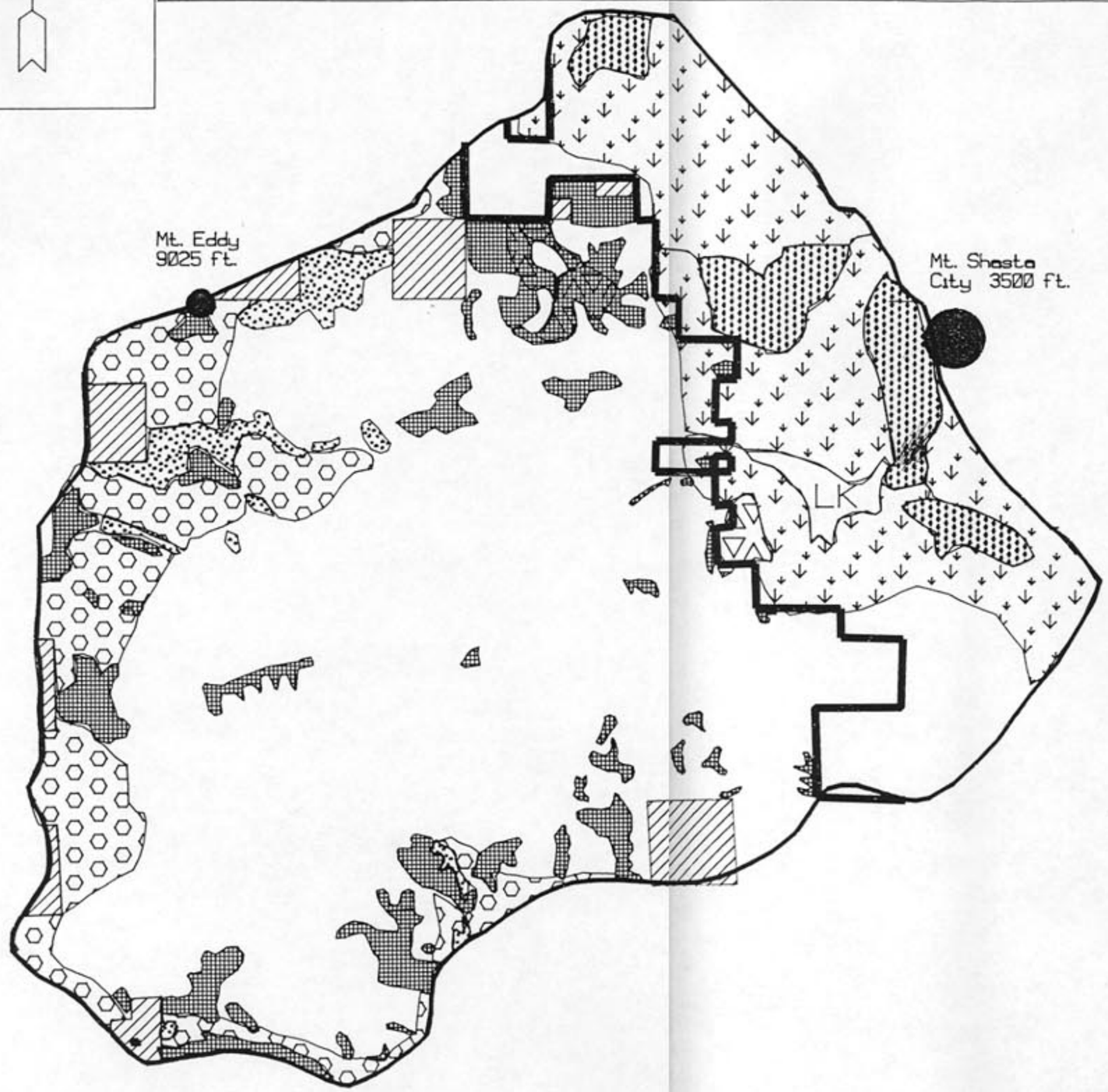
MT. SHASTA RANGER DISTRICT, SHASTA-TRINITY N.F.'S

Map # 6

Date: 6/95

1 2 3 Miles

Mapscale



LEGEND

VEGETATION TYPES

Red Fir/Lodge Pole Pine

Knobcone Pine

Mix Conifer

Mixed Conifer/
Black Oak

Grasslands

Seral Shrublands

Barren

N.F. BOUNDARY

PRIVATE LAND

HEADWATERS SACRAMENTO RIVER

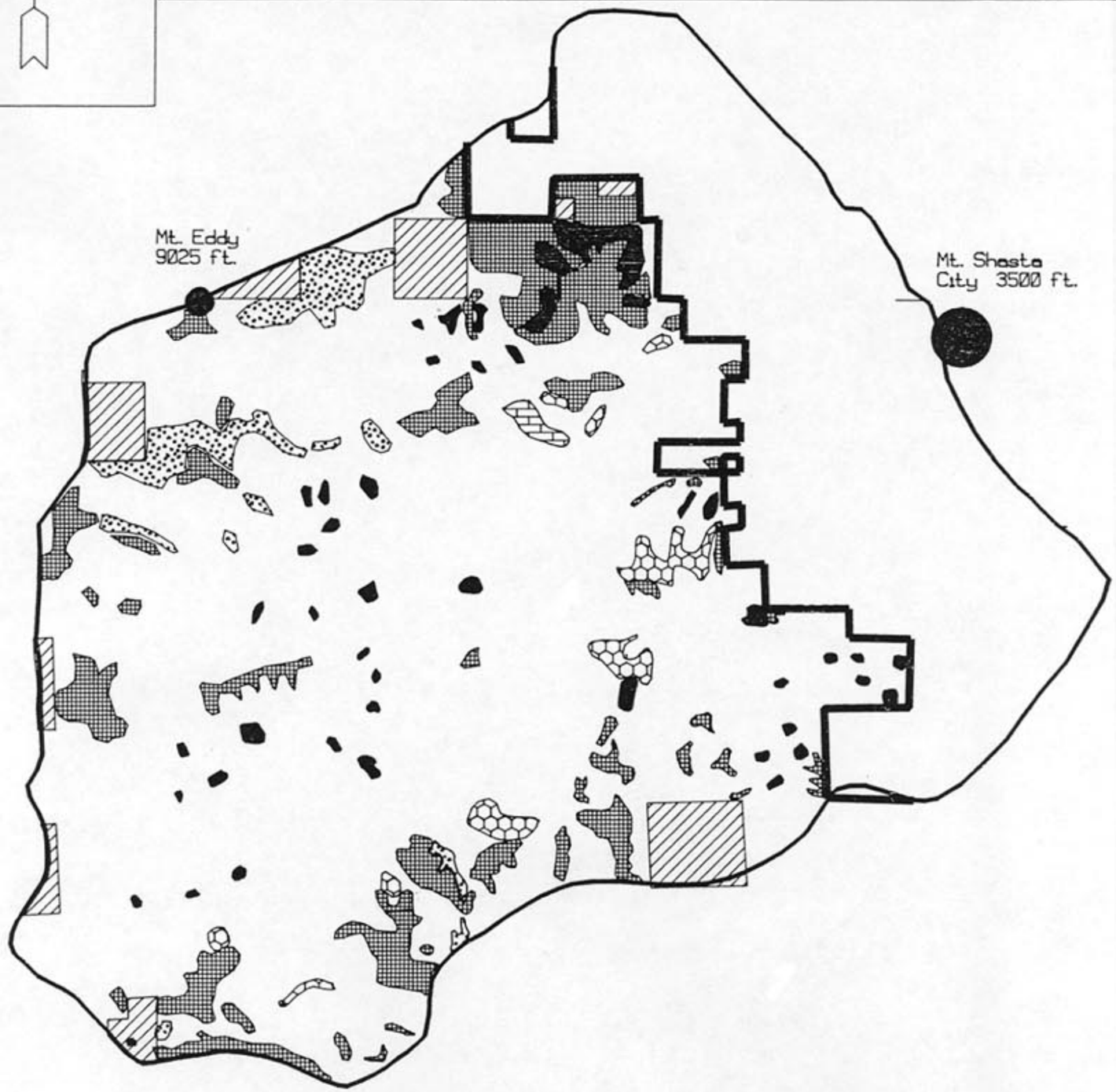
MT. SHASTA RANGER DISTRICT, SHASTA-TRINITY N.F.'S

Map # 7

Date: 6/95

1 2 3 Miles

Mapscale



LEGEND

CONIFER TREE SIZE

Seedling/Saplings
(Size Class 1)

Poles (<12" CD)
(Size Class 2)

Small/Medium Timber
(12"-24" CD)
(Size Class 3)

Large Timber
(>24" CD)
(Size Class 4)

Seral Shrublands

Barren

N.F. BOUNDARY

PRIVATE LAND

HEADWATERS SACRAMENTO RIVER

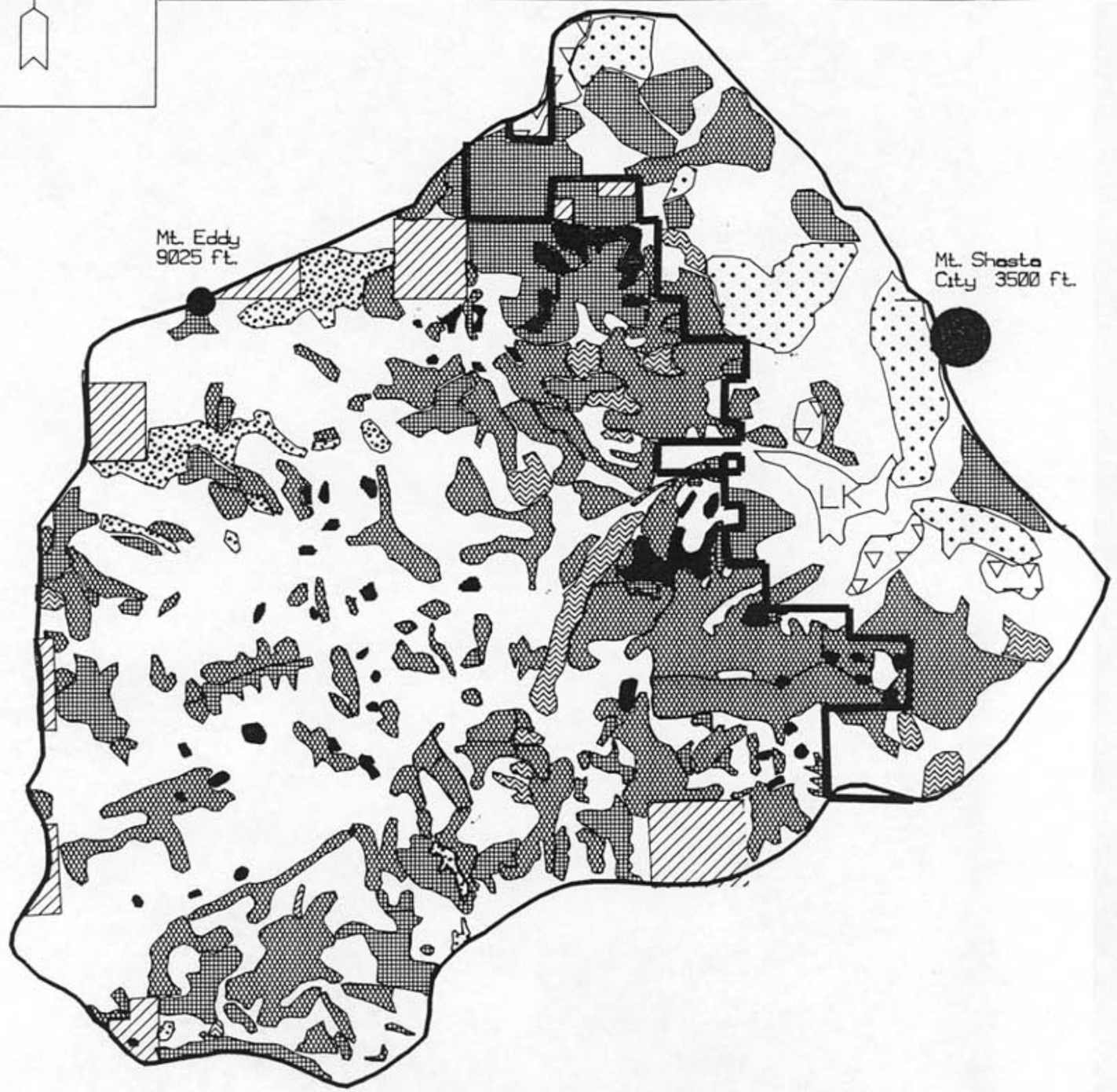
MT. SHASTA RANGER DISTRICT, SHASTA-TRINITY N.F.'S

Map # 8

Date: 6/95

1 2 3 Miles

Mapscale



LEGEND

VEGETATION DENSITY

- 10-39% canopy closure (Density Class P)
- 40-70% canopy closure (Density Class N)
- 70+ canopy closure (Density Class G)
- Plantations
- Seral Shrublands
- Barren
- Grasslands
- Black Oak

- N.F. BOUNDARY
- PRIVATE LAND

HEADWATERS SACRAMENTO RIVER

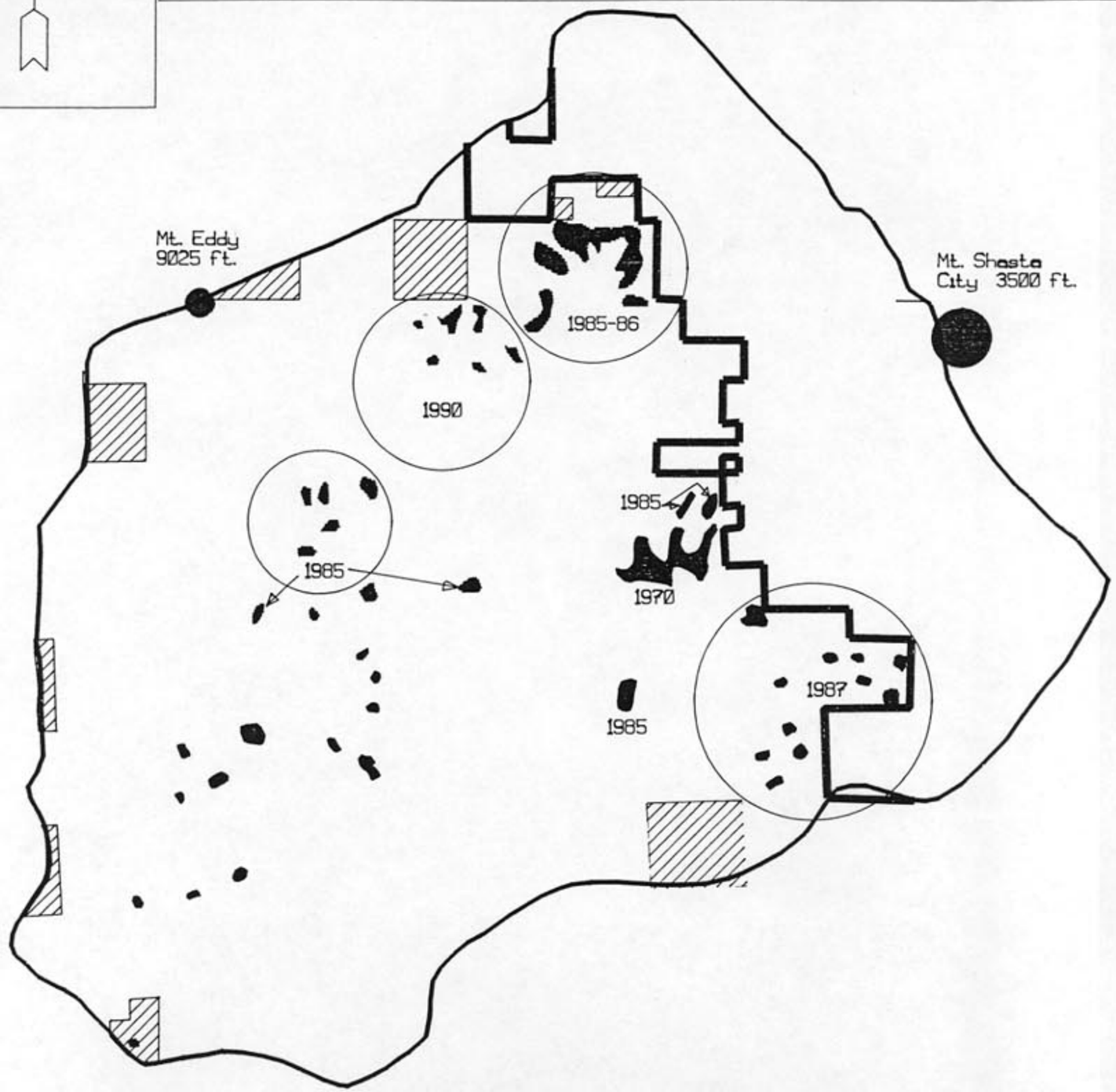
MT. SHASTA RANGER DISTRICT. SHASTA-TRINITY N.F.'S

Map # 9

Date: 6/95

1 2 3 Miles

Mapscale



LEGEND

1985 Plantations By Year Planted

N.F. BOUNDARY

PRIVATE LAND

HEADWATERS SACRAMENTO RIVER

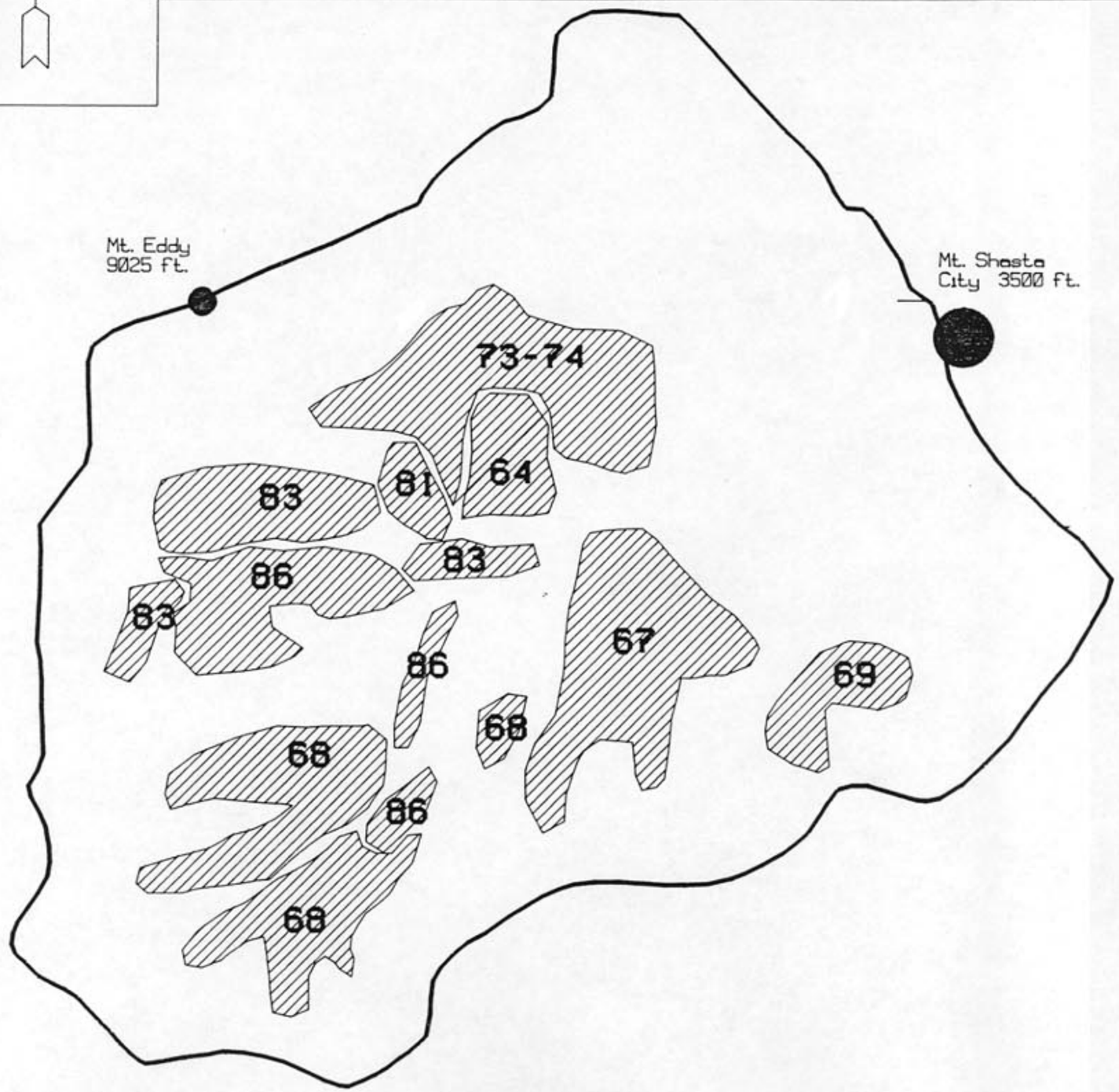
MT. SHASTA RANGER DISTRICT, SHASTA-TRINITY N.F.'S

Map # 10

Date: 6/95

1 2 3 Miles

Mapscale



LEGEND

Partial Harvest Areas by Year (National Forest Land Only)

HEADWATERS SACRAMENTO RIVER

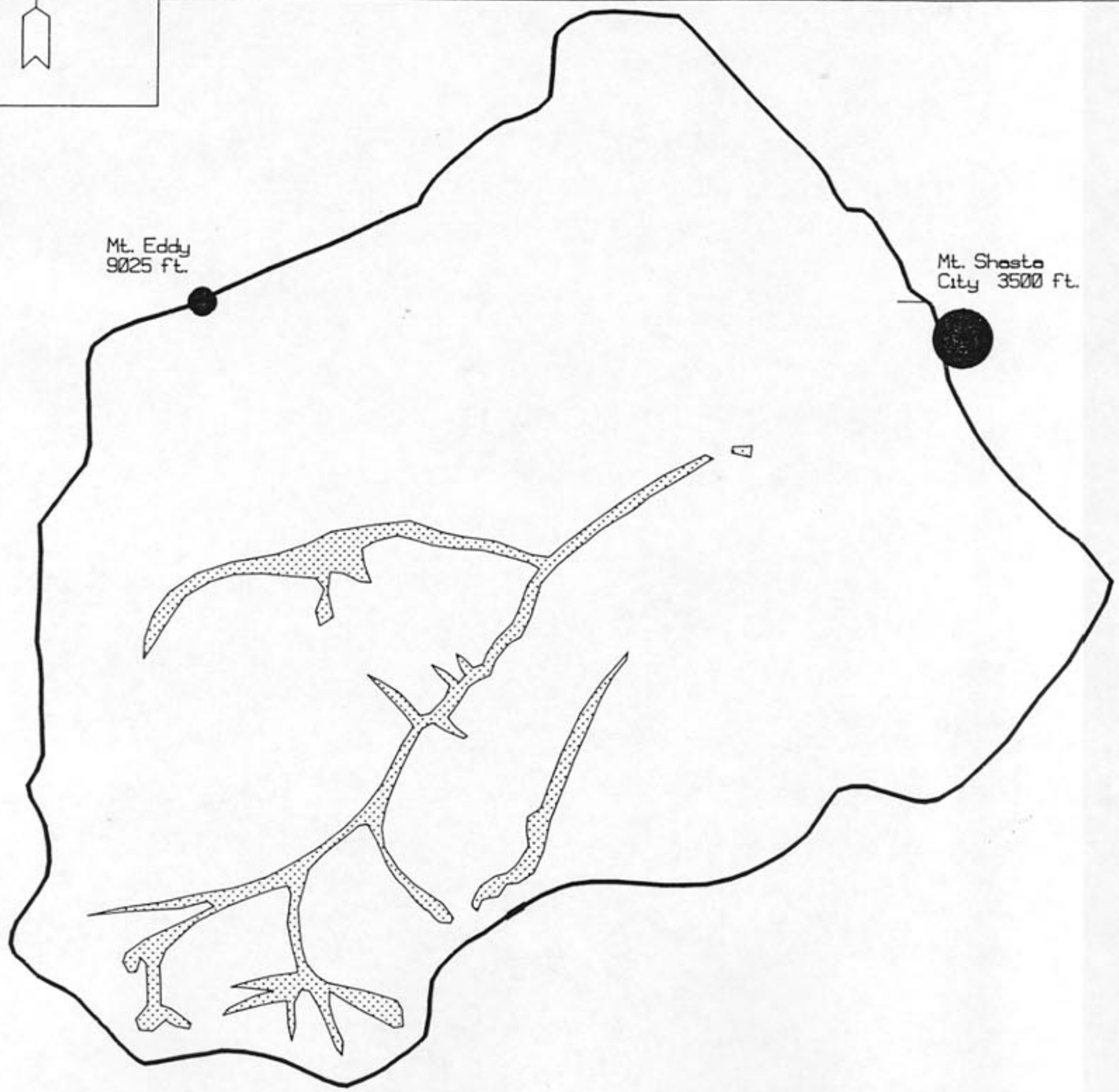
MT. SHASTA RANGER DISTRICT, SHASTA-TRINITY N.F.'S

Map # 11

Date: 6/95

1 2 3 Miles

Mapscale



LEGEND

Port-Orford Cedar Locations

HEADWATERS SACRAMENTO RIVER

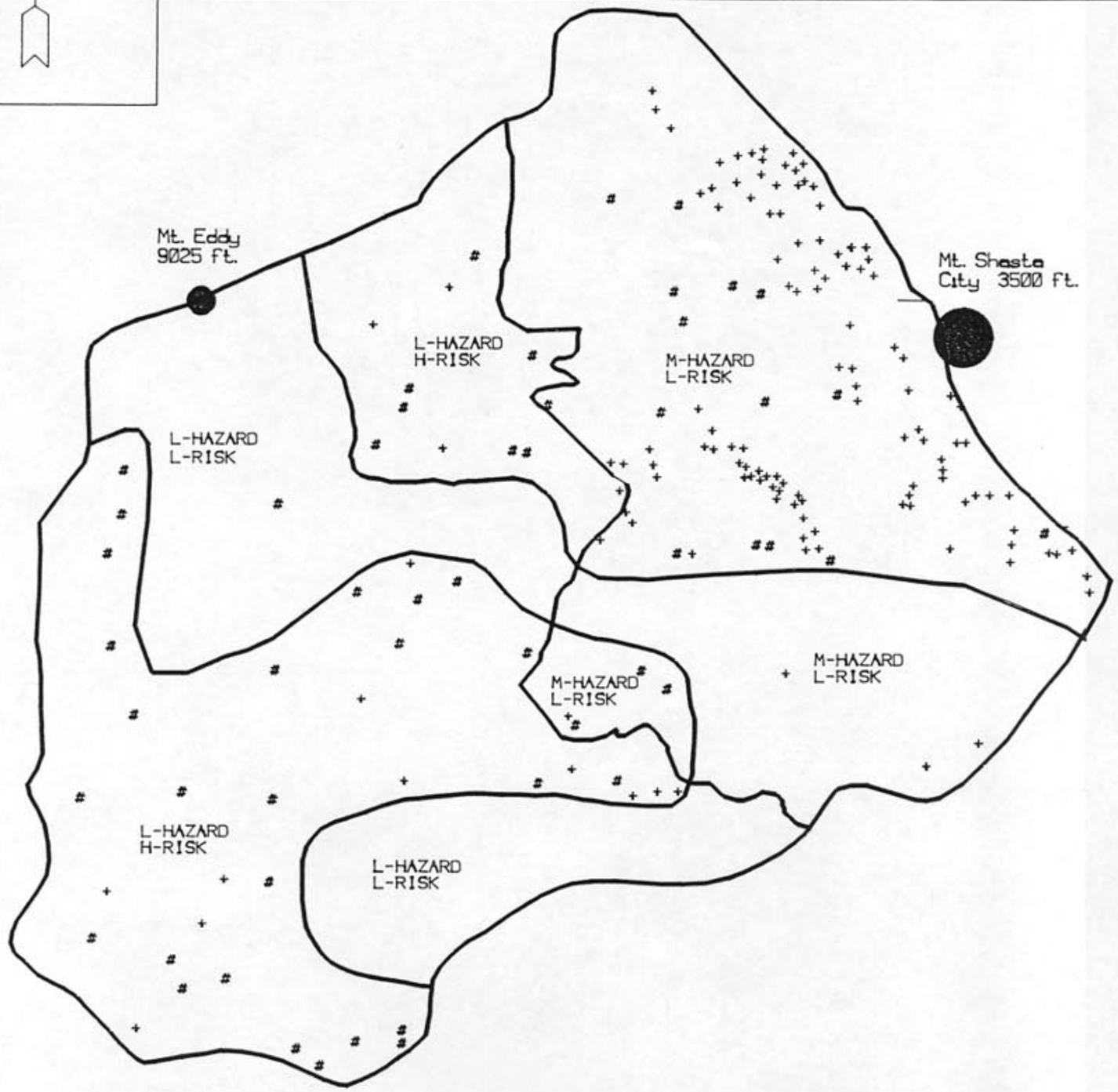
MT. SHASTA RANGER DISTRICT, SHASTA-TRINITY N.F.'S

Map # 12

Date: 6/95

1 2 3 Miles

Mapscale



LEGEND

FIRE OCCURRENCE
1970 TO 1994

\# LIGHTNING

\+ HUMAN - CAUSED

HEADWATERS SACRAMENTO RIVER

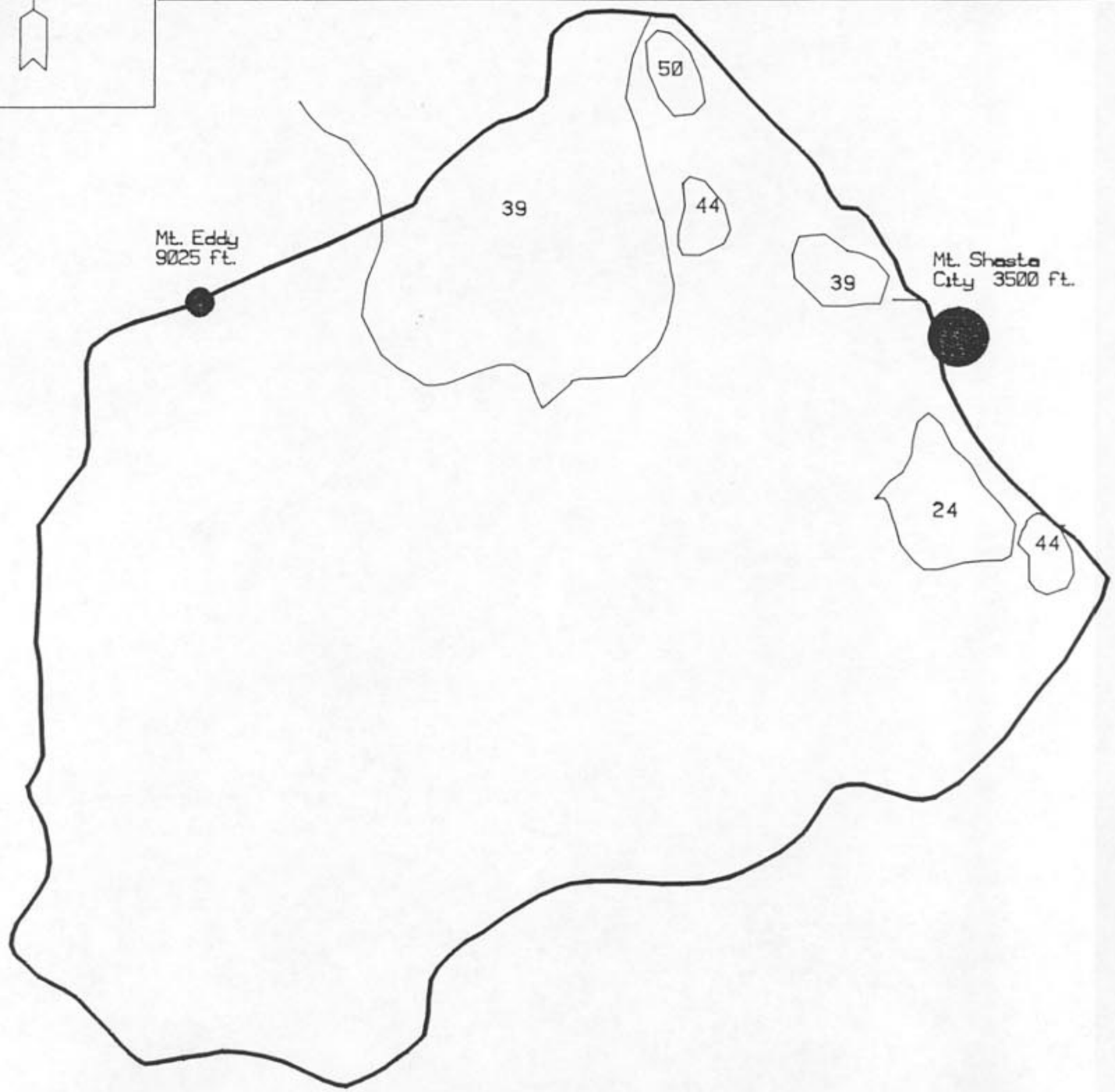
MT. SHASTA RANGER DISTRICT, SHASTA-TRINITY N.F.'S

Map # 13

Date: 6/95

1 2 3 Miles

Mapscale



LEGEND

Historic Escaped Fire
Boundaries & Year

HEADWATERS SACRAMENTO RIVER

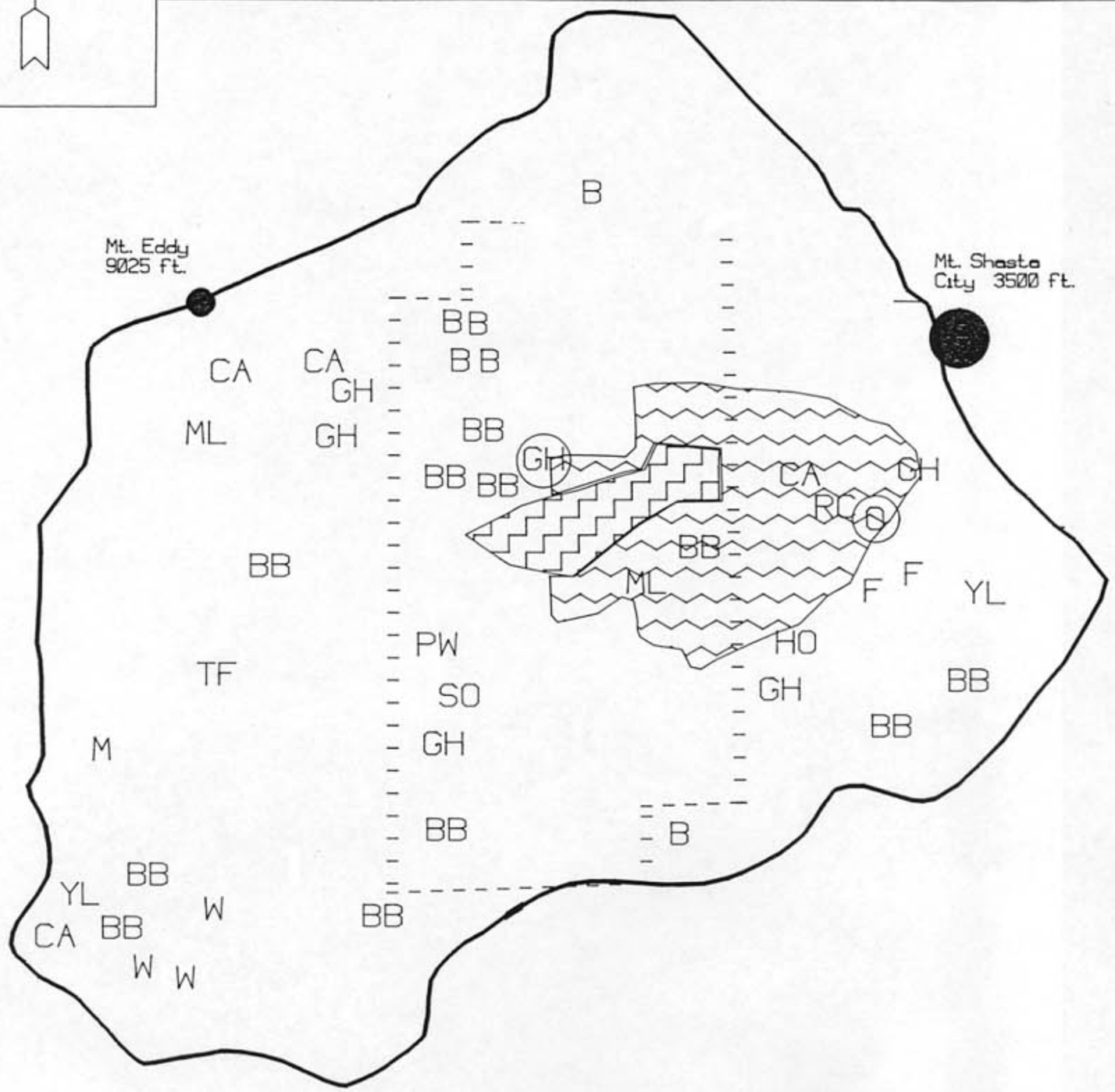
MT. SHASTA RANGER DISTRICT, SHASTA-TRINITY N.F.'S

Map # 14

Date: 6/95

1 2 3 Miles

Mapscale



LEGEND

WILDLIFE OBSERVATIONS

- - - Spotted Owl Critical Habitat

Bald Eagle Primary Habitat

Bald Eagle Secondary Habitat

SO Spotted Owl (not available)

HO Great Horned Owl

O Osprey

GH Goshawk

M Pine Marten

W Wolverine

BE Bald Eagle (not available)

BB Black Bear

ML Mountain Lion

RC Ring-tailed Cat

PW Pileated Woodpecker

F Fisher

CA Cascade Frog

YL Yellow-legged Frog

TF Tailed Frog

○ Nest Site

HEADWATERS SACRAMENTO RIVER

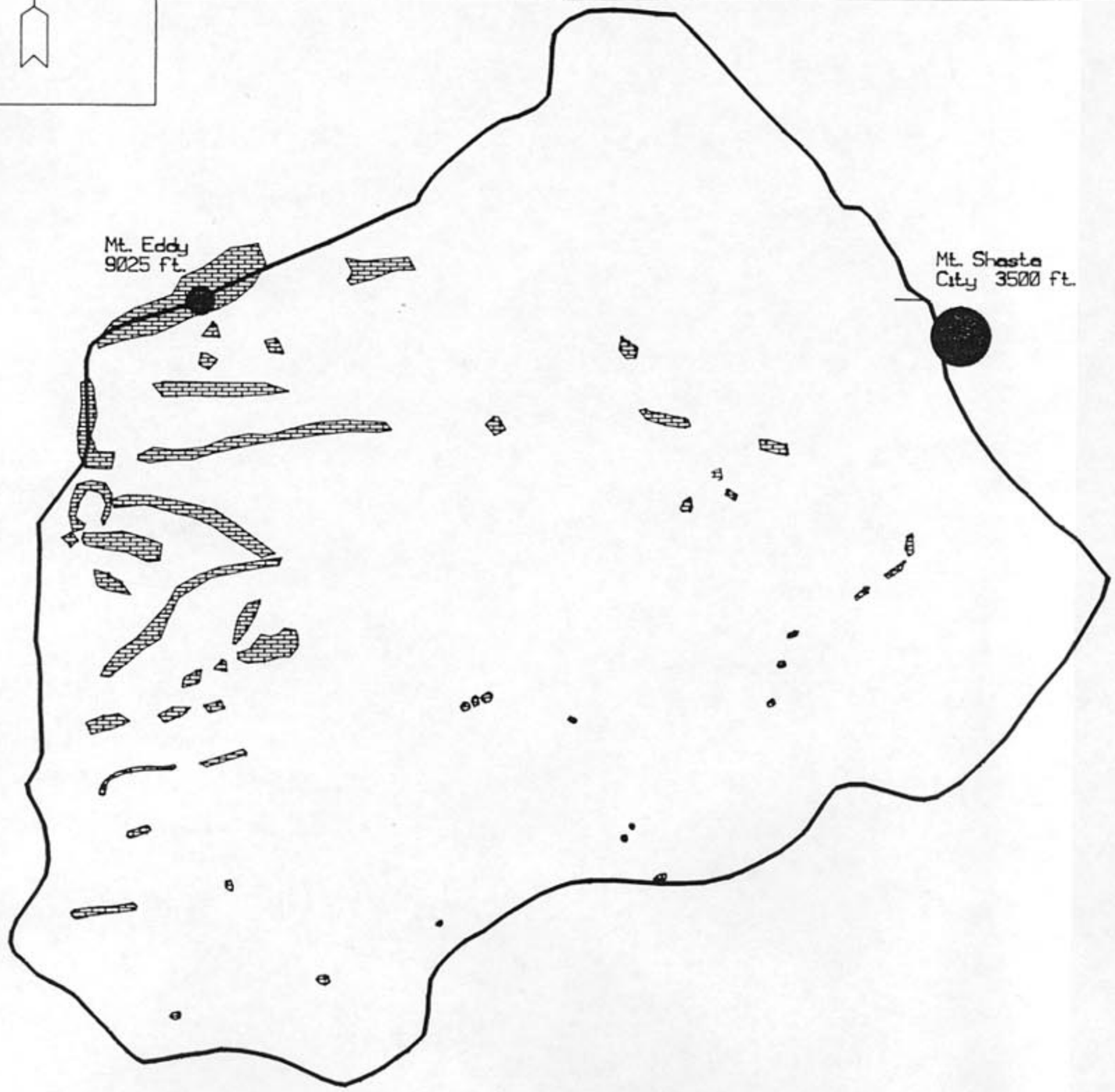
MT. SHASTA RANGER DISTRICT. SHASTA-TRINITY N.F.'S

Map # 15

Date: 6/95

1 2 3 Miles

Mapscale



LEGEND

Sensitive Plant Locations

HEADWATERS SACRAMENTO RIVER

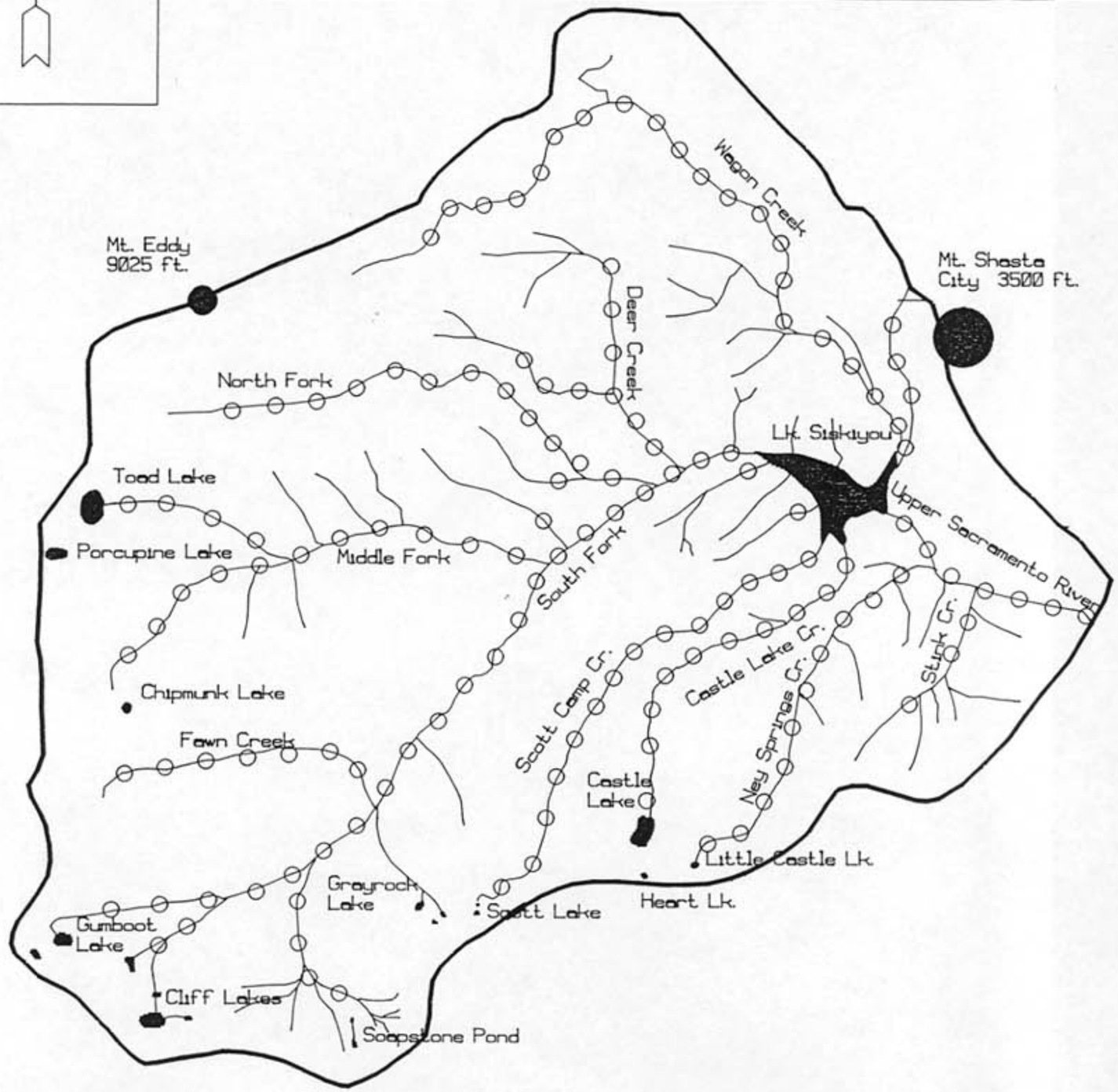
MT. SHASTA RANGER DISTRICT, SHASTA-TRINITY N.F.'S

Map # 16

Date: 6/95

1 2 3 Miles

Mapscale



LEGEND

Lakes and Streams

o o o o Fish-Bearing Streams

HEADWATERS SACRAMENTO RIVER

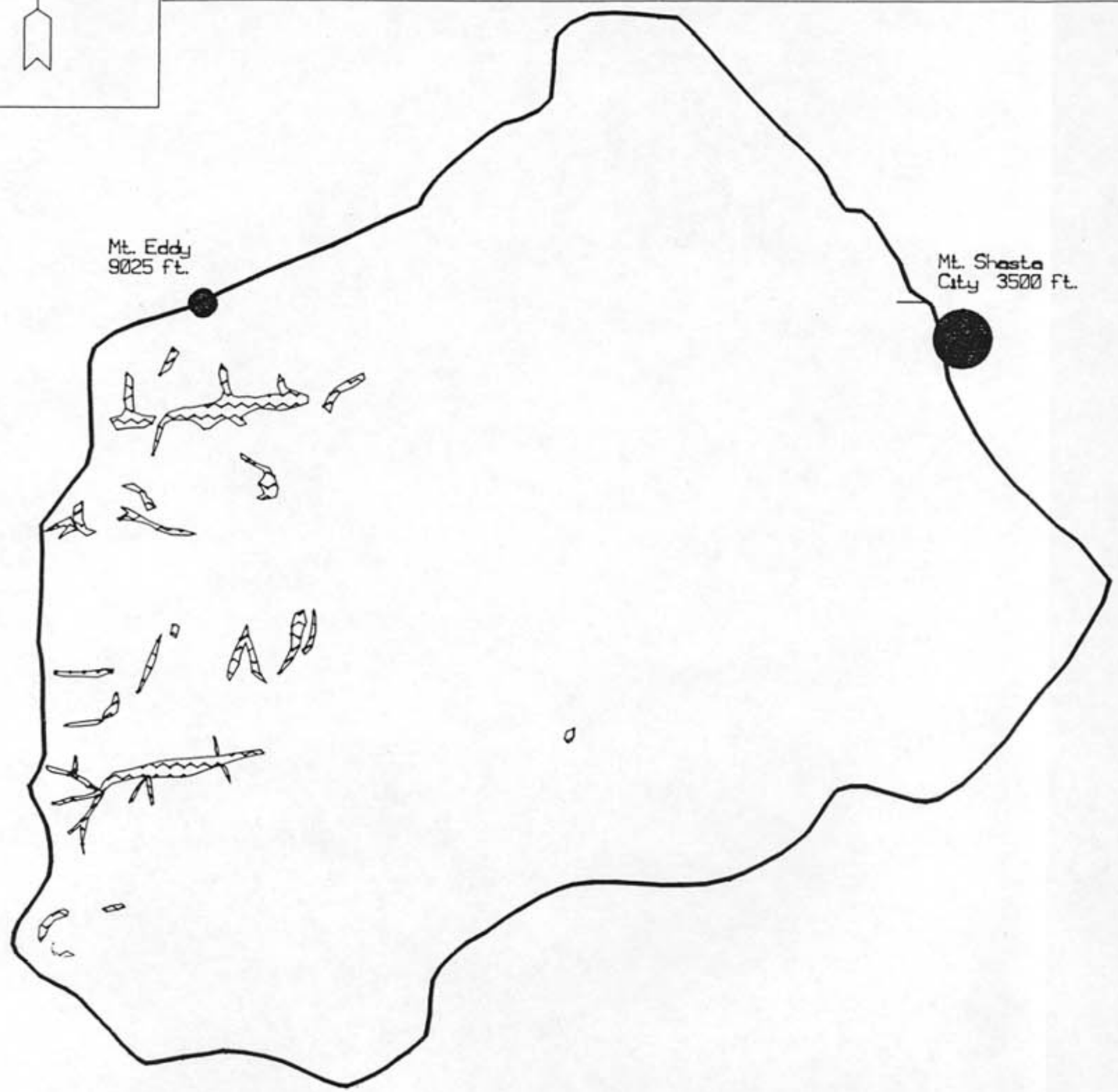
MT. SHASTA RANGER DISTRICT, SHASTA-TRINITY N.F.'S

Map # 17

Date: 6/95

1 2 3 Miles

Mapscale



LEGEND

Wet Meadows
(NFSL only)

HEADWATERS SACRAMENTO RIVER

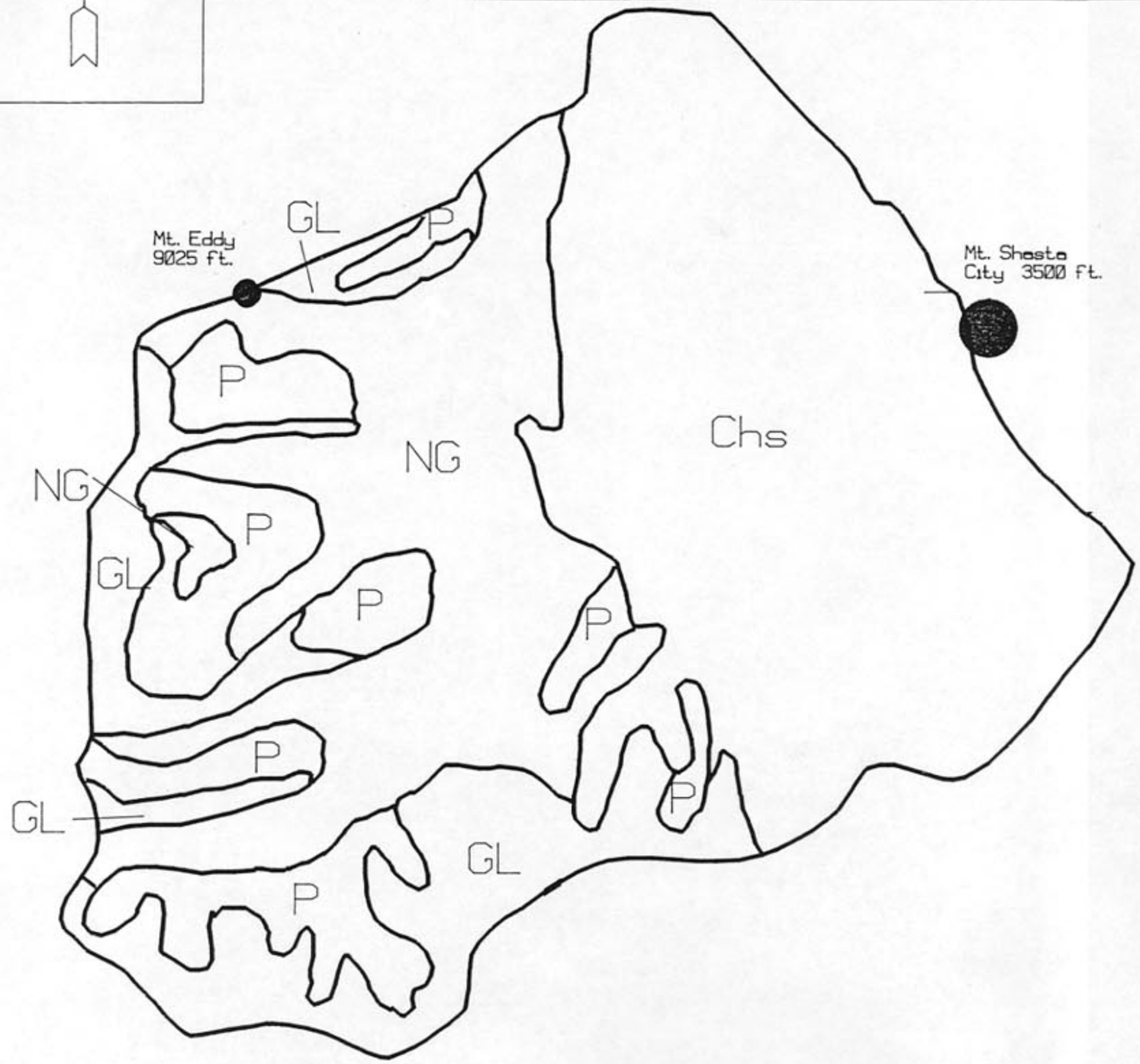
MT. SHASTA RANGER DISTRICT, SHASTA-TRINITY N.F.'S

Map # 18

Date: 6/95

1 2 3 Miles

Mapscale



LEGEND

GEOMORPHOLOGY

GL=Glaciated side slopes

P=Periglacial side slopes

NG=Non-glaciated slopes

Chs=Colluvial hills & footslopes

HEADWATERS SACRAMENTO RIVER

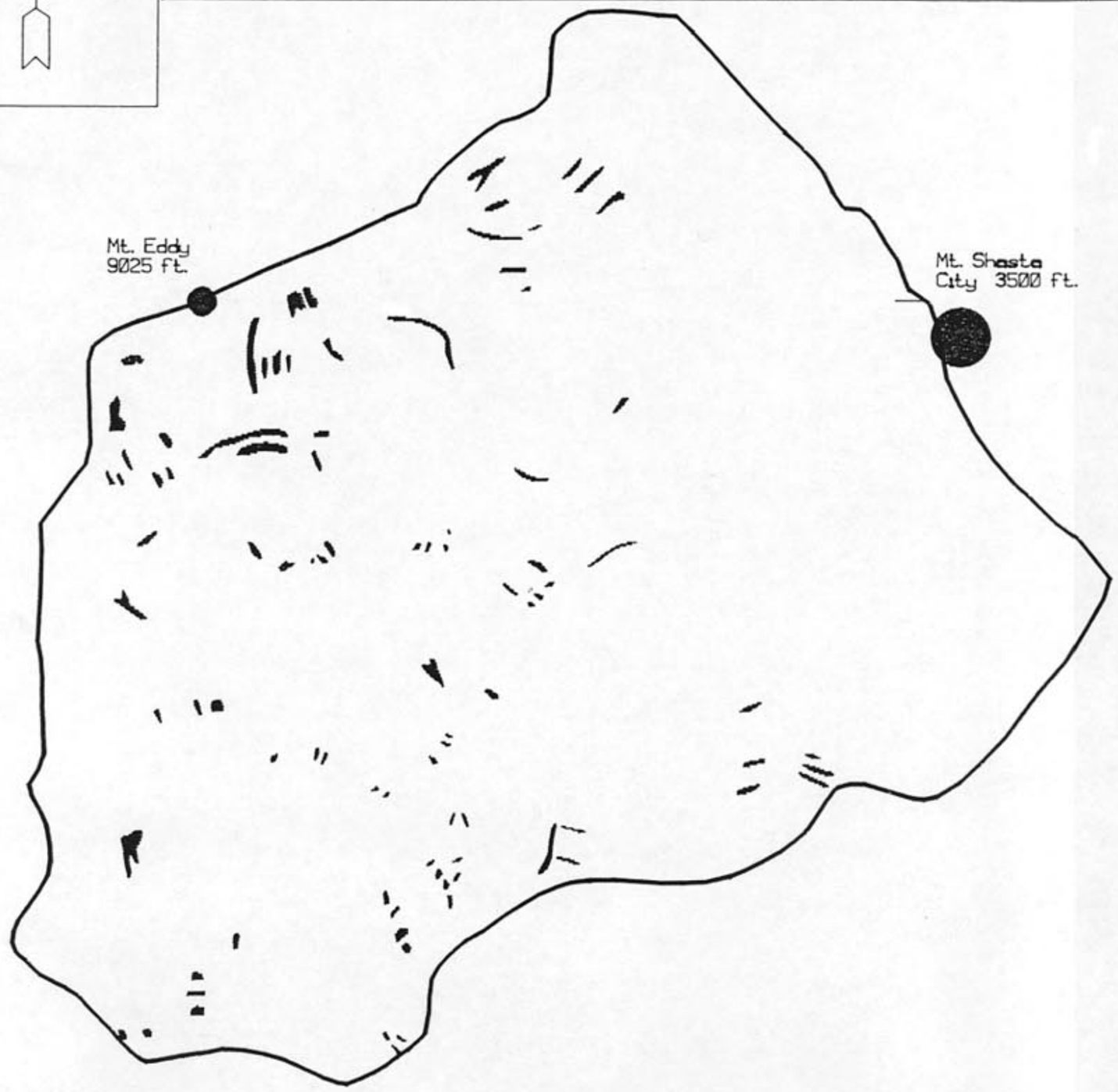
MT. SHASTA RANGER DISTRICT, SHASTA-TRINITY N.F.'S

Map # 19

Date: 6/95

1 2 3 Miles

Mapscale



LEGEND

Possible Landslide Areas

HEADWATERS SACRAMENTO RIVER

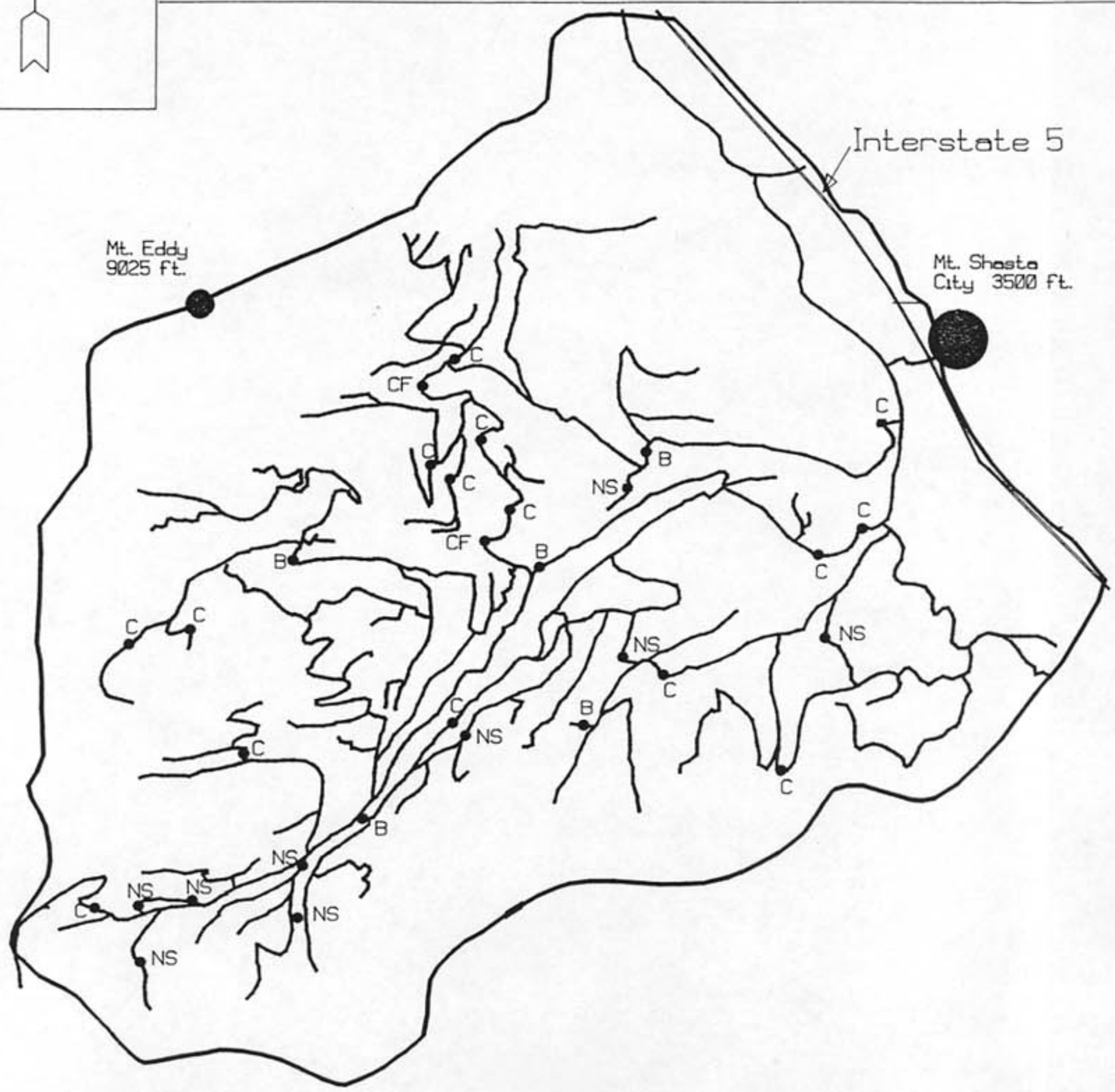
MT. SHASTA RANGER DISTRICT, SHASTA-TRINITY N.F.'S

Map # 20

Date: 6/95

1 2 3 Miles

Mapscale



LEGEND

System Roads —

Perennial Stream Crossing Types:

B= Bridge

C= Culvert

CF= concrete ford

NS= no structure

HEADWATERS SACRAMENTO RIVER

MT. SHASTA RANGER DISTRICT. SHASTA-TRINITY N.F.'S

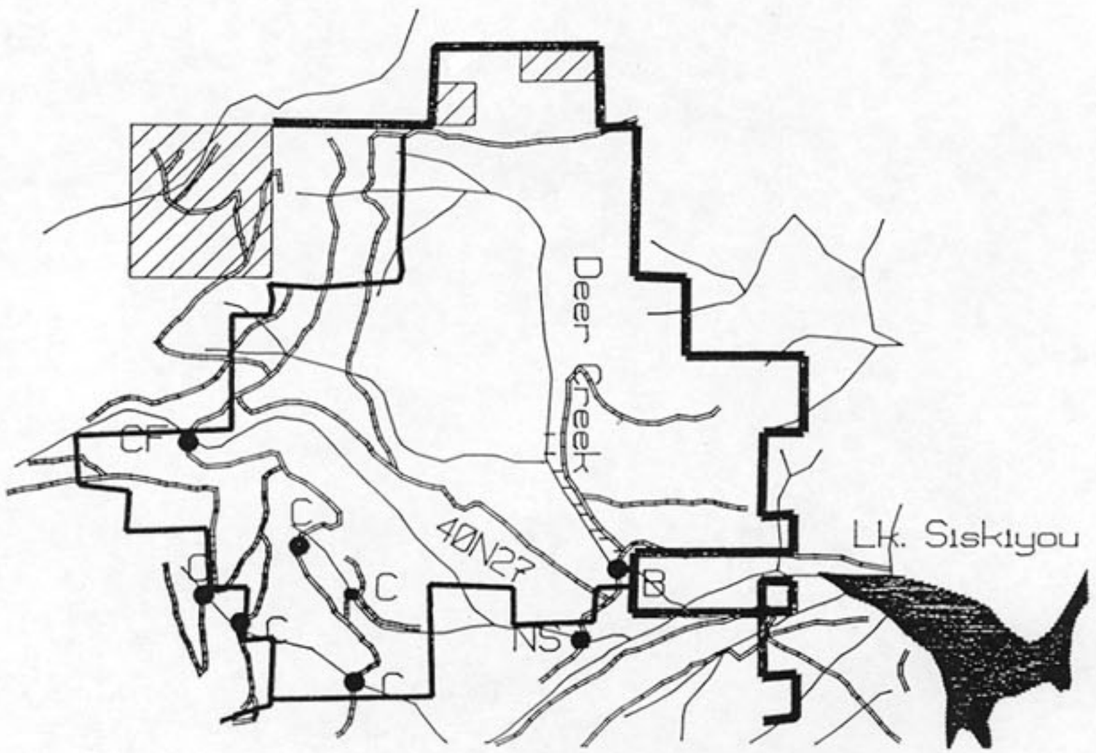
Map # 21

Date: 6/95

1 2 3 Miles

Mapscale

(map scale not correct)



LEGEND

DEER CREEK LATE SUCCESSIONAL RESERVE

40N27 System Road Number

----- Old Railroad Grade

● Perennial Stream Crossing

C Culvert

CF Concrete Ford

B Bridge

NS No Structure

HEADWATERS SACRAMENTO RIVER

MT. SHASTA RANGER DISTRICT, SHASTA-TRINITY N.F.'S

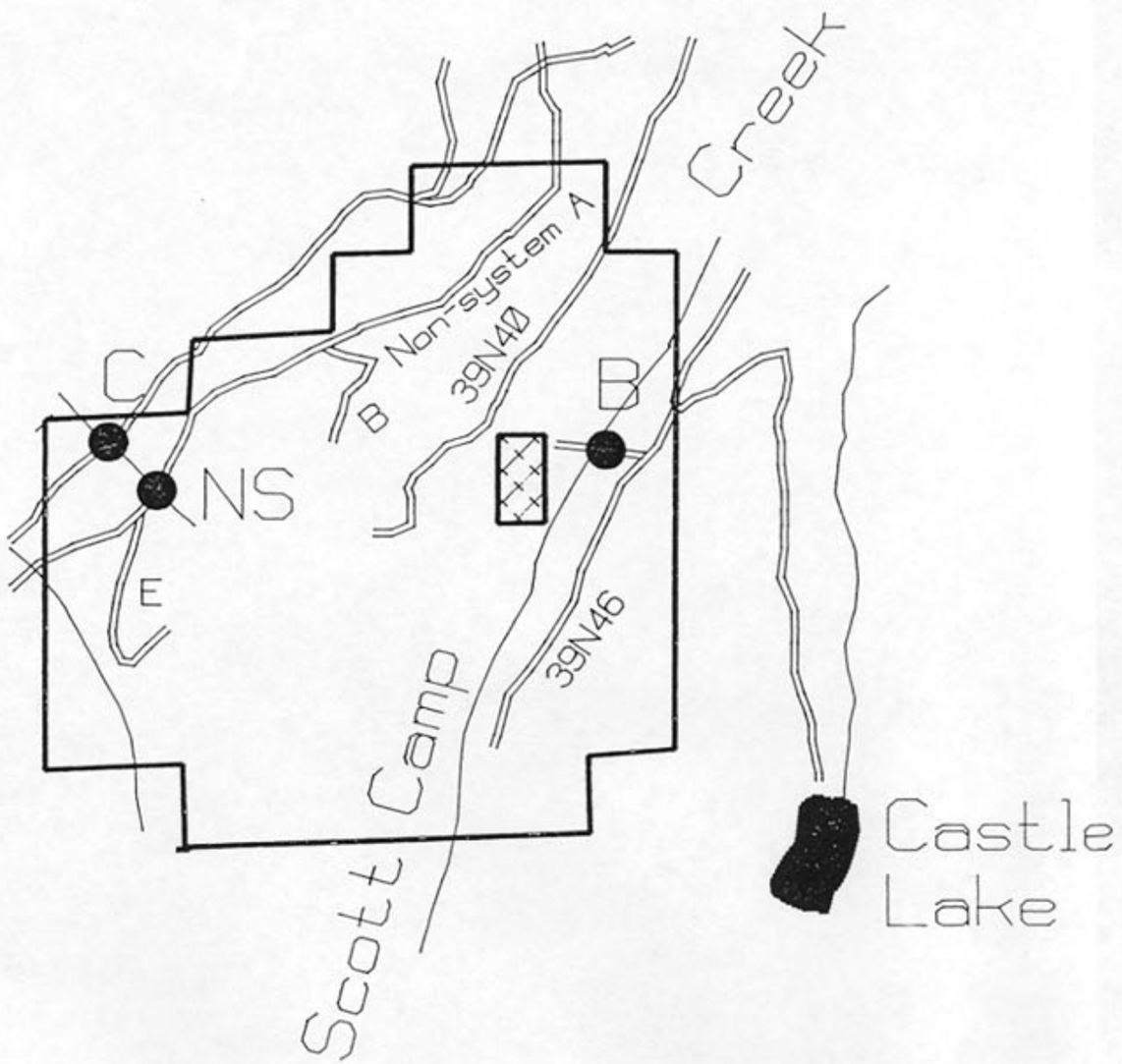
Map # 22

Date: 6/95

1 2 3 Miles

Mapscale

(map scale not correct)



LEGEND

SCOTT CAMP CREEK
MANAGED LATE
SUCCESSIONAL AREA

Methodist Camp Permit Area

39N46 System Road Number

Perennial Stream Crossing

C Culvert

B Bridge

Appendix B - References

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