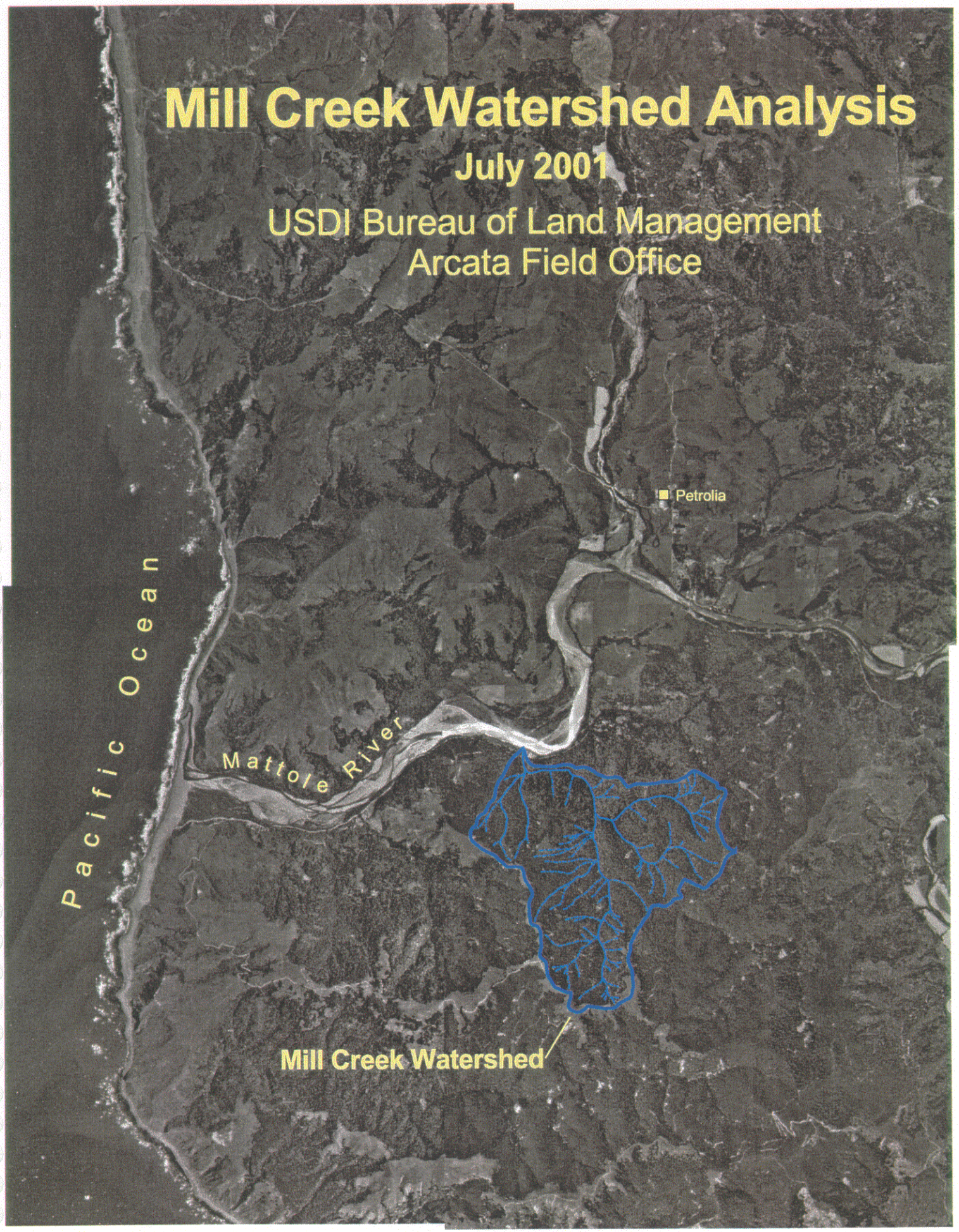
Mill Creek Watershed Analysis

July 2001

USDI Bureau of Land Management
Arcata Field Office



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USDI Bureau of Land Management
Arcata Field Office
1695 Heindon Road
Arcata, California 95501
707/825-2300
www.ca.blm.gov/arcata

List of Preparers:

David Fuller, Fisheries Biologist
Sam Morrison, Geologist
Hank Harrison, Forester
Steve Hawks, Wildlife Biologist
Marelene Grangaard, Archeologist
Tom Reid, Fire Management Officer
Paul Roush, Wildlife Biologist
Jessica Scanlan, Forester
Jennifer Wheeler, Botanist
Bob Wick, Outdoor Recreation Planner
Gary Pritchard-Peterson, King Range Manager
Dan Averill, Assistant Field Manager

List of Contributors:

Ali Freedlund, Mill Creek Watershed Conservancy
Freeman House, Mill Creek Watershed Conservancy
Gary Peterson, Mattole Salmon Group
Rex Rathbun, Mill Creek Watershed Conservancy
David Simpson, Mill Creek Watershed Conservancy
Randy Stemler, Mattole Restoration Council
Maureen Roche, Mill Creek Watershed Conservancy
Rob Yosha, Mill Creek Watershed Conservancy
Seth Zuckerman, Mill Creek Watershed Conservancy

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I. INTRODUCTION

The Northwest Forest Plan (USDA/USDI 1994) designates the entire Mattole River watershed as a Tier 1 Key Watershed. This designation was made because the Mattole River system is considered to contain refugia habitat for Pacific salmon species and restoration efforts have high potential to significantly improve habitat conditions over time.

The Northwest Forest Plan requires the BLM to prepare a watershed analysis in key watersheds prior to implementing any activity requiring an analysis under the National Environmental Policy Act. The BLM Arcata Field Office has completed two watershed analyses for tributaries to the Mattole: Bear Creek (1995) and Honeydew Creek (1996).

The Mill Creek watershed is smaller than the recommended range of acreage for conducting watershed analysis (USDA/USDI 1994). However, a significant body of data exists for the Mill Creek watershed due to intense interest of local residents over the past thirty years to learn about the natural resources of the watershed. The Mill Creek Watershed Conservancy (MCWC) was formed in 1983 specifically to protect a 220 acre old-growth forest in the watershed and its relationship to the salmon-bearing Mill Creek. At the time, the old-growth forest was owned by Ell River Sawmills (ERS) and was slated for logging. MCWC worked for fifteen years to raise funds for purchase of the forest, but as years went by, prices went up and the cost remained out of reach. Finally, the MCWC approached the BLM and directed attention to the ecological value of the area. BLM acquired the 220 acre parcel and other parcels in 1996 through a land exchange with the cooperation of the American Lands Conservancy.

Because of the interest in preserving old-growth and the integrity of the watershed numerous investigations on fish, amphibians, birds, mammals, vegetation, and geology have been undertaken by and reported upon by local residents and agency scientists. Much of the focus of these studies involved a large area of un-logged forest which is a rarity in the lower Mattole watershed. The old-growth forest is a rarity in the lower Mattole watershed.

Given the level of data available for this watershed and the opportunity to undertake cooperative watershed restoration efforts with local residents, the BLM Arcata Field Office is conducting this watershed analysis.

PHYSICAL SUMMARY

A. Climate and rainfall: Mill Creek is in an area of abundant rainfall, with an average of 72 inches of rain per year which occurs primarily from October to April (Rex Rathbun pers comm, Figure 1). Temperatures are moderate year round, ranging as low as 30 F in winter and as high as 90 F in summer. Strong winds associated with intense winter storms are common and coastal northwest winds occur during spring and early summer. On rare occasions dry east winds occur in late summer.

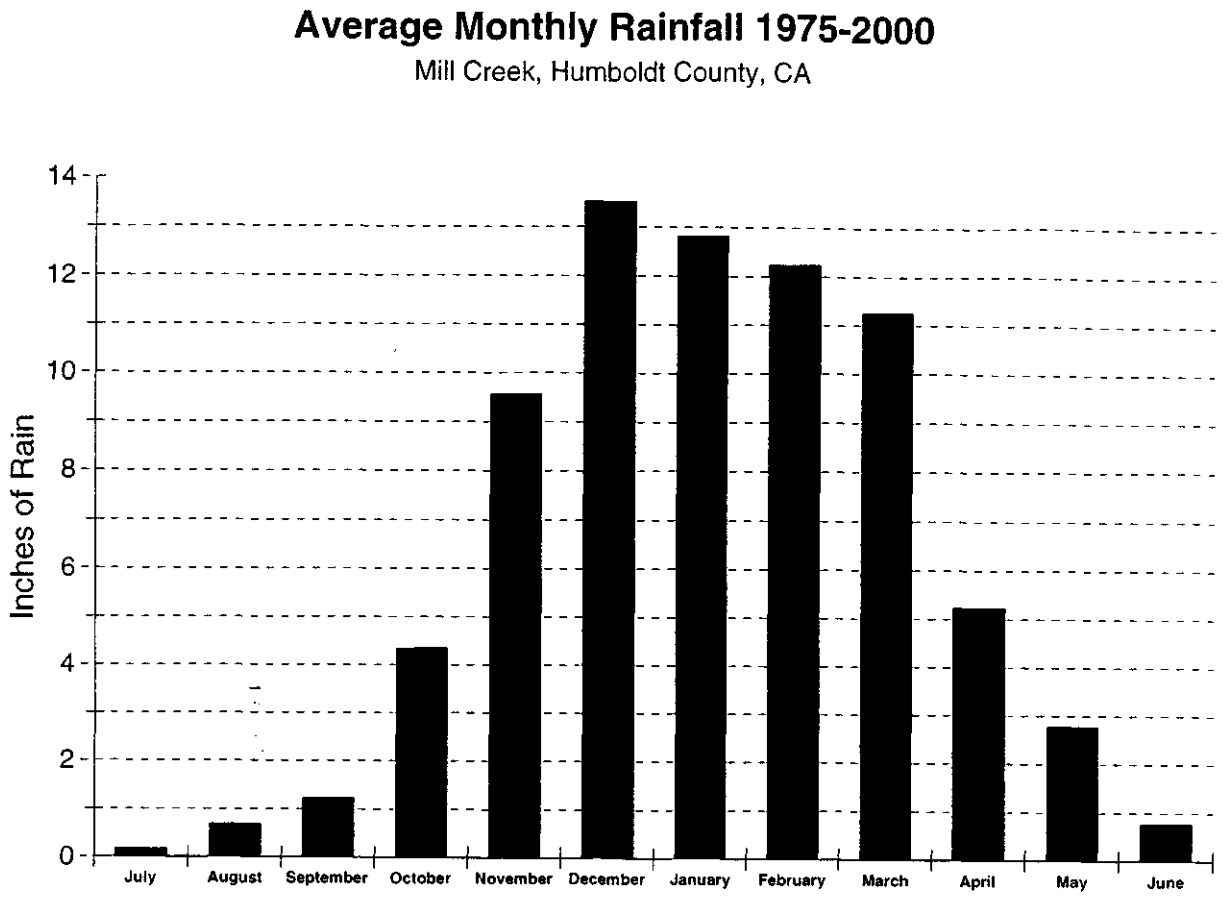

Figure 1.

B. Topography: lowest elevation is 20 ft above mean sea and rises to a high elevation of 2460 ft near Cooskie Mountain.

C. Size of watershed: 1336 acres

D. Drainage: Drainage is north into Mattole River, and watershed is exposed to northwest wind and storms. Confluence with Mattole River is 2.63 miles from the mouth of the Mattole River and Pacific Ocean (MRC 1995). Approximately 1/3 mile upstream from the Mattole River confluence Mill Creek is fed by two branches, and then one mile upstream from the confluence Mill Creek separates into the mainstem and the two branches to the east, all of which are perennial streams. The mainstem of Mill Creek is 2.3 miles long (MRC 1995) (Figure 2).

F. Geology and Terrain: The Mill Creek watershed lies within an area of extremely high tectonic uplift, frequent earthquakes, high rainfall, and rapid erosion rates. The watershed also has high relief with steep slopes and deeply incised streams, the result of the high uplift rates related to colliding oceanic and continental plates at the nearby Mendocino Triple Junction. Rock types are highly fractured marine sandstones and shales of the Coastal Belt Franciscan Formation which are subject to landslides, especially on steep hill slopes- typical of rocks within the King Range. The

terrain is dominated by forested slopes with grades ranging from 40 to 100 percent (Zuckerman,1990) .

Two landslide histories were developed by the Bureau of Land Management and Pacific Watershed Associates (PWA), with the histories covering a time period from1942 to1996. The largest number of debris torrents and stream-side landslides occurred between 1960 and 1981, a time interval which included many intense storm and flood events (PWA , 2000). The pattern of increased frequency of landslides associated with intense storm activity and road building during this time period is well documented on the northern coast of California.

A total of 32 landslides and debris torrents occurred over the 54 year period in the Mill Creek Watershed (PWA 2000). Most of these features were smaller than 3 acres, though some of the debris torrent tracks mapped in stream courses by Pacific Watershed Associates involved more acreage and probably caused severe stream bank erosion and channel damage. Today most of the landslide features and streambanks have stabilized and are in various stages of re-vegetation.

The landslide study and subsequent field mapping revealed that one portion of lower Mill Creek watershed appears more resistant to landsliding than others areas. This is due to a large resistant rock body with near vertical rock faces near the mouth of Mill Creek and it shows very little landslide activity. This resistant rock mass occupies almost one fifth of the total Mill Creek watershed area and also contains the last remaining old growth forest in the watershed.

Numerous prehistoric landslides and unstable land areas (hill slope prairie areas) were noted on the older air photos, but these features were covered in forest and grass by the 1940's. However, these older features indicate that in the past, larger and more frequent landslides may have occurred during periods of wetter climate and increased earthquake activity.

BIOLOGICAL SUMMARY

The Mill Creek watershed is dominated by tanoak forest types containing large Douglas-fir trees, but also contain grasslands. Both old-growth and second-growth forests exist within the watershed. Due to the mosaic of vegetation types, the watershed contains a diversity of terrestrial wildlife, including 114 species of birds (Vargo 1979).

Water quality in Mill Creek is considered excellent. Mill Creek is the most significant source of cold water in the lower Mattole (MRC 1995). Given the elevated water temperatures in the Mattole River, the cold water from Mill Creek is considered important to the estuary system and salmon populations in the lower Mattole River.

Mill Creek supports a relatively healthy riparian forest and contains populations of coho salmon and steelhead, both listed under the federal Endangered Species Act. In addition, Mill Creek and its tributaries support populations of amphibians including sensitive species such as tailed frogs and southern torrent salamanders.

SOCIAL SUMMARY

Approximately 50% of the watershed is public land managed by the BLM with the remaining 50% divided among twelve landowners owning relatively small parcels. The watershed sits within the community of Petrolia. Past land use activities have included tanoak harvest, sheep grazing, cattle grazing, and tractor logging. Current activities are restricted to rural residences.

CULTURAL SUMMARY

The lower Mattole is the prehistoric homeland for the Mattole Indian tribes which were displaced in the mid-1800's by Euro-american settlements and ranchers. Several Indian allotments remain in and adjacent to the Mill Creek watershed. There are no known prehistoric or historic sites on the BLM portion of Mill Creek, however, only one acre has been archeologically surveyed. Given the extreme steepness of the watershed, there is a low probability for prehistoric resources.

Evidence exists that parts of the Mill Creek watershed were used for harvest of tanoak bark. An road that is likely a wagon road which exits the watershed near the mouth of Mill Creek is still in existence (Rathbun, pers. comm.).

II. ISSUES AND KEY QUESTIONS

A. Fire Management:

1. How can the fuel load in previously logged areas be managed to prevent catastrophic fires?

2. What are the likely sources of ignition?

3. What role could recreationists play in wildfire ignition or prevention?

4. What is the role of rural residents in ignition or prevention of wildfire?

5. What effects could a fire have on threatened and endangered species?

B. Roads and Erosion

1. What are impacts to fisheries from the road system in Mill Creek if left in place, especially when a large flood event occurs?

2. When a major flood event occurs will the road system in the Mill Creek watershed be a major sediment source to the Mattole River and estuary immediately downstream (i.e. stream crossing failures and debris torrents)?

3. How many miles of old road and new road are in the watershed? What are road conditions, level of repair and upgrade schedules?

C. Fish and Wildlife

1. What were the historic salmonid species in Mill Creek and where were they distributed?

2. What is the role of Mill Creek in the recovery of coho salmon in the lower portion of the Mattole River?

3. What steps can be taken to protect and restore native aquatic fauna?

4. What is the role of old-growth/late-seral terrestrial wildlife species in the watershed relative to the basin and regional scale?

5. Is there a need for acceleration of plant succession (conifer and hardwood forest growth toward LSOG) in previously harvested forest stands?

D. Recreation and Human Use:

1. What is the potential for increasing numbers of residences and further subdivision of private lands?

2. How can recreation on BLM lands be compatible with private residences?

III. REFERENCE CONDITIONS

A. Erosion

Landslide Activity: Adjacent watersheds (Stansberry Creek and Clear Creek) show abundant recent landslide activity, mostly associated with abandoned logging roads, but Mill Creek has very few large active landslides. Two natural active slides on upper slopes, 1 acre and 0.5 acre in size, are visible on recent air photos, and some small natural stream side debris slides were visible on historical air photos. The small stream side slides are on very steep inner gorge areas along the main stem of Mill Creek and were most likely triggered during large storm events.

Other potentially unstable areas were mapped on historical air photos and they consist of very large but old landslide depressions covered with hardwoods and conifers (Figure 3). These areas are probably older than 100 years based upon the estimated age of the remaining conifers and stumps left from older logging. The open prairie areas that occur on the upper slopes in Mill Creek represent unstable earthflow terrain with highly erosive soils which are covered with grass and young conifers. Currently no large scale erosion was detected in these areas.

B. Fire

No data exist for reference conditions concerning fire. Some information can be surmised from vegetation patterns and knowledge of indigenous human lifeways. Fire was prevalent in the northwest California coast ranges and has left a mosaic of vegetation patterns on the landscape. Generally, ridges and upper slopes are comprised of grasslands, brush, or early-seral forests where warmer temperatures and lower humidity prevails while the older seral forests remain in bottoms of drainages where humidity is higher and temperatures are lower. This is generally the case in Mill Creek except a higher proportion of late-seral forests exist presumably because of the northern aspect of the watershed. The oldest trees in the watershed are approximately 400 years old which may be a result of a large, stand-replacing fire.

Lightning strikes were probably the most common form of ignition, either within the watershed or from outside the watershed spreading into the watershed. It is known that Native Americans which inhabited the Mattole basin used fire and thus some fires in the watershed may have been a result of Native American burning, but it is unknown to what extent this may have occurred.

C. Species and Habitats

No data exists concerning reference conditions in the watershed but certain conditions can be surmised from knowledge of vegetation types and seral stages in nearby watersheds and with some knowledge of land use activities of Native Americans in the region. Vegetation assemblages and seral stages of the mixed evergreen forest formed a mosaic through much of the Mattole watershed primarily in response to moisture available to plants, soil type and depth, and to fires (both lightning and fires set by Native Americans). Large continuous stands of late-seral or old-growth forests that occurred in the Pacific Northwest were thought to be absent from this area (Barbour and Majors 1977), although Mill Creek watershed may have contained a higher proportion of old-growth or late-seral forest then other Mattole watersheds because of its northern aspect. The oldest Douglas-fir in the watershed is approximately 400 years old (Rex Rathbun, pers comm) which means that a large disturbance such as a stand-replacing fire or a large earthquake occurred in the area approximately 400 years ago. It is likely that during some periods of time, the watershed contained a larger percentage of old-growth and late-seral forests than currently exists.

Wildlife species inventories and surveys prior to the influence of Europeans are nonexistent. Species occurrence can only be extrapolated from species occurrences documented for similar vegetative types over the general geographic area of Northwestern California. Lists of hypothetical historic species occurrence have not been compiled for this document, but many sources are available such as contained in Marcot et al. 1979. Long-term current residents in the larger Mattole watershed comment on the relative abundance of commonly seen species such as deer, bear, coyotes, and small game, but have no recollections of forest species which have until the modern era gone largely undetected (fishers, for example). Large scale timber harvesting in the past has artificially created an inordinate amount of lower-successional vegetation which allowed for expanded black-tailed deer populations during the 1960's and 1970's. The small size of the watershed probably negates the possibility of larger northern spotted owl populations in the past, but marbled murrelets may have nested there. In interviews with long-time Mattole watershed residents conducted for past watershed analyses, it was consistently stated that populations of salmon and steelhead were abundant in the early part of the 20th century, and thus it can be assumed that Mill Creek had a large population of coho salmon, steelhead, and possibly chinook salmon during that period, as well. The large anadromous fish populations would have been attended by bald eagles, which may have nested in the watershed.

D. Human Uses

Little is known for certain about the original inhabitants of the Mattole watershed. Ten years after contact with Euro-Americans in the mid-1800s, these people had been virtually eliminated by genocide and disease. It is believed that the people living in or near the Mill Creek watershed were “Mattole”, a name given by early ethnographers, of an Athabascan language speaking group of people. The word “Mattole” is believed to mean “clear water”. The Mattole are considered by ethnologists to be “transitional people”, the southernmost to share the Northwest salmon culture and the northernmost to share Central Valley Indian characteristics. The influence of the northwest salmon culture is seen in the reliance on salmon, the use of building materials, the architecture of

their dwellings, and the use of canoes for hunting marine mammals and fishing in the ocean. The influence of Central California culture is seen in the role of acorns, religions, and tools.

Evidence from archeological test excavations suggest the Mattole used the area on a seasonal basis. The traveled to the coast in winter, spring, and summer to harvest sea mammals, shellfish, surf fish, kelp, acorns and for salmon runs. The Mattole had major seasonal villages on the coast and inland.

Fire was by far the most powerful tool available to native Californians. Fire has the most potential for profound effects on the landscape; however, native Californians utilized fire in very specific situations for very specific purposes. Fire was applied to oak woodlands (Raphael 1974) and perennial grasslands to increase harvest of important food sources such a acorns and grass seed. Fire was also used to maintain coastal prairies which were important hunting grounds for elk and deer (Bicknell 1992). The extent of fire use by indigenous people in the Mill Creek watershed is unknown.

IV. CURRENT CONDITIONS

A. Roads and Erosion

Most of the active and abandoned road networks within the Mill Creek watershed were built during logging operations. From analysis of aerial photography, it appears that two major periods of road building associated with logging occurred in about 1963 and also again in 1973 (Figure 4, Table 1) although about a third of the roads were constructed prior to extensive logging activities.

Table 1. Miles of road constructed in Mill Creek watershed by date of construction.

Year of Construction	No. of Miles
1940's-1963	10.4
1963-1970	10.8
1973-1981	5.2
Unclassified	8.5
TOTAL	**35**

An inventory and assessment of these road networks has been completed (PWA 2000, BLM records). These studies found 2700 cubic yards of potential erosion into watercourses from road-related erosion. Relative to many other watersheds in the Mattole basin, this is a small amount of potential road-related erosion.

An additional source of sediment could be the gullying of the highly erosive soils on the open prairie areas and delivery to streams on slopes below. The most likely source of gullying and sediment delivery from the prairie areas would be from ground disturbing activities such as road building or excavation for new home sites.

B. Stability

Currently, very little landslide activity is apparent, although occasional landslides do occur and are believed to be mostly associated with large precipitation events. Most older natural slides and landslides associated with logging in the 1960's and 1970's are re-vegetating (air photo analysis only, field verification for smaller streamside debris slides is needed). Most of watershed appears to be very stable based on air photo analysis, with exception of ancient slides scars which have re-vegetated prior to logging activities.

C. Vegetation

A detailed inventory of the vegetation for the all of BLM land was conducted by Dr. Tom Jimerson of the US Forest Service in 1997 using aerial photography and vegetation plots in the field. This inventory classified the vegetation in Mill Creek into series, sub-series, and plant associations based on potential natural vegetation types. The vegetation sub-series are summarized in Table 2 and Figure 5.

Table 2. Acres of vegetation sub-series categories in the Mill Creek Watershed, from Jimerson 1997.

Vegetation Sub-Series	Acres	% of Watershed
Tanoak/California Bay	569	42.6
Tanoak/Huckleberry	415	31.1
Tanoak/Salal	75	5.6
Douglas-fir	20	1.5
Douglas-fir/California Bay	19	1.4
Landslide	1	0.1
Grassland	38	2.8
Unmapped	198	14.9

Tanoak is by far the dominant potential natural vegetation series type in the watershed, and its associations with California bay, huckleberry, and salal comprise 79.3% of the inventoried vegetation sub-series. The tanoak series is described by Jimerson (1997) as forest stands where tanoak are greater that ten percent of cover and also regenerating. In Mill Creek, the dominant conifer growing in these stands is Douglas-fir. The Tanoak/California bay sub-series is found on lower elevation, cool, shaded, moist, lower and middle third slope positions. The Tanoak/Huckleberry sub-series is found in cooler, moister, lower slope position and has moderate conifer production. The Tanoak/Salal subseries is found in cool, shaded upper slope positions and has a high rate of conifer production.

Approximately two-thirds of the watershed was classified by vegetation seral stage. In Mill Creek, 11 different seral stages were classified and segregated by natural successional processes or logged (“harvest”) areas. Table 3 and Figure 6 summarize seral stages.

Table 3. Vegetation seral stages in Mill Creek Watershed, from Jimerson 1997.

Seral Stage	Acres	% of Watershed
Old-growth	221	16.5
Late Mature	42	3.2
Mid Mature	147	11.0
Early Mature	33	2.5
Pole Natural	53	4.0
Shrub Natural	37	2.8
Mid Mature Harvest	43	3.2
Early Mature Harvest	4	0.3
Pole Harvest	286	21.4
Shrub Harvest	18	1.4
Landslide	1	--
Unclassified	450	33.7

The seral stage data show that approximately 20% of the watershed is in old-growth and late mature forest. This is a relatively large proportion of late-successional forest compared to other watersheds in the Mattole (MRC 1995). Mill Creek watershed has a lower proportion of late-successional forest than Honeydew Creek which was found to have 38% late-successional forest (BLM 1996), but Mill Creek has a higher proportion than Bear Creek which was found to have approximately 15% late-successional forests (BLM 1995) (although Mill Creek is roughly one-tenth the size of Bear Creek). It is unlikely that any of the lands that were not classified for seral stage contain any late-successional forests.

Approximately 26% of the classified lands were logged with the great majority of those lands now in the pole seral stage. The mid mature harvest category most likely reflects logging operations where the largest trees were removed (aka “high grading”) and the smaller trees were left while much of the pole harvest category is a result of clearcuts. It is likely that much of the unclassified lands experienced some logging treatments.

D. Fuels and Fire:

Natural fire hazards during normal climatic conditions are considered low to moderate in this area because of the northern topographic aspect of the watershed and cool moist climatic regime associated with the nearby Pacific Ocean. However, during late summer a strong, dry, offshore flow may develop resulting in increased fire danger for human caused ignitions.

Fuel loadings vary throughout the watershed with changes in vegetation. The exclusion of natural fire has increased fuel loadings in some areas. Areas where logging and other ground disturbing activities have occurred contain unnaturally high concentrations of early successional vegetation. These areas are of special concern due to the increased potential for large, resource damaging fires.

Although virtually no fire history has been documented for the Mill Creek watershed, it can be surmised that lightning and the use of fire by Native Americans was an active process in the natural management of vegetation in this watershed. Recent large fires have occurred in the neighboring watersheds but records of modern day fires are few. Since 1975, three small fires (five acres or less) are known to have burned in the Mill Creek watershed, two were ignited by lightning and one by a resident (Rathbun, pers. comm.).

Human activities which have resulted in fires in adjacent watersheds are equipment use, brush clearing by landowners, and unattended campfires. It can be inferred that the threat of human caused fires would be similar to that of the adjacent watersheds.

Lightning strikes in the watershed, the surrounding areas, commonly occur on ridge top and mid-slope areas. Lightning ignited fires generally burn with low intensity and spread at slow rates as a result of cooler temperatures and higher relative humidity associated with sub-tropical moisture during thunder storm activity. Low intensity fires which reduce the understory vegetation of brush and leaf litter are typically beneficial to the northern King Range and its environs. If understory vegetation is not removed periodically it can act as a ladder allowing fire to spread to the overstory vegetation, resulting in larger more damaging fires when conditions are conducive.

The highest potential for a catastrophic fire occurs late in the summer when the moisture present in vegetation is low and strong, dry, offshore winds occur. Strong, dry offshore winds is characterized by high temperatures, elevated wind speed and low relative humidity. Although these conditions are rare, when they do occur they can last 1 to 3 days. Fires that develop under these conditions tend to burn intensely with high spread rates and are very unpredictable.

E. Stream Channel Conditions

The mainstem of Mill Creek and its tributaries are deeply incised and well shaded by red alder (CDFG 1996). The lower mile of mainstem Mill Creek, where the bulk of the anadromous fish production occurs, is two to four percent gradient, with a streambed dominated by cobbles and boulders. Several small log jams occur throughout this area. Upper mainstem Mill Creek and other tributaries are much steeper and dominated, for the most part, by boulder steambeds (CDFG 1996, Vargo 1979). Unlike many Mattole River tributaries, the stream channels in Mill Creek show little evidence of sedimentation from the 1955 and 1964 floods.

A stream habitat inventory conducted in 1996 (CDFG 1996) found that the lower mile of Mill Creek was comprised of 36% pools, 31% riffles, and 34% flatwater type habitats. Of the pools inventoried, 38% had a maximum depth of two feet or greater. This inventory also found that small and large woody debris were lacking throughout the reach surveyed. In addition, this inventory found a mean canopy density of 82% which is considered well shaded.

F. Water Quality

The most significant aspect of water quality in Mill Creek is its year around cool water temperature. Cool water temperatures have been cited by many past reports (eg. CDFG 1966, Vargo 1979, Barnhart and Day 1992, MRC 1995). Continuous temperature monitoring during the summer of 1996 in the lower mainstem of Mill Creek found a maximum summer water temperature less that 60 degrees Fahrenheit (Welsh, pers. comm) with a mean weekly average temperature (MWAT) of 56.8 F. Mill Creek is thought to be the most significant source of summertime cool water in the lower Mattole River (MRC 1995) and thus valuable to fish and other aquatic organisms. Cool waters is likely a function of its northern aspect, highly incised stream channels, and dense tree canopy.

Another indicator of water quality that has been measured is the aquatic macroinvertebrate community. Samples collected in the spring and fall in the lower mainstem from 1996 to 1999 consistently found invertebrate communities that reflect high water quality with little pollution (Vinson 1996, 1997, 1998, 1999, 2000). Turbidity has not been measured but local knowledge is Mill Creek gets less turbid and clears more quickly than any other stream in the lower Mattole River.

G. Aquatic Fauna

Mill Creek supports populations of coho salmon and steelhead, both of which are listed as "threatened" under the federal Endangered Species Act. Mill Creek supports the only population of coho salmon in the lower 27 miles of the Mattole River. A significant event for the coho salmon population occurred after the 1964 flood when Humboldt County Department of Public Works replaced the culvert under Lighthouse Road which became a barrier to upstream migration

of coho salmon, and likely a hindrance to steelhead migration. While a 1966 CDFG survey found a few coho salmon, a subsequent survey in 1975 found no coho salmon and less steelhead. The culvert and its outlet were re-configured in 1977 and 1980 to facilitate better fish passage. It is expected that Humboldt County will replace the existing culvert with a bridge in the near future. The Mattole Watershed Salmon Support Group (now the Mattole Salmon Group), working with CDFG re-introduced coho salmon to Mill Creek through juvenile plantings from 1981 through 1987. This population of coho salmon is hoped to have stabilized as a naturally reproducing population. Spawner surveys have been conducted by the Mattole Salmon Group on a regular basis which seem to indicate a small population of coho salmon persits in Mill Creek but the total population size has not been estimated.

Mill Creek also contains populations of tailed frog and southern torrent salamander (Welsh et al, in press). These species are highly correlated with old-growth forests and streams of high water quality.

H. Terrestrial Fauna

The one northern spotted owl territory currently in the Mill Creek watershed contains only 462 acres of suitable nesting/roosting (N/R) habitat, well below the 1,336 acres considered necessary to provide a sustainable territory. The territory has produced young in the past but has not been surveyed in the past few years. A 1994 survey detected marbled murrelet “fly-overs” in the Mill Creek watershed and additional surveys may detect occupancy of the bird within the 249 acres of suitable habitat currently in the watershed.

Vargo (1979), compiled a current list of birds and mammals occurring in the Mill Creek watershed (see Appendix A). Recent track plate and photo station inventories captured the presence of deer mice, raccoon, grey fox and ring-tail cat. No rare meso-predators (fisher or marten) were detected.

I. Human Use

Recent human use includes old-growth logging, both clearcutting and high-grading which occurred during the 1950s, 1960s, and 1970s. Along with these logging operations came the construction of haul roads and skid trails. At this time, much of the logged areas are well re-vegetated but the network of haul roads and skid roads remains on the landscape.

Approximately 25% of the watershed was sub-divided for rural homes in the early 1970s (estimated from aerial photographs). Rural residences are now the dominant human use in the watershed.

BLM acquired 515 acres of forest land in the Mill Creek watershed in 1996 through a land exchange. Of this 515 acres, 220 acres is an old-growth forest and the remaining 295 acres are forest lands of various ages. This land is currently being managed as "Late-Successional Reserve" under the Northwest Forest Plan (USDA/USDI 1994). No public access to these lands is currently available but some trail access may become available in the near future.

V. SYNTHESIS AND INTERPRETATION

A. Fire and Fuels:

1. How can the fuel load in previously logged areas be managed to prevent catastrophic fires?
Answer: Although no measurements of fuel loading have been recorded in the Mill Creek watershed a visual inspection reveals high concentrations of ground fuels in areas where logging and other ground disturbing activities have occurred. Reduction of fuel loads can be accomplished by a combination of hand, mechanical, and prescribed fire treatments. Further planning is necessary to determine an appropriate course of action.

2. What are the likely sources of ignition?
The common sources of ignition are lightning and human activities. Human activities include recreation (camping, hiking, vehicle use, etc.) and actions by rural residents (trash burning, land clearing, use of equipment, and house fires).

3. What role could recreationist play in wildfire ignition or prevention?
Answer: Recreationists could potentially cause fire in the Mill Creek watershed during periods when environmental conditions are conducive to support fire ignitions. Historically, large catastrophic fires travel from east to west. Escaped campfires from the beaches would travel easterly with an onshore flow. Onshore flows are characterized by cooler temperatures and higher relative humidity resulting in less hazardous conditions. Prevention activities can include a public education program of signing and posting prevention material, and the issuance of fire restrictions as conditions warrant.

4. What is the role of rural residents in ignition or prevention of wildfire?
Answer: The activities of rural residents in and around the Mill Creek watershed have potential for ignition of a fire. Rural residents regularly engage in activities which might ignite a fire but are generally aware of periods of high fire danger and tend to suppress any potentially dangerous activities.

5. What effects could a fire have on threatened and endangered species?
Answer: A large, high-intensity, stand-replacing fire could significantly alter habitat for both terrestrial and aquatic species listed under the federal Endangered Species Act. Such an event, which has likely occurred several times in the past few millenia, could “re-set” much of the seral stage to brush and eliminate much of the late-successional forests and thus habitat for late-successional species.

A more common type of fire, and the type that has probably occurred most often, is a low to medium intensity fire that burns more intensely near the ridges and less intensely in the drainages leaving a mosaic of underburn and crown fire. These types of fires probably have little effect on late-successional forests and associated fauna.

B. Roads and Erosion

1. What are impacts to fisheries from the road system in Mill Creek if left in place, especially when a large flood event occurs?
Answer: Inventories of potential road-related sediment found that a total of 2,700 cubic yards of sediment could be yielded to watercourses from the road system. Compared to other Mattole basin tributaries this is a relatively small volume of sediment. However, some failed road crossings could initiate debris torrents which could greatly increase the amount of sediment delivered to stream channels. Impact to fish habitat, located primarily in the lower mile of the mainstem, may be relatively minor or could be significant depending on the incidence of debris torrents. Impacts could be immediate or could take decades to detect depending on the volume of sediment and the routing of this sediment through the stream channels.

2. When a major flood event occurs will the road system in the Mill Creek watershed be a major sediment source to the Mattole River and estuary immediately downstream?
Answer: If unstable lands and ancient landslides become mobilized by a large flood, then there is a potential for hundreds of thousands of cubic yards of sediment to be yielded into Mill Creek and its tributaries. This sediment would eventually be routed to the Mattole estuary. However, when a flood of this magnitude occurs, the amount of sediment from Mill Creek would probably be less than that from nearby watersheds in the Mattole basin.

3. How many miles of roads are in the watershed? What are road conditions, level of repair and upgrade schedules?
Answer: Approximately 3.3 miles of road are abandoned and have not been maintained (PWA 2000). Approximately 4 miles of road, most of which lead to private residences, have been assessed for upgraded road maintenance which is planned for the near future (PWA 2000). The potential for new roads is limited to the 50% of the watershed which is private and would likely be associated with logging or new home development.

C. Fish and Wildlife

1. What were the historic salmonid species in Mill Creek and where were they distributed?
Answer: Coho salmon and steelhead populations are known to have been in Mill Creek during the 20th century. It seems likely that chinook salmon may have used Mill Creek as well but no data exists on chinook in Mill Creek. Given the gradient of Mill Creek, it seems likely that salmon have always been restricted to the lower mile (or so) of the mainstem while steelhead may have migrated further, and even up one small tributary, if flow conditions were favorable and barriers were absent.

2. What is the role of Mill Creek in the recovery of coho salmon in the lower portion of the Mattole River?
Answer: Mill Creek is the sole tributary in the lower Mattole basin to contain coho salmon and thus plays a vital role in any eventual recovery of coho salmon in the lower basin. The typical model for recovery into other streams would be straying of adult Mill Creek coho salmon into

nearby streams which would spawn and eventually lead to a self-sustaining naturally spawning population in other suitable streams. The larger the population of coho salmon in Mill Creek, the more likely that successful straying into other streams would occur. The population size of coho salmon in Mill Creek is unknown and thus the probability of straying is unknown.

3. What steps can be taken to protect and restore native aquatic fauna?
Answer: The 50% of the land that is public land is managed for protection of late-successional forests and aquatic fauna. The other 50% of the land is private, primarily used for rural residences. Control of erosion from roads would reduce to potential of damage to aquatic habitat. Further restoration of stream channel conditions may be possible.

4. What is the role of old-growth/late-seral terrestrial wildlife species in the watershed relative to the basin and regional scale?
Answer: Adding Mill Creek watershed lands to the King Range Late-Successional Reserve (LSR) is a small but significant improvement in threatened species management in the context of the Northwest Forest Plan. The Mill Creek land brings one more pair of spotted owls under the management of the King Range LSR, inching the LSR closer to becoming a sustainable owl population unit. The marbled murrelet detection is one of only two that have been documented in the entire KRNCA and if follow-up surveys detect occupied behavior this could be significant for the Mattole watershed.

5. Is there a need for acceleration of plant succession (conifer and hardwood forest growth toward LSOG) in previously harvested stands?
Answer: There is the potential to accelerate the development of pole-size forest stands into suitable spotted owl nesting/roosting habitat which could almost double the amount currently available.

D. Recreation and Human Use:

1. What is the potential for increasing numbers of residences and further subdivision of private lands?
Answer: The potential for increasing number of potential residences is unknown but could increase over time as rural properties become attractive for retirees and others seeking to escape urban lifestyles. Rural residences are the primary human use in the watershed and have the greatest impact on natural resources due to use of water, roads, and potential for fires.

2. How can recreation on BLM lands be compatible with private residences?
Answer: Concerns of local residents regarding recreation in the Mill Creek watershed include: potential for fire, loss of privacy, and vandalism. At this time, no recreation opportunities exist in the watershed but public purchase of over 500 acres of land in the watershed in 1996 has led to some interest in allowing public access. If a recreation plan developed for the watershed developed solutions to the concerns of the local residents it would be most compatible.

VI. RECOMMENDATIONS FOR PROJECT PLANNING

Fire and Fuels

Three options exist for management of fuels or reduction of fire danger in the watershed:

1. Manual thinning in forest stands where fuel loads are highest or are considered to pose the greatest danger to forest habitat and homes. Given the steep terrain and relative inaccessibility to many parts of the watershed, this may not be feasible.

2. Prescribed burning in forest stands where fuel reduction is considered necessary and could be treated effectively with fire. Given the proximity to homes and rapidly changing weather conditions, this may not be feasible.

3. Create a fuel break on the eastern edge of the watershed, mainly using existing roads. This may reduce the risk of catastrophic fire spreading into the watershed from the east during periods of low humidity and high temperatures. The lands on the eastern edge of the watershed are mostly private lands and thus such an effort should be coordinated with the California Department of Forestry and Fire Protection.

Data Gaps:
An investigation into fuel loads and fire danger should be undertaken prior to undertaking any these actions.

Fire prevention activities which should be considered include:

1. BLM should continue to issue fire permits and stress fire safety for recreationists using Mattole campground and Lost Coast Trail.

2. Local residents should be encouraged to trim brush and limbs around their structure to reduce fire risk.

3. Local residents should be encouraged to refrain from burning or using power tools during periods when fire danger is high.

Roads and Erosion

1. Road treatments recommended by PWA (2000) should be implemented.

Fish and Wildlife

1. The BLM, Mattole Salmon Group and other cooperators should continue cooperative monitoring of adult salmon spawning and aquatic macroinvertebrate communities.

2. Instream habitat improvement structures placed in previous years should by analyzed for proper function, and repaired or replaced if necessary.

3. The BLM and cooperators should consider monitoring water quality parameters such as turbidity, pH, and conductivity. Mill Creek is a candidate for a reference stream for lower Mattole tributaries.

4. Consider monitoring bird and mammal species in the watershed.

Recreation and Human Use

1. BLM should work with local residents and other interested parties when planning recreation alternatives in the Mill Creek watershed so that needs of both local residents and public can be met to the greatest degree possible.

Cooperative Management

Since 1998, the Mill Creek Watershed Conservancy has had a Cooperative Management Agreement with the BLM with regards to any management of the Mill Creek public lands. This agreement is for the purpose of accomplishing any or all of the above stated recommendations. A Cooperative Management Plan is currently under development.

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FIGURES 2 - 6

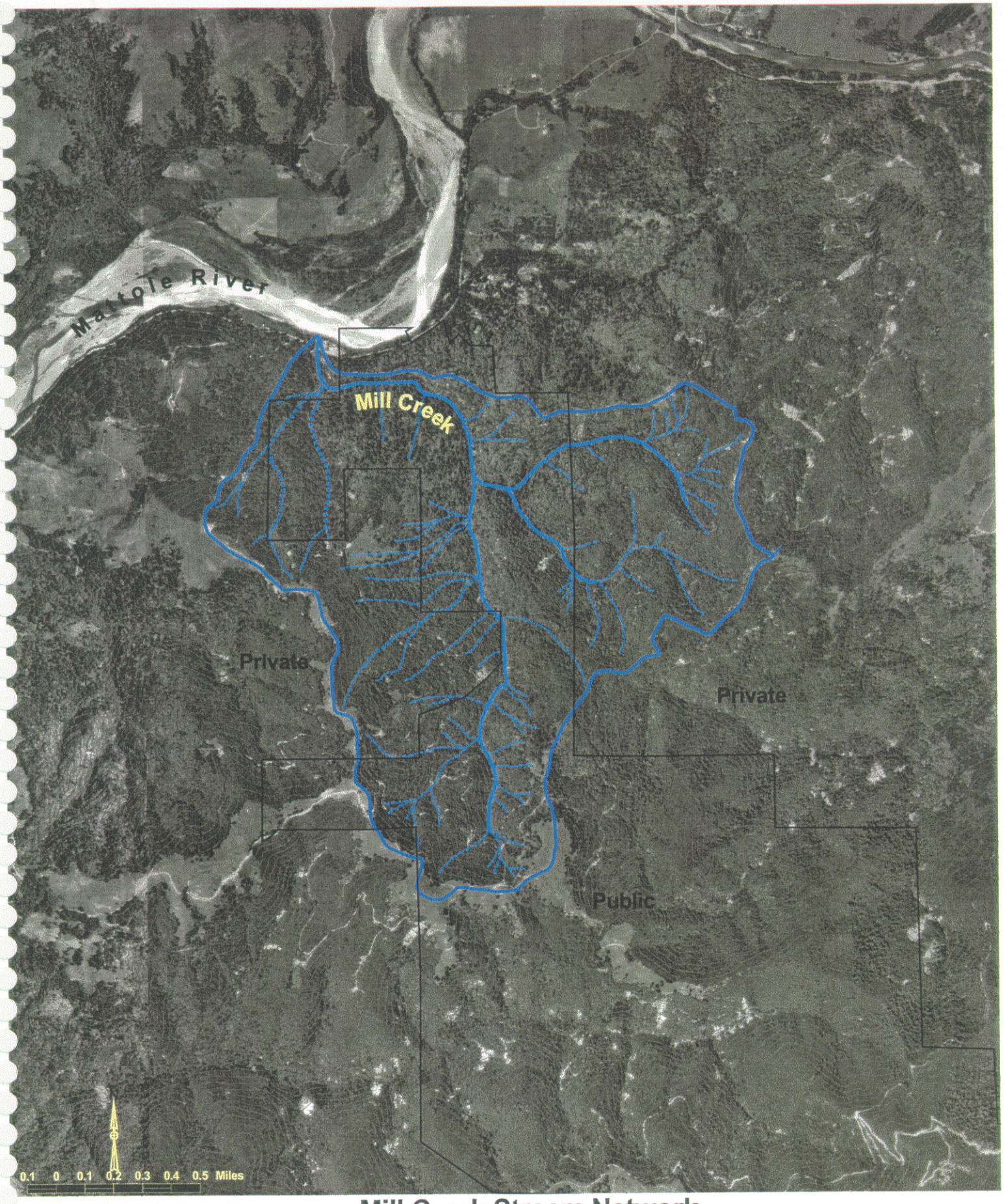

Figure 2. Crenulated stream network for Mill Creek, Humboldt County, California, from 7.5 minute USGS quadrangle map

Figure 3. Unstable lands in Mill Creek, Humboldt County, California, mapped from historical air photographs

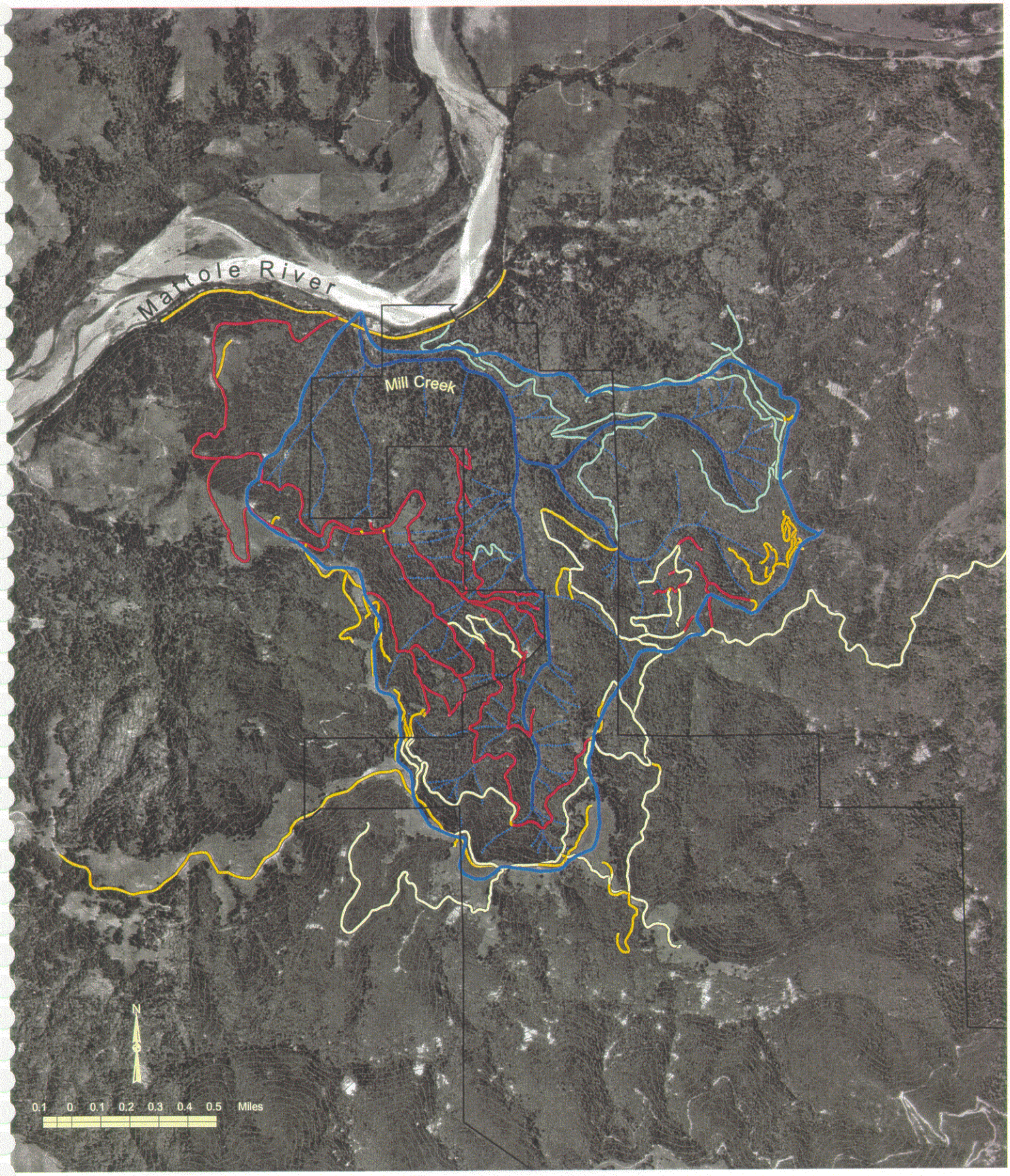

Figure 4. Road network, by road age from aerial photos, Mill Creek, Humboldt County, California

Mill Creek Existing Vegetation - Plant Association

Plant Association

- Douglas Fir
- Douglas Fir/California Bay
- Grassland
- Landslide
- Tan Oak/California Bay
- Tan Oak/Huckleberry
- Tan Oak/Salal
- Public/Private Property Boundary
- Watershed Boundary

Figure 5. Vegetation series/subseries, Mill Creek, Humboldt Co., California, as mapped by Jimerson 1997

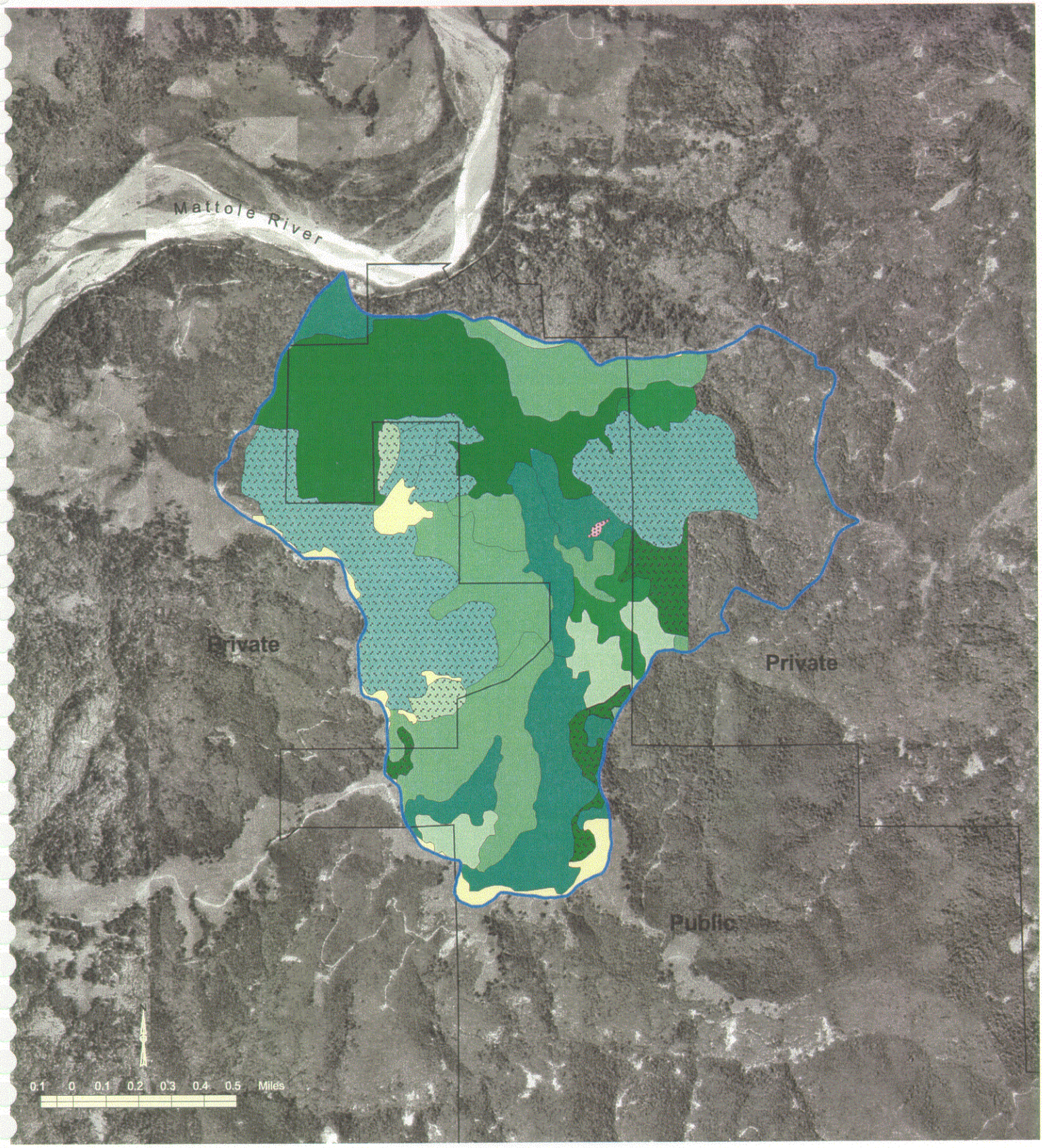

Figure 6. Seral stages of vegetation, Mill Creek, Humboldt County, California, as mapped by Jimerson, 1997