Mattole Basin Profile and Synthesis

Introduction

Mattole meant "clear waters" in the language of the Athabaskan-speaking Mattole and Sinkyone Native Americans when the first settlers from the Eastern United States arrived in the early 1850s. Little is known about these Native Americans, for they were quickly displaced by the new settlers. Disputes over hunting ground and domestic stock culminated in a massacre at Squaw Creek in 1864. Survivors were sent to the Round Valley Reservation in the Middle Fork of the Eel River, where most succumbed to the measles epidemic in 1868 (Elements of Recovery, 1989). Based upon the practices of other North Coast native peoples, it is presumed they utilized an abundant and local salmon and steelhead resource for their sustenance.

We have little specific information about the levels of abundance of those mid-nineteenth century fishery stocks. However, based upon turn-of-the-century cannery records from the river systems in northwestern North America, including the neighboring Eel River, we can infer a great deal about the historic plenitude of Chinook, coho, and steelhead in the Mattole Basin. Old-timers and descendants of those early settlers, like Cecil Etter, born at the beginning of the twentieth century in a house that still stands near the confluence of Honeydew Creek and the Mattole River, reported an ever-ready supply of salmon and steelhead before the floods of 1955 and 1964. Those fish were easily caught for the table or smokehouse with a pitchfork or gaff hook in "any creek of the Mattole." With a twinkle in his eye, he added, "before the war (WWII) no-one knew what a fishin' pole was, or what one was good for in regards to salmon or steelhead," (C. Etter, personal communication).

More recent accounts from Mattole anglers like Lynn Mantooth, "Hippie Bob," and the "Nevada Boys," fishing in the 1945 – 1970 period, describe a fabled sport fishery where in good stream conditions a group of four or five anglers could expect to hook and release over a hundred fish, mostly steelhead, in a day of fishing (J. Clary, personal communication). Salmon poaching beneath the Petrolia Bridge, and elsewhere, was a viable means of making a "little Christmas money" by selling fresh and smoked salmon as late as the 1960s, (C. Wright, personal communication).

By the late 1970s, those fish populations had collapsed to levels that alerted locals to their depressed condition, and initiated the formation of the Mattole Salmon Group. In 1981, the Mattole Salmon Group with the cooperation of landowners, and the support of the California Department of Fish and Game (CDFG), and others like the Mattole Restoration Council, began stock restoration activities that included public education, artificial propagation, and habitat improvements. Their efforts have been important in preserving the Mattole's fragile fishery stocks in the face of very challenging conditions.

Today, those ancient and robust Mattole Basin salmon and steelhead stocks, like most on California's North Coast, are depressed to levels that have led to listing of coho, Chinook, and steelhead under the authority of the Endangered Species Act. Additionally, we have enough current water quality observations to believe that the residents of the Mattole Basin in 2001 would likely not have thought to name their valley's river "clear water."

Location and Area

The Mattole Basin encompasses approximately 296 square miles of Northern California's Coast Range (Figure 7). Although nearly three percent of the Mattole's headwaters are in Mendocino County; the vast majority of the basin is within Humboldt County. The mainstem Mattole River is approximately 62 miles long, and receives water from over 74 tributary streams. There are approximately 545 perennial stream miles in the basin. The basin drains into the Pacific Ocean just south of Cape Mendocino. During most summers, a sand-spit encroaches all the way across the river mouth to form a bay mouth barrier, which creates a lagoon behind it. Generally, the barrier remains until runoff from fall rains breeches it. However, in some years, large swells at times of high tide overtop the barrier and a new outlet channel is carved through the barrier. This overtopping has occurred up to six times during a year before the lagoon finally remained closed.

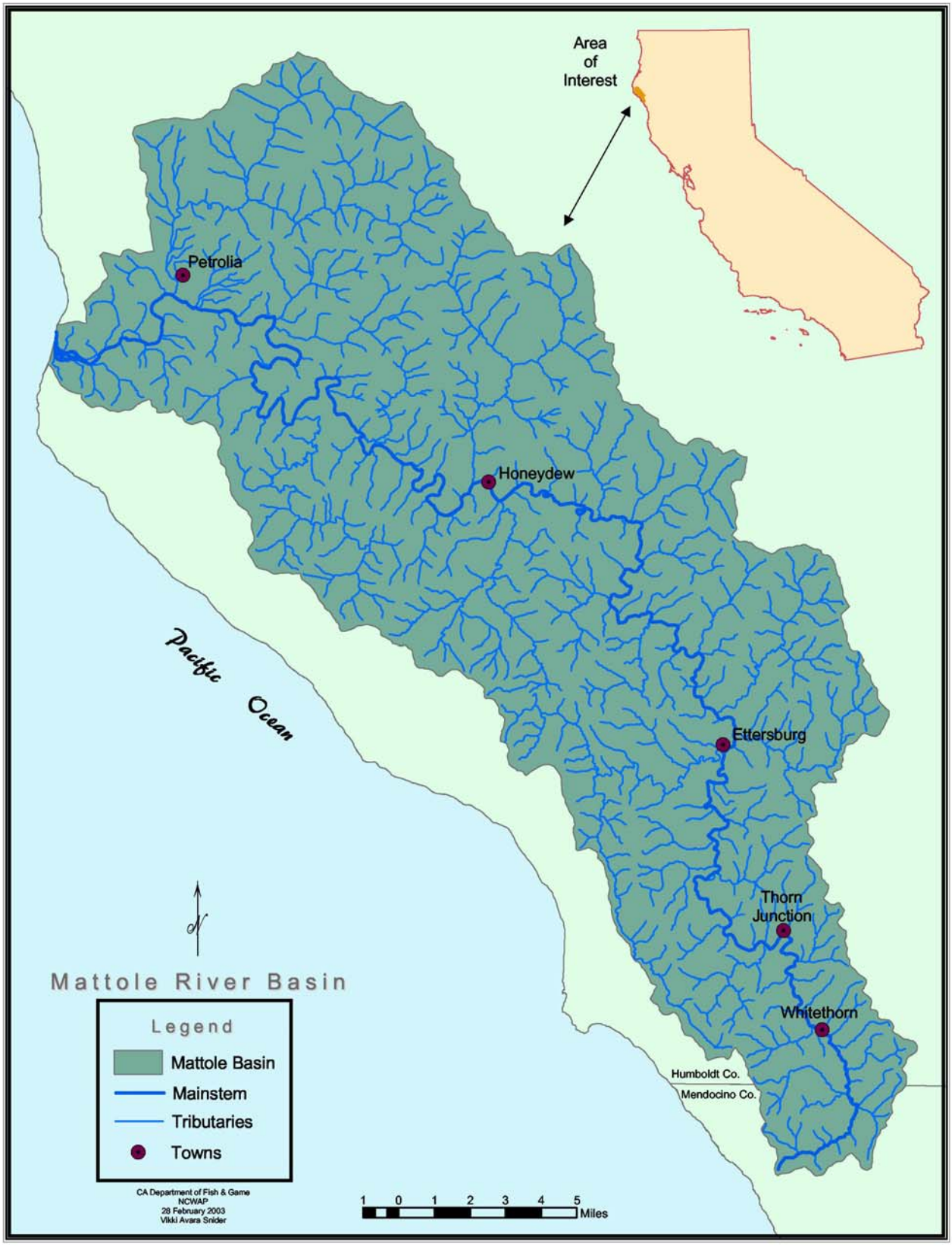


Figure 16. Mattole Basin and Tributaries.

The Mattole Basin is mostly steep mountainous topography. The basin's higher elevation slopes commonly exceed 15 percent gradient. Broad, alluvial streamside flats are present in the lower valleys. The lower stream channels are dominated by large gravel bars typically composed of cobble, gravel, and fine sediments (Elements of Recovery, 1989). Headwater elevations range from 1,350 feet at Four Corners at the mainstem headwaters, to 4,088 feet at Kings Peak, which is located less than three miles from the ocean and is the tallest mountain in the coastal range.

Mattole Subbasin Scale

For the purpose of the NCWAP study of the Mattole Basin, the basin has been divided into five subbasins based on twenty-five distinct planning watersheds as defined by CalWater 2.2a. Four of the five subbasins in the basin were designated based on geography, geology, climate patterns, and land use, and conforms to CalWater 2.2a Planning Watershed boundaries. The fifth subbasin, the Estuary, has been designated as a distinct subbasin for this study because of the importance of the estuarine environment as a down-migrant holding area for juvenile fish stocks.

- The Estuary Subbasin is two square miles in area and contains the basin downstream of the confluence of lower Bear Creek and the Mattole mainstem. The estuary drains the Mattole River to the Pacific Ocean. The Mendocino Triple Junction, where the Gorda, the North American, and the Pacific geologic plates meet, occurs in the vicinity of the estuary, making the Mattole Basin as a whole one of the most tectonically active in California. The southern extent of the basin is owned and managed by the BLM as part of the King Range National Conservation Area.
- The Northern Subbasin is located between the estuary and Honeydew Creek; one of three towns in the watershed, Petrolia, is located near the confluence with the North Fork Mattole River and the Mattole mainstem. It drains an area of 98 square miles and contains some of the largest continuous areas of large landslides and high to very high landslide potential of all the subbasins. The largest contiguous old growth forest remaining in the entire watershed can be found here, but vegetation type is predominantly second-growth mixed hardwood/Douglas Fir forest, although grasslands are a significant component. It is partially bordered on the east side by Humboldt Redwoods State Park. Steelhead are currently present in the subbasin. Based on previous CDFG surveys, coho were once found here.
- The Eastern Subbasin is located between Honeydew Creek and Bridge Creek; the second of the three towns, Honeydew, is located near the confluence of Honeydew Creek and the Mattole mainstem. It drains an area of 79 square miles and geology and slope stability varies widely. Much of the land in this subbasin has been converted from large ranchlands to rural sub-divisions. The predominant vegetation type is second growth mixed hardwood/Douglas fir forests. Coho, Chinook, and steelhead trout can all be found in this subbasin.
- The Southern Subbasin is located south of Bridge and McKee Creeks and encompasses the headwaters of the Mattole River at the southern end. It is divided between Humboldt and Mendocino Counties. The third of the three towns, Whitethorn is located near the confluence of upper Mill Creek (RM 56.2) and the Mattole mainstem. It drains an area of 28 square miles and contains the largest continuous areas of hard terrain and lowest landslide density of the subbasins. The predominant vegetation type is mixed hardwood/coniferous forest including old and second growth Redwood forests. This subbasin is the most densely populated of the subbasins but is considered to have some of the best remaining fish-rearing habitat of the entire basin. Coho, Chinook, and steelhead trout can all be found in this subbasin.
- The Western Subbasin is located from the border with the Estuary in the north to the headwaters of Bear Creek in the south. It drains 89 square miles and geology and slope stability varies. Much of this subbasin is under public ownership, managed by the BLM as part of King Range National Conservation Area. The predominant vegetation type is second growth mixed hardwood/Douglas fir forest. King Peak, at 4,088 feet is the highest elevation in the basin. Coho, Chinook, and steelhead trout can all be found in this subbasin.

Figure 17. Mattole River with Subbasins and Tributaries.

Table 7. General attributes for the Mattole subbasins.

	Estuary	Northern	Eastern	Southern	Western	Total
Square Miles	2	98	79	28	89	296
Acreage, Total	1,326	62,857	50,794	17,640	57,144	189,761
Private Lands (Acres)	939	62,028	47,897	15,158	30,462	156,484
Public Lands (Acres)	385	829	2,897	2,482	26,682	33,277
Principal Communities	Petrolia	Petrolia, Honeydew	Ettersburg, Thorn Junction	Thorn Junction, Whitethorn	Honeydew, Ettersburg	
Predominant Geology	Quaternary fluvial, beach, and dunes deposits	Franciscan Coastal Terrane; minor Yager terrane & Wildcat Group; Quaternary surficial deposits	Franciscan Central belt; Yager terrane; Coastal terrane	Franciscan Coastal Terrane	Franciscan Coastal terrane; King Range terrane	
Predominant Vegetation Type	Grassland, Hardwood Forest	Oak, Grassland, Douglas Fir, Hardwood Forest	Douglas Fir, Hardwood Forest	Douglas Fir, Hardwood Forest, Redwood Forest	Douglas Fir, Hardwood Forest	
Predominant Land Use	Recreation	Ranching Timber Production	Ranching Timber Production	Rural Residential Timber Production	Recreation	
Rainfall	60 in.	50-115 in.	80-115 in.	70-85 in.	60-100 in.	
Miles of Blue Line Stream	61.0 (Mainstem Mattole)	69.4	49.9	27.5	85.6	303.4
Low Elevation (ft)	Sea Level	20	344	930	20	Sea Level
High Elevation (ft)	20	2,500	2,300	1,500	2,800	4,087
Fish Habitat Conditions	High summer temps; heavy sediment; lack of pool depth and cover; Steelhead only	Good Steelhead populations despite warm summer temps; little canopy; Steelhead only	High summer temps; high sediment little canopy; LWD adequate; Steelhead and Coho	Favorable water temps; good canopy; good LWD; Steelhead, coho, Chinook	Favorable temps in small tribs/upper reaches of larger tribs; good canopy; Steelhead, coho, Chinook	
Fish Species	Chinook salmon Coho salmon Steelhead trout Pacific Lamprey Coast Range sculpin Prickly sculpin Threespine stickleback Surf smelt Redtail surfperch Shiner surfperch Walleye surfperch Staghorn sculpin Speckled sanddab Starry flounder	Chinook salmon Coho salmon Steelhead trout Pacific Lamprey Coast Range sculpin Prickly sculpin Threespine stickleback	Chinook salmon Coho salmon Steelhead trout Pacific Lamprey Coast Range sculpin Prickly sculpin Threespine stickleback	Chinook salmon Coho salmon Steelhead trout Pacific Lamprey Coast Range sculpin Prickly sculpin Threespine stickleback Green sunfish	Chinook salmon Coho salmon Steelhead trout Pacific Lamprey Coast Range sculpin Threespine stickleback	Chinook salmon Coho salmon Steelhead trout Pacific Lamprey Coast Range sculpin Prickly sculpin Threespine stickleback Surf smelt Redtail surfperch Shiner surfperch Walleye surfperch Staghorn sculpin Speckled sanddab Starry flounder

Climate

The Mattole Basin has a Mediterranean climate characterized by cool wet winters with high runoff, and dry warm summers with greatly reduced flows. Most precipitation falls as rain. Along the coast, average air temperatures range from 46 to 56°F. Further inland, annual air temperatures are much more varied, ranging from below freezing in winter to over 100°F in summer. The Mattole Basin receives one of the highest annual amounts of rainfall in California averaging 81 inches. Average rainfall near the coast in Petrolia is about 60 inches per year and well over 100 inches per year falls near the center of the basin in Honeydew. Extreme rain events do occur, e.g. over 240 inches fell over parts of the basin during 1982-83.

Hydrology

The Mattole Basin lies within the Cape Mendocino Hydrographic Unit, a subunit of the Eel River Hydrographic Area as described by the Department of Water Resources in Bulletin Series 94-8. The Mattole River Hydrographic Unit Code: 18010107 as described by the United States Geologic Survey (USGS). The Department of Water Resources (DWR), Statewide Planning Program delineates the Mattole Basin within the North Coast Hydrologic Region (HR), the Coastal (#03) Planning Subarea (PSA), and the Mattole-Bear (#27) Detailed Analysis Unit (DAU).

Winter monthly stream flows in the Mattole River measured near Petrolia average between 1,710 and 4,170 cubic feet per second (cfs). However, peak flows measured on December 22, 1955 and December 22, 1964 were 90,400 and 78,500 respectively. Bank full discharge at Petrolia occurs at approximately 31,000 cfs. "Summer and fall flows drop below 60 cfs, with a minimum measured flow of 15 cfs" (Department of Water Resources).

High seasonal rainfall on bedrock and other geologic units with relatively low permeability and steep slopes contribute to the very flashy nature of the Mattole's watersheds. In addition, the runoff rate has been increased by extensive road systems and other land uses. High seasonal rainfall combined with a rapid runoff rate on unstable soils delivers large amounts of sediments to the river. As a result, the Mattole River transports a very high sediment load. This sediment is deposited throughout the lower gradient reaches as it is transported downstream through the system.

Diversions, Dams, and Power Generation

There are 50 licensed, permitted, or pending water rights within the Mattole Basin. This number does not include riparian users and other diversions that are not registered with the State Division of Water Rights (State Water Resources Control Board, 2001). No major dams or power generating facilities are located within the Mattole Basin.

Geology

Bedrock underlying much of the basin has been tectonically broken and sheared making it relatively weak, easily weathered, and inherently susceptible to landsliding and erosion. The unstable bedrock and soil conditions combined with heavy rainfall, high regional uplift rates, and seismicity produce widespread landsliding and large volumes of sediment input to streams. The geologic unit and/or landslide type present can affect the nearby sediment load (i.e., coarse versus fine-grained). The following provides a brief description of the basin geology and related landslide processes. Detailed discussions of the basin geology, associated mass wasting processes and land use issues are provided in the Geology Appendix A, along with 1:24,000 scale maps illustrating spatial distributions of the geologic units and mass wasting features.

Table 8 summarizes the geologic attributes by subbasin. The Mattole Basin is situated in a geologically complex and tectonically active area, with some of the highest rates of crustal deformation, surface uplift, and seismic activity in North America (Merritts, 1996). Basement rocks, assigned to the Coastal belt and Central belt of the Franciscan Complex by Irwin (1960) are predominantly structurally deformed marine sedimentary rocks (McLaughlin and others, 1982, 1983, 1994). The Coastal belt has been divided into three pervasively folded, sheared, and otherwise tectonically-disrupted terranes; from northeast to southwest, separated by generally northwest-trending shear zones, are the Yager, Coastal, and King Range

terranes (McLaughlin and others, 1997). Late Cenozoic marine and non-marine deposits (Wildcat Group or equivalent) underlie a limited area of the watershed west and northwest of Petrolia. Quaternary alluvial deposits cover the bedrock along streambeds in the lower reaches of some tributaries and mainstem Mattole River, while remnants of older surficial deposits are locally preserved on elevated fluvial terraces in some valley areas and on wave-cut terraces along the coast.

Table 8. Geologic attributes summary in the Mattole Basin.

	Estuary	Northern	Eastern	Southern	Western	Coastal
Predominant Geologic Unit(s)	Quaternary fluvial, beach, and dunes deposits	Franciscan Coastal Terrane; minor Yager terrane & Wildcat Group; Quaternary surficial deposits	Franciscan Central belt; Yager terrane; Coastal terrane	Franciscan Coastal terrane	Franciscan Coastal terrane; King Range terrane	King Range terrane; Franciscan Coastal terrane
Predominate Rock/Soil Conditions	Unconsolidated, migrating sand and gravel deposits	Weak, broken argillite and mélange; thick, clayey soils	Intact sandstone and argillite cut by broad shear zones with weak rock and clayey soils	Relatively strong, intact sandstone and argillite; thin, sandy soils	Relatively intact sandstone and argillite in King Range; more broken in eastern and northern areas	Relatively intact sandstone and argillite in King Range; more broken in eastern and northern areas
Typical Mass Wasting	Sediment transport/ deposition	Abundant earthflows; rock slides; composite slides; gully and stream bank erosion	Debris and rock slides in strong rock areas; earthflows, composite slides and gullies around shear zones	Debris slides; scattered deep-seated rock slides	Debris slides, deep-seated rock slides and debris flows	Debris slides, deep-seated rock slides and debris flows
Relative Degree of Stream Disturbance	N/A	Highest in basin	High in specific portions of subbasin	Lowest in basin	Highly variable throughout subbasin	N/A

Through photo-interpretive mapping, McLaughlin and others (2000) further subdivided the Central belt and each terrane within the Coastal belt into three or four subunits, which form the geologic map units depicted on Plate 1 of the geologic report. These subunits are based on topographic expression and general changes in lithology and structural condition of the rock. For example, where sandstone dominates and is relatively intact (i.e., subunits y3, co4, and krk3 on Plate 1), hard topography, consisting of sharp-crested ridges with steep slopes and well-incised drainages, tends to develop. The pervasively sheared, clay-rich mélange (i.e., subunits cm1 and co1) generally form soft topography, characterized by rounded hilltops with gentle slopes and poorly developed sidehill drainages. Additional subunits of McLaughlin and others (2000) show topographic characteristics between these two end members. These subunits show a good correlation with the different types of mass wasting processes that occur in the study area, as discussed in Analyses and Results by Subbasin later on in this document.

The bedrock map units have been consolidated into three groups, herein referred to as hard, moderate, and soft geomorphic terrains. Specifically, the bedrock map units have been grouped into geomorphic terrains as follows:

- Soft Terrain – Geologic subunits identified as having the greatest landslide density (cm1, serpentinite, and co1 on Plate 1, geologic report).
- Moderate Terrain – Geologic subunits identified as having intermediate landslide density (y1, co2, and krk1), along with the small units of different lithology (e.g., cols, krb) which collectively underlie less than 1% of the study area.

- Hard Terrain – Geologic subunits identified as having the lowest landslide density (y2, y3, co3, co4, krk2, and krk3).

The unconsolidated Quaternary deposits mapped overlying the bedrock are grouped together as a fourth geomorphic terrain. The terrain distribution for the entire Mattole Basin is presented on Figure 18. These terrains show a strong correlation with mapped landslide occurrence and type, and provide a simplified division of the watershed based on geology and landform that is useful in the analysis of other spatial data. The distribution of active and dormant slides in each of the three bedrock geomorphic terrains is shown on Figure 19, Figure 20, and Figure 21.

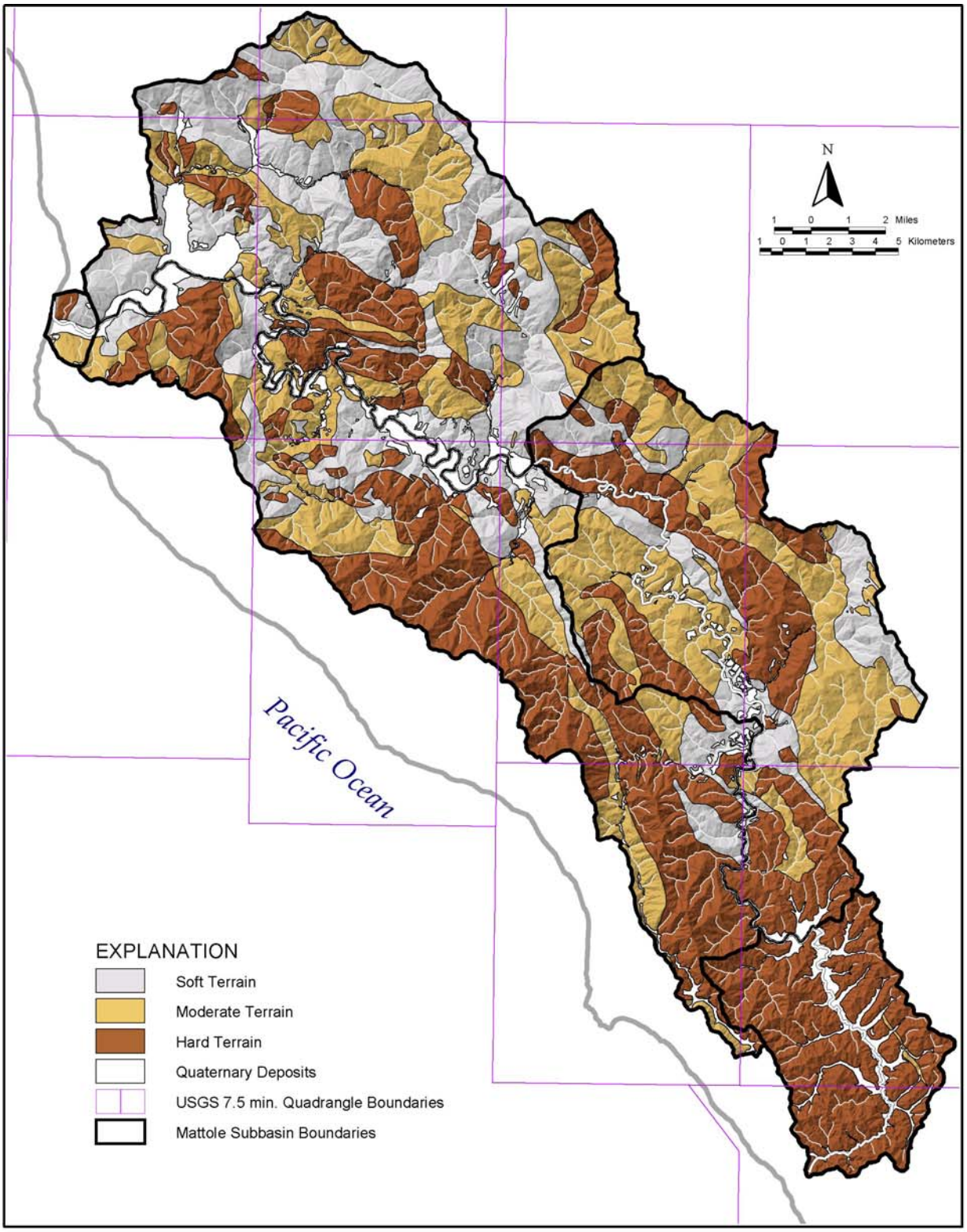


Figure 18. Distribution of geomorphic terrains within the Mattole Basin.

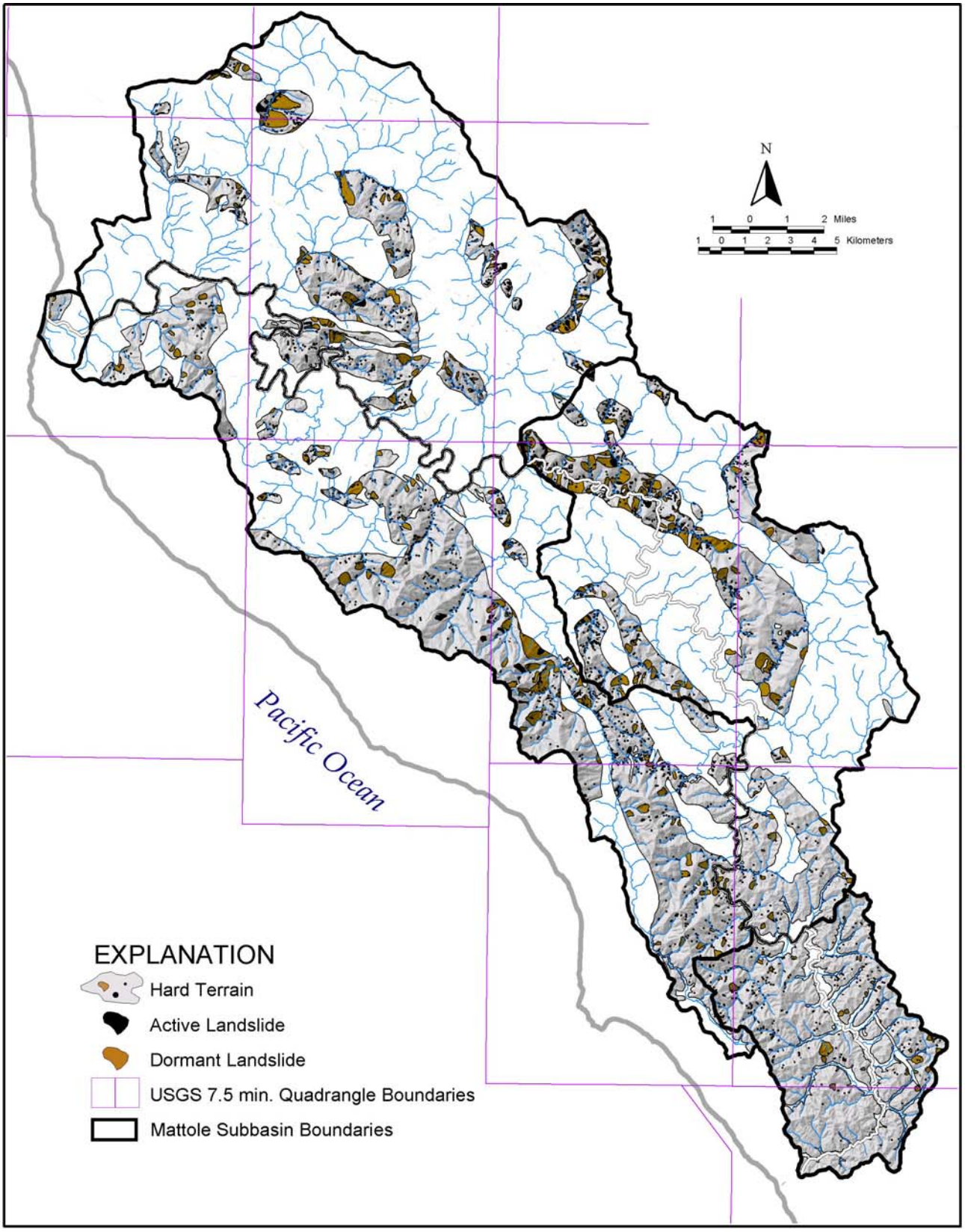


Figure 19. Occurrence of historically active and dormant landslides on hard terrain.
Dots represent slides smaller than approximately 100 feet in diameter.

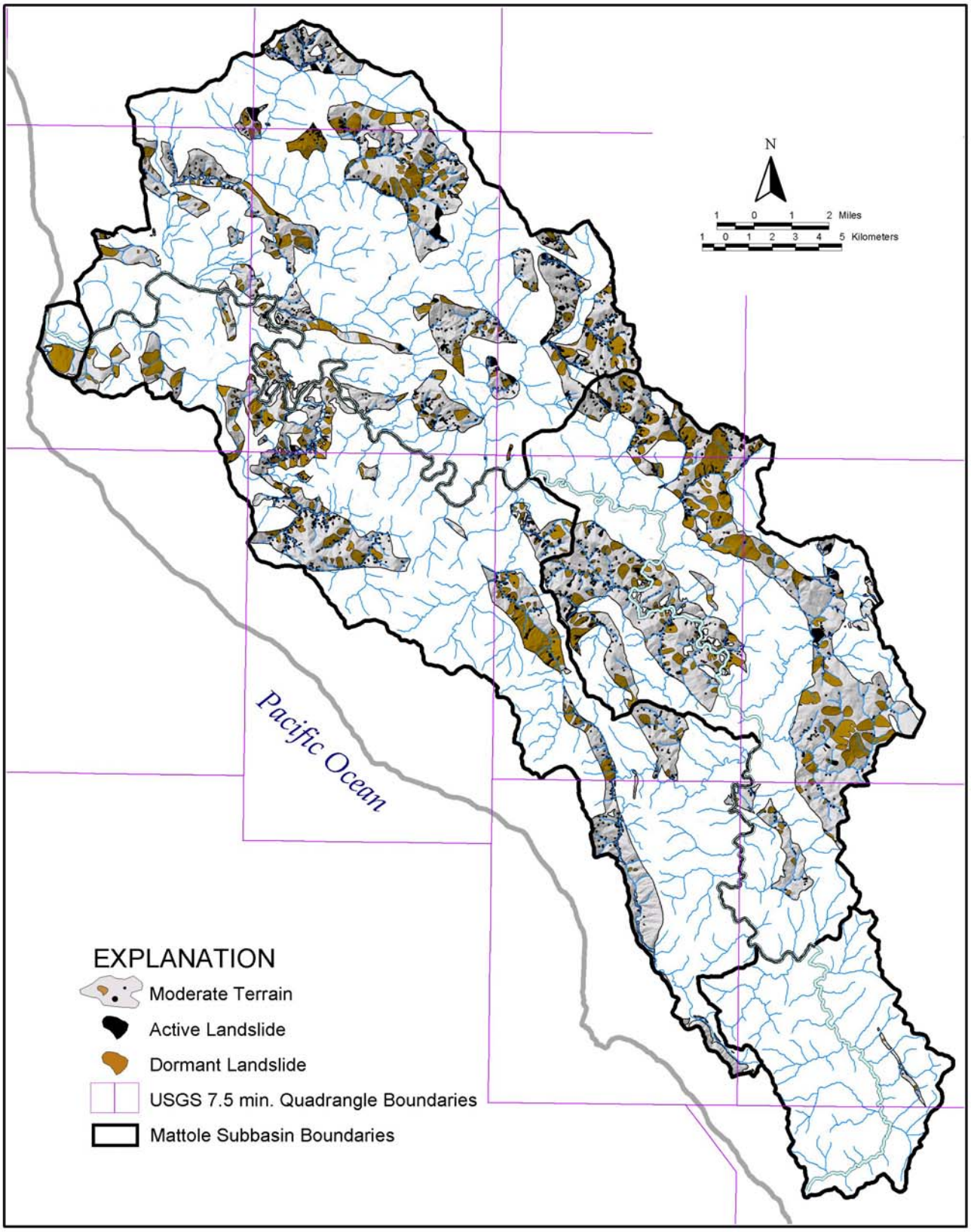


Figure 20. Occurrence of historically active and dormant landslides on moderate terrain.
Dots represent slide smaller than approximately 100 feet in diameter.

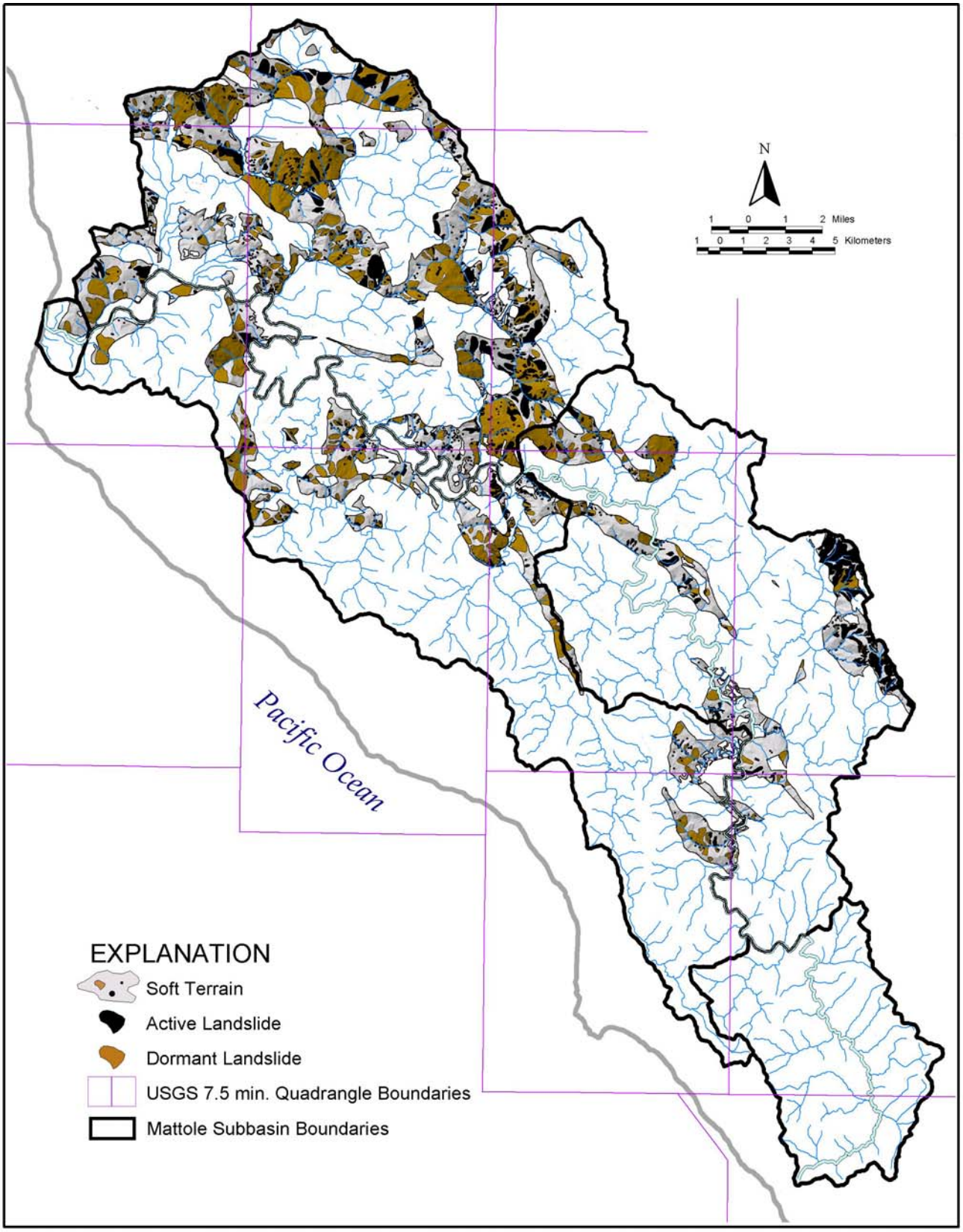


Figure 21. Occurrence of historically active and dormant landslides on soft terrain.

Faulting, Seismicity, and Regional Uplift

The Mattole Basin is located in a complex tectonic setting near the junction of three crustal plates (North American, Pacific, and Gorda). The region experiences a high level of seismic activity, and major earthquakes have occurred in intraplate areas as well as along well-defined faults (Dengler et al., 1992).

The major fault structures within the Mattole Basin study area are the Cooskie and Petrolia shear zones, and the San Andreas Fault (Geology Report, Appendix A, Figure 3). The Cooskie shear zone, a poorly defined zone of sheared and broken rock, extends easterly from Punta Gorda. The Petrolia shear zone is a similar structure, extending southeast through Petrolia toward Honeydew along the Mattole River. If the Cooskie and Petrolia shear zones are on-land extensions of the offshore plate boundary fault systems (the Mendocino fracture and the Cascadia subduction zone, respectively), they may represent significant, potentially-active fault zones (McPherson and Dengler, 1992; Clarke and McLaughlin, 1992).

Major historical earthquakes in the region have occurred in intraplate zones as well as along well-defined faults (Dengler and others, 1992; Oppenheimer and others, 1993). For example, the rapid uplift described below is being accommodated along a system of thrust faults, some of which may not extend upward to the ground surface (McLaughlin and others, 2000; Geology Report, Appendix A, Figure 5). The Honeydew earthquake (August 1991, M 6.2) occurred on one of these faults, when the southwest block was thrust upward over the northeast block at depth. Although the earthquake reactivated landslides and resulted in a zone of ground cracking, the rupture surface along the fault plane did not extend to the ground surface (McPherson and Dengler, 1992). Similarly, the main shock of the Cape Mendocino earthquake (April 1992, M 7.1) centered near Petrolia occurred on a low-angle thrust fault near the base of the North American plate that caused significant ground shaking and coastal uplift, but did not produce surface rupture (Oppenheimer and others, 1993). The two largest aftershocks to the Cape Mendocino earthquake apparently occurred within the Gorda plate offshore and were both M 6.6 events (Oppenheimer and others, 1993).

High rates of regional uplift provide a regenerating source of sediment to the watershed. Wave-cut Holocene (<10,000 years old) platforms along the coast have been elevated up to more than 50 feet above a rising postglacial sea level (Merrits, 1996). Elevated alluvial and strath terraces along the Mattole River indicate that relatively high rates of uplift persist inland within the watershed. Following the 1992 Cape Mendocino earthquake sequence, extensive mortality of intertidal organisms from coastal emergence indicated a rough maximum of 1.4 m of coseismic uplift occurred between Cape Mendocino and the South side of Punta Gorda (Carver and others, 1994).

Landslide Potential

Once relevant relationships between geology and landsliding were recognized, a landslide potential map was created by CGS using the GIS as a tool to capture the geologists' interpretation of relative landslide potential within the study area. This Landslide Potential Map was generated using a matrix that assigns relative landslide potential levels to areas, based on landslide feature type and activity, geomorphic features, geology, and slope found within the watershed. The Relative Landslide Potential for the Mattole Basin was defined and illustrated in five categories, from 1 (lowest) to 5 (greatest landslide potential). The Landslide Potential Map was produced at a scale of 1:24,000, and is presented on Plate 2 in the Geologic Report, Appendix A. The methods and matrix used to develop the Landslide Potential Map are discussed in further detail in the Geologic Report Appendix A

The results of the landslide potential evaluation are dominated by potential categories 3 through 5. This is considered reasonable in this geologically active watershed (Figure 22,

Figure 23, Figure 24, and Figure 25). Overall, approximately 52% of the Mattole Basin has high to very high landslide potential. The results of the landslide potential evaluation are discussed further in the Analyses and Results by Subbasin section of this report.

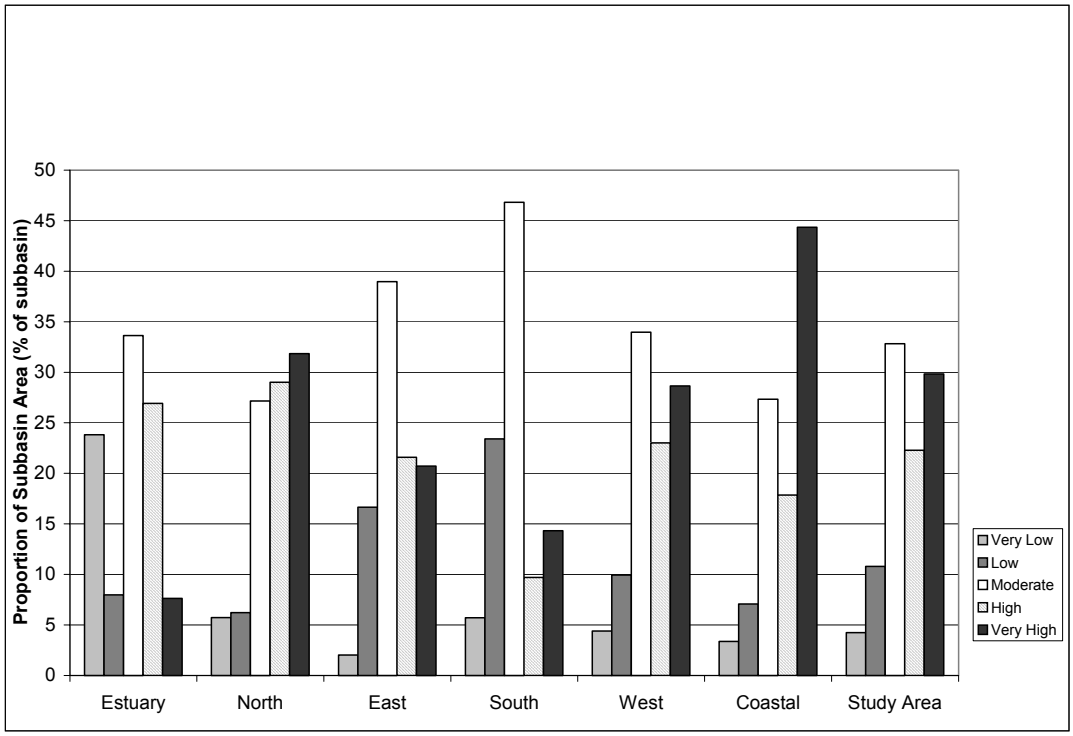


Figure 22. Proportions of each subbasin area that was assigned to the various landslide potential categories.

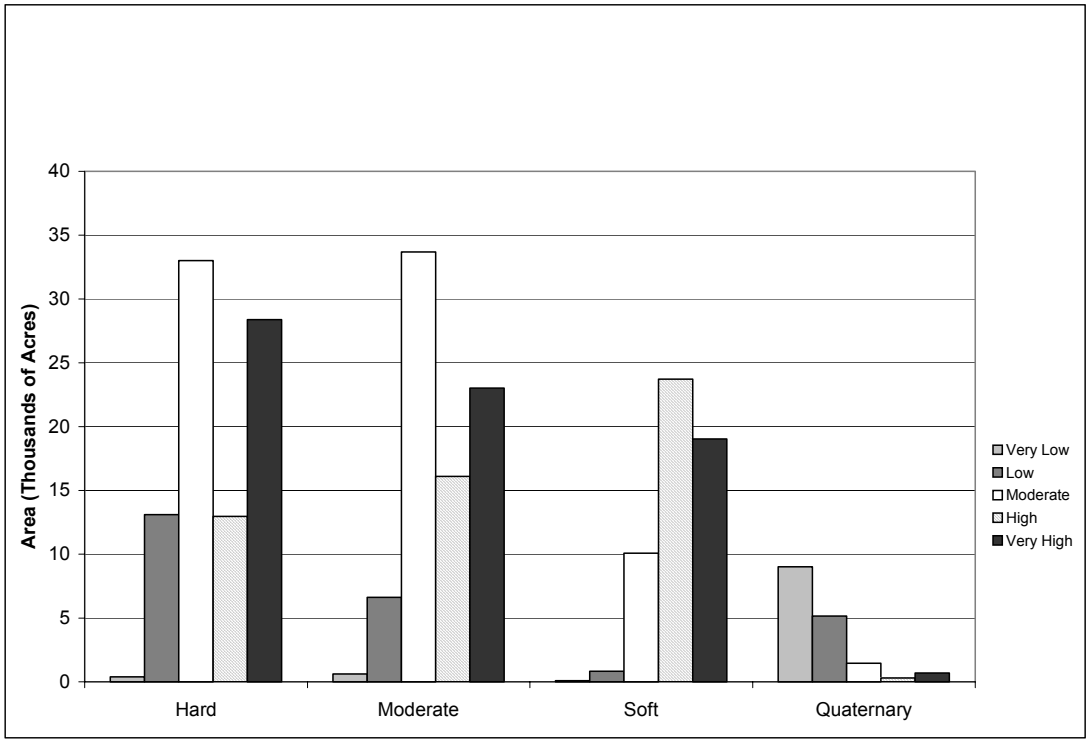


Figure 23. Area within each terrain type that was assigned to the various landslide potential categories.

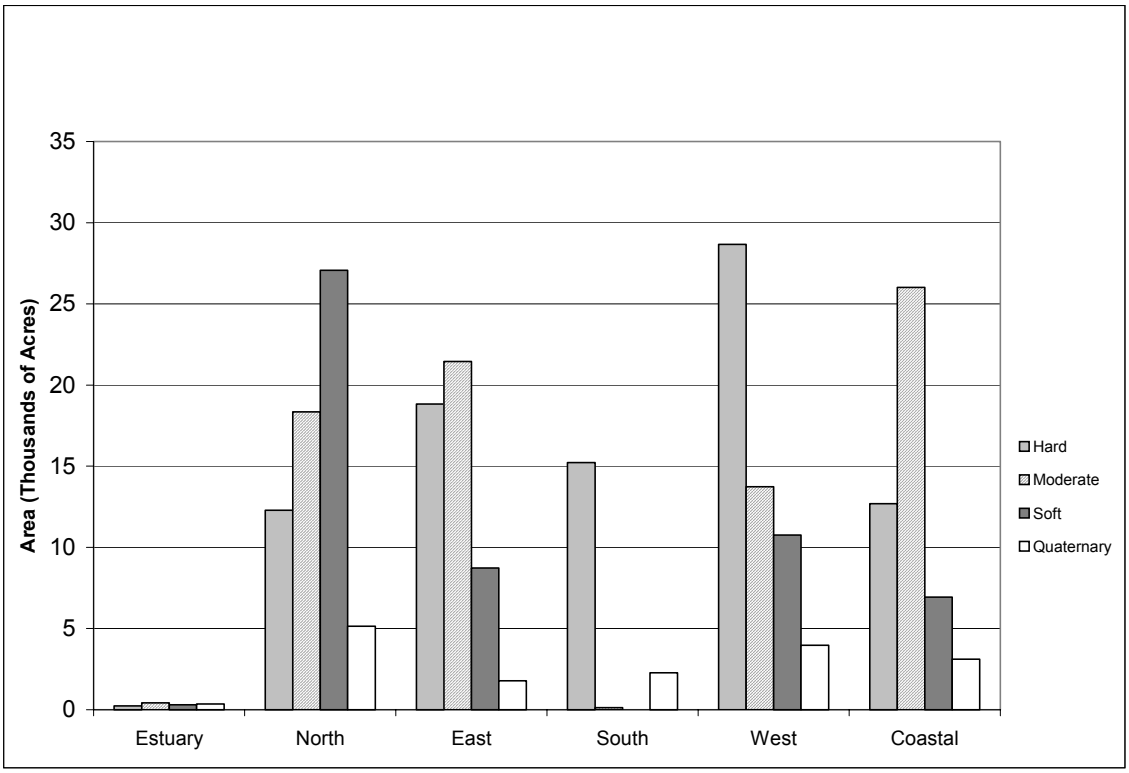


Figure 24. Area within each subbasin occupied by each of the various geomorphic terrains.

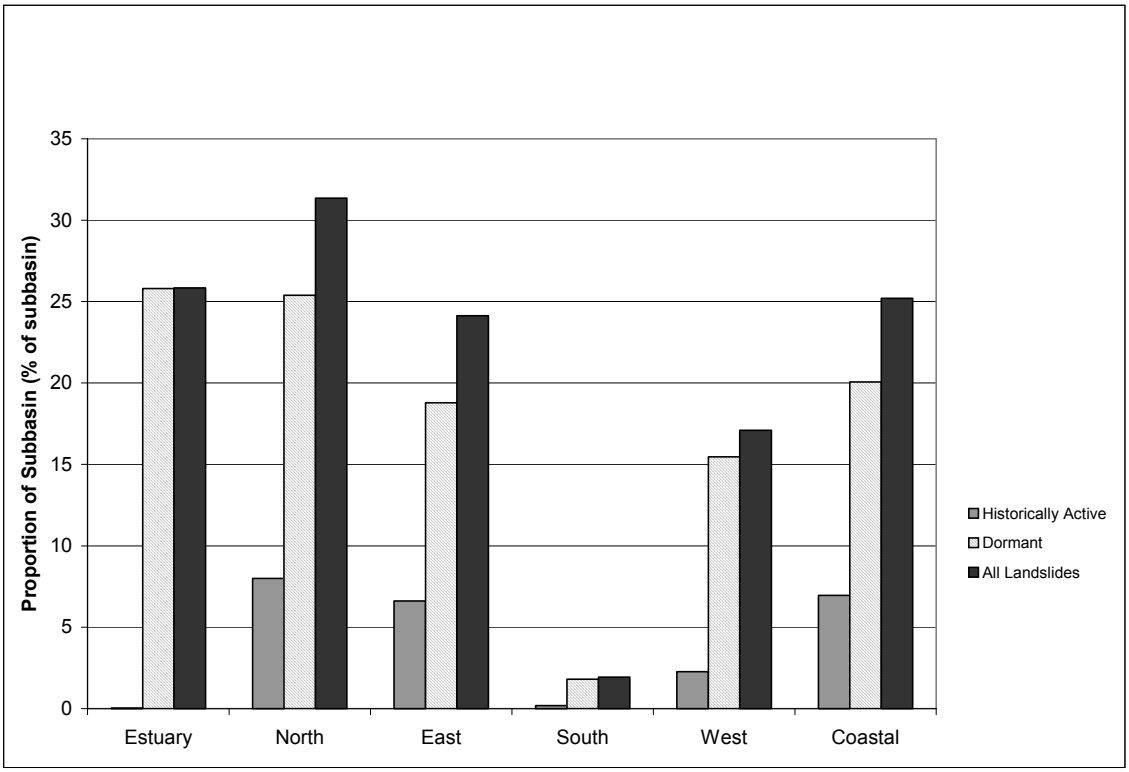


Figure 25. Percentage of each subbasin underlain by historically active and/or dormant landslides.

Those too small to delineate at map scale were assumed to have an average area of 400 square meters (approximately 4,505 square feet), and were combined with larger mappable landslides. Histogram reflects data from 1981, 1984, and 2000 photographs. Portions of dormant landslides overlain by historically active landslides were not included in the collective totals.

Vegetation

Prior to European settlement, coniferous forest extended throughout most of the 190,000 acre Mattole Basin. Natural prairie grassland is concentrated on the northwestern portion of the basin, but prairie soils occur throughout the basin, mostly on ridgetops. The structural attributes, seral stages, and mix of species on the forestlands are determined by a combination of physical, biological, and disturbance factors. Physical factors include soil, moisture, temperature, and topography. The Mattole Basin is unusual within the Northern California coast as having very little redwood forest present; it is thought to be primarily due to the King Range blocking the summer fog. The interaction between soil types and strong salt-laden air are also possible factors that influence the redwood free areas of much of the Mattole and Bear River basins (Zinke, 1996). Forested stands consist primarily of tan-oak and Douglas-fir as the major tree species. Madrone, big-leaf maple, chinquapin, bay, canyon live-oak, and alder occur as minor components whose occurrence generally varies according to soil type, slope, and aspect controlling summer moisture regimes. Seral stages are dependent upon disturbance regimes, both natural and human induced. Natural disturbance includes fire started by lightning. Other coniferous species include yew, isolated sugar pine stands, and redwood in the southern headwaters.

The current vegetation (Figure 26) is predominately forestland. Mixed conifer and hardwood forestland occupy 57% of the watershed while hardwood forests occupy 17% and coniferous forests occupy another 8%. Annual grasslands occupy 15% of the watershed. All other vegetation types occupy the remaining three percent of the watershed. With the exception of the estuary and areas where the river broadens out, there are no lakes or other reservoirs of significant size. Half of the watershed is covered by trees that have an average size of 12-24 inches diameter at breast height (dbh). Twenty percent of the area is covered by stands that average greater than 24-inch dbh trees and another 11% is covered by pole-sized trees 6-11 inches dbh.

Vegetation age classes in the Mattole Basin are quite young except for the scattered remaining un-entered old-growth stands. These are in protected status where they are in public ownership. The last stands of old growth in the Northern Subbasin are in private ownership and timber-harvesting plans there are invariably controversial. The previous harvest and grazing activities moved most stands to an earlier successional stage and consequently, hardwoods are now a part of the dominant canopy cover. However, it is clear from aerial photographs from the 1940s that hardwood was a major stand component. Early harvesting activities had a splotchy appearance from small stands and corners being left entirely un-entered and other areas having the appearance of an over-story removal, which left a substantial amount of vegetation in place. Other areas that are classified as forestland have a low level of livestock grazing. The size and location of mapped grasslands has also changed in response to past activities. Many of the existing grasslands are being encroached by woody vegetation. Studies cited in the draft Redwood Creek Watershed Analysis (RNSP 1999) suggest a number of causes including a climatic shift towards the currently cooler and moister climate about 2500 to 2800 years ago (West 1983). While Native American burning practices prior to the arrival of European settlers suppressed the encroachment of Douglas-fir and other woody vegetation, in Redwood Creek the loss of about one-quarter of the prairie and oak woodlands since 1850 is attributed to fire exclusion and road building (Popence et al. 1992).

The hypothesis that the mosaic of vegetation that existed prior to the historic land practices of the last 150 years was probably more varied and in smaller patches than now was tested by the BLM as part of the BLM Honeydew Watershed Analysis (1996). The BLM made a comparison of the 1948 vegetation from soil and vegetation maps prepared by the USDA Forest Service and the State of California Division of Forestry using 1947-48 aerial photography and vegetation data acquired as a part of their analysis project. Their text indicates that of their three sub-watersheds, 90% of the Upper Honeydew sub-watershed has never been harvested, while Beartrap and Eastern Honeydew sub-watersheds were harvested between 1954 and 1966; thus, the patchy and variable 1948 vegetation is characteristic of the pristine vegetation for that time period.

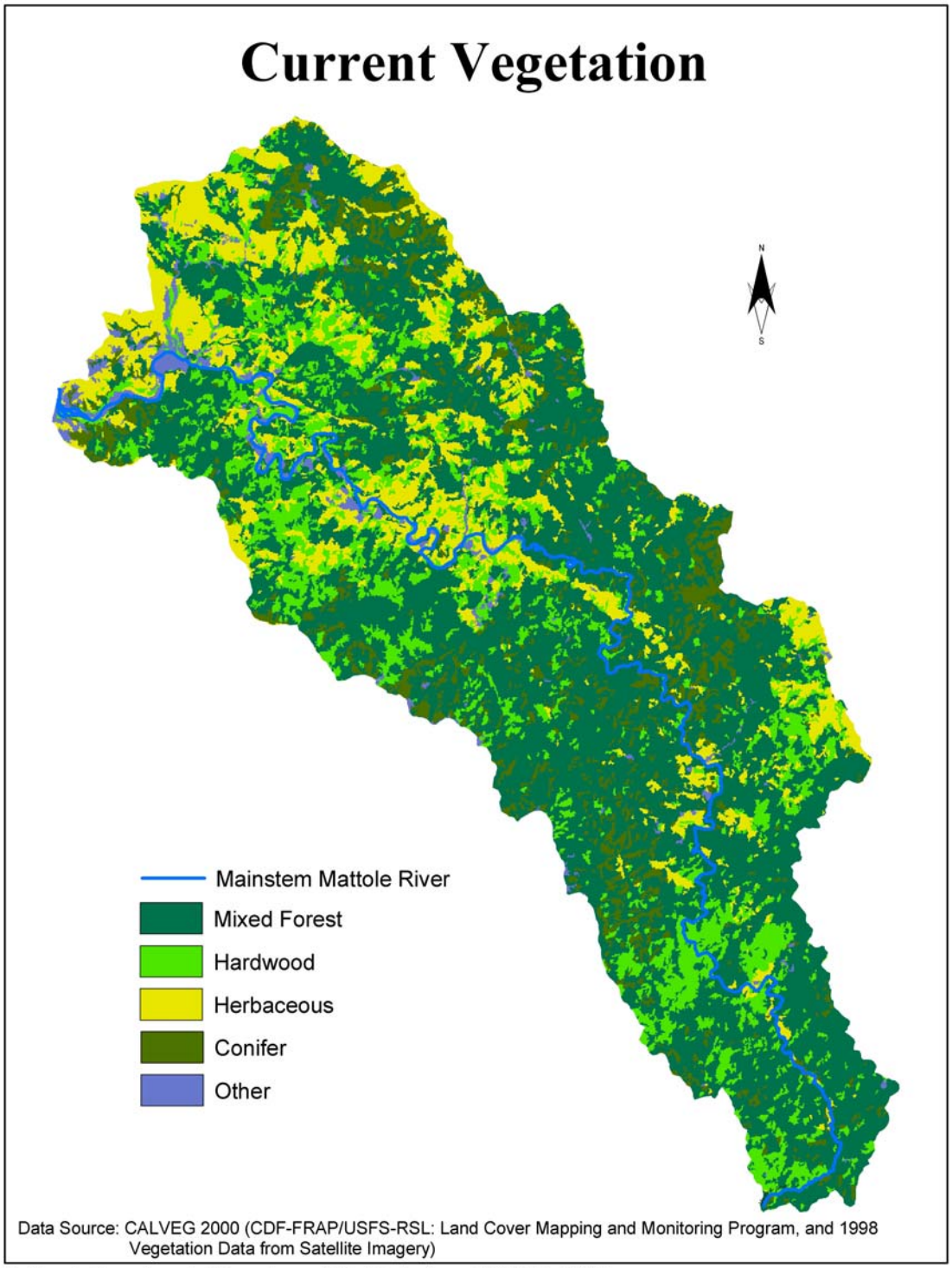


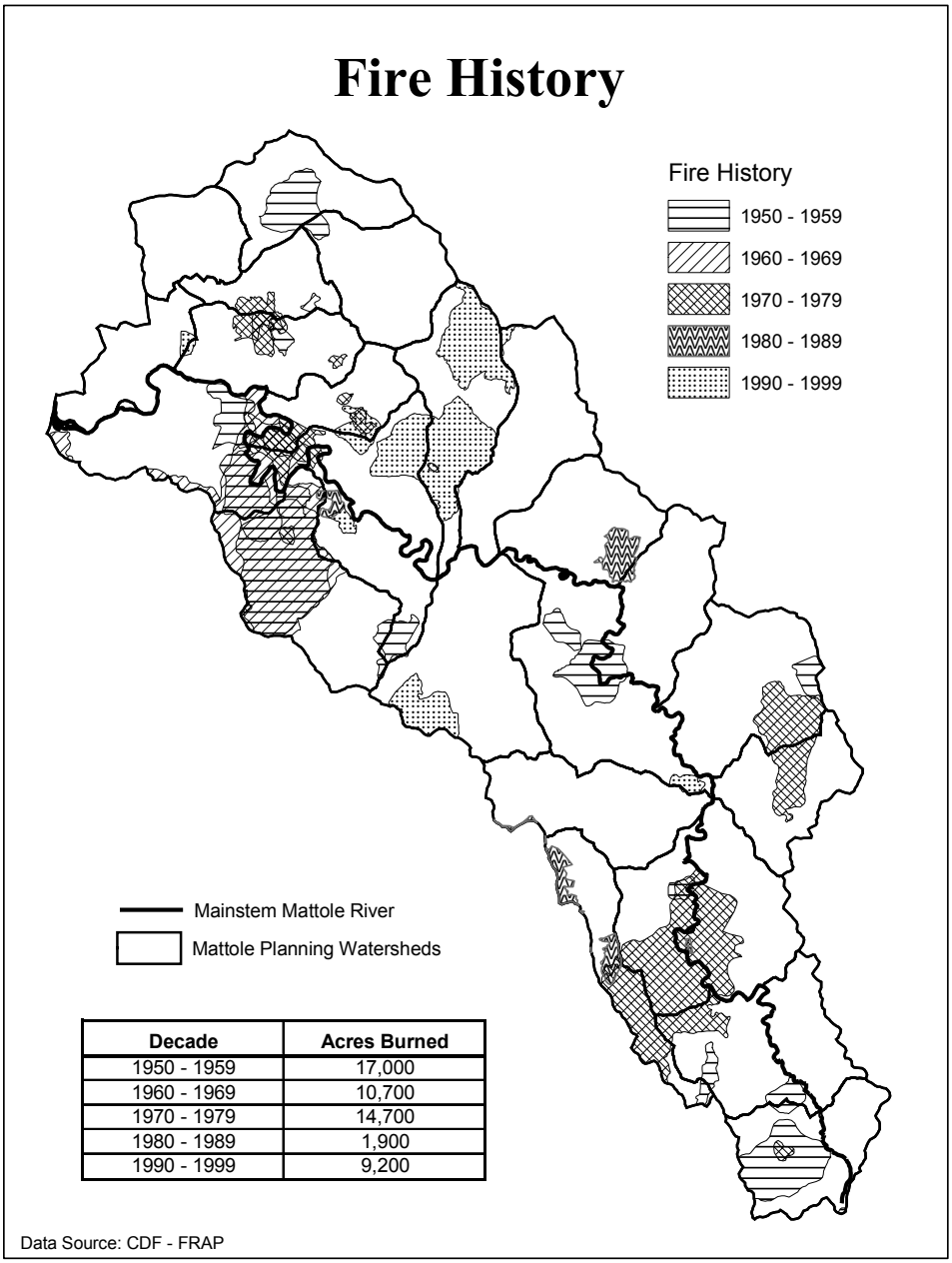
Figure 26. Vegetation map of the Mattole Basin.

Current vegetation is the result of fire history in addition to timber harvesting and grazing. As noted earlier, fire was a natural and frequent visitor to the Mattole Basin. Interviews of Honeydew Creek Watershed residents, as part of the BLM watershed analysis, indicated that many ranchers burned the same areas every two or three years to control poison oak and other brush (Anders 1995). However, active suppression efforts beginning in the 1940s changed the nature of wildlife from frequent, low intensity ground fires to occasional, catastrophic fires. Fires now have the ability to burn through large acreages and to severely damage both upslope and riparian areas, setting back the seral stage. A summer weather pattern of lightning and periods of strong winds, combined with unnaturally high fuel loading may lead to forest

stand replacement wildfire as a major upslope contributor to the quality of anadromous fish habitat within the Mattole Basin.

The towns of Petrolia, Ettersburg, Whitethorn, and Honeydew are all listed in the California Fire Plan as being in a high wildfire threat area and that some or all of the threat comes from federal lands (http://firesafecouncil.org/fireplanindex.html, May 2002). The Mattole Valley/Prosper Ridge area and the Shelter Cove subdivisions, which extend to the watershed boundary, are identified in the CDF Humboldt/Del Norte Ranger Unit Fire Management Plan as being two of the highest risk areas in the County.

A fire risk and fuels model for Humboldt County is being prepared for release at the end of 2002. This same report notes that some of the largest fires in Humboldt and Del Norte County have occurred in this area and suggests that there is a microclimate that provides the potential for the occurrence of extreme fire behavior (CDF 2002). Figure 27 displays wildfires over 300 acres in size and CDF-managed prescribed burns of any size. It does not include site preparation burns after timber harvesting or non-agency sponsored prescribed burning of grasslands by ranchers.



Decade	Acres Burned
1950 - 1959	17,000
1960 - 1969	10,700
1970 - 1979	14,700
1980 - 1989	1,900
1990 - 1999	9,200

California Department of Forestry and Fire Protection - NCWAP - 2002

Figure 27. Fire history of the Mattole Basin.

Population

There are three post office towns in the Mattole Basin: Whitethorn in the headwaters region; Honeydew near the center of the basin; and Petrolia near the mouth. The total Mattole Basin resident population in the year 2000 census was estimated at about 1,200 people.

Census data for the year 2000 was analyzed to provide population estimates for each subbasin. The main Census Bureau statistical levels (in descending order) are: State, County, Census County Division (CCD), Census Tract, Block Group, and Block. The Mattole Basin straddles the Ferndale CCD (northern portion) and the Garberville CCD (southern portion). Additionally, the basin is almost evenly divided between Census Tract 112 (Ferndale) and Census Tract 113 (Garberville). Figure 28shows population and density by square miles and stream miles.

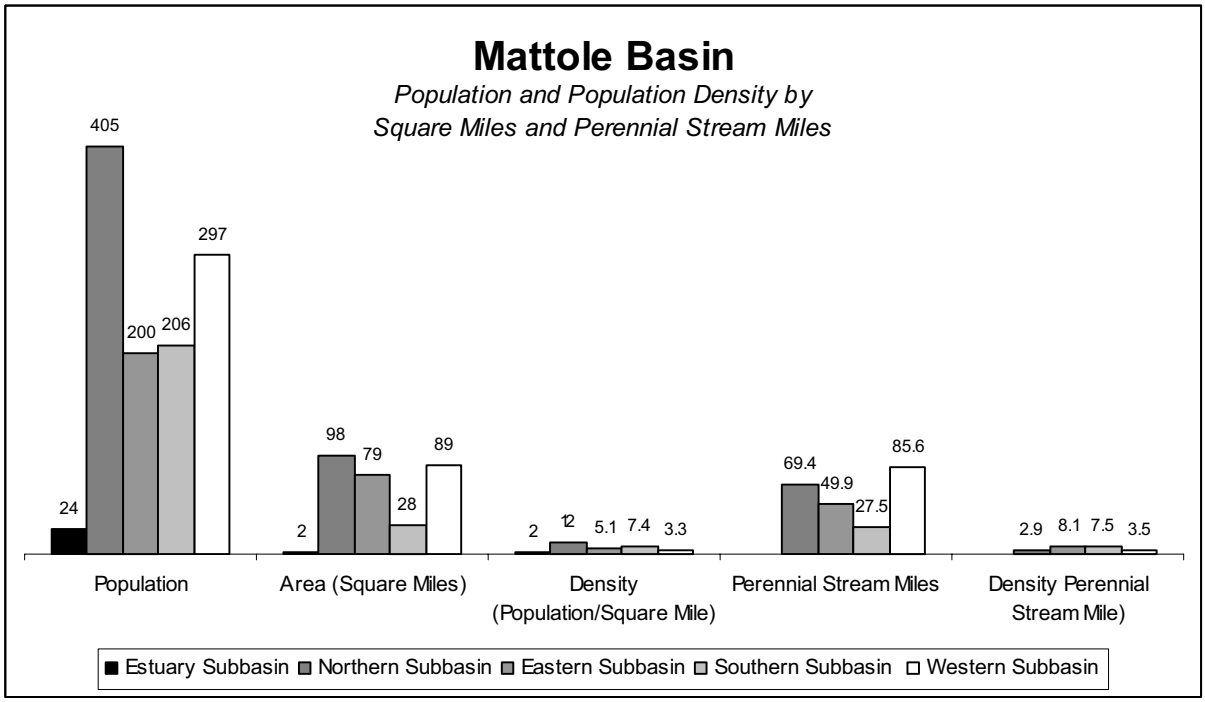


Figure 28. Mattole Basin 2000 census population by subbasin.

Ninety percent of the Northern Subbasin's total population lives within three miles of the population centers of Petrolia or Honeydew, which are both near the southern boundary of this subbasin. The Eastern Subbasin has the most pockets of population. This is due to the numerous rural subdivisions in this area. This trait is shared with the Southern Subbasin. The major difference is that Southern Subbasin populations are concentrated along the Mattole River and its major tributaries. Most of the Western Subbasin population lives near the county roads running along the northern, eastern, and southern edges of this area. These roads lie near the river from the Estuary to Honeydew, near the downstream terminus of the Eastern Subbasin, and then generally follow the ridgetops until reaching the boundary of the Southern Subbasin.

Land Use

The Mattole Basin was occupied by Athabaskan-speaking Mattole and Sinkyone Native Americans when the first settlers from the Eastern United States arrived in the early 1850s. Disputes over hunting ground and domestic stock culminated in a massacre at Squaw Creek in 1864. Survivors were sent to the Round Valley Reservation on the Middle Fork of the Eel River, where most succumbed to the measles epidemic in 1868 (Elements of Recovery, 1989).

The first known white explorer of the Mattole Basin was John Hill of Fort Humboldt, who glowingly described, in an 1854 report, tall clover in the prairies, rich grassland in the valleys, and timbered slopes underlain by wild oats and other grasses (Humboldt Times Weekly, September 23, 1854). Within this report he noted streams with riparian corridors of alder, willow, and cottonwood and the Douglas fir and tan-oak on the slopes. He mistakenly described redwood forests in the nearby woods (W.W. Roscoe, 1940). He also commented on the numerous Indians who appeared to have not seen white men before. This was the only first hand description of the land cited in Elliott's History of Humboldt County, 1881.

W.W. Roscoe provided a series of personal accounts in his self-published monograph, A History of the Mattole Valley, 1940. He recorded this interview of Samuel S. Pollock, one of the first Mattole Valley settlers, in which Mr. Pollock describes the vegetation and condition of the Grange area, about 9 miles upriver of Petrolia. Pollock said:

> "The Mattole Valley was certainly a wonderful sight when I first saw it in the spring of 1857. There were no fences to stop a horseback rider then. I rode my horse all over the valley and right through the tall grass. My horse had hard work to get through the tall grass because it was so badly tangled up. My head would just stick above the grass heads as I sat in my saddle and guided my horse. Every little way a big buck deer or a buck elk, not to mention the little ones, would jump up and run away in the tall grass."
>
> "One day I say (sic) three big grizzly bears besides a number of black and brown bears. Gee whiz, weren't those grizzlies independent! They didn't try to hurt me. They just lumbered out of the way, then sat down and looked at me in a curious sort of way. I felt that it would be best not to go too close to them, so I turned my horse to one side and gave them wide berth. Jingoes, how different things look now. I wonder what the teacher and the children of the Upper Mattole School would think now if I could make them realize what their schoolyard and the country around looked like in June 1857, with the tall grass on the flat six or seven feet high, my horse out of sight as I rode, and that big grizzly bear looking at me from the ridge while the deer and the elk were running away. They can't understand it."

In 1858, just four years after Hill explored the valley, and with the influx of new pioneers, farming began in earnest. The very first settlers were farmers and ranchers who converted native grassland into home sites, home gardens, orchards, and rangeland. As grazing activities increased, conversion of the adjoining forests began. Timber was harvested for local needs or simply felled and then areas broadcast burned for conversion to grazing lands.

Petrolia grew rapidly during the short-lived oil boom of 1864-65. Natural gas vents and oil seeping from the ground began a local land rush that almost doubled the Valley population of 282 to over 450 people by 1870 (Elliott). While many land patents were obtained and numerous test wells drilled, there was never a truly commercial volume of oil produced. Many of the oil seekers remained.

Elliott's 1882 Encyclopedia of Humboldt County noted that the Mattole area produced butter, cheese, wool, beef, mutton, and pork. The encyclopedia further states that though the best fruit of the county grows in the Bear River and Mattole districts, the distance to market was too great for commercial production. This theme of distance to market and poor roads is recurring and has stymied rural prosperity in the Mattole (Roscoe, 1977).

Just after the turn of the century, tannin produced from the bark of tan oak trees became a commercial commodity in the Mattole Basin. The Wagner Leather Company in Briceland processed tan-bark and shipped the solution in barrels to the wharf in Shelter Cove between the years 1901 and 1922 (Cook, 1997). During the boom years, over three thousand cords of bark were processed each year by Wagner Company (Raphael, 1974). The Mattole Lumber Co. in the lower Mattole utilized a one-mile rail line, which led to a wharf constructed in 1908 at the mouth of the Mattole. The valley's tan oak bark was first hauled out by mule and then transferred to horse and wagon (Clark, 1981). The wharf required constant and expensive maintenance and was not rebuilt after a storm in the winter of 1913/1914. Tan bark harvesting continued until the supply was depleted in the early 1920s, (Clark, 1981) at about the same time that the tannin extract was replaced by synthetic products.

In 1941, the most widespread use of the watershed appears to have been grazing and is indicated by the amount of grassland and recent fires, which appear to be deliberate conversion of pre-existing brush and timberland. Conifer timber harvesting activities are readily apparent near Harris Creek and continue further upstream into the redwood belt. Timber harvest operations began in earnest as Douglas fir became a

merchantable building material during the post World War II boom. The 1952 air photos show the beginning of the large-scale timber-harvesting era in the Douglas-fir forests of the Mattole Basin. This was the first entry into most of the forestland by mechanized equipment. Harvests were not designed as silvicultural treatments and were an extractive land use. The on-the-ground effects varied from a type of selection to a seed tree cut with a large amount of remaining vegetation consisting of unmerchantable conifers, tan-oak, and brush. Many of these harvests became precursors to range conversion. The roading was typical of the time period; log landings and access roads were generally at the bottom of the slopes in or adjacent to stream channels.

By the late 1980s, timber harvesting decreased while environmental awareness increased. Changes in policy concerning management of federal lands and the designation of the Northern Spotted Owl as federally threatened led to the designation of BLM lands, a large proportion of the Western and a smaller percentage of the Eastern Subbasins, as Late Successional Reserve (BLM, Bear Creek 1995) lands that are not subject to harvest. In the Eastern Subbasin, Eel River sawmill proposed several harvest plans, some in old-growth, which were hotly contested. These lands became part of the effort by some groups, including those formed to influence BLM land use designations and policies on Gilham Butte, to create a Redwoods to the Sea wildlife corridor. In the Southern Subbasin, increased harvest plans reflect the value of redwood timberlands and efforts to bring previously cut-over lands into greater productivity. The Northern Subbasin contains the bulk of Pacific Lumber/Scopac ownership in the Mattole Basin. Although Pacific Lumber Company is operating under an approved HCP, some of their timber harvesting plans are first entries into old-growth stands, causing protests that include civil disobedience.

In Table 9, harvest periods are broken into irregular time intervals as a result of the way existing data were compiled. For the most part, the first period consists of the post-war logging boom although portions of the southern headwaters were harvested just prior to the 1942 aerial photos. This category includes most of the area harvested and roaded before the 1964 flood which is estimated to be a one hundred year event, meaning that in any given year there is a one percent chance of the stream carrying the same volume of water. Thirty-eight percent of the basin was harvested during this time period. The harvest period 1964-1974, also prior to the establishment of the first iteration of the Forest Practice Rules authorized by the Z'Berg-Nejedly Forest Practice Act of 1973, brought the cumulative total of 49% of the basin area logged by tractor and skidded downhill to log landings and access roads low on the slopes and often adjacent to streams. The next interval, 1974-1983, is a time period of Forest Practice rules prior to substantive watercourse protection. The acres listed in the years 1984-2001 are based on the completion date of timber harvesting plans (THP) and submission dates for non-industrial timber management plans (NTMP) submitted to the California Department of Forestry and Fire Protection. There were 1,022 acres submitted as NTMP's in the time interval of 1990-1999 and 73 acres in 2000-2001. This latest time period reflects increasingly restrictive measures for harvesting practices, including reduced activities near watercourses. These years are broken into intervals that are similar to those used for other analyses in the NCWAP program.

Table 9. Timber harvest history, entire Mattole Basin.

TIMBER HARVEST HISTORY - ENTIRE WATERSHED*				
	Total Harvested Acres	**Total Area Harvested (%)**	**Average Annual Harvest (ac)**	**Average Annual Harvest Rate (%)**
Harvested ~1945 – 1961**	72,897	38%	4,288	2%
Harvested 1962 – 1974**	21,141	11	1,626	<1
Harvested 1975 – 1983**	6,948	4	772	<1
Harvested 1984 – 1989	3,900	2	650	<1
Harvested 1990 – 1999	8,405	4	840	<1
Harvested 2000 – 2001	1,809	1	905	<1
Not Harvested:				
Grasslands	33,504	18		
Brush and Hardwoods	38,828	20		

* Does not add to 100% due to data discrepancies, re-harvest areas, and uncut timber areas.

** NCWAP has not yet validated the accuracy of this data (obtained from MRC).

A rough rate of harvest would indicate that from 1945-1966, an average of 2.2 % of the basin was harvested per year, from 1962-74, 1%, and about .0.5% of the basin harvested per year from 1984-2001. Much of the basin is in young stands of trees. As these grow into harvestable size, one could reasonably anticipate an increased rate of harvest on private lands in about ten to twenty years.

Ranching has focused almost entirely on cattle since the passage of propositions limiting predator control options. County-wide, beef cattle numbers between 1980 and 2001 have ranged between 21,000 to 24,000 head, while sheep numbers have plummeted from 25,000 animals in 1980 to 15,600 animals in 1992 and 4,500 sheep in 1997, the latest figures available (http:/www.nass.usda.gov, 2002). Land holdings in the Mattole Basin are increasingly fragmented (and Figure 29) and the amount of livestock is difficult to quantify. Many of the smaller ownerships have hobby livestock, but there is no way to estimate numbers.

The 1960s were the beginning of the back to land movement of young, largely urban people onto subdivided property, generally recently logged. Many of these new residents were interested in learning how to work on their land, to rehabilitate it, and to find an income. Both Honeydew and Petrolia are about two hours driving time south of Eureka and provide few business opportunities for employment or shopping. There are some home-based businesses, but many people commute to the Highway 101 corridor in their own vehicles, as no public transportation exists (Figure 30). Local unemployment was estimated at around 50% in 1999, but is acknowledged as variable because of seasonal work and an underground economy of marijuana cultivation. In 1999, over half of the elementary students were on the federal reduced lunch program, but the enrollment of approximately 117 students does not include charter school students (www.co.humboldt.ca.us, 2001). There is a strong pride of place amongst many local residents that belies bleak and dismal statistics. Current census data indicate that approximately 1200 people call the Mattole Basin their home.

More recently, much of the land use in the Mattole Basin is centered on relatively small, private non-industrial timber management, cattle and sheep ranching activities, and other agricultural pursuits like orchards, pasture, and field crops. Recreational activities in the King Range National Conservation Area are also important land uses (Figure 31). In association with most of these current non-recreational land uses are many roads that have been newly constructed or re-built from old, abandoned logging roads. Many of these roads have increased the amount of sediment contributed to streams.

However, many private non-industrial landowners are currently concerned about their ability to manage their property for income products such as livestock and timber. Non-industrial landowners fear that sustained low livestock prices and the escalating cost of additional regulatory requirements associated with timber, ranching, and agricultural activities will destroy their economic viability. Timber harvest plan preparation is costly and landowners feel regulatory requirements are exorbitant and counter-productive to good stewardship since the high cost must be absorbed through increased short-term timber harvest rates.

Non-industrial Timber Management Plans (NTMP), established as an alternative permit process in 1991, are not extensively utilized by Mattole Basin landowners. Landowners provided a number of reasons for not using NTMP's: the maximum acreage is too low, high preparation costs forces initial harvest of more timber than the landowner wants to cut, the fear of un-anticipated long-term and expensive mitigations required after the major cost of plan preparation, and the fear that future regulations will change and economically impact previously approved plans. When several landowners were asked how they envisioned their land being managed ten years from now, not one of them knew.

Table 10. Land ownership of Mattole Basin.

Ownership	Percent	Acres	Square Miles
Private Lands*	83.6	158,509	247.7
Bureau of Land Management**	15.8	30,022	46.9
Other Public Lands	0.6	1,230	1.9
Total		**189,761**	**296.5**

* Private lands ownership may include parcels scheduled to be placed into public ownership.
** The percentage of BLM owned lands may be higher due to recently acquired lands

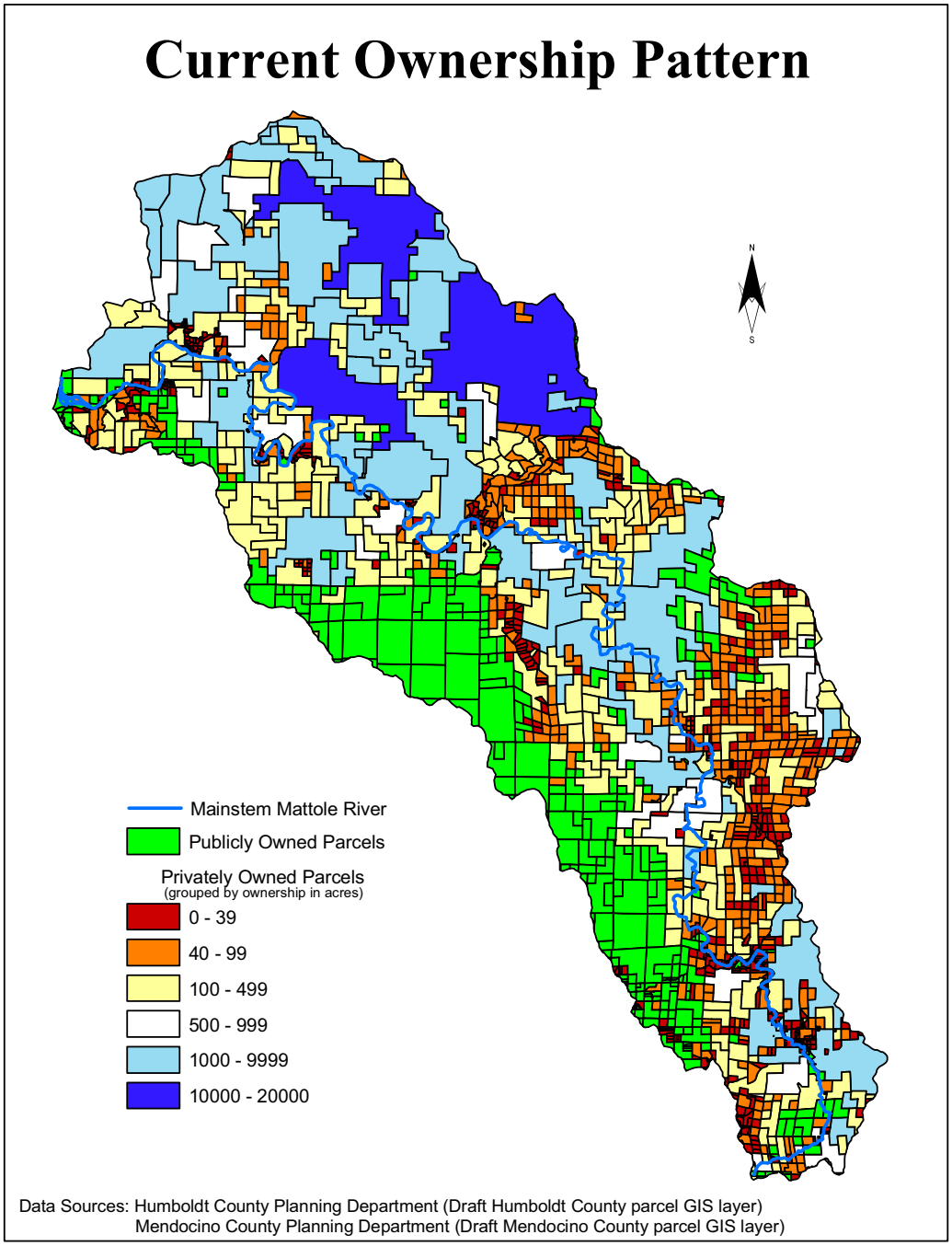


Figure 29. Land ownership in the Mattole Basin.

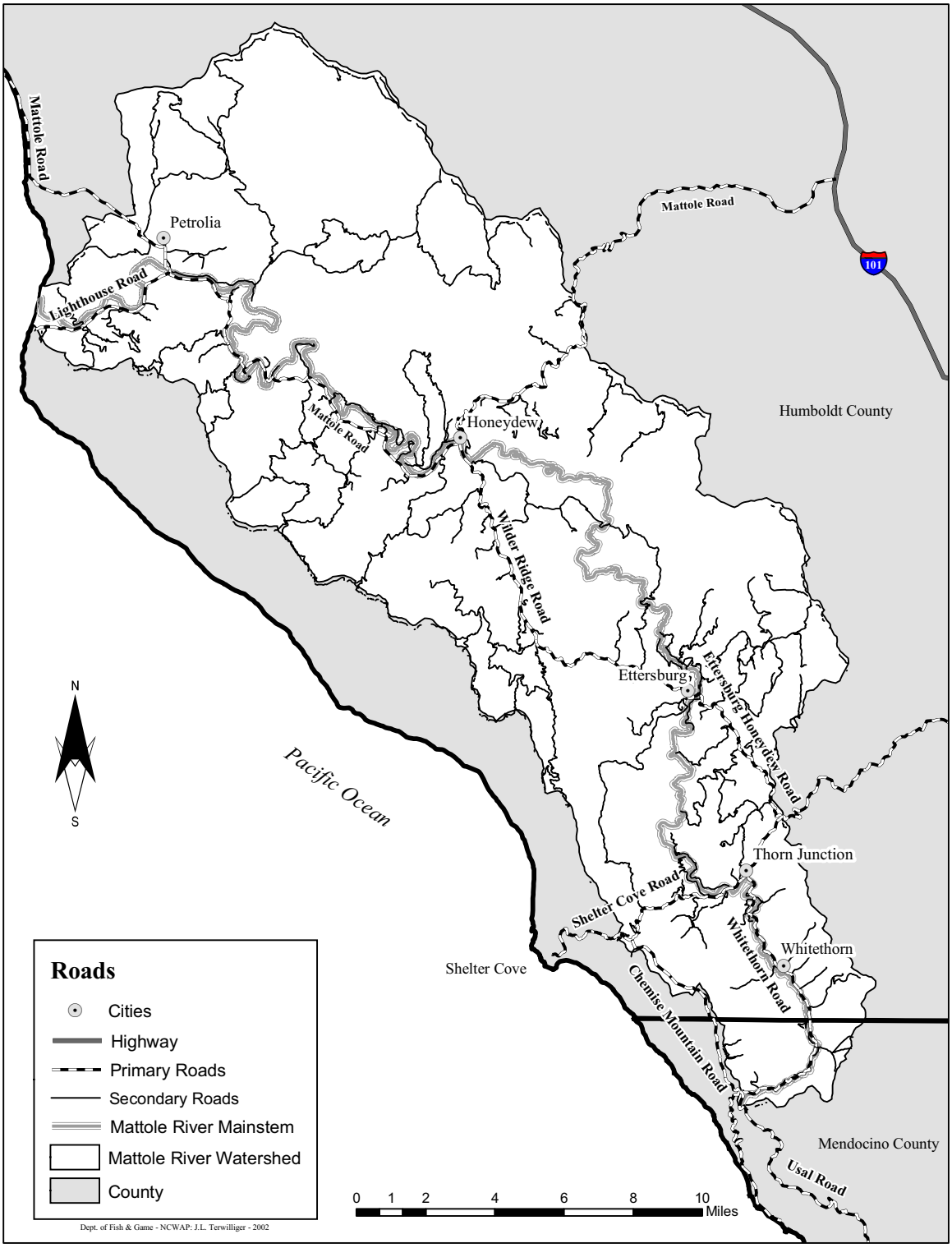


Figure 30. Major roads in the Mattole Basin.

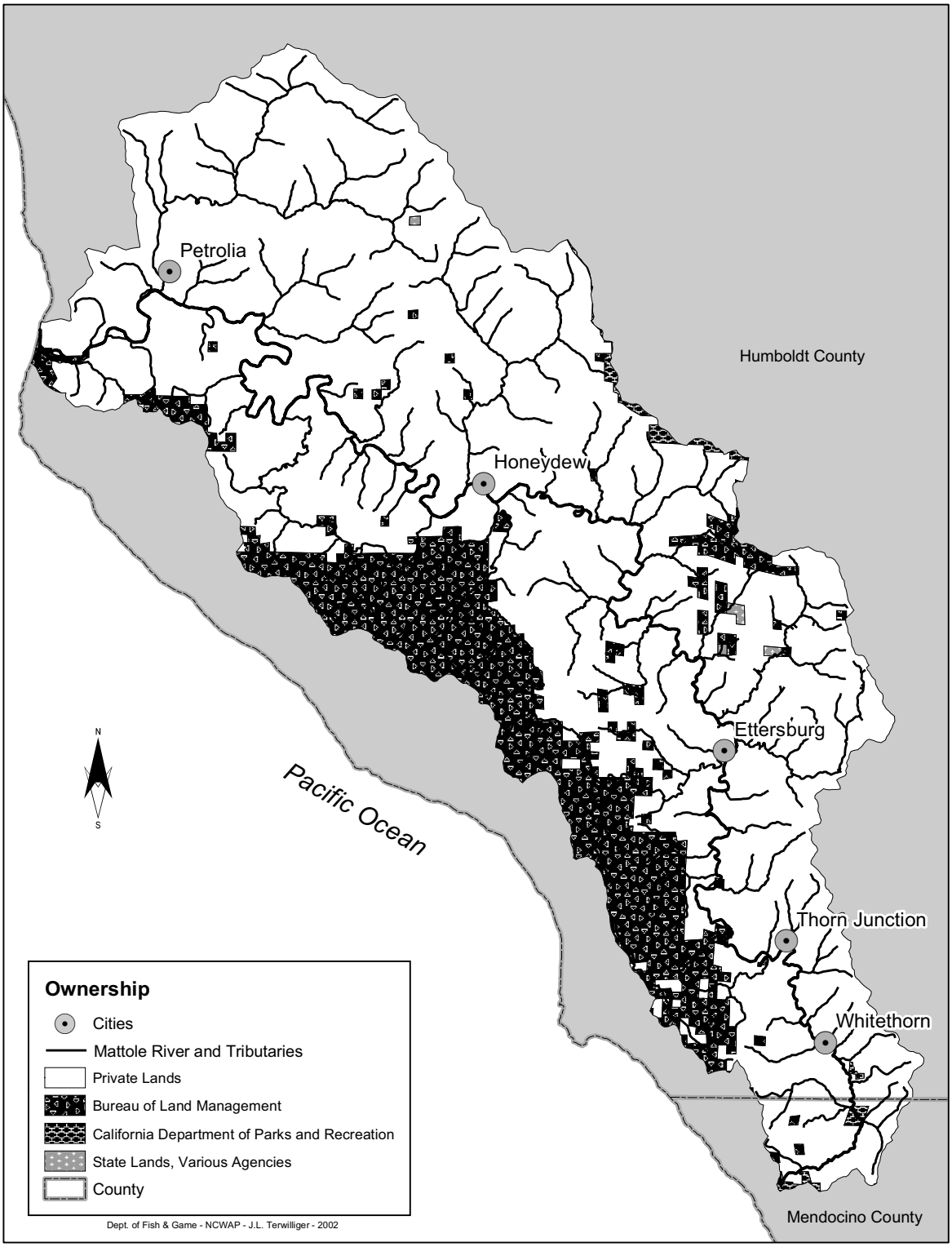


Figure 31. Major land ownership in the Mattole Basin.