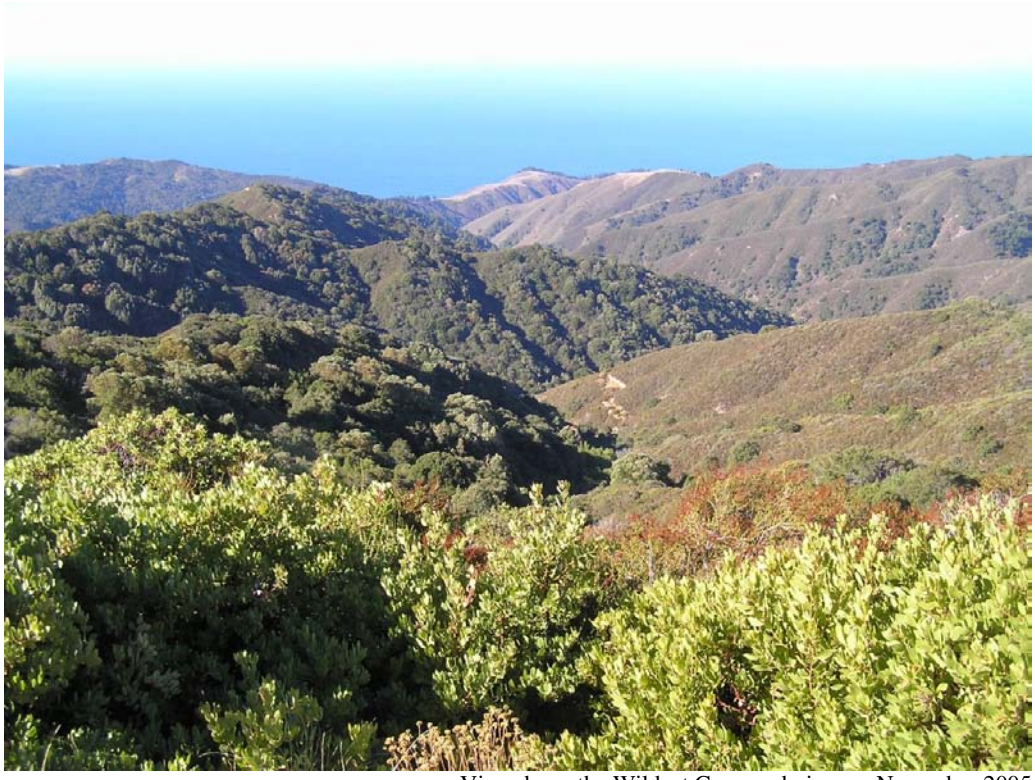
Garrapata Creek Watershed Council

Garrapata Creek Watershed Assessment

Phase Two: Upper Watershed



View down the Wildcat Canyon drainage. November 2005.

Nicole Nedeff
Consulting Ecologist
11630 McCarthy Road
Carmel Valley, CA 93924

December 15, 2005

Preface

The following report was prepared for the Garrapata Creek Watershed Council as a component of the Garrapata Creek Watershed Assessment and Restoration Plan, a project funded in part by the California Department of Fish and Game under Senate Bill 271. Phase One of the Watershed Assessment was completed in December 2004 and focused on riparian vegetation resources in the lower portion of the drainage basin (Nedeff, 2004). The Phase One report was funded under DFG Grant Agreement # PO230475.

The riparian element of the Phase One Watershed Assessment and Restoration Plan includes a description of vegetation history and contemporary natural community composition in the watershed, as well as a discussion of management challenges, enhancement opportunities and data gaps (Nedeff, 2004).

Phase Two of the Watershed Assessment was conducted during the Fall of 2005. The 2005 Phase Two report is designed to augment the 2004 Phase One document and provides additional data that describe habitat conditions in the upper Garrapata Creek, Wildcat Canyon and Joshua Creek watersheds. The combined drainage basins form the greater Garrapata Creek Watershed. A general description of roadways in the upper watershed is presented and particular attention is given to an evaluation of habitat conditions and natural community composition subsequent to remediation measures completed during the early 1990's on unpermitted roads in upper Wildcat Canyon. The qualitative habitat survey along roadways provides some measure of restoration success in the upper watershed. Phase Two of the Watershed Assessment was funded under Pacific States Marine Fisheries Grant # PO410500, and can function as a stand-alone document. Unless noted, all photographs in the report were taken by the author in the Fall of 2005.

Acknowledgments

The following individuals facilitated the development of the Phase Two portion of the Garrapata Creek Watershed Assessment and deserve thanks for their field support, information exchange, and community involvement:

Jeff Cann, Kevin Dummer, Ken Ekelund, Lynn Overtree, Terry Palmisano

Background Information

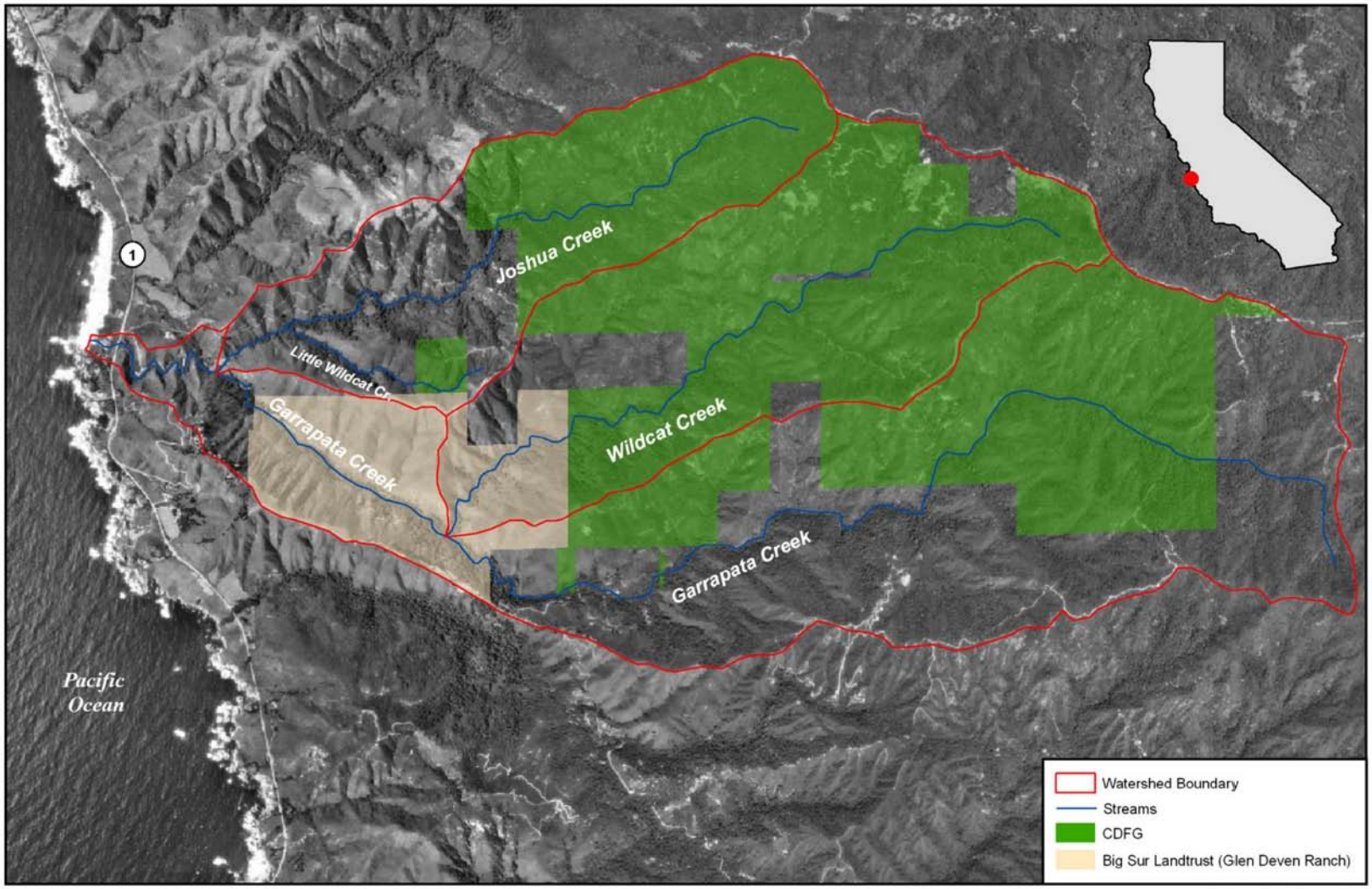
The Garrapata Creek Watershed (GCW) is a coastal drainage framed by the northern margin of the Los Padres National Forest and rugged terrain along the Pacific slope of the Santa Lucia Range. Most of the watershed is composed of faulted and fractured Cretaceous granitic rocks of the Soberanes Point Formation. Large portions of the upper watershed are in public ownership through the Los Padres National Forest and the California Department of Fish and Game. The remainder of the watershed, including the estuary/lagoon at the mouth of Garrapata Creek, occurs on privately owned property.

The mouth of Garrapata Creek is about 10 miles south of Carmel. Elevations in the drainage basin range to 3445-feet on White Rock Ridge and approximately 3935-feet close to the edge of the Los Padres National Forest east of Twin Peaks. Two primary tributaries, Joshua Creek and Wildcat Canyon, contribute perennial flow to the principal Garrapata Creek and collectively these stream systems comprise a watershed of about 10.7 square miles in area.

The GCW has some limited population and distribution data for the South/Central California Coast Steelhead Ecologically Significant Unit (Steelhead ESU), however information about the character of upland and riparian vegetation resources in the watershed is not known from the sparse literature. Field survey and watershed assessment work that was completed by Pacific Watershed Associates in March 2003 identified the reduction of erosion and sediment delivery throughout the watershed as key to the restoration and ultimate recovery of stream habitat supporting salmonids (PWA, 2003). However, the focus on reducing sediment inputs to restore stream values for the fishery did not address the character, or functional health of associated watershed vegetation resources, including riparian habitat.

The following text describes natural communities in upper watersheds of Joshua, Wildcat and Garrapata canyons. The text describes typical species composition, relative vigor and stability of natural communities. The text also provides a qualitative description of roadways in the upper watershed and evaluates remedial measures undertaken in the early 1990's to reduce sedimentation hazards along illegally graded roadways in the Wildcat Canyon drainage basin.

The Garrapata Creek Watershed and major tributary drainage basins are presented in the following map (prepared by Joel Casagrande, Casagrande and Smith, 2004). The green overprint represents the Joshua Creek Ecological Reserve owned by the California Department of Fish and Game. The tan overprint represents the Glen Deven Ranch owned by the Big Sur Land Trust.


Joshua Creek
Little Wildcat Cr.
Garrapata Creek
Wildcat Creek
Garrapata Creek
Pacific Ocean
1
Watershed Boundary
Streams
CDFG
Big Sur Landtrust (Glen Deven Ranch)
0 0.5 1 Kilometers
0 0.5 1 Miles
N
Map Produced By: Joel Casagrande
Stream Layer: CDFG
1:100k Hydrography Version: 2003.6
Boundary Layer: GCWC
DOQ Imagery: CaSIL
Image Date: 2 May 1996
(C) CCoWS, 2004

Natural Communities

The Garrapata Creek Watershed (GCW) is a classic mosaic of coastal and inland vegetation types typical of Pacific slope watersheds in central California. In a transect from the upper watershed divides to the estuary/lagoon at the mouth of Garrapata Creek, the natural communities in the GCW reflect bedrock, tectonics, soil, aspect, moisture, fire, land use and marine influences. For a complete survey of habitats types encountered in the GCW, including coastal communities, please refer to the 2004 Nedeff report.

Uplands:

Upper watershed vegetation in Joshua, Wildcat and Garrapata canyons is remarkably similar; the vegetation is a patchwork mosaic of differing habitat types that reflect edaphic (soil) differences, fire histories and microclimate conditions. Sunny, exposed, generally south-facing slopes are mantled with chamise-dominated Chaparral, with patches of mesic Canyon Live Oak/Bay Forest tucked into the folds of narrow drainages. Floristically diverse Mixed Chaparral usually occurs on south slopes in inland areas of the watershed, particularly on higher elevation DFG lands. Most all north-facing slopes support Mixed Evergreen Forest, with a few unique groves of enormous Madrone (*Arbutus menziesii*) and Canyon live oak (*Quercus chrysolepis*) in the highest elevation areas of the Wildcat drainage. Most narrow drainage bottoms support linear Canyon Riparian communities that snake their way along increasingly steep gradients towards watershed divides.

As one moves towards the coast and the omnipresent marine influence of persistent coastal fog, Chaparral vegetation gives way to Northern Coastal Scrub and occasional patches of rare Central Maritime Chaparral, which is found on marine terraces in the Highway 1 corridor. Closest to the coast, the bluffs and dunes at the mouth of Garrapata Canyon host uncommon communities noteworthy in their own right for their floristic composition and vegetative complexity.

Large tracts of Grassland ecosystems occur on the northern margin of the watershed along the northern edge of Joshua Creek. Although dominated by introduced annual species and forbs, the Joshua divide includes notably large patches of native, perennial grasses and both perennial and annual wildflower species. The eastern edge of the Wildcat Canyon drainage has a few small, but distinctive patches of Grassland that are also notable for their composition of native, perennial species. Other areas of Grassland ecosystems in the watershed tend to be very small, widely scattered, and composed primarily of introduced, annual species and weedy forbs.

As is typical of watershed vegetation, the most extensive coverage of specific natural community types occurs in the upper watershed areas, with the most restricted plant community distribution at the narrow mouth of Garrapata Creek.

Chamise Chaparral: On the hottest, driest slopes that are also often the poorest in terms of soil development, shrub-dominated chaparral vegetation is characterized by a predominance of chamise (*Adenostoma fasciculatum*). Occasionally, shrubby forms of canyon live oak (*Quercus chrysolepis*) and coast live oak (*Q. agrifolia*) occur with yerba santa (*Eriodictyon californicum*) and poison oak (*Toxicodendron diversilobum*). Areas with more open cover closer to the coast may include deerweed (*Lotus scoparius*), sticky monkey flower (*Mimulus aurantiacus*) and black sage (*Salvia mellifera*).

Mixed Chaparral: The farthest inland and highest elevation south-facing slopes in the Joshua, Wildcat and Garrapata drainages include shrub species more typical of inland chaparral communities removed from persistent marine influences. The "inland" chaparral mosaic includes Eastwood's manzanita (*Arctostaphylos glandulosa* ssp. or var. ?), bush poppy (*Dendromecon rigida*), golden fleece (*Ericameria arborescens*), toyon (*Heteromeles arbutifolia*), coffeeberry (*Rhamnus californica*), and several species of ceanothus, including warty-leaved ceanothus (*Ceanothus papillosus*) and buck brush (*C. cuneatus*). Occasionally, the endemic Santa Lucia monkey flower (*Mimulus aurantiacus* var. *bifidus*), scarlet bugler (*Penstemon centranthus*) and California buckwheat occur (*Eriogonum fasciculatum*).

Mixed Evergreen Forest: The forested hill slopes on north-facing aspects are generally damper and more shaded areas of the watershed. These slopes are vegetated with a variable mixture of tanbark oak (*Lithocarpus densiflora*) and California bay (*Umbellularia californica*), with scattered canyon live oak (*Quercus chrysolepis*) and madrone (*Arbutus menziesii*). Closer to the ocean, coast live oak (*Quercus agrifolia*) increases in the mix of other evergreen species. Beneath the canopy, hairy honeysuckle (*Lonicera hispidula*), coffeeberry (*Rhamnus californica*), and the endemic Santa Lucia gooseberry (*Ribes sericeum*) occur. The gooseberry is found only in moist canyons of the Santa Lucia Range and is considered rare, but not endangered by the California Native Plant Society (List 4).

Canyon Live Oak/California Bay Forest and Woodland: The Canyon Live Oak/California Bay habitat is a variant of Mixed Evergreen Forest, however it usually has a more open canopy and occurs in small, discontinuous patches tucked into drainages on more xeric (dry) south-facing slopes. This habitat is dominated by Canyon live oak (*Quercus chrysolepis*) and California bay (*Umbellularia californica*). Areas with closed canopies are considered forest types, while areas of more open canopy cover qualify as woodland. Often the Oak/Bay woodland includes shrubby forms of canyon live oak that intergrade with ceanothus and other shrubs typical of both the Mixed Evergreen Forest and Mixed Chaparral.

Redwood Forest: This natural community is indicated by the dominant presence of coast redwood (*Sequoia sempervirens*). The Redwood Forest canopy in the Joshua, Wildcat and Garrapata drainages extends along canyon bottoms and up canyon sides where damp soils maintain these moisture-dependent trees. Coastal fog and the supplemental moisture provided by fogdrip sustain redwoods for short distances along tributary canyons with variable seasonal flow. An understory of tanbark oak (*Lithocarpus densiflora*), big-leaved maple (*Acer macrophyllum*), California bay (*Umbellularia californica*), redwood sorrel (*Oxalis oregana*), sword fern *(Polystichum munitum*), lady fern (*Athyrium filix-femina*), iris (*Iris douglasiana*), pink star-flower (*Trientalis latifolia*), vanilla grass (*Hierochloe occidentalis*) and false Soloman's seal (*Smilacina racemosa*) occurs under the redwood canopy. Deep shade often makes understory vegetation in these forests quite open, as sunlight has difficulty penetrating the thick canopy.

Although notable large old growth trees occur sporadically throughout the watershed, most of the Redwood Forest habitat in Joshua, Wildcat and Garrapata canyons is second growth forest. There may be areas where repeated logging or thinning has produced third growth conditions.

Grassland: Grassland ecosystems in the GCW occur on the northern margin of the Joshua Creek drainage and in small, discontinuous patches in the uppermost watershed areas of Wildcat Canyon. As mentioned in the text above, most of the Grassland in the study area is dominated by non-native, annual species, however there are large patches of native perennial grasses that speak to the

biological significance of these habitats. Common native species at higher elevations include purple needle grass (*Nassella pulchra*) and western ryegrass (*Elymus glaucus*). Non-native annuals include wild oats (*Avena fatua*), rupgut brome (*Bromus diandrus*), Italian ryegrass (*Lolium mutiflorum*) and barnyard foxtail (*Hordeum leporinum*), as well as many others.

Northern Coastal Scrub: This shrub-dominated habitat occurs on hill slopes that are heavily influenced by the presence of cool, moist advective fog. The sparse, brittle appearance of this evergreen habitat is characteristic of many south and west-facing slopes in the GCW. Typical dominant species in the Northern Coastal Scrub community include coast sagebrush (*Artemisia californica*), poison oak (*Toxicodendron diversilobum*), lizard-tail *(Eriophyllum staechadifolium*), coyote brush (*Baccharis pilularis*), blue blossom (*Ceanothus thyrsiflorus*), deerweed (L*otus scoparius*) and occasional western bracken fern (*Pteridium aquilinum*). Twining coast morning glory (*Calystegia macrostegia* ssp. *cyclostegia*) and wild cucumber (*Marah fabaceus*) can often be seen draped over the shrub vegetation.

Breaks in the shrub canopy and margins of disturbed areas can support California fuchsia (*Epilobium canum*), bird's-foot fern (*Pellaea mucronata*) and sparse native purple needle grass (*Nassella pulchra*). Under the thick, closed canopy of generally short shrubs (5-foot average height), yerba buena (*Satureja douglasii*) and infrequent bunches of California oat grass (*Danthonia californica*) occur along the exposed edges of the scrub community where there is less competition from other plants and more open habitat conditions.

Coastal Sage Scrub: This transitional natural community occurs on more gradual slopes topographically below Northern Coastal Scrub and above Coastal Bluff Scrub. Many of the typical Northern Coastal Scrub species also occur in Coastal Sage Scrub, however the Sage Scrub community is characterized by prominent bush lupine (*Lupinus arboreus*), silver bush lupine (*Lupinus albifrons* var. *albifrons*), seacliff buckwheat (*Eriogonum parvifolium*), black sage (*Salvia mellifera*), sticky monkey-flower (*Mimulus aurantiacus*), and bee plant (*Scrophularia californica*). Seacliff buckwheat is the host plant for the Federally Endangered Smith's blue butterfly.

<u>Riparian</u>:

Riparian natural communities in the Garrapata Creek Watershed run the gamut from coastal forms that are pruned and stunted by salty winds at the mouth of the mainstem, to narrow, linear habitats restricted to the seasonally damp folds of the chaparral-covered watershed divides. By definition, riparian vegetation is associated with the margins of streams and is restricted to the narrow belt of land influenced directly by stream flow. High water tables in the alluvium fringing streams in the GCW sustain riparian species, which otherwise could not survive in the seasonally arid climate of central California.

As noted by Henson and Usner in "The Natural History of Big Sur" (page 149):

> The exact character of this plant community differs from creek to creek and is dependent on several factors. The steepness and orientation of a river canyon's walls determine how much sunlight reaches the canyon floor. The makeup of the riverbed – whether it is sandy or rocky – influences what plants can take hold. The grade, shape, and width of the stream channel determines where and how fast water flows.

This is especially significant during floods when many plants are torn up at the roots by high water and floodplains are cut.

The following descriptions of riparian communities provide general characteristics and note typical species in the vegetation associations found throughout the watershed.

Lower Watershed Riparian: The lower reaches of the GCW support a collection of riparian habitat types that include several species of willow (*Salix*) as dominant or co-dominant taxa. Each of the following natural communities is noted individually in the DFG List of California Terrestrial Natural Communities Recognized by the California Natural Diversity Data Base (DFG, 2003). However, the lower watershed riparian habitats are being described together for this report and the reader should recognize that each association reflects slightly differing environmental conditions and cover of primary plant indicators.

The following natural communities occur along lower Garrapata Creek and the lowest portion of Joshua Creek where the mainstem canyon bottom is relatively wide and floodplain development has created appropriate habitat for riparian vegetation recruitment:

- Central Arroyo Willow
- Red willow/Arroyo willow
- Red Alder/Arroyo Willow

Each of these streamside communities includes varying proportions of arroyo willow (*Salix lasiolepis*), which occurs in pure stands, as well as with other riparian species as a co-dominant. Arroyo willow is usually a relatively small tree that can grow in very shrubby forms. Wind-borne seeds produced in early spring are designed to fall to recruitment sites veneered with fresh sediment exposed as stream levels retreat at the close of the rainy season. Arroyo willow, as all genera in the Willow Family found in central California - the Salicaceae (*Populus, Salix*) - can also propagate vegetatively by sprouting roots from stems and twigs when woody portions of the plant are buried by alluvium or submerged in water. The ability of the stem material to reform into tissue that can sprout adventitious roots is an adaptation to the active and dynamic stream environment that will predictably be disrupted by occasional flood and sedimentation events.

Occasionally, arroyo willow will occur with red willow (*Salix laevigata*), a willow species that can attain tree heights of 15 to 40 feet, or more under favorable conditions. Leaves of the red willow are noticeably larger and more linear than those of arroyo willow and generally taper to a fine point. The leaf margins of red willow are dentate, meaning that the leaf edge is finely toothed.

Both arroyo and red willows can occur with red alder (*Alnus rubra*) in the lower GCW. Red alder is a pioneering colonizer along the banks of streams in the watershed and often the relative dates of large flow events can be determined by the even age of alder trees that occur in dense stands. Alders require constant high water tables and usually can not grow where their shallow roots fail to reach abundant moisture. Shifting stream channels, channel incision, or drops in watertable levels result in alder mortality and the presence of dead alders may provide clues to lowering groundwater or the geomorphic history at particular sites in the watershed.

Typical understory plants in various phases of willow/alder habitat in the lower GCW include creek dogwood (*Cornus sericea* ssp. *occidentalis*), which is also called western red dogwood, thimbleberry (*Rubus parviflorus*), California blackberry (*R. ursinus*), mugwort (*Artemisia*

douglasiana), chain fern (*Woodwardia fimbriata*), shield fern (*Polystichum californicum*), wood rose (*Rosa gymnocarpa*) and wood mint (*Stachys bullata*). Occasionally, damp cobbles or fine soils adjacent to the active channel support patches of liverwort (*Conocephalum* sp.), and areas of slow moving water are choked with watercress (*Rorippa nasturtium-aquaticum*).

The lower GCW riparian habitat is composed of areas where open canopies and abundant light create dense, shrubby stands dominated by arroyo willow, however there are quite different areas where tall canopies of mature red alder and naturalized blue gum eucalyptus (*Eucalyptus globulus*), Monterey pine (*Pinus radiata*) and Monterey cypress (*Cupressus macrocarpa*) create structurally simple plant associations with understories dominated by low, tangled vines of blackberry and non-native species. The "natural communities" throughout the lower reaches of the GCW are mostly compromised by invasive species and weed-free habitat is relatively hard to find.

Redwood-Riparian Forest is a phase of adjacent redwood-dominated habitat restricted to the edges of perennial stream reaches of Joshua, Wildcat and Garrapata creeks. The riparian phase of the adjacent Redwood Forest occurs where canyon bottoms narrow and stream gradients increase in steepness. Shaded by dense canopies that open up ever so slightly where divided by stream courses, the Redwood-Riparian communities of the GCW include many species found in the neighboring Redwood Forest, but also include species unique to streamside habitats.

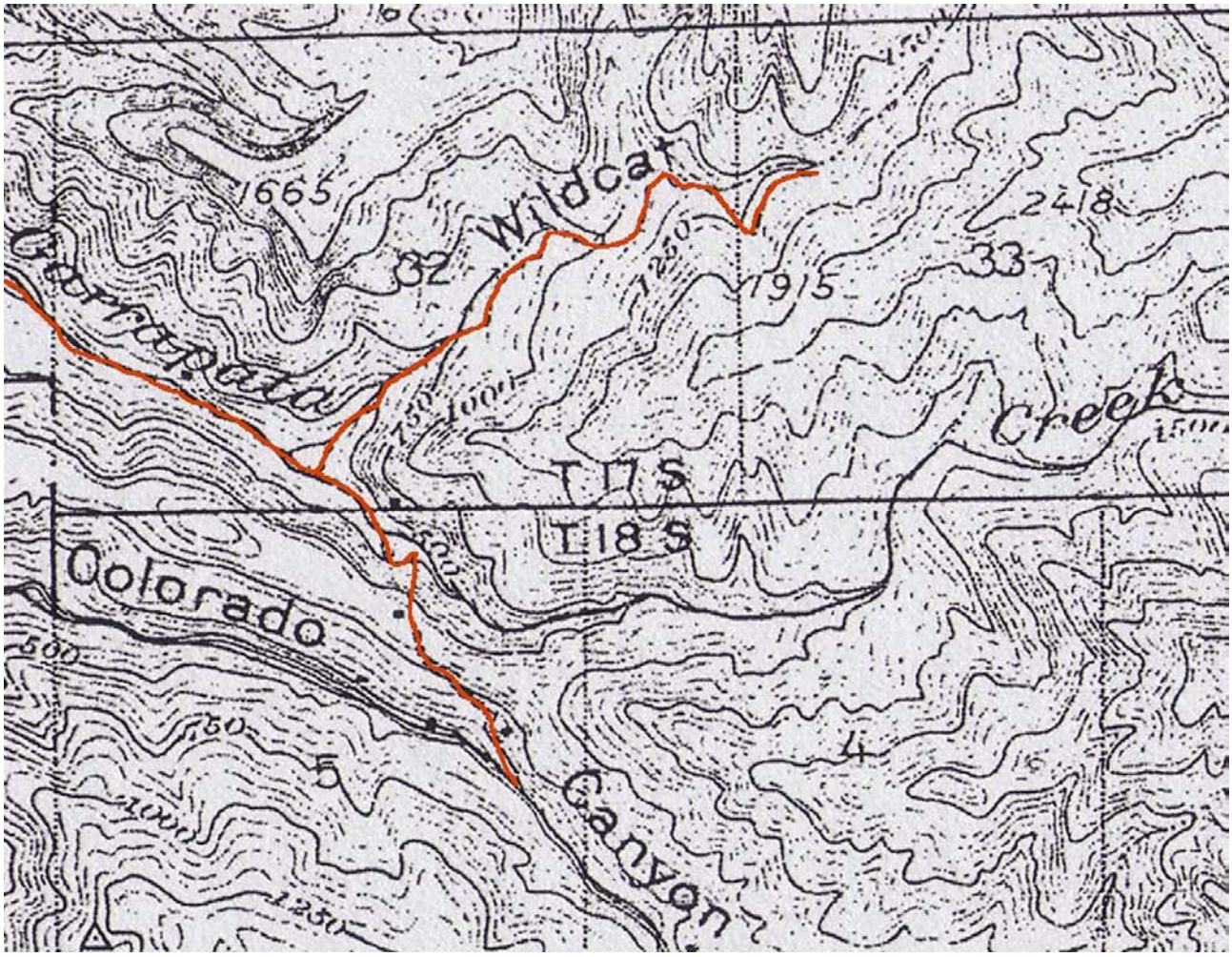
Redwood, tanbark oak, big-leaved maple and bay usually provide the overstory above redwood sorrel and widely scattered shrubs. Vegetation lining the banks of Joshua, Wildcat and Garrapata creeks tends to be discontinuous and is either confined to areas above steep banks, or floodplain terraces immediately adjacent to the active channels in each drainage. The shrub component of the Redwood-Riparian Forest can include coffeeberry, thimbleberry, sticky monkey flower, canyon gooseberry (*Ribes menziesii*), Santa Lucia gooseberry (*R. sericeum*), creambush (*Holodiscus discolor*), elk clover (*Aralia californica*) and osoberry (*Oemleria cerasiformis*).

A variety of ferns species generally grow in separated locations along stream banks, with chain fern and shield fern found with five-finger fern (*Adiantum aleuticum*), lady fern (*Athyrium felix-femina*), western bracken (*Pteridium aquilinum*), sword fern (*Polystichum munitum*), wood fern (*Dryopteris arguta*) and occasionally maidenhair fern (*Adiantum jordanii*). Common, although not ever abundant, herbaceous species include sedges (*Carex* spp.), vanilla grass (*Hierochloe occidentalis*), stinging nettle (*Urtica dioica* ssp. *holosericea*), crimson columbine (*Aquilegia formosa*), boykinia (*Boykinia elata*), and the lovely leopard lily (*Lilium pardalinum*). Western colt's foot (*Petasites palmatus*) is found growing in both coarse cobble, as well as fine sediments. Colt's foot can be partially submerged adjacent to active channels and also higher on floodplains above bankfull stage.

Canyon Riparian: As one moves up in elevation above the zone where redwood dominates the canopy, canyons become increasingly narrow and v-shaped stream valleys are constrained by bedrock-controlled topography. Canyon Riparian habitat is restricted to the narrow canyon bottoms that usually support seasonal flow. This moisture-dependent habitat thins out as elevation and steepness increase throughout the watershed and the diversity of riparian or wetland obligate species lowers as the number of upland types increases. Fog and the supplemental moisture from fogdrip become negligible. Big-leaved maple (*Acer macrophyllum*), occasional sycamore (*Platanus racemosa*), poison oak and blackberry typify Canyon Riparian communities until elevations increase and mesic habitat grades into upland types of Canyon live oak/Bay or Mixed Chaparral. Often the only noticeable indicator of a Canyon Riparian habitat will be an occasional maple or a solitary sycamore in an otherwise evergreen canopy.

Upper Watershed Road Habitat Survey
Background Information

The USGS Mt. Carmel 1:24,000 scale 7.5' topographic maps from 1956, 1983 and 1995 display a changing road network in the upper reaches of Joshua, Wildcat and Garrapata canyons. The earliest topographic map reviewed during this study was the 1925 edition of the Point Sur quadrangle. The 1925 edition is at a 1:62,500 scale, and was first published in 1918 and reprinted in 1946. It is not known whether historic road data presented on the 1925 map actually occurred on the 1918 edition, or whether cultural features were added to the landscape between the 1918 map and the publication of the 1925 edition.



Enlargement of 1925 USGS Point Sur quad. Red highlights the route of the historic road that heads up Wildcat Canyon. Few traces of this road remain upstream of the Wildcat Canyon Creek confluence with Garrapata Creek.

The trace of a historic road follows the contemporary alignment of Garrapatos Road off Palo Colorado Road, but then tops the ridge and heads down into Garrapata Canyon through what is now the Glen Deven Ranch. The historic road is mapped in red. From the bottom of Garrapata Canyon, the old road heads downstream, as well as up the Wildcat Canyon drainage. Note that there is no indication of a road upstream anywhere along Garrapata Canyon.

The site of a structure on the slope north of Garrapata Creek (and upstream of Wildcat) is marked with a small square on the 1925 map enlargement, however this is not the site of the stone homestead that occurs in the bottom of Wildcat Canyon at the base of the first waterfall. Unfortunately, nothing is known about the history of the old, stone structure near the waterfall. Today, the old homestead at the base of the waterfall is partially buried with sediment and debris that have elevated the grade of Wildcat Canyon up to the mantle of the fireplace. This structure may have been swamped by the episodic deposition of sediment that reflects historic land use practices and soil destabilization in the upper Wildcat watershed.

Coarse sediment up to the mantle of the fireplace at Wildcat Canyon homestead near the waterfall. November 2004.

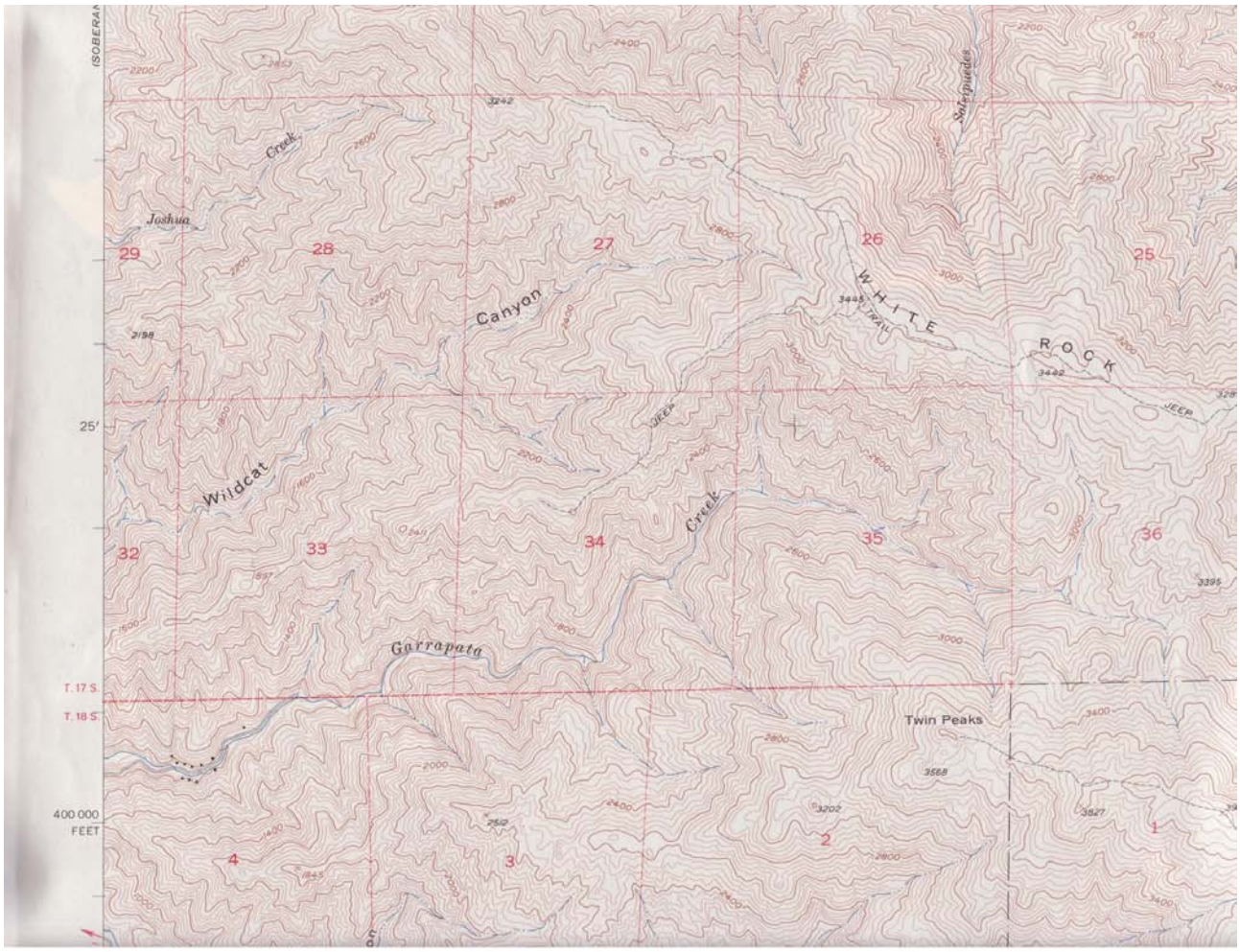
Apparently, the historic road depicted on the 1925 map somehow traversed around the east side of the waterfall, through what is extremely steep terrain. The old roadway continues up the inner gorge of the canyon until it ends abruptly on the map.

The historic roadway is very interesting, in that it provided logging access from the coast to the old growth redwood groves in Wildcat Canyon. No evidence of this historic route appears to be visible today in the dense cover of vegetation that mantles the steep slopes flanking the Wildcat waterfall. Later routes may have followed portions of this alignment in the inner gorge, but abandoned the lower Garrapata Canyon access in favor of upstream access points off Palo Corona Road and upper Garrapatos Road. The historic "Carter" logging roads that have been mentioned in the literature (Williams and Kondolf, 1991) are not depicted on any of the older USGS maps of Wildcat Canyon, and it remains unclear when the Carters operated, whether they constructed roads, and what the logging and related road-building history is in this drainage.

Later Maps: According to various maps available for this study, the upper portion of the Garrapata Creek Watershed has traditionally been very difficult to access. However, regional maps are often notoriously incomplete in depicting roadways that are known to have provided access at some time in the past. For example, the old logging road that winds along the shaded banks of Garrapata Creek upstream of the privately maintained Garrapatos Road is not depicted on any of the USGS quadrangles for this area.

It is evident from the historic road network, both mapped (as on the 1925 map) and unmapped, that the upper Garrapata Creek and Wildcat Canyon watersheds were once accessible for logging, and possibly homesteading activities. Historic literature also describes that upper Joshua Creek supported a variety of land uses that were carried out via historic roads that over time included a sled route from the Doud Ranch, a vehicular route from the Trout Farm, and the current route which was surveyed by Rudolph Lange and built by Frank DeAmeral in 1936 (Norman, 1992-1993). Only the Lange/DeAmeral route is depicted on the USGS 1956 Soberanes Point quadrangle. No roads of any kind into the Joshua Creek drainage are shown on the 1925 Point Sur map.

Four-wheel drive vehicular access to the upper reaches of the Garrapata Watershed is provided by the "Palo Corona Road", a portion of which first appears on the 1956 Mt. Carmel 7.5' USGS quad. The Palo Corona Road traversed along White Rock Ridge from the area of the White Rock Gun Club. The route split near the crest of the Garrapata/Wildcat Divide and a spur descended along the ridgeline separating upper Wildcat from upper Garrapata canyon. The primary Palo Corona Road seems to dead end a short distance before the watershed divide separating Joshua and Garzas Creek.

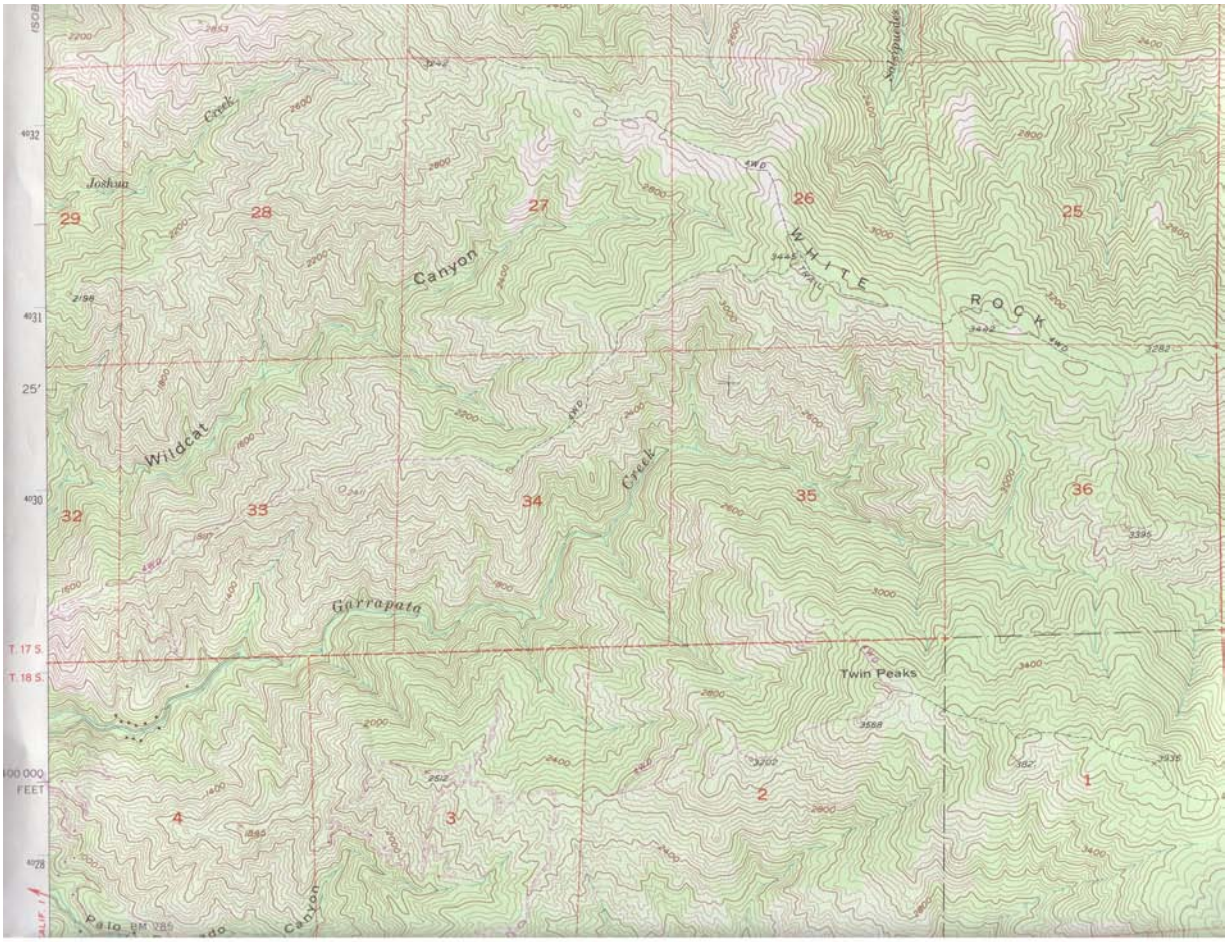


A portion of the 1956 Mt. Carmel USGS 7.5' topographic quadrangle.

The 1983 edition of the Mt. Carmel quadrangle displays an extension of Palo Corona Road towards the west, as well as an extension of the Garrapata/Wildcat Divide Rd. all the way to the nose of the ridge and from there down to the creek bottom in Garrapata Canyon. The Garrapata/Wildcat Divide Road is noted as 4WD. The road extensions are mapped in the purple tone (light purple color)

depicting photo-revised features. These features were first seen on 1980 aerial photography and then placed on to the 1956 edition of the Mt. Carmel map, which was then reissued in 1983. The 1983 photo-revisions also include a mapped road that seems to be placed along the incredibly steep spine of a short ridge, which connects sections of the roadway that descends off the Garrapata/Wildcat Divide to Garrapata Creek below. Although the incredibly steep connector is no longer visible as even a trace of different-aged vegetation on the landscape, the sweeping traverse of the main roadway down into Garrapata Canyon remains a noticeable scar. This route is essentially impassable to all but the most intrepid hikers willing to forge through tall, thick brush over a badly eroded roadbed.

The 1983 USGS quadrangle also depicts new roads (in purple) on the south flank of Garrapata Canyon in what is today the Green Ridge area. In 1983, new roads were mapped that accessed the top of the Green Ridge area from Palo Colorado Road to the south. These new roads also connected to the historic Mt. Carmel trail, which once ended at Twin Peaks. Mt. Carmel was accessed off Skinner Ridge and served as the site of a radio relay station during World War II. In addition, the 1983 USGS quadrangle shows that several new roads were created in a trajectory down-slope towards the bottom of Garrapata Canyon from Green Ridge. These new roads opened the southern watershed divide to rural, residential development and the construction of additional roadways.

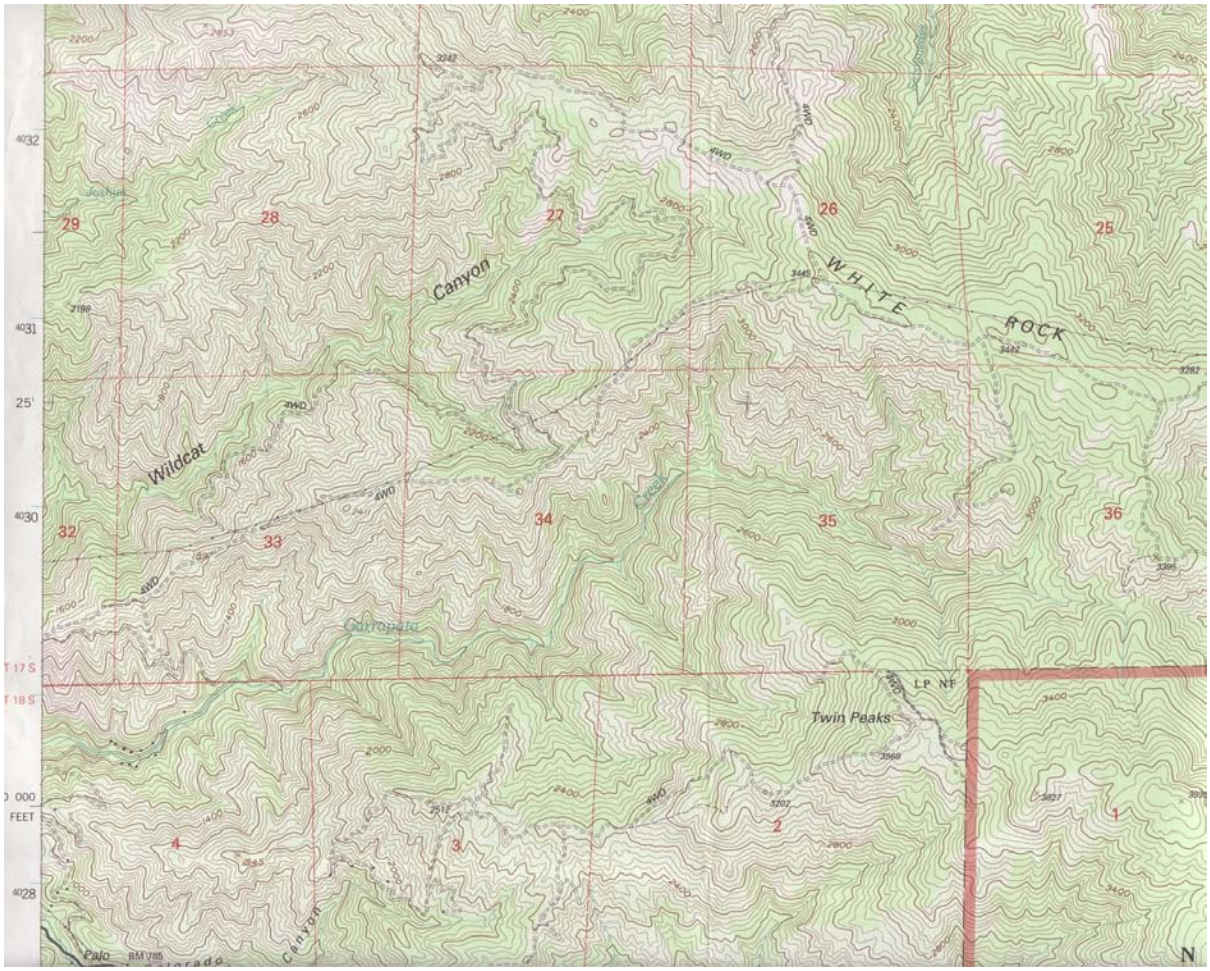


A portion of the 1983 Mt. Carmel USGS 7.5' topographic quadrangle. Note new roads extending Palo Corona Road to the west and the Garrapata/Wildcat Divide Road all the way down into Garrapata Canyon. In addition, note new roads connecting Twin Peaks with the Green Ridge area and road spurs (dead ends) from the top of the watershed boundary down into the upper reaches of Garrapata Canyon.

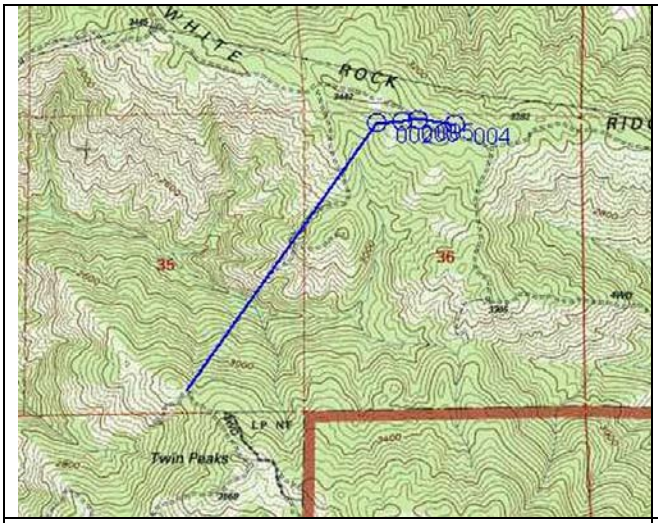
The Palo Corona Road is today an occasionally maintained four-wheel drive route that traverses mostly along the ridgeline in the CDFG Joshua Creek Ecological Reserve. The Palo Corona Road can be accessed for research purposes with permission from the CDFG staff in the Monterey office. Authorization is required from the Big Sur Land Trust (via Mitteldorf Preserve) or the Monterey Peninsula Regional Park District (via Palo Corona Regional Park) if entering the CDFG property from the north, or from the White Rock Gun Club if entering the property from the east. Vehicular access from Rancho San Carlos requires permission from several private land owners, as well as from the Santa Lucia Preserve.

The 1995 edition of the Mt. Carmel USGS topographic quadrangle depicts an extensive new road network in Wildcat Canyon, as well as a road spur that extends southwards into upper Garrapata Canyon from near the southeastern boundary of the CDFG Joshua Creek Ecological Reserve with White Rock Gun Club. The road spur was actually created to facilitate the installment of the high tension electrical lines that span the upper reaches of Garrapata Canyon. Incidentally, the powerline route is incorrectly mapped in the 1995 USGS quadrangle - the powerline right-of-way actually traverses across upper Garrapata Canyon from Section 35 in T17S, R1E, towards Twin Peaks on the southern flank of the watershed. Also of note is that all the roads in Wildcat Canyon were decommissioned in 1991 as partial compliance for the unpermitted installation of that same road network by the land owner at the time.

In addition to new roads in both Wildcat Canyon and upper Garrapata Canyon, there is a newly mapped road that connects the privately owned Lopez-Perez parcel along the Palo Corona Road with points to the north in the Rancho San Carlos.



A portion of the 1995 Mt. Carmel USGS 7.5' topographic quadrangle. New roads are seen in the Wildcat Canyon watershed. The powerline route is incorrectly mapped.



Powerline route across Garrapata Canyon.

Powerline from north to south. August 2004.

Prior Road Survey Work by Pacific Watershed Associates

The history of the unpermitted road grading incident in the southern portion of the historic Little Horse Ranch (now the CDFG Joshua Creek Ecological Reserve) is widely known, and research to document detail pertaining to the road grading violation could not be completed during this Phase Two Watershed Assessment study. Records archived by the California Coastal Commission and the County of Monterey could be researched for additional detail.

In 1990, the former owner of the Little Horse Ranch conducted major road improvements on his property without benefit of requisite permits from any federal, state or local agency with governance powers over land use change. The land owner was fined by the California Coastal Commission for the unpermitted road work and was required by the Commission and the County of Monterey (perhaps other agencies, as well) to remediate damages to watershed resources.

Sources differ on which portions of the road network in the upper Wildcat Canyon drainage pre-dated the 1990 illegal grading. The 1983 USGS Mt. Carmel topographic map does not depict roads in upper Wildcat Canyon, however Pacific Watershed Associates has prepared a map that portrays the upper Wildcat Canyon road network as having been installed between 1970 and 1985 (PWA, March 2003). Written discussion of the upper Wildcat Canyon road network in the March 2003 PWA report makes note that the illegal roads on the Little Horse Ranch were "illegally re-constructed in 1990" (PWA, March 2003, page 21). The exact date and the responsible party who installed the upper Wildcat Canyon roads remain ambiguous.

It is certain that in 1990, major excavation and fill occurred along the middle reaches of Wildcat Canyon, and serious sediment load hazards in Wildcat Canyon creek were documented by Williams and Kondolf (1991). Pacific Watershed Associates evaluated the unpermitted road work and prepared a restoration implementation plan for 7.7 miles of road in Wildcat Canyon. The restoration plan described site specific treatments, outlined equipment and materials needed to complete the work, and estimated equipment and labor time (hours), and costs (Weaver and Hagens, 1991).

The 1991 PWA road assessment and restoration plan addressed existing and potential erosion problems that threatened to deliver sediment to local streams. "The road decommissioning project was designed to protect and improve salmonid habitat through controlling and preventing road-related erosion on several inner gorge slopes of Wildcat Creek, a tributary of Garrapata Creek. The primary objective of the project was to implement cost-effective erosion control and erosion prevention work on high priority roads that were identified as a part of the comprehensive watershed assessment and inventory project for the basin. The most effective treatment available for the bulk of the most severe areas was the direct removal of remaining unstable, potentially erodable soil material using mechanized earth moving equipment" (Weaver and Hagens, 1991).

The Pacific Watershed Associates team presented a straight-forward approach for restoration. Where soil material generated by illegal road grading threatened to enter local stream channels, prescriptions were developed to:

- Remove unstable material that was still within reasonable reach of equipment operating on the roadbed.

- Replace excavated material, as long as it did not threaten to enter any stream channel.
- Protect bare soil that was exposed during remediation activities.

Work on the Little Horse Ranch was administered and conducted by an outside construction and excavating business in 1991. Treatments were carried out using a bulldozer and excavator to:

- Open access to each site by brushing and filling of gullies.
- Excavate soil and organic material (logs and wood debris) from stream crossings.
- Place small volumes of excavated spoil on stable slopes near decommissioned stream crossings.
- Decompact roadbeds by ripping the surface.
- Outslope roadbeds.
- Mulch treated roads with logs, limbs, and brush.
- Construct water bars and cross road drains on decommissioned roads.

During 2001-2002 field work and coincidentally close to the 10-year anniversary of the 1991 road remediation project on the Little Horse Ranch, the past road decommissioning work conducted along Wildcat Canyon Creek was evaluated by Pacific Watershed Associates. The monitoring work was conducted as a component of the Garrapata Creek Watershed Assessment funded by S.B. 271 grants (PWA, 2003).

Field inventories in 2001-2002 quantified post-treatment erosion and the potential future volume of sediment that could be eroded and delivered to Wildcat Canyon Creek. Erosion hazards and sedimentation quantities are included on pages 23 and 24 of the 2003 PWA report to the Garrapata Creek Watershed Council. On page 22, the 2003 report notes that, "For each treated worksite that was identified, a database form was filled out and the site was mapped on a mylar overlay over a 1:12,000 scale aerial photograph."

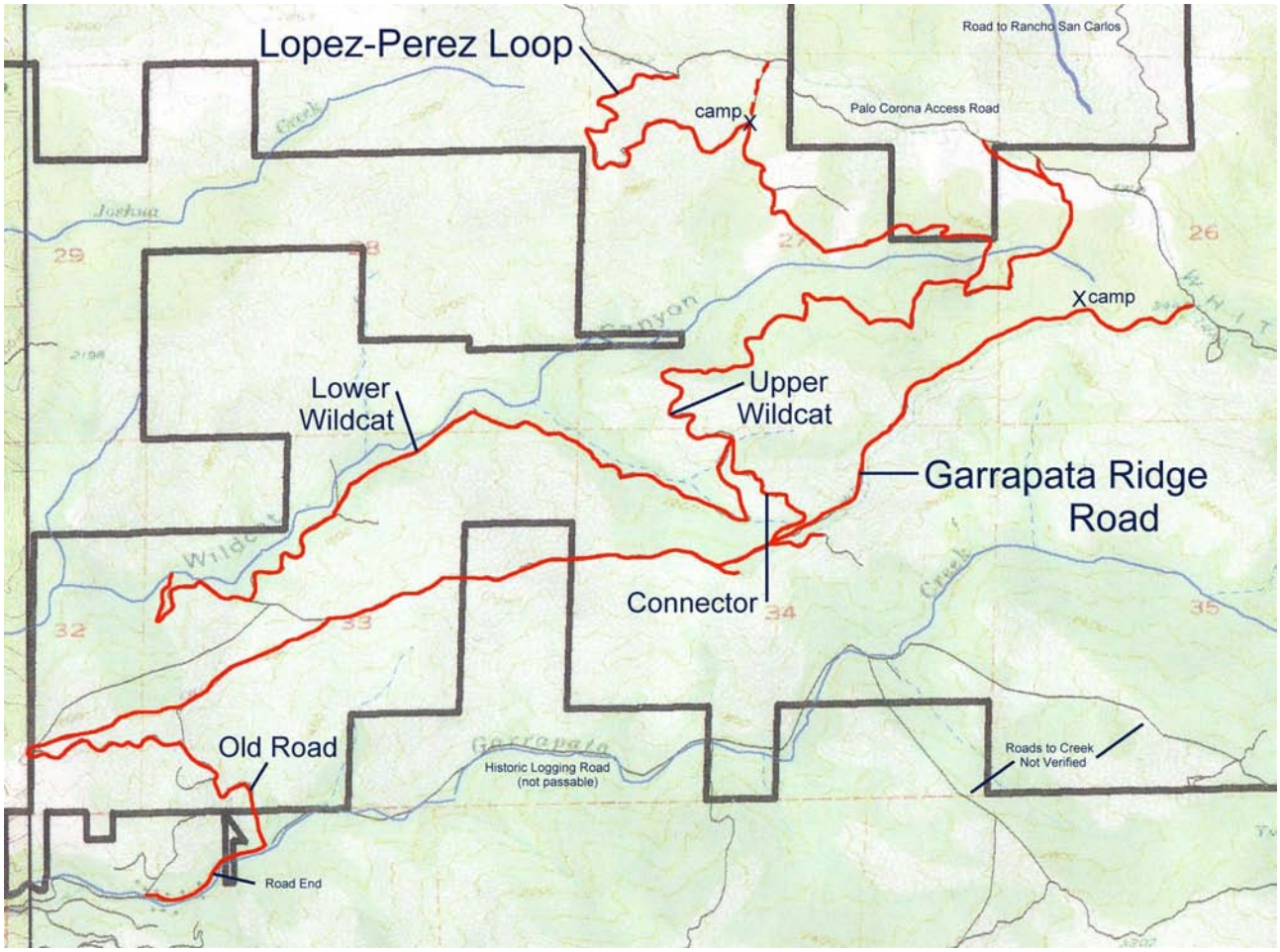
Unfortunately, repeated attempts to access the raw data documenting PWA's "10-year anniversary" monitoring results were not successful. Despite calls to PWA principals, the database records and mylar overlays, as well as the 1:12,000 aerial photography were not available for review pursuant to the Fall 2005 study.

Habitat and natural community descriptions that augment the 2001-2002 PWA evaluation of road treatment sites along decommissioned Wildcat Canyon roads are presented in the following section.

Road Remediation and the Restoration of Natural Community Function

Roads were decommissioned, erosion hazards were remediated, and potential future sedimentation problems were mitigated by the 1990/1991 restoration work in Wildcat Canyon. These efforts were monitored ten years afterwards by PWA staff in 2001. On-going sedimentation issues were addressed in 2001-2002, however an assessment of how well associated habitat is functioning on restored sites does not appear to be a component of the 10-year anniversary work. The following section of the report describes natural community attributes along historic and decommissioned roadways in the upper Wildcat Canyon and Garrapata Creek watersheds.

Hiking access points that were used during this study are located along the Palo Corona Road. Unfortunately, access to approach the upper reaches of the Garrapata Creek Watershed was only available from points within the CDFG Joshua Creek Ecological Reserve, as private land owners on the south side of the watershed west of Twin Peaks did not provide permission for research access during the watershed assessment.



Portions of the Garrapata Creek Watershed. Red lines indicate decommissioned and historic roads evaluated for habitat conditions in Fall 2005. Black boundary line surrounds the former Little Horse Ranch, which was acquired by CDFG. Garrapata Ridge Road is also known as the Garrapata/Wildcat Divide Road. Base map prepared by Lynn Overtree.

The base map above was prepared by Lynn Overtree in 2000 when she was employed by Craig McCaw, former owner of what is now the CDFG Joshua Creek Ecological Reserve. Ms. Overtree used historic maps and 1994 ortho-photography to plot historic roadways, including decommissioned roads in the Wildcat Canyon watershed. All historic and decommissioned roadways highlighted in red were hiked on foot during October and November of 2005. The dashed red line roadway connecting one of the hunt camps with Palo Corona Road was walked for a short distance from either side, but was not fully traversed.

Lopez-Perez Loop: The Lopez-Perez Loop may have been constructed in 1990 to bypass a small, but key privately owned parcel along the Palo Corona Road. It is not known whether legal access across the Lopez-Perez property is included in the grant deed for the Little Horse Ranch (now known as the Joshua Creek Ecological Reserve). The decommissioned road was well-engineered and had a slight grade that took advantage of ridgelines and gentle slopes that separate the Joshua Creek and Wildcat Canyon drainage basins. No part of the Lopez-Perez Loop occurs within the Joshua Creek watershed.

The upper portion of the Lopez-Perez Loop seen from the Garrapata Ridge Road.

The Lopez-Perez Loop traverses through dense upland Mixed Chaparral stands that support Eastwood's manzanita (*Arctostaphylos glandulosa*) , bush poppy (*Dendromecon rigida*), deerweed (*Lotus scoparius*), Santa Lucia monkey flower (*Mimulus aurantiacus* var. *bifidus*), buck brush (*Ceanothus cuneatus*) and warty-leaved ceanothus (*C. papillosus*). Abundant chamise (*Adenostoma fasciculatum*) is evident in the photograph above and below where rust-colored tones punctuate the thick canopy of Chaparral shrubs. Both coffeeberry (*Rhamnus californica*) and redberry (*Rhamnus crocea*) occur in the matrix of Mixed Chaparral, and occasional yucca (*Yucca whipplei*) and sticky snapdragon (*Antirrhinum multiflorum*) can be found with chia (*Salvia columbariae*) and Turkish rugging (*Chorizanthe staticoides*) where there are open places in the decomposing granitic soil.

Sections of the road bed do not appear to have been treated during 1990/1991 road decommissioning work, and other sections of the old route are all but impassable due to the dense cover of native vegetation. Decompacting the roadbed by ripping the surface would have facilitated natural revegetation from the existing soil seed bank, however ripping may also have provided good recruitment sites for weedy invasives. Weed diversity is very low in the Mixed Chaparral

community, unlike other sections of decommissioned roads in Grassland areas along the Lopez-Perez Loop where soil disturbance may have promoted the spread of non-native annual species.

Upper portion of Lopez-Perez Loop traverses through dense Mixed Chaparral and small groves of Coast Live Oak and Canyon Live Oak Woodland. The saddle on the right side of the photograph separates the Wildcat Canyon and Joshua Creek watershed basins.

Revegetating roadbed along the upper portion of the Lopez-Perez Loop. Low shrubs are mostly deer weed and widely scattered rush rose.

Roadbed along Lopez-Perez Loop. Note steep road cut at left. Manzanita and warty-leaved ceanothus occur in roadbed.

Mixed Chaparral areas along the upper portion of the Lopez-Perez Loop - view towards the south and Grassland areas in upper Wildcat Canyon watershed. Note trace of Lopez-Perez Loop across lower grassy slope. This grassy area is to the southwest of the hunt camp situated at the junction of a short connector road and the Lopez-Perez Loop.

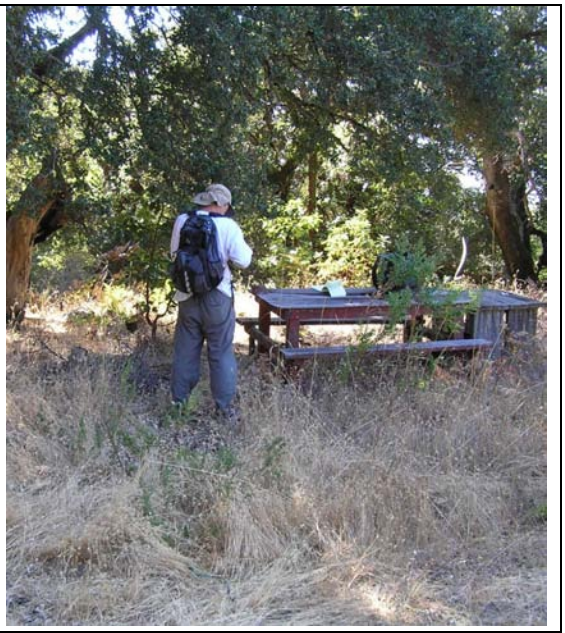
In general, the Lopez-Perez Loop appears to have been decommissioned in a satisfactory manner. Some road reaches do not appear to have been actively put to rest, yet other sections are clearly outsloped and there are areas where it appears that side-cast fill material may have been replaced on the roadbed. Several gullies that were filled during road construction may not have been excavated and are continuing to supply small amounts of sediment during seasonal rainfall events. Decommissioning activities likely addressed key erosion hazards and let other, less problematic locations heal themselves without significant manipulation.

Short sections of the Lopez-Perez Loop are densely vegetated with nearly impassible stands of chaparral shrubs and other sections of road support very sparse vegetation cover and much bare soil. Some of the road sections in the hot, exposed Mixed Chaparral zones are more densely vegetated than shaded road sections under the canopy of oaks, however there is a great deal of site-specific variability in vegetation cover. Most road reaches through Grassland areas have been completely grown over by a mix of native and non-native species. There are clear, although narrow, trails that follow the decommissioned roadbed through many of the Grassland areas and weedy invasives, like Italian thistle (*Carduus pycnocephalus*), dog-tail grass (*Cynosurus echinatus*) and hedge parsley (*Torrilis nodosa*) become thick in places.

Decommissioned roadbed in Grassland area along the Lopez-Perez Loop southwest of the hunt camp. This stretch of road does not appear to have had noticeable "treatment" related to road decommissioning, however the simple act of ripping the compacted roadbed could have led to invasion of weedy annuals, as is depicted in this photograph.

The hunt camp along the Lopez-Perez Loop had been visited in early October 2005, as evidenced by matted grasses in the tire tracks of quad-type all-terrain vehicles. The hunt camp had several rusted bed frames, piles of debris, and stacks of thick, milled redwood lumber.

Hunt camp at junction of Lopez-Perez Loop and short road connecting to Palo Corona Road. Bed frame is leaning on enormous canyon live oak tree.



Picnic table at hunt camp along Lopez-Perez Loop.

Headward erosion creating gully along Lopez-Perez Loop where road decommissioning may not have occurred in 1990/1991. Roadbed fill across small, ephemeral stream is being actively eroded and sediment is moving down-slope.

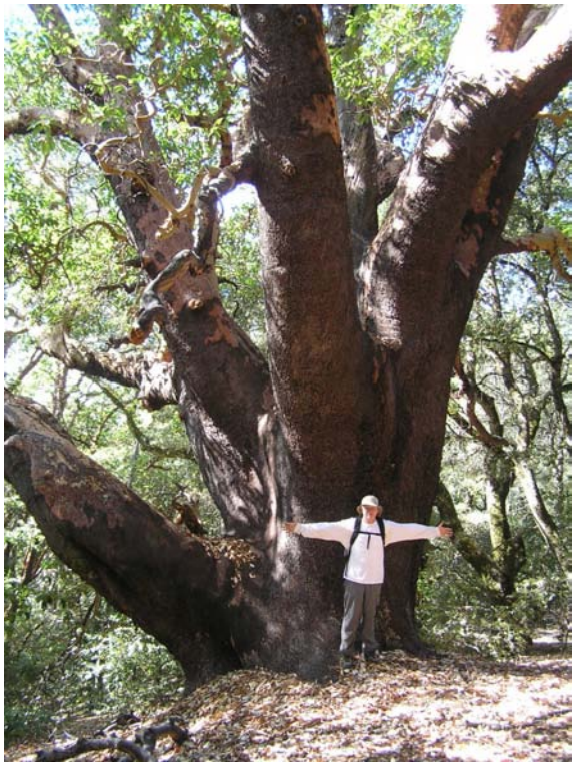
Oddly placed metal T-posts and 3" diameter perc tube near hunt camp along Lopez-Perez Loop. Mountain quail were seen near this location, a very "coastal" and low elevation occurrence for this species.

As the Lopez-Perez Loop winds into the narrow-walled upper Wildcat Canyon, the roadway becomes more trail-like and better decommissioned. Road reaches in the canyon may have been restored to a greater degree because of potential erosion threats associated with the occasional stream crossings delivering sediment to Wildcat Canyon Creek. There are still noticeable areas of active erosion, where slides along stream channels are contributing sediment to small drainages. The road/trail crosses drainages which are deeply entrenched, up to six feet in places, through road fill that was not adequately excavated and sloped back at the crossings. Two of the creek crossings are over Wildcat Canyon Creek, although it is difficult to be correctly oriented in the dense forest and GPS signals were not available. Several of the narrow perennial streams support chain fern (*Woodwardia fimbriata*), elk clover (*Aralia californica*), blackberry (*Rubus ursinus*) and creeping snowberry (*Symphoricarpos mollis*).

Active erosion creating gully at seasonal stream crossing along Lopez-Perez Loop near hunt camp.

Road Between Lopez-Perez Loop and Upper Wildcat Road - Connector Back to Palo Corona Road: At the junction of the Lopez-Perez Loop and the Upper Wildcat Road, the "decommissioned" roadway that connects back to Palo Corona Road becomes much more passable. The large road cuts were likely more difficult to repair and there may not have been sufficient material to restore original grades or contours. Much of the "connector" back to the Palo Corona Road occurs under the very dense canopy of Mixed Evergreen Forest that hosts unusually large madrone (*Arbutus menziesii*) and canyon live oak trees (*Quercus chrysolepis*), with bay (*Umbellularia californica*) and tanbark oak (*Lithocarpus densiflora*) as co-dominants in the forest matrix. Many of the tanbark oak trees exhibit signs of Sudden Oak Death disease and the fuel loads seem relatively high in this portion of the watershed. Revegetation along the roadbed is very sparse, likely because of the dense shade and thick leaf litter under the forest canopy.

	
Decommissioned roadway is slightly outsloped between upper section of Upper Wildcat road and Palo Corona Road. Outsolping may be a function of natural soil and duff accumulation along inboard side of roadcut.	Decommissioned roadway and steep roadcut between upper section of Upper Wildcat road and Palo Corona Road.



Very large madrone along road connecting Upper Wildcat route and Lopez-Perez Loop to Palo Corona Road.

As one approaches the Palo Corona Road, a large mound of placed soil and rock blocks the connector route from vehicular traffic. Frequent traffic accessing the "decommissioned" road beyond (and uphill of) the soil mound has maintained the rest of the roadway in a very open and groomed condition. Most traffic appears to access this portion of the CDFG Joshua Creek Ecological Reserve via the private Lopez-Perez parcel and the route to the north into the adjacent Rancho San Carlos.

Upper section of the connector route into upper Wildcat Canyon experiences frequent vehicular traffic that enters the area via the Rancho San Carlos and other private holdings.

<u>Garrapata/Wildcat Ridge (Divide) Road</u>: The Garrapata/Wildcat Ridge Road is a historic route down the watershed divide that separates the upper reaches of Garrapata Creek from Wildcat Canyon. The Divide Road first appears on the 1956 USGS Mt. Carmel quadrangle and was likely accessed from the adjacent White Rock Gun Club. The Divide Road was extended along the ridgeline all the way down to the bottom of Garrapata Canyon by the time the 1983 USGS map was issued, although today the route down to the canyon bottom from the ridgetop is not passable without extreme difficulty. It is believed that this historic route along the ridgetop was not included in the decommissioning work conducted pursuant to the 1990 illegal grading violation in Wildcat Canyon, however short spur roads off the primary Garrapata Ridge were likely treated in 1991.

The Garrapata/Wildcat Ridge Road was last maintained in 2001 or 2002 as a fire break by staff working for the former private land owner. Portions of the route were bladed at that time, however it seems likely that the equipment operator did not scrape the entire road. The maturity of some of the shrub vegetation growing in the center of the road indicates many years of uninterrupted growth. Portions of the Garrapata/Wildcat Divide Road are alternately densely vegetated and then clear of any sort of understory plants. The route is remarkably free of invasive, exotic weed species, although a small patch of tocalote (*Centaurea melitensis*) was observed along the steep slope seen in the bottom right photo below. Genista (*Genista monspessulana*) occurs at the top of the route near the junction with Palo Corona Road.

The road begins in a Mixed Evergreen Forest area along White Rock Ridge, and quickly descends into Mixed Chaparral and stands of Canyon Live Oak/California Bay Woodland. Closer to the coast at the western edge of the Garrapata/Wildcat watershed divide, the vegetation cover abruptly changes to a low Northern Coastal Scrub community dominated by coast sagebrush (*Artemisia californica*). As is typical of the mosaic landscape in the upper Garrapata Watershed, the floristic diversity of the vegetation throughout each major natural community type can vary over very short distances in response to exposure, soil depth and moisture availability.

Extremely steep sections of Garrapata/Wildcat Ridge Road, with soil movement originating from improperly graded roadbed. Sediment is likely not being delivered to stream drainages, as this slide occurs upslope of densely vegetated Evergreen Forest and Mixed Chaparral habitat.

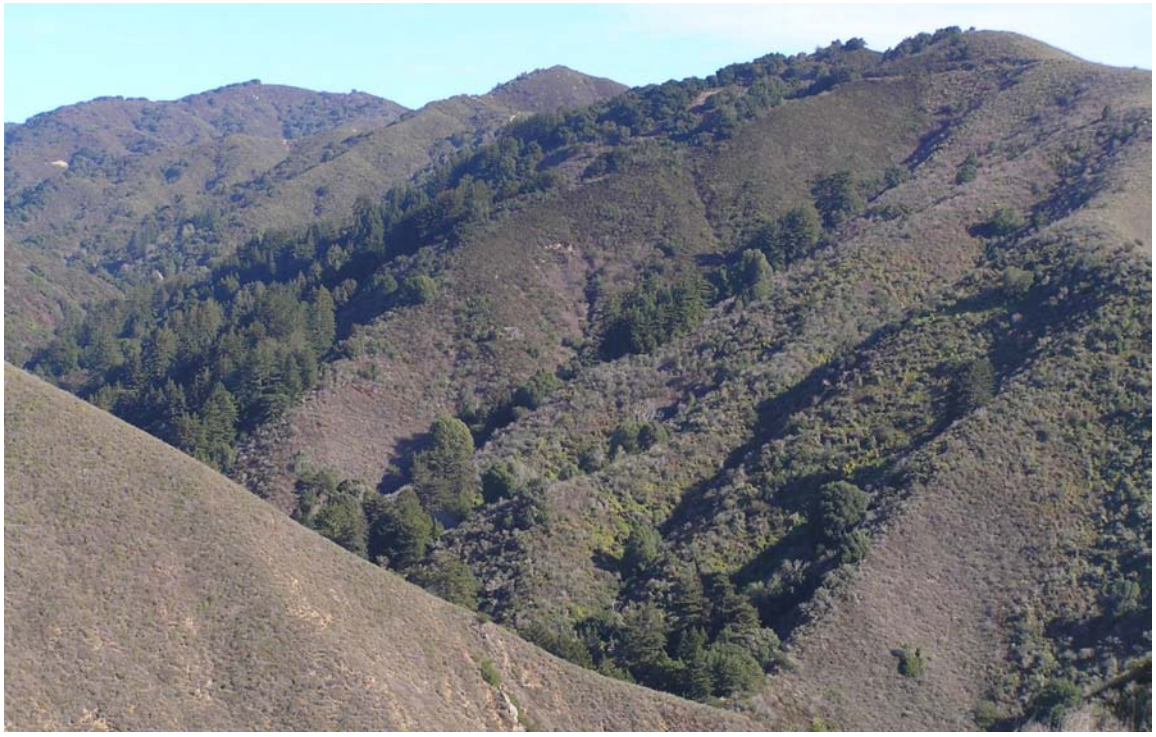
Barren, rocky soil along Garrapata/Wildcat Ridge Road with chamise and occasional manzanita in Mixed Chaparral habitat on either side.

Well-vegetated section of roadbed along Garrapata/Wildcat Divide ridgeline. Annual grasses, deer weed and rush rose characterize the plant cover in this area.

	
Junction of Garrapata/Wildcat Ridge Road, decommissioned "Connector" to Wildcat Canyon on left, and decommissioned spur road on right (looking towards the east). Entry points to "Connector" and spur are densely vegetated with Mixed Chaparral shrubs.	View of decommissioned spur road immediately to the right of junction with Garrapata/Wildcat Ridge. Note tall road cut and evidence of landslide below the head wall of the decommissioned road.

The western nose of the Garrapata/Wildcat watershed divide and the section of the roadway that descends into Garrapata Canyon below. View is across Garrapata Canyon from the King Road on the north-facing side of the drainage basin. Vegetation dramatically changes from the marine-influenced Northern Coastal Scrub on the left, to Mixed Chaparral on the right. A small, natural slope failure has occurred below the roadway, which speaks to the occasional, natural landslides that will occur from time to time in this steep terrain.

Wildcat Canyon - Decommissioned Roads:



View looking upstream into lower and mid-Wildcat Canyon from the Glen Deven Ranch. The nose of Garrapata Ridge and the roadway that descends to the right down into the Garrapata Creek canyon is visible on the top right of the image. The road at the nose of Garrapata Ridge also veers towards the left into Wildcat Canyon. This route was not investigated for this study and remains an interesting opportunity for future survey. This road first appears on the 1983 USGS quad and may be associated with logging activities reported to have occurred in Wildcat Canyon during the 1950's and 1960's.

The majority of road decommissioning activities in 1991 occurred in the mid, and upper Wildcat Canyon watershed. Wildcat Canyon is today a challenging drainage to visit, as access is by foot over routes that have benefited from fifteen years of vegetation growth after road treatments were installed. Access for this study was achieved from hiking points off the Palo Corona Road.

The watershed is similar to adjacent Joshua and Garrapata Canyons, in that it supports a typical mosaic of natural communities that change over relatively short distances as a result of marine influence, soil differences, micro-climate and terrain.

The trace of the route in the right-center of the image is the decommissioned "Connector" road that joined the Garrapata/Wildcat Ridge Road and the roads along the north-facing flank of Wildcat Canyon.

View of the "Connector" road, which has been heavily invaded by yellow start thistle and other non-native, invasive plants. Topographic contour has been restored by road decommissioning at this location.

The "Connector" road between Wildcat Canyon and Garrapata/Wildcat Ridge was decommissioned by outsloping and replacing sidecast fill material on the roadbed. Unfortunately, much of the roadbed has been heavily invaded by yellow star thistle (*Centaurea solstitialis*), milk thistle (*Silybum marianum*) and wild oats (*Avena fatua*). The old roadbed is densely vegetated with annual species and occasional groups of native shrubs typical of the adjacent Mixed Chaparral, however the lack of native recruitment may not be ameliorated as this landscape matures due to the heavy cover of invasives in the road. The predominance of weedy species along this roadway seems to be confined to the open, exposed slope areas surrounded by Mixed Chaparral. Other weed infestations were also noted along decommissioned sections of the Upper Wildcat road, where yellow star thistle was found in dense, discontinuous patches. It is probable that this pioneering invasive plant was transported to the Wildcat watershed by heavy equipment during road work, and the species seems to be confined to treatment areas in xeric, grassy locations.

The decommissioned "Connector" road crosses a small perennial stream near the junction with the "Upper" and "Lower" Wildcat roads. The banks and narrow channel of the stream support a solitary sycamore (*Platanus racemosa*) and a thick stand of leather root (*Hoita macrostachya*), an indicator of perennially saturated soils. Other small canyons and drainages supporting Canyon Riparian habitat and occasional sycamore and big-leaved maple (*Acer macrophyllum*) were readily observed during the Fall 2005 road survey due to changing leaf color of deciduous trees.

The decommissioning of Upper and Lower Wildcat roads within the canyon exhibits varying success, as some treatment areas continue to deliver sediment or have failed since they were installed in 1991 and other locations along the roadways have only very slowly begun to revegetate through natural processes. Road prism dimensions at many sites are large and were probably difficult to restore to stable conditions. Rock and loose soil calving off headcuts accounts for some of the material built up in the decommissioned roadways, but there are areas of the roadbed that were very obviously outsloped. Natural recruitment of looser, thicker soils has provided growing sites for several species of currant and gooseberry (*Ribes* spp.), poison oak (*Toxicodendron diversilobum*), creeping snowberry (*Symphoricarpos mollis*) and ceanothus, particularly hairy ceanothus (*Ceanothus oliganthus*), which can occur in nearly impenetrable thickets.

Roadcut along Lower Wildcat road is still quite prominent. Note dead tanbark oak at left, which has probably died as a result of Sudden Oak Death.

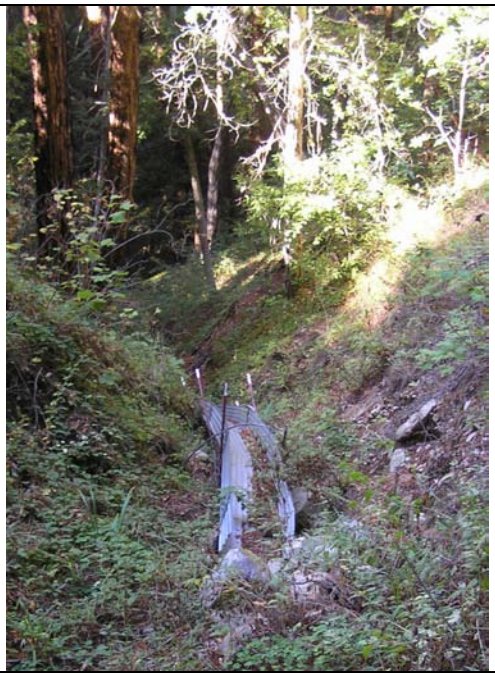
A different roadcut that is equally as prominent. Hairy ceanothus in a loose stand at left occupies more than half of the remaining roadbed at this site.

Location where fill of roadbed has failed leaving a 5-foot scour that may supply sediment during episodic events. Duff and redwood sorrel cover helps to mitigate potential future erosion at this location, however fill is unstable and may continue to erode.

Nails hammered into solid rock of roadcut. One nail had a small piece of yellow flagging still attached, which suggests these marked 1991 road treatment sites. Nails may have been originally installed at waist level above the old roadbed, which has been elevated approximately four feet with accumulated soil and leaf liter. Madrone seedling has recruited at this site.

Road sign still in place along decommissioned Lower Wildcat road.

Redwood stump above narrow channel of Wildcat Canyon Creek and second-growth in "fairy ring" that may be between 30 and 50 years old.

	
Very old bridge constructed out of redwood logs. No visible erosion is apparent along this reach of the road down into Wildcat Canyon. Redwood Forest supports a dense understory.	Open culvert constructed of corrugated tin along old roadway down into bottom of Wildcat Canyon. Metal T-posts supporting downstream end of culvert have not rusted, indicating their relative youth compared to other cultural features in the bottom of the canyon.

Wildcat Canyon Creek in narrow, bedrock-controlled channel near crossing of old logging road. Classic Redwood Riparian habitat with chain fern, redwood sorrel and thimbleberry.

Near the terminus of decommissioned roads surveyed in Wildcat Canyon. Roadbed is all but obscured by dense Northern Coastal Scrub vegetation and canopy of Mixed Evergreen Forest habitat. Non-native milk thistles are in the lower center of the image and a thick patch of seacliff buckwheat occurs between the man and the thistle plants. Extensive stands of seacliff buckwheat are found on northwest-facing slopes in this portion of the canyon.

Several small debris slides were observed along the Lower Wildcat Canyon road, where over-steepened roadcuts are sloughing off into the roadbed below. These slope failures may contribute sediment to Wildcat Canyon Creek, which had deposits of fine sediment embedding coarser material at the location surveyed in November 2005. It may be that debris remaining after early logging activity and the significant earth moving in 1990 is still being transported through the system, or that small, active slides are delivering new material off the roadways.

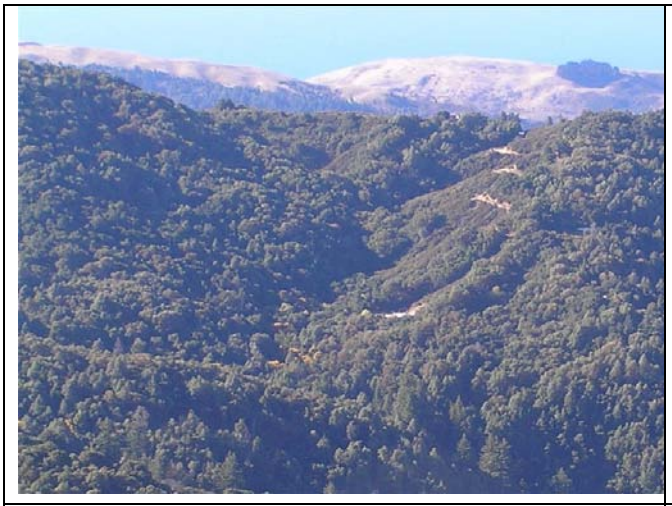
The dense cover of native vegetation in the majority of Wildcat Canyon, and in all the drainages in the greater Garrapata Creek Watershed system, has been key to the stabilization of decommissioned roads and cultural scars associated with logging and road-building. Where vegetation cover is dense, particularly in the moist canyons shaded by Redwood or Mixed Evergreen Forest habitat, abundant organic matter and plant cover have reduced the potential for erosion. As vegetation decomposes, it contributes organic matter to the soil, which improves aggregate stability and decreases bulk density. This makes conditions much more favorable for infiltration of precipitation. Plant cover also protects against direct splash of rain and overland "sheet" erosion by absorbing energy associated with raindrops before they hit the ground. Vegetation cover and leaf litter also help to inhibit surface flow by slowing the movement of water across the ground surface.

Concluding Remarks

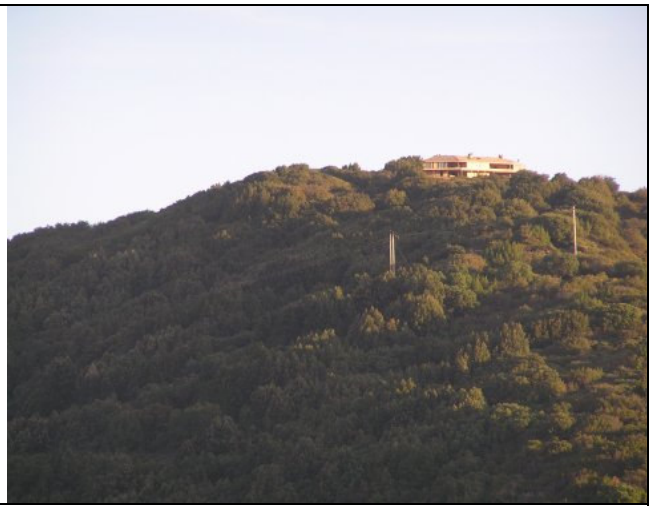
In general, the upper watersheds of the Joshua, Wildcat Canyon and Garrapata drainage basins are well-vegetated and exhibit limited erosion problems. This is largely because the entire region is densely vegetated and experiences very low levels of human disturbance. The Garrapata Creek Watershed is rugged, difficult to access and often impassable. Past logging and road-building practices have increased the vulnerability of the watershed to erosion, however the relative success of road decommissioning and the vigorous growth of mostly native plant cover have worked together to improve overall habitat conditions.

Minor erosion problems were observed along all roadways surveyed during this study, however the natural function of attendant vegetation communities is not compromised by the minor erosional features encountered. Sediment delivery to streams should be relatively low, although conditions in Wildcat Canyon will continue to reflect the massive earth-moving and natural community alterations associated with logging efforts over the past century. Sediment delivery to Wildcat Canyon has been greatly reduced by the road decommissioning work in 1991, and the return of natural community function will accelerate as vegetation stabilizes cultural features. The occasional natural slide and slope failure, and the eventual wildland fire that may occur, will periodically add material to drainage systems, however sediment inputs should be reduced over time in the upper Garrapata Creek Watershed through natural recruitment and growth of diverse vegetation types.

What may compromise the integrity of the natural habitat, as well as increase the potential for erosion and sedimentation of streams throughout the watershed, are the incursions of rural residential development that are penetrating deeper in the watershed. Roads providing access to the upper watershed reaches of the Joshua, Wildcat Canyon and Garrapata watersheds should be constructed according to strict specifications that minimize erosion and preserve habitat values to the largest degree possible.



Roadway that switchbacks down from the Green Ridge area towards the Garrapata Creek canyon bottom.



Power lines that span Garrapata Canyon are below the new home west of Twin Peaks. This structure has been built since the August 2004 photo on page 14.

Largely undisturbed Redwood Forest habitat reaches far up small canyons on the north-facing flank of upper Garrapata Canyon. The crest of the Green Ridge area is along the horizon in the center of the photograph.

View of the upper-most portion of Garrapata Canyon. Big-leaved maple trees add spots of brilliant gold to the Canyon Riparian habitat following Garrapata Creek.

References

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