Planning Level Wetland Delineation and Geospatial Characterization of San Juan and Portions of San Mateo Watersheds, Orange County, California

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Executive Summary

A planning level delineation of aquatic resources was performed within the San Juan and portions of San Mateo Creek Watersheds in Orange County, California. A planning level delineation is defined here as the identification of areas that meet the jurisdictional requirements under Section 404 of the Clean Water Act (Section 404), but is done at watershed scale and covers regulated water bodies (including aquatic resources regulated under the California Department of Fish and Game 1600 Code) at a high level of accuracy but it is not specific to any one site. Thus, a planning level wetland delineation does not replace the need for a jurisdictional wetland delineation from the Corps of Engineers (COE) permitting program.

The modification of standard delineation sampling protocols and the development of wetland ratings for Regulatory purpose for the riparian vegetation map units allowed for a watershed scale delineation. The sampling protocols outlined in the Corps of Engineers Wetlands Delineation Manual (Environmental Laboratory 1987) and 33 CFR 328 were modified for use at the watershed scale. To delineate at a this scale we mapped geomorphic surfaces in the riparian zones that represent several different return intervals, which were later interpreted for frequency requirements under Section 404. Individual vegetation units were sampled at 65 sites to develop a characterization of the wetland indicators for both wetlands and WoUS. Wetland decisions were determined by combining the field data for wetland criteria for each separate vegetation map unit with the distribution patterns of vegetation units within the geomorphic surfaces. By combining the wetland indicators with flood frequency information obtained from the geomorphic surface map, we made jurisdictional decisions with regards to “Waters of the United States (WoUS), including wetlands” decisions across the entire study area.

The vegetation units in the riparian areas were then rated for their probability of meeting the criteria as either wetland or non-wetland WoUS. These ratings resolved the issue that some vegetation units had repeatable characteristics that always meet the criteria of a WoUS including wetlands, and others were so ecologically diverse that they were able to occur in various landscape positions. By combining field sampling and observations with distribution patterns analyzed within the GIS database, probabilities ratings intended for regulatory purposes were developed to accommodate all variations. Six categories of wetland ratings were assigned to each of the riparian vegetation units with ratings ranging from always regulated to very low probability of being regulated to upland or not regulated. An addition rating was assigned for those areas that have been set aside for wetland mitigation purposes.

We delineated a total of 1246 ha (3080 ac) of wetlands and WoUS in the riparian areas and 201.57 km (1252 miles) of intermittent streams as WoUS within the watershed.

1. Introduction

1.1 Background

The U.S. Army Corps of Engineers, Los Angeles District (LA District) in cooperation with other Federal, State of California, and private interests recently funded an effort to map the aquatic resources within the San Juan and portions of San Mateo Creek watersheds, Orange County, California. This effort began by using vegetation coverages obtained from Orange County. By combining these preliminary data layers with onsite mapping efforts for hydrogeomorphic surfaces and field sampling, we were able to develop a large scale wetland delineation for the watershed. Our report provides support to the LA District and other sponsors on wetland locations and their regulatory status (under Section 404) that will be useful for the large scale future assessment of impacts to wetlands in the watershed. Specifically, it provides information necessary to identify and characterize regulated waters of the United States (WoUS) including wetlands, in the context of Section 404 permit review. In addition, this planning level delineation of aquatic resources provides a comprehensive mapping of aquatic resources regulated under California Department of Fish and Game's 1600 program. This planning level also supports in part the concurrent landscape level functional assessment for the watershed. [1]

1.2 Objectives

The objectives of the study were to:

1. Conduct a planning level identification of aquatic resources within the boundaries of San Juan and parts of San Mateo Creek[2] watersheds as provided by the LA District through the interpretation of orthophoto quadrangles and stereoscopic aerial photography.

2. Verify jurisdictional status and location of identified aquatic resources using sampling and global positioning system (GPS) techniques at a representative numbers of field locations.

3. Produce a planning level map of aquatic resources that includes jurisdictional WoUS (including wetlands) for an ArcINFO and ArcView based geographical information system (GIS).

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[1] Aquatic resources delineated in this study is intended to include those regulated under Section 404 of CWA and CDFG's 1600 program. The term aquatic resources is used to be inclusive of these regulated resources.

[2] References to San Mateo Creek Watershed include those within the study area.

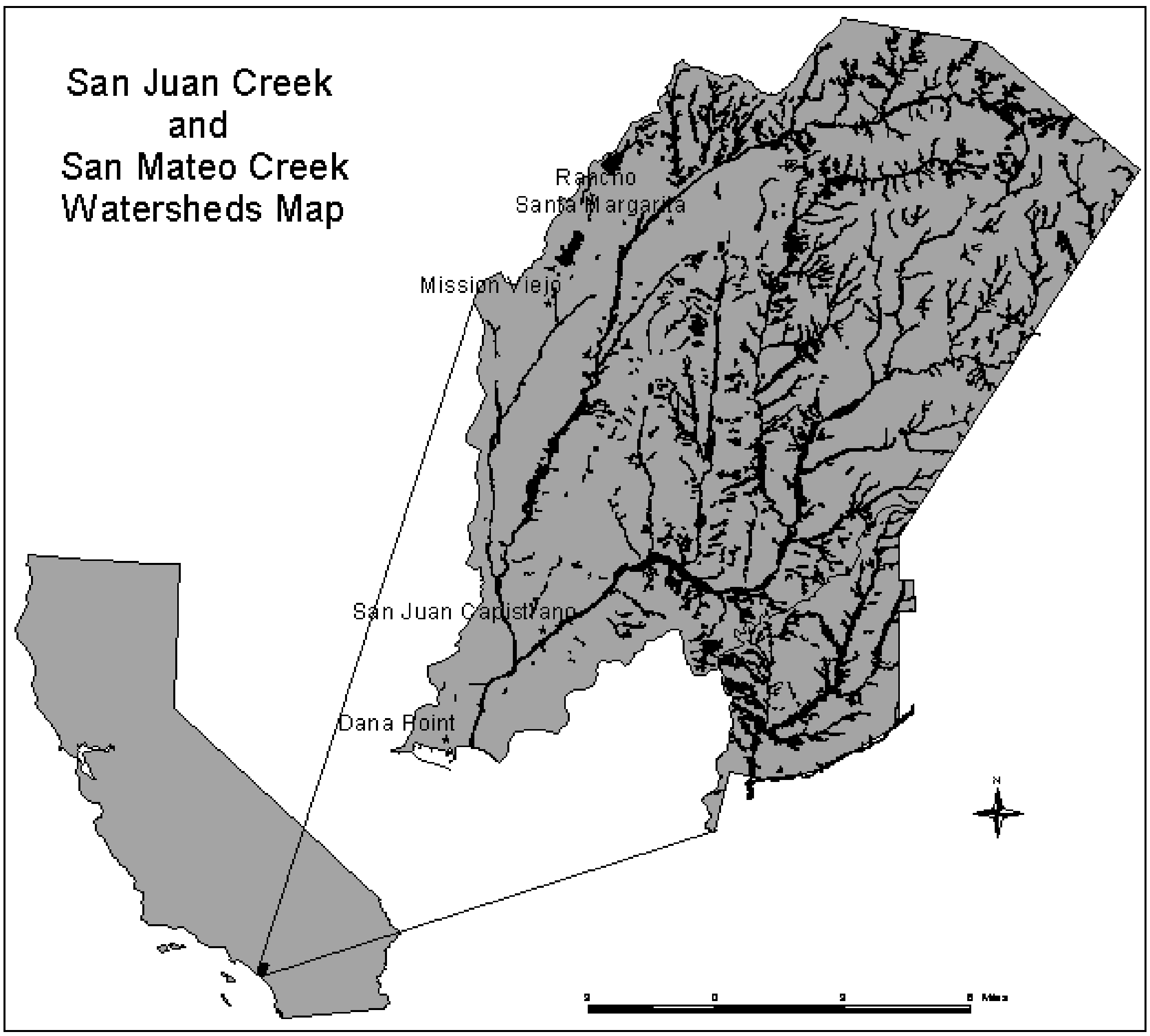
4. Develop a GIS based database of riparian ecosystem and watershed characteristics.

5. To provide aquatic resource occurrence data, characterization and digital coverages to support a concurrent landscape level wetland functional assessment within the watershed.

2. Study Area

San Juan and San Mateo Creek watersheds encompass ca. 46,147 ha (114,029 ac) approximately 95.78 km (59.49 miles) south of downtown Los Angeles in Orange County, CA. The cities of San Juan Capistrano and San Clemente are located in the lower reaches of the watersheds. Several other communities are located within or near the watershed including Dana Point, San Juan Capistrano, Rancho Santa Margarita, and Mission Viejo. The watershed is bounded by Route 5 and the Pacific Ocean on the west, Ortega highway on the southeast**,** and the Cleveland National Forest to the Northeast (Figure1).

Figure 1. Study Area Site and Location Map.



Elevations range from sea level at the mouth to 1,594 m (5,321 ft) in the northern areas of the watershed. Terrain includes rugged mountains, steep-walled canyons and gently sloping floodplains. The southern portion of the watershed is located on a marine terrace, or mesa, on the coastal plain that rises gradually from the Pacific Ocean. The western section changes from a relatively flat valley to foothills with deeply incised canyons. The eastern part of the watershed is made up of coastal foothills and canyons with moderate to steep slopes.

The major vegetation types include chaparral, coastal sage scrub, grassland, and riparian vegetation.

2.1 Climate

The regional climate in the San Juan and San Mateo watersheds is classified as Mediterranean, which is characterized by warm, dry summers, and mild, wet winters. Precipitation averages approximately 30 cm (12 inches) per year and is associated with low intensity storms in the winter and spring. Frosts are light and infrequent, with the growing season ranging from 345 to 360 days. The average annual temperature is about 63 degrees Fahrenheit. The average daily high is 71 degrees, and the low 53 degrees (11.63 C). The major influences on the regional climate are the Eastern Pacific High, a strong persistent anticyclone, and the moderating effects of the cool Pacific Ocean (USACE 1999).

During summer, the Eastern Pacific High block storm systems originating in the Gulf of Alaska and produces a temperature inversion that traps air pollutants near the earth's surface, resulting in poor air quality throughout the Los Angeles basin. Cool marine air condenses into fog and stratus clouds below the inversion layer during the evening but dissipates the following morning as the land heats up. Onshore airflows, associated with low-pressure systems over the inland desert, are the norm. Precipitation associated with tropical air masses during the summer is generally infrequent and unsubstantial.

During winter, polar storm systems begin to pass through the area as the Eastern Pacific High weakens and shifts south. Most regional precipitation occurs during this period. Excessive rainfall can occur when the jet stream maintains a position over southern California and carries multiple storms across the region. Major flooding events for this region typically occur December to March and have been documented for the following years during the 20th century: 1910, 1916, 1937, 1938, 1943, 1969, 1978, 1980, 1983, 1995 and 1998. A strong northeastern wind is prevalent in the fall and winter, referred to as Santa Ana's, can ventilate the Los Angeles basin, preventing the buildup of air pollutants.

2.2 Regional Geology

The San Juan Creek watershed lies on the western slopes of the Santa Ana Mountains that are comprised of Cretaceous volcanics at the peaks to non-marine conglomerated and sands in the foothills. The Mission Viejo fault crosses

San Juan Creek about three miles upstream from the confluence with Bell Canyon Creek and acts as a boundary between the Cretaceous and Tertiary sediments (USACE 1999). The Tertiary sediments are interbedded marine and non-marine deposits, which are tilted approximately 10-15 degrees to the west. The marine deposits become more dominant to the west. Quaternary alluvial fan and debris deposits are scattered over the eastern highlands of the watershed while Quaternary alluvial terrace and channel deposits are found in association with drainages to the west.

2.3 Soils

The U.S. Department of Agriculture study divides Orange County for soil classification and surveys into the following major types: an area of terraces and rolling foothills extending to the Santa Ana Mountains and the alluvial flood plains (USDA-SCS 1978). The soils of primary interest for this study are those developed in riparian areas and active flood plains. The majority of these flood plain soils are classified as Entisols and are poorly developed. The USDA soil survey (1978) describes the soils along the streambeds as: somewhat excessively drained to poorly drained, nearly level to moderately sloping soils on alluvial fans and flood plains and in basins of the coastal plains. Flood plain soils are young in age and are mainly composed of silt loam and silty clay loam alluvial deposits. In terrace locations in the flood plain where fine silts and organic material have accumulated for years, the soils have developed horizons within the soil profile.

The lower to middle reaches of the watersheds are dominated by the Riverwash (RM) landform type. This flood plain soil unit is composed of soil that has developed on alluvium and is moderately well drained to excessively drained. In the upper reaches of the watersheds, another land type, Stony land (SvE) is commonly associated with smaller reach bottoms. This map unit is dominated by stones, rocks, or boulders located on the soil surface. This unit is generally associated with the first and second order streams that have intermittent flowing water.

Outside of the flood plains are a variety of soil associations that are used to describe alluvial fans, slopes of both fine and cobbly materials, and other sandstone, shale, metavolcanic, and sedimentary formations.

2.4 Topography

Elevations within the watershed range from just over 1,594 m (5,321 ft) in the east to nearly sea level in the west. The uplands to the east are cut by southwesterly trending canyons that open onto alluvial fans, which broadening on to an alluvial plain. Along drainages on the alluvial plain are a series of fluvial terraces composed of coarse channel deposits. The alluvial plain thins to the west as marine deposits that are partially covered by younger alluvial fan deposits appear. The foothills to the south have approximately half of the elevation as the uplands to the east and are about cut by northwesterly trending canyons that open onto alluvial fans. These fans broaden as well onto the terraced alluvial plain.

2.5 Subwatersheds

Local watersheds drain to the south and west. The major subwatersheds were subdivided into highlands, foothills, and lowlands. The incised highland subwatersheds include Upper San Juan, Upper San Juan and Hot Springs, and Upper Trabuco, which drain to the southwest. The elongate foothill subwatersheds include Lower San Juan and Canada Gobernadora, Lower San Juan and Verdugo, Middle San Juan and Lower Bell, Middle Trabuco and Hickey, Middle Trabuco and Tijeras, Upper Oso, Upper San Juan and Lucas, and Upper San Juan and Upper Bell, which drain predominately to the south and west. The lowland plain subwatersheds include Lower San Juan, Lower San Juan and Canada Chiquita, and Lower Trabuco and Lower Oso, which drain to the southwest. These subwatersheds drain at some point into San Juan Creek.

The section of San Mateo watershed was not divided into subwatersheds because only the northwest section was delineated. The major drainages within the San Mateo watershed that was delineated include Gabino Creek, Christianitos Creek, which drain to the southwest, and Talega Creek, which drains to the west.

2.6 Vegetation Communities

A total of 16 vegetation types are mapped within the San Juan and San Mateo watersheds in the Orange County Regional vegetation mapping effort (Holland 1986, County of Orange, 1992). A diversity of vegetation typifies most of these two watersheds. Riparian woodlands and forests occur along most portions of the stream corridors. Some of the major stands of riparian vegetation can be found in the following areas: San Juan to the confluence with Oso Creek; Canada Gabernadora tributaries; bell Canyon; and many of the tributaries to San Juan and San Mateo creeks. Dispersed sections of riparian vegetation occur along Oso, Horno, and Canada Chiquita creeks. The slopes along these corridors are dominated by coastal sage scrub or chaparral communities. With increasing elevation, chaparral communities replace coastal sage. Coastal sage scrub is restricted to xeric, south facing slopes. Oak woodlands and forest become common in the upper reaches of the watershed on north-facing slopes and along drainages. In several parts of the watersheds, increased urbanization has eliminated the natural vegetation.

The riparian vegetation is one of the most dynamic vegetation communities within the watershed. The dramatic changes in vegetation patterns over short time scales are a result of periodic cycles of destruction and regrowth from flooding events and human disturbance. As a result of these disturbances, the ability of riparian vegetation to have "pure stands" or "climax" vegetation is limited in these dynamic environments. The natural events caused by periodic flooding can quickly change the distribution and species composition and reset the disturbance-recovery cycle. Additionally, land development within parts of some watersheds has modified the potential of the natural vegetation to reestablish itself after flooding events. These disturbances have modified watercourse directions, changed silt loads, and have allowed areas to maintain water for longer periods of time than previous occur. Impacts from water being discharged from parking lots and other developed areas have allowed for more disturbed willow forests and ponds to occur. Finally, most of the major native riparian vegetation areas in the lower watershed have been eliminated and replaced by concrete lined flood control structures.

2.7 Streams and Riparian Ecosystems

San Juan and San Mateo watersheds encompass 12 major subwatersheds. The larger subwatersheds are drained by the Canada Chiquita, Canada Gobernadora, Verdugo, Oso, Bell, Hicks, Tijeras, Hot Springs, Lucas, Mateo, San Juan and Trabuco creeks. Smaller watersheds are drained by streams originating in the foothills immediately adjacent to the coastal plain.

Streams within the study area fall into several of the Rosgen (1996) stream classes. Ephemeral and some intermittent and 1st order streams fall into the "A3-4" stream type which is characterized as steep, entrenched, cascading step/pool streams often in sand and gravel or bedrock and boulder dominated channels. More typically intermittent and 1st order streams fall into the lower gradient (2-4% slopes) "B4" or "B5" stream type with sand and gravel substrates. Second and 3rd order streams are typically of the "C3-4" stream type with slopes <2% and cobble, gravel, or sandy substrates. Fourth, 5th, and 6th order streams are of the braided channel "D3-5" stream types with slopes <2 %.

Associated with the higher order streams are riparian ecosystems. Based on the work of Richards (1982); Harris (1987); Kovalchik and Chitwood (1990); Gregory et al. (1991); Malanson (1995); and Goodwin et al. (1997), riparian ecosystems were defined as the relatively narrow ecotones that exist between the bankfull channel of alluvial streams and adjacent upland habitat. The riparian ecosystem consists of two distinct parts or zones, although either may be absent under certain circumstances, i.e. in narrow canyons. The first zone is that portion of riparian ecosystems flooded by surface water from the stream channel at least every five to ten years. Throughout this report we refer to this part of the riparian ecosystem as active floodplain or Riparian Zone 1 (Figure 2).

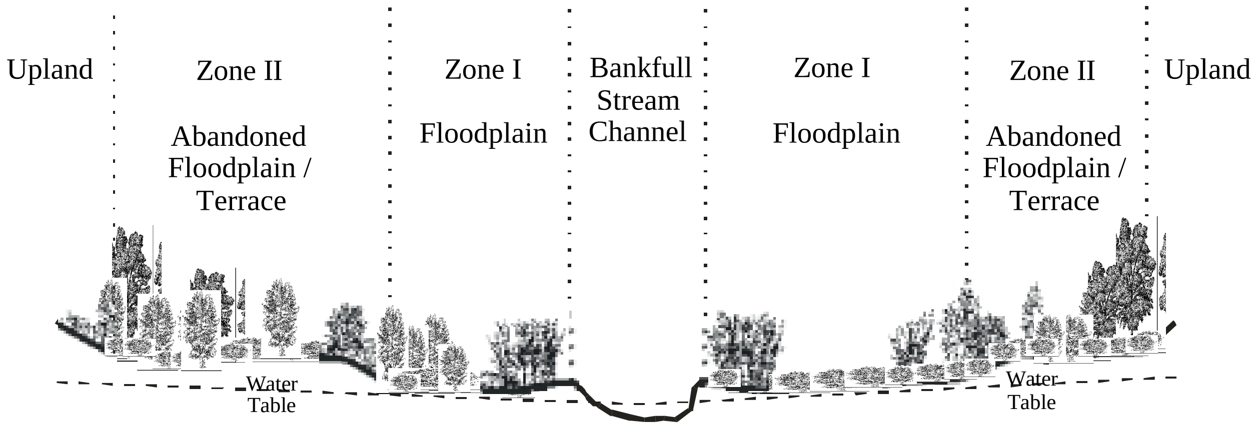


Figure 2. Cross-section depicting hydrogeomorphic floodplain surfaces.

The second zone of the riparian ecosystem consists of abandoned floodplains and terraces formed by fluvial processes operating under different climatic or hydrologic regimes. Under current climatic and hydrologic conditions, these areas are flooded episodically during larger magnitude events (Dunn and Leopold 1978). This part of the riparian ecosystem is referred to as terrace or Riparian Zone II (Figure 2).

3. Definitions

3.1 Riparian Ecosystems

Riparian areas typically border rivers and streams. These riparian areas are particularly important because they link and integrate across landscapes by serving as corridors through which water, materials, and organisms move. In arid regions they are also critical to maintaining regional biodiversity because they provide habitat for a disproportionately large number of species in spite of their limited aerial extent. Riparian areas typically include a zone of frequent flooding (bank full), that is regulated under existing federal and state law, as well as a less frequently flooded transition zone between these areas and adjacent uplands (active floodplain to floodplain terrace). These transition zones vary in regulated statute from WoUS (including wetlands) to uplands even though they contribute greatly to the habitat, hydrologic, and biogeochemical functions performed by riparian areas. In this delineation and characterization we identify and discuss all these units because they constitute the “functional” riparian ecosystem, and that this functional riparian ecosystem should be identified, assessed, and managed as a unit.

3.2 Waters of the United States

Waters of the United States (WoUS) are regulated under Section 404 of the Clean Water Act (CWA). The areas delineated as WoUS in this study met the requirements outlined in the Corps of Engineers Wetlands Delineation Manual (Environmental Laboratory 1987), subsequent guidance from the Office of the Chief of Engineers (1992; 1995), and 33 CFR 329.11(a)(1-7). These areas include the following, "…1) all waters that are currently used, or were in the past, for interstate or foreign commerce, including all waters that are subject to the ebb or flow of the tide; 2) all interstate waters including interstate wetlands; 3) all other waters such as intrastate lakes, rivers, streams, (including intermittent streams), mud flats, sandbars, wetlands, sloughs, prairie potholes, wet meadows, playa lakes, or natural ponds; 4) all impoundments of waters otherwise defined as waters of the United States; 5) tributaries of waters identified in numbers 1-4 above; 6) the territorial seas; and 7) wetlands adjacent to waters listed in 1-6 above". All surface waters within the study area boundary were considered WoUS including streams, intermittent streams, ponds, lakes, and reservoirs.

3.3 Ordinary High Water Mark

The jurisdictional limits of streams are defined by using the "ordinary high water mark" (OHW). The OHW is defined at 33 CFR 328.3(e) as "... that line on the shore established by fluctuations of water and indicated by physical characteristics such as clear, natural lines impressed on the bank, shelving, changes in the character of the soil, destruction of terrestrial vegetation, the presence of litter and debris, or other appropriate means that consider the characteristics of the surrounding area". Additionally, seasonal wetlands, as described in the Corps of Engineers Wetland Delineation Manual, are where "... water in a depression (is) ... sufficiently persistent to exhibit an ordinary high-water mark or the presence of wetland characteristics."

The regulated waters delineated in this study are intermittent streams, riverine, isolated wetland depressions, and coastal salt marshes. The isolated depressions, coastal marshes, and parts of the riverine system were determined to be wetlands because they met the three parameter criteria. The intermittent stream and some portions of the perennial streams were treated as WoUS.

3.4 Wetlands

Wetlands are one of six special aquatic sites included under WoUS. Wetlands are defined as "... areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions" (33 CFR 328.3(b)). The methodology for delineating the boundaries of jurisdictional wetlands, using hydrologic, hydrophytic vegetation and hydric soil criteria, is outlined in the Corps of Engineers Wetlands Delineation Manual (Environmental Laboratory 1987).

Despite the fact that “wetlands” are technically WoUS, throughout this report we will follow the common convention of distinguishing between wetlands and WoUS. The term “wetland” will refer to WoUS that are regulated by virtue of the fact that they meet the hydrologic, hydrophytic vegetation, and hydric soils criteria outlined in the Corps of Engineers Wetlands Delineation Manual (Environmental Laboratory 1987). The term WoUS will refer to those waters are regulated under the CWA despite the fact they may not meet the three criteria used to distinguish wetlands.

4. METHODS

4.1 Delineation of Aquatic Resources

Aquatic resources were identified using a high precision planning-level delineation approach that adjusts the sampling methods outlined in the Corps of Engineers Wetlands Delineation Manual (Environmental Laboratory 1987) and 33 CFR 328 and applies them at a watershed scale. This delineation approach allows for the identification of different types of regulated wetlands and WoUS over a large area. <u>While the approach provides a high quality map of jurisdictional wetlands and WoUS, suitable for use in project planning, it does not serve as a substitute for the on-site jurisdictional delineation that is normally conducted as part of Section 404 permit review process.</u>

4.2 Initial Identification of Aquatic Resources

Aquatic resources were initially identified by interpretation of existing vegetation spatial data bases (maps). These initial maps were supplied by Orange County, CA, Natural Resources Office. It was determined that these maps had several limiting issues, 1) they had numerous rectification problems, 2) they lacked enough detail to produce acceptable wetland maps, and 3) the spatial extent of the map units was too large to be used for our purposes. To develop the wetland delineation map units we used a combination of resources and techniques.

We delineated map units using true color aerial photographs at a scale of 1:4800. These aerial photographs were color copied and used to delineate riparian vegetation in the field with a minimum mapping unit size of about one quarter of an acre. Each riparian vegetation unit was labeled using the modified Holland (1986) classification for CA vegetation. These delineated aerial photographs were later digitized in the laboratory using ArcINFO software. Other landscape features useful for digitizing and rectification were contours (at 1:24,000 at a scale of 10 foot contour interval), vegetation community/land, hydrology, soil, and major roads that were obtained from Orange County GIS center in ArcINFO format. The mapping base data consisted of scanned aerial photographs at a resolution of 6 inches per pixel as well as USGS 2 meter quarter orthoquadrangles. These images were used as a backdrop for digitizing the delineated riparian vegetation units. A list of the riparian vegetation communities and other map unit types, the codes used to designate them, and other information is provided in Appendix 1.

These same sources of information were used to develop a GIS coverage of the hydrogeomorphic surfaces within the riparian ecosystem. Three types of surfaces were identified including the bank full channel, the active floodplain (Zone 1), and terraces (Zone 2). In addition to the delineating of vegetation units on the copied aerials, the hydrogeomorphic surfaces were mapped in the field using the same copies. Likewise, the hydrogeomorphic surface polygons were digitized on screen using the orthophoto quadrangle along with GIS coverage as a base map. This resulted in spatial database with two attribute fields, one for riparian vegetation (hereafter referred to as the riparian vegetation base map) and the other of geomorphic surfaces within the riparian ecosystem.

The first order streams were digitized by stereoscoping the locations on the aerial photographs and then digitizing the coverage by using the rectified orthophoto quadrangle as a background. The first order streams, identified on the coverages in this report as red lines, are typically 15 feet or less wide. These single line features were not associated with other hydrogeomorphic surfaces. In several instances, second and third order streams were also identified as a single red line due to their narrow width and lack of other hydrogeomorphic surfaces. Typically, these single lined second and third order stream channels resulted from human influences that caused down cutting in the channel.

4.3 Field Verification

We sampled 55 sites in the field to verify the regulatory status of riparian vegetation communities identified on the riparian vegetation base map (Appendix 6; data sheets will go here). Representative sites were selected using a stratified random approach with subwatersheds and riparian vegetation communities serving as the stratification criteria. At each sample point the wetland boundary was established using GPS equipment, the information necessary to complete a routine wetland delineation was collected. In addition, physical and biological information was collected to help classify and characterize vegetation communities and riparian reaches and providing information for the functional assessment. This information included: geomorphic surface (channel, active floodplain, and terrace), soil texture, plant species and abundance by stratum, adjacent land use/land cover, and cultural alterations.

The data collected during field sampling was summarized to provide a description of the geomorphology, hydrology, soils, and vegetation of various vegetation community types. This was used to modify the riparian vegetation/wetlands and geomorphic surface base maps.

Any boundaries that needed to be corrected were redrawn later in the laboratory using a stereoscope. The map is developed as an iterative process that combines both field and laboratory efforts. Sample data sheets may be obtained from U.S. Army Corps of Engineers, Los Angeles District upon request.

4.4 Analysis of Field Verification Data

Data collected during the field verification was summarized and analyzed to characterize the common riparian vegetation types in terms of riparian vegetation species and environmental variables. Canonical Correspondence Analysis (CCA) (ter Braak 1988) was used to determine the relationship between species density values and environmental variable values in the 48 sample points at San Diego watershed. CCA is a direct gradient analysis technique that relies on the assumption of unimodal relationships between species and environmental variables. CCA, like other ordination techniques, is used to construct a multidimensional graph whereby each axis represents some environmental descriptor. Within this graph, those species occurring in clusters generally occur in similar habitats, whereas species found relatively far from each other occur in differing habitats. The environmental descriptor associated with each axis can be interpreted by examining the environmental variables that extend roughly parallel to the axis. The length of the arrow for each variable is an indicator of the strength of the relationship between that variable and the axis. Therefore, the greater the length of the arrow, the greater the relationship between the species, the environmental variable and the axis. To determine which components explain the greatest proportion of variance in the data, stepwise, forward selection of environmental variables was employed. Environmental variables examined in this study were primarily descriptors of the vegetation and soil characteristics at the site (Table 1). Finally, Monte Carlo permutation analysis was performed on the ordination axes to determine their significance (Manly 1990). In addition, descriptive statistics were performed on the values for select environmental variables.

Table 1. Environmental variables collected at San Juan Creek Watershed

Vegetation Variables	**Soil Variables**
% Cover – coarse woody debris	% Silt
% Cover – trees	% Sand
% Cover - shrubs	% Gravel
% Cover – herbs	Gravel Size (cm)
% Cover - exotics	% Cobble
% Cover - litter	Cobble Size (cm)
Species Richness	
Prevalence Index Value	

4.5 Final Map of Wetlands and Waters of the United States

The final map for WoUS was developed by assigning probability ratings for regulatory purpose (Section 404) to the riparian vegetation/hydrogeomorphic base map. These designations were made based on the results of the field verification sampling, and by evaluating the hydrology for each geomorphic surface, and its vegetation type. These designations were further evaluated using GIS software to compare their spatial distribution patterns with those of other types (e.g. watersheds, human disturbance and geomorphic surfaces).

The bank full, active flood plain, and first order ephemeral streams were found to be mostly WoUS, and therefore regulated. The wetland status of vegetation types occurring in terrace geomorphic surfaces and along some of the first order streams varied depending on a number of factors and therefore could be placed in one of several Section 404 jurisdictional wetland categories. Due to the variation in site conditions and lack of fidelity of certain riparian vegetation types for similar site conditions in the terrace and first order stream positions, probability ratings were adopted to determine the likelihood that wetlands or WoUS occurring in both the floodplain and non-floodplain areas. Each riparian vegetation type within the three geomorphic surfaces (hereafter referred to as floodplain riparian vegetation) was assigned a rating of 1-6. The ratings are explained in Table 2. The non-riparian wetland, those wetlands not located within a floodplain or riparian corridor (hereafter referred to as non-floodplain riparian vegetation), associated with first order streams and outlier positions were also assigned a similar but separate rating as shown in Table 2. This allowed for distinguishing the different hydrologic regimes associated with each major ecological setting. The Ratings assigned to both the floodplain and non–floodplain riparian vegetation ratings are compared and shown in Appendix 2. In addition to these wetland ratings, another category called water resources (WR) was applied to those areas requiring further legal investigation and decisions from the local Corps District. This category of units goes beyond the scope of this study and includes water bodies like sewage lagoons and water retention basins.

Table 2. Wetland / WoUS ratings assigned to riparian vegetation types

Rating	Description
1	Types meet the criteria for a wetland or WoUS 100% of the time
2	Types meet the criteria for a wetland or WoUS 67-98% of the time
3	Types meet the criteria for a wetland or WoUS 33-66% of the time.
4	Types meet the criteria for a wetland or WoUS 2-32% of the time (primarily uplands)
5	Types meet the criteria for a wetland or WoUS <2% of the time (primarily uplands)
6	Unregulated upland
7	Mitigation
WR	Water Resource (contact local Corps District for jurisdiction interpretation)

Section 404 jurisdictional designations were assigned to each polygon, intermittent, and ephemeral stream reaches as follows. The bank full channel geomorphic surface meets the criteria for a jurisdictional wetland if it is vegetated because the hydrology criteria has been met "in most years or [with a] greater than 50 percent probability." It also met the hydrology criteria, which allows the soils to be considered hydric as a result of long periods of flooding or ponding. However, when hydrophytic vegetation is lacking the polygon qualifies as a WoUS based on the presence of a bed and bank or OHW. Unlike the bank full channel geomorphic surface, the active floodplain geomorphic surface is characterized by a recurrence interval of 10 years or less, and consequently, may meet the hydrologic criteria required for a jurisdictional wetland (Section 404). But because of the frequency of flooding events is then considered a non-wetland WoUS regardless of the hydrophytic nature of the vegetation or the status of the hydric soils. Included within the active flood plain are occasional adjacent wetlands that met the criteria for a jurisdictional wetland. Also occasional tributary channels bisecting the active flood plain and the terrace generally met the criteria as a WoUS. Terraces had several types of regulated units: the lateral tributary, adjacent wetlands and areas that receive over bank flooding or groundwater influence enough to develop wetland features. Adjacent wetlands that meet all three criteria were usually located in the linear paleo channels. In the upper most reaches of the watershed, the 1st and 2nd order streams, and some 3rd order streams were identified as WoUS based on the location of the OHW, i.e. bed and bank. Riparian vegetation associated with these locations was assigned a probability rating for non-floodplain riparian vegetation. These non-flood plain riparian wetlands also include isolated wetlands scattered throughout the watershed that are not associated with flood plain areas.

5. Results and Discussion

5.1 Description of Vegetation Community Types

Thirty-two of the 88 vegetation types within the coverages provided by Orange County were identified as potential vegetation units containing WoUS including wetlands, and sampled. These 30 subset types were contained within 14 major vegetation units within the Holland classification. These 14 major types were identified as those vegetation units most likely to occur within the riparian corridor. Of these 14 types, eight of them had a sample size large enough to allow for limited descriptive statistical analysis. The mean for seven environmental variables and four of the most frequently associated species are presented in Table 3. The types Fresh Water Marsh (6.4), Riparian Mulefat (7.3), and Riparian Southern Willow Forest (7.6) had soils with a high percentage of silt content. Two of these three units also had a higher probability rating for being regulated, which corresponds to soils with the ability to hold water longer with higher silt content. Mulefat (7.3) had a lower rating because it is scattered throughout the riparian zone and and lacks wetland features at many sites. This may be due to having soils that were greater than 50 percent content of sand and 34 percent cobble. These soil textures are typically associated with more active parts of the floodplain.

The two wettest community types were Fresh Water Marsh and Riparian Alder Forest. The Prevalence Index, a weighted average calculation using the wetland indicator status by species and their cover estimate, was 2.1 and 2.13 respectively. The driest three units were the Flood Plain Sage (2.6), Riparian Herb (7.1) and the Riparian Sycamore Woodland. These were 3.55, 3.28, and 3.12 respectively. The Flood Plain Sage type was dominated by soils with a high gravel to cobble content and positioned on less active flooding surface within the terrace. The Sycamore Woodland typically was situated in a position that infrequently floods. The riparian herb type tended to be areas that had previously been under some agricultural modification and reverting to dry uplands dominated by weedy herbaceous species.

The most challenging type of vegetation to associate with a specific soil variable problematic type was Riparian Mulefat (7.3). This type, dominated by *Baccharis salicifolia*, was scattered in the low flow, active, and flood plain terrace geomorphic surfaces. This species of Mulefat has a Facultative Wet (FACW) indicator (Reed 1988). This species appears to be responding to several variables including moist soils. We found this species frequently in the active flood plain on sandy terraces. In addition, it occurs on the flood plain terrace in areas with sand to gravel textured soils. Since the ecological amplitude of this species is so broad, regardless of its apparent preference for the active flood plain position, we assigned a probability rating of 3 (33-66 percent probability of being a regulated wetland) to this group in the terrace position.

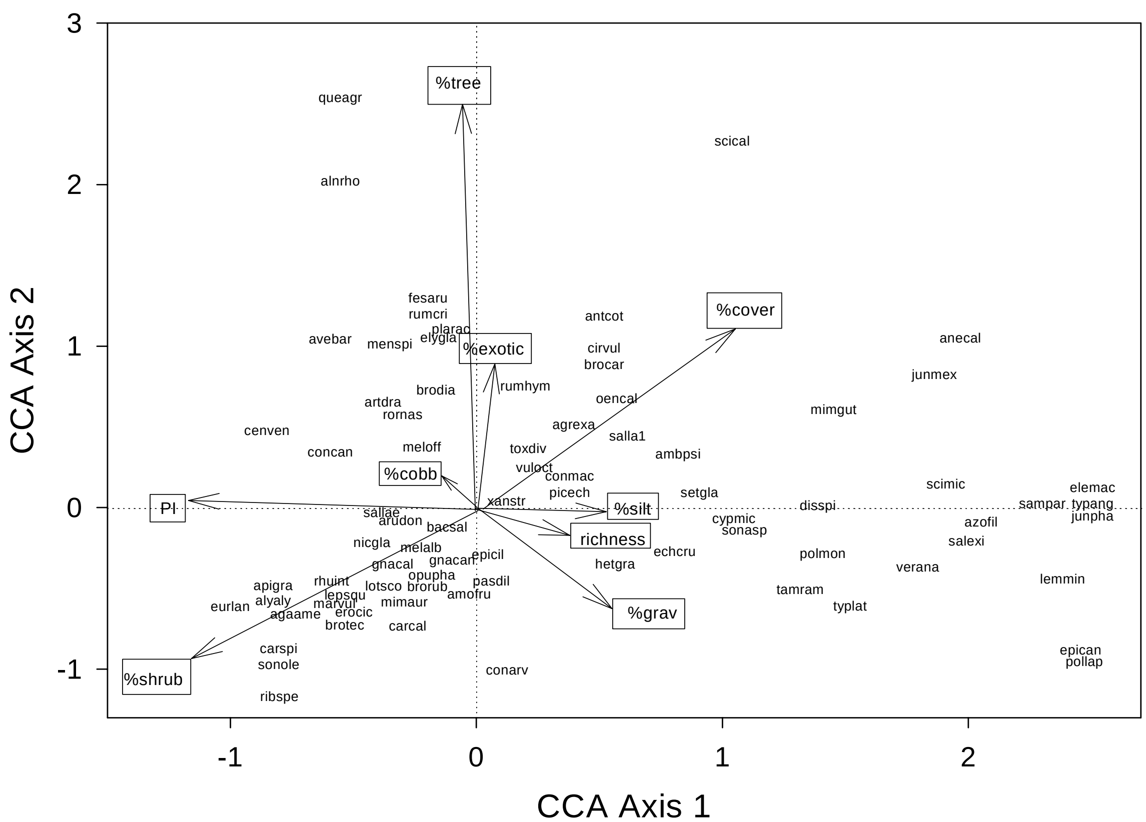
Table 3. Dominant riparian vegetation species and range of variable values for common riparian vegetation .

Type	Associates	% Cover	% Exotics	Spp. Rich.	% Silt	% Sand	% Gravel	% Cobble	PI Value
2.6 N=8	***Opuntia phraecantha, Salvia mellifera, Eriogonum fasiculatum***	52	19	8	7	7	37	32.3	3.55
6.4 N=4	***Scirpus californicus, Typha latifolia, Eleocharia macrostachya***	81.8	12	8.8	16	18	27	33.8	2.1
7.1 N=3	***Conium maculatum, Cressa truxillensis, Artemisia dranunculus***	62	56.8	4	15	62.5	0	1.2	3.28
7.2 N=5	***Salix lasiolepis, Baccharia salicifolia,***	93.6	17.2	6.6	9	47.8	2	43.2	2.74
7.3 N=9	***Baccharis salicifolia, Baccharis piluraris, Artemisia californica***	84.6	16.9	13.3	16.3	51.7	3.4	34.4	3.23
7.4 N=5	***Plantus racemosa, Avena fatua, Sambucus mexicanus***	85.5	33	5.8	7	78	0	29	3.12
7.6 N=4	***Salix lasiolepis, Scirpus microcephalu s, Juncus dubius,***	81.5	10.25	7	26.3	47.5	0	0	2.56
7.9 N=3	***Alnus rhombifolia, Salix lasiolepis***	71	3.3	5.3	3.3	55	13.3	58.3	2.13

5.2 Analysis of Field Verification Data

A total of 86 species in 55 sample points were used to determine the relationship between the vegetation and environmental variable. Canonical Correspondence Analysis (CCA) suggested that soil moisture was the primary factor determining species composition at San Juan and San Mateo Creeks (Figure 3). Indeed, species that occur in drier conditions (i.e. *Rhus integrifolia, Conzya canadensis, Leptospartum squarrosum*) were found on the left side of the first axis, while species occurring in wetter conditions (i.e. *Typha angustifolia, Eleocharis macrostachya, Scripus microcephalus*) were found on the right side of the first axis. Monte Carlo permutation analysis showed that all canonical axes were significant ($p > 0.05$).

Figure 3. CCA ordination of select environmental variables using plant species occurrence frequencies.



5.3 Hydrology

Three main types of hydrologic flow characterized the flood plain wetlands: (1) flood flow over open flood plains, (2) precipitation combined with over bank flooding into topographic, and (3) groundwater discharge to seeps and springs.

Field indicators for these three hydrology sources were assessed in the field for making jurisdictional decisions at various locations. Surface runoff and groundwater supplies water to riverbeds throughout most of the year and provides for a perennial source of water. These wetland vegetation units had positive indicators of all 3 parameters of a wetland and easily meet the wetland criteria. However, in those areas not directly influenced by perennial water, water received from storm events dominated the characteristics of the wetland type. During some storms, the amount of water throughout various parts of the flood plain increases dramatically. We estimated that the bank full and active flood plains geomorphic surface fill with water during storms that occur at intervals of less than 10 years. The remainder of the flood plain is estimated to flood at various stages depending upon the storm severity until in certain events all of the flood plain is full. In larger events, greater than 10 years, the WoUS and wetland primary hydrology indicators of drift and silt material is scattered across some or all of the flood plain. These indicators are not reliable for assessing jurisdictional wetland occurrence since they can be remnants of an infrequent but large event that scattered these indicators across most of the flood plain. Because of this issue, we relied on bed and bank features and geomorphic surfaces combined with certain vegetation units as field indicators for meeting regulatory criteria.

Over bank flooding, local precipitation, and occasional groundwater discharge provides the hydrology for wetlands within the paleo channels and other depressional sites in the flood plains. For those seasonally wet areas in the flood plain that have less than a 50 percent likelihood of having ponded or saturated soils in the upper part for at least 17 days (5 percent of the 345 to 360 day growing season in the coastal and foot hill regions) and do not meet the hydrology requirements for a jurisdictional wetlands (Section 404) were considered regulated because they met the definition of non-wetland WoUS with an ordinary high water mark. Most of the paleo channels located in the terrace geomorphic surface don't hold water for long periods of time. But some of the paleo channels are supplied water from tributaries entering the flood plain. These larger and slightly depressed zones are typically covered by *Salix lasiolepis* (Southern Arroyo Willow; vegetation type 7.6) vegetation type, which can hold water for longer periods. The soils in these depressional sites typically have higher silt content so consequently they can pond water for extended periods. These observations and the analysis of soil textures in CCA (Figure 3) support the Ratings assigned to several of the vegetation types associated with these flood plain settings.

Alkali seeps were located within the floodplain riparian area. The primary hydrology source for these sites is groundwater discharge. These seeps are located within the active floodplain and associated with more silty soils. Most of the dominate plant species, *Distichlis spicata* (FACW) and *Scirpus americanus* (OBL), are also halophytic species. These species and other are responding to the more alkaline waters being discharged in these locations.

5.4 Soils

The USDA Soil Conservation Service (1978) listed several miscellaneous land types as hydric and seven map units as non-hydric with hydric inclusions in the 1978 survey of Orange County, CA (SCS 1973). The miscellaneous land types are river wash (Rm) and pits (Pt). The Rm and Pt soil landscape features are hydric because of hydric soil criteria 3 and 4 (NRCS 1996; Environmental Laboratory, 1987) as those soils or areas are ponded or flooded for at least seven days every other year during the growing season. Of the seven soil units classified as non hydric with hydric inclusions, 3 had hydric components based on flooding frequency and durations and meet criterion 3 and 4 (frequency of ponding and flooding).

The floodplain is dominated by the Rm map unit, which is located in intermittent stream channels and in floodplains. In our study area this soil was usually located on the terrace where the flood return interval is 10-100 years. Other soil map units occurring with Rm are Bolsa, Chesterton, Chino, Myford, Sobobo, Corralitos, and Metz. These map units are not hydric but frequently occur along streams and flood plains and meet the flooding criteria.

Only those soils with redoximorphic features could be classified as hydric soils. In the field it was not possible to determine which of the soils, mapped as hydric by definition of criteria 3 and 4 for ponding and flooding, qualified as hydric because drift and rack was scattered across the entire flood plain from a recent flood event. Using field indicators for hydric soils was useful for soil map units in certain parts of the terrace in the flood plain. At eight sample locations, redoximorphic features were observed within the top 12 inches of the soil. These features are similar to those described by the USDA-NRCS as Indicator F3- Depleted Matrix (NCRS 1996).

5.5 Delineation Results: Aquatic Resources (including Waters of the United States)

Aquatic resources within the San Juan watershed totaled 1246 ha (3080 ac) and there were 2015 km (1252 miles) of intermittent and ephemeral streams identified within the watershed. Table 4 shows how the regulated areas correspond to the geomorphic surfaces and other parts of the watersheds. The jurisdictional ratings for Section 404 each geomorphic surface and all riparian vegetation types occurring in them are provide in Appendices 3, 4, 5. The aquatic resource vegetation types, geomorphic surfaces, and jurisdictional rating coverages are shown in Appendix 7**.**

Table 4. Regulated decisions for each geomorphic surface in the riparian wetland GIS coverage.		
Geomorphic Surfaces and Ratings	**Number of Vegetation types**	**Hectares or Kilometers (Acreage or Miles)**
Bankfull channel (Rating 1)	15	258 ha (637 ac)
Active flood plain (Rating 1)	20	23 ha (57 ac)
Terrace		
Rating 1	0	0 ha (0 ac)
Rating 2	3	102 ha (253 ac)
Rating 3	3	113 ha (279 ac)
Rating 4	2	83 ha (205 ac)
Rating 5	2	81 ha (200 ac)
Rating 6	7	24 ha (59 ac)
Rating 7 (Mitigation Sites)	0	0 ha (0 ac)
Non-Floodplain Riparian		
Rating 1	1	0.4 ha (1 ac)
Rating 2	0	0 ha (0 ac)
Rating 3	4	224 ha (554 ac)
Rating 4	2	207 ha (511 ac)
Rating 5	2	141 ha (349 ac)
Rating 6	11	2076 ha (5129 ac)
Rating 7 (Mitigation Sites)	1	8.9 ha (22 ac)
Intermittent Streams (Rating 1)		2015 km (1252 miles)
Water Resources (WR)	5	3.6 ha (9 ac)
Total of regulated wetlands and WoUS		**1246 ha (3080 ac) and 2015 km (1252 miles)**

The wetland ratings for 30 subset riparian vegetation units gave the following results for each geomorphic surface. Within the bank full and active floodplain channel there was a combination of 23 riparian vegetation types and unvegetated watercourse that were considered jurisdictional (Rating 1). Of the 23 types that were located in these two geomorphic surfaces, there were 16 wetland units and 7 WoUS.

There were 757 ha (1871 acres) 6 of vegetation types that were considered jurisdictional within the bank full and active flood areas (Appendices 4 and 5). Of these regulated wetland vegetation types, there was only a slight overlap of the larger and more abundant types. Of those units in this category, 3 units were in the bank full and 4 in the active flood plain. The most frequent and largest units are listed in Table 5.

Table 5. Largest and most frequent riparian vegetation types in the bank full and active flood plain.			
Type	**Location**	**Frequency**	**Size (ha)/(ac)**
Perennial rivers and stream	bank full	2	63 /156
Flood control channels	bank full	71	24/59
Coastal Freshwater Marsh	bank full	31	36/90
Southern Arroyo Willow Scrub	active flood plain	68	53/132
Mulefat	active flood plain	149	147/363
Floodplain sage	active flood plain	29	23/58

Of the 15 riparian vegetation types located in the terrace geomorphic surface, most had either a low probability of being a regulated wetland under Section 404 or were uplands (Appendix 3).). However, these low probability polygons may have a high probability of being regulated under CDFG's 1600 program. The largest and or most frequent vegetation units in the tertiary were Southern Willow Scrub, Mulefat, and Sycamore Riparian Woodland. There were 403 ha (996 acres) of riparian vegetation considered to be wetlands (Rating of 1, 2,3, and 4).

There were 2015 km (1252 miles) of ephemeral and intermittent stream channels identified as WoUS. These areas were mostly first and second order streams and located higher in the watersheds. The location of these stream channels resulted from some being partially identified on the vegetation type map and the remaining being identified form our stereoscoping efforts.

5.6 Distribution patterns of riparian vegetation types

Several distribution patterns of the riparian vegetation types were observed within the three major topographic relief zones within the study area. These general distribution patterns are shown in Figure 4. Examples of various vegetation units are shown (Table 6) along with brief comments. Codes for riparian vegetation community types are provided in Appendix 1.

Figure 4. Topographic relief of San Juan/San Mateo Creek watersheds DEM. The major topographic zones are delineated.

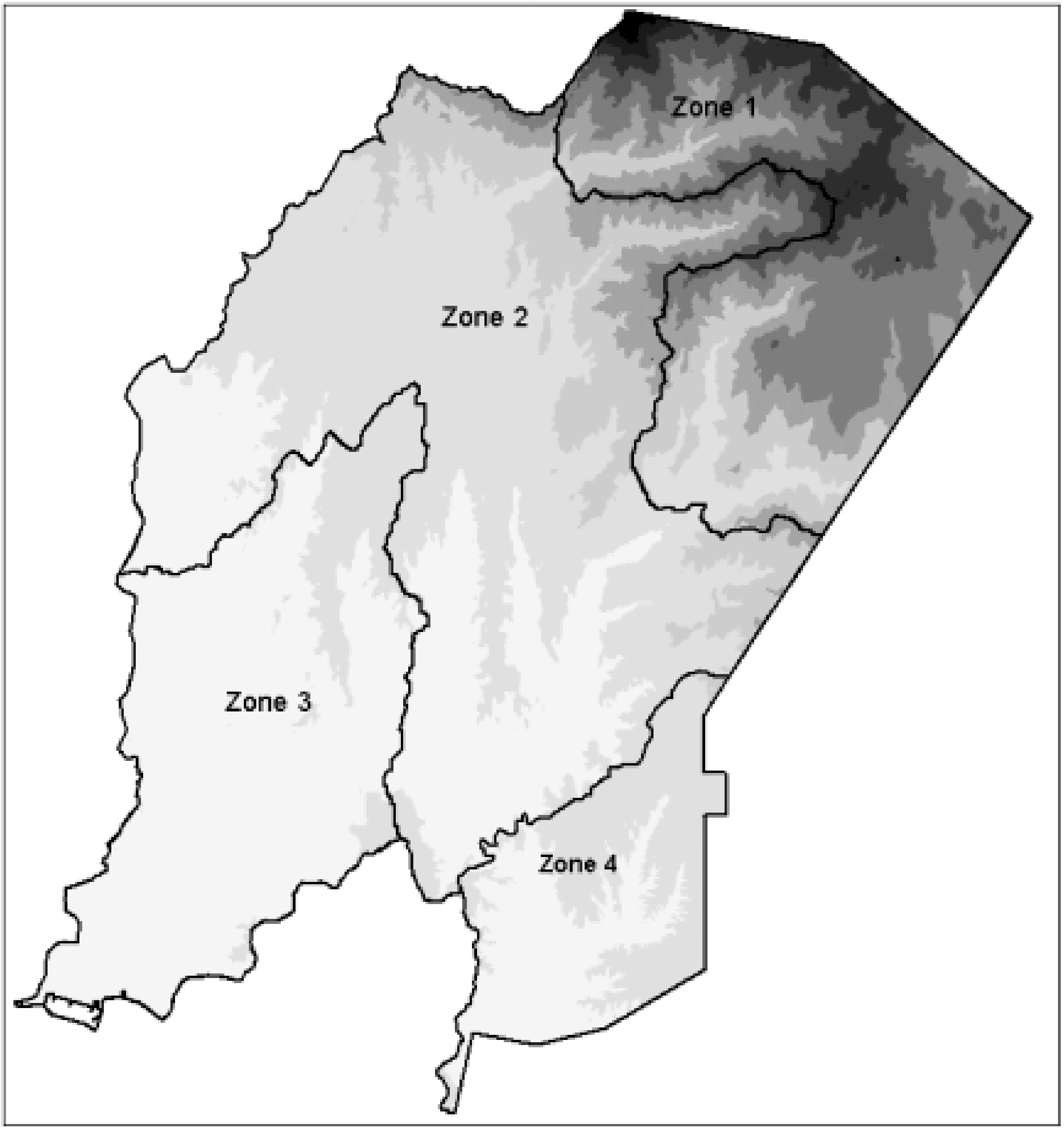


Table 6. Major Vegetation Distribution Patterns by Zones.		
Zones	**Major Landform**	**Units and Comments**
Zone 1	Mountainous	Southern Willow Scrub (7.2), Southern Coast Live Oak (7.5), White Alder (7.9), Bigcone Spruce-Canyon Live Oak (9.6); most areas were first or second order streams with poor development of flood plain terraces
Zone 2	Coastal Foothills	Floodplain Sage Scrub (2.6), Mulfat Scrub (7.3), Southern Arroyo Willow (7.6), Arundo (7.16), intermittent channels (12.1); development of some flood plain terraces; mixed active flood plains with flood plain terraces
Zone 3	Central Flats	Southern Willow Scrub (7.2), Mulfat Scrub (7.3), Southern Sycamore Riparian Woodland (7.4), Southern Coast Live Oak (7.5), Southern Arroyo Willow (7.6); highly modified for agricultural and urban development purpose
Zone 4	San Mateo	Floodplain Sage Scrub (2.6), Mulfat Scrub (7.3), Southern Sycamore Riparian Woodland (7.4), Southern Coast Live Oak (7.5); highly modified for agricultural and urban development purpose

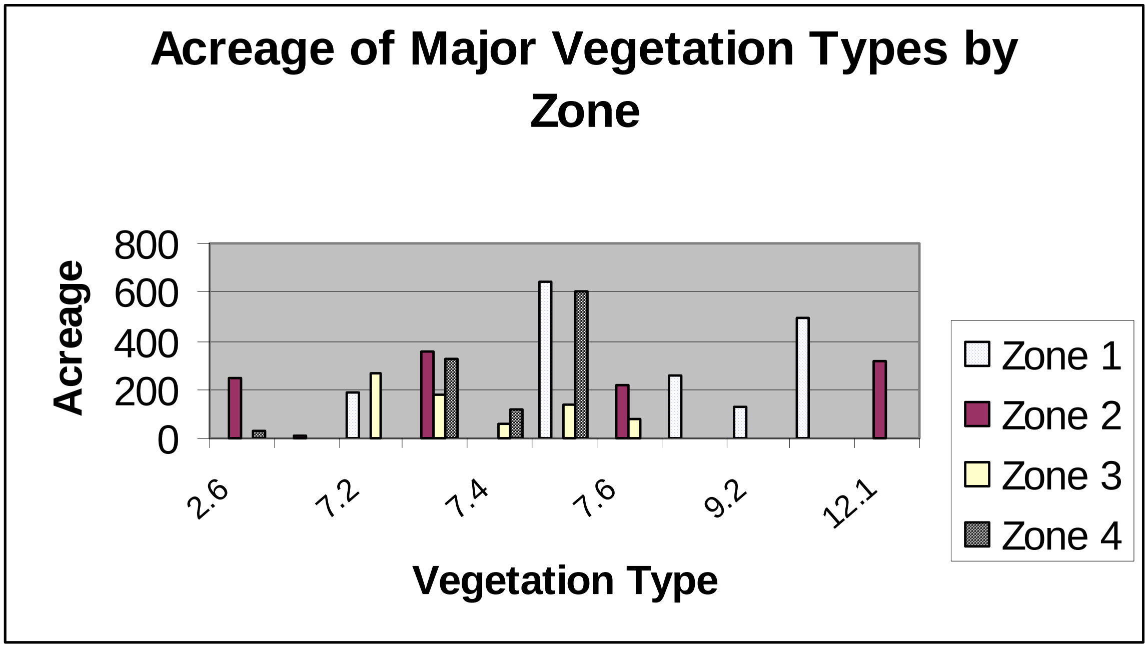
Wetland vegetation distribution patterns within the San Juan/San Mateo Creek watersheds are driven by two major features outlined in Figure 4 and 5. These are human development and major landforms associated with topographic positions. Riparian vegetation units in Zone 1 (mountainous) reaches of the watershed are less impacted from human development than those in lower reaches. In the higher elevations of the watersheds the riparian vegetation types are associated with rocky to gravelly channel substrates. Upland chaparral vegetation types are common in these reaches since the intermittent stream channel areas are dry most of the time. Zone 1 contains an equal mix of upland vegetation types (9.2, 9.6) and vegetation types that have hydrophytic species (7.2, 7.5, 7.9). In the lower elevations of Zones 2, 3 and 4; where there is an increase in hydrology, flood plain terraces, and culturally influenced hydrology regimes; the cover of wetland type vegetation units increases. The disturbance types such as Southern Arroyo Willow riparian forest (7.2) are located in areas below discharge points for storm water from human developments or in association of agricultural field and urban development. Generally, most of the larger and wetter wetland areas are located in the lower parts of the watersheds where human influences are prevalent. Plant species compositions in these areas are mostly wetland plants. The Sycamore woodlands that are located in parts of Zone 3 and 4 are located in dry upland terraces with very little wetland features. The conversions of Sycamore woodlands to pastures are common here.

In most of the watershed, one of the several types of Willow units is the dominant vegetation type found on the terraces. These types are located mostly along the edges of the active floodplain or on the terrace. At some locations the level of introduced species are lower and the site is less disturbed, but overall it appears that the Willow communities have been able to either adapt or respond to all the human modification. In areas of the watershed where there are concrete lined channels for flood control structures, Willow communities have been able to maintain themselves without a flood plain terrace. Some of these areas in the lower reaches have been designated mitigation sites. In many of the mitigation sites, the occurrence of hydrophytic species tends to drop off and most of the soils are considered non hydric.

The fresh water marsh type is dominated by man-made features. Most of these wetland types have occurrences of Tule (*Scirpus californicus*), Cattail (*Typha latifolia*), and Spike Rush (*Eleocharis macrostachya*).   Each of these species is indicators of disturbances and reflects the altered wetland conditions they are located in. Most of the features associated with this type are settling ponds, abandoned barrow pits, and margins of man made reservoirs located throughout the watershed.

The most dramatic impact to wetlands and flood plain riparian systems has been the agricultural and human developments that occurred within the watershed. In Zone 3 and 4, most of the historical flood plains and wetlands have been eliminated and replaced with concrete line channels. This elimination of floodplains terraces in these reaches limited our mapping of wetlands to the top of the control channel. Any wetland vegetation within the channel was not mapped since we could not determine the hydrogeomorphic surfaces. However, in the lower most reaches of San Juan Creek where the control channel is broad enough to allow for some similar development of floodplain terraces within the channel, we separated out both the vegetation and recently developed terraces. In general, the riparian vegetation within the flood plain and terrace at San Juan/San Mateo Creek watersheds are associated with modified flood control channels or human developed features. Due to modifications in the watershed for enhanced runoff, flood control and agricultural usage, the floodplain terraces have been greatly reduced in their ability to act as a functional part of the flood plain. Historically, more of the terrace may have been considered wetland than has been currently determined. Vegetation types such as Mulefat (7.3) are typically common within the active flood plain and parts of the terrace in this region of southern California. Within the San Juan/San Mateo Creek watersheds, these occurrences have been reduced in frequency as a result of modifications in the flood plains.

Figure 5. Acreage of Major Vegetation Types by Zone



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Appendix 1 Holland Vegetation codes used in the study and their common names

Holland Vegetation Codes	Common Name
20600	Floodplain Sage Scrub
30102	Chamise-Sage Scrub
40100	Annual Grassland
40500	Coast Live Oak Savanna
40600	Ruderal
60100	Southern Coast Salt Marsh
60400	Coastal Freshwater Marsh
70100	Riparian Herb
70200	Southern Willow Scrub
70300	Mulefat Scrub
70400	Southern Sycamore Riparian Woodland
70500	Southern Coast Live Oak Riparian Forest
70600	Southern Arroyo Willow Forest
70900	White Alder Riparian Forest
71000	Canyon Live Oak Ravine Forest
71200	Salix exiqua
71300	Eucalytus
71400	Rin
71600	Arundo donax
80100	Coast Live Oak Woodland
90100	Coast Live Oak Forest
90200	Canyon Live Oak Forest
90600	Bigcone-Spruce-Canyon Live Oak Forest
120100	Open Water
120200	Fluctuating Shorelines
120300	Spreading Grounds and Detention Basins
130100	Perennial Rivers and Streams
130200	Intermittent Streams and Creeks
130300	Ephemeral Drainages and Washes
130400	Flood Control Channels

Appendix 2: Ratings for non-floodplain and floodplain riparian vegetation.

Common Name	Floodplain Riparian Rating	Non Floodplain Riparian Rating
Floodplain Sage Scrub	5	6
Chamise-Sage Scrub	6	0
Annual Grassland	6	6
Coast Live Oak Savanna	6	0
Ruderal	6	6
Coastal Freshwater Marsh	0	1
Riparian Herb	5	5
Southern Willow Scrub	2	3
Mulefat Scrub	3	3
Southern Sycamore Riparian Woodland	4	5
Southern Coast Live Oak Riparian Forest	6	6
Southern Arroyo Willow Forest	2	3
White Alder Riparian Forest	3	4
Canyon Live Oak Ravine Forest	6	6
Salix exiqua	2	0
Eucalytus	0	6
Rhus integrifolia	6	6
Arundo donax	4	0
Coast Live Oak Woodland	0	6
Coast Live Oak Forest	0	6
Canyon Live Oak Forest	0	6
Bigcone-Spruce-Canyon Live Oak Forest	0	6
Intermittent Streams and Creeks	3	0

“0” Indicates that it doesn’t occur in this setting.

Appendix 3: Frequency and area of riparian vegetation community types on the terrace geomorphic surface

Wetland Rating	Riparian Vegetation Community Type	Frequency	Acres	Hectares
Rating 2	Southern Willow Scrub	57	113.5851	45.94
	Southern Arroyo Willow Forest	49	138.6334	56.16
	Salix Exiqua	6	0.6749	0.27
Rating 3	Intermittent Streams and Creeks	2	2.304	0.93
	Mulefat Scrub	169	275.4389	111.45
	White Alder Riparian Forest	4	1.3036	0.53
Rating 4	Southern Sycamore Riparian Woodland	172	197.7092	80.05
	Arundo donax	19	6.9231	2.8
Rating 5	Floodplain Sage Scrub	70	196.9431	79.68
	Riparian Herb	2	2.8375	1.15
Rating 6	Chamise-Sage Scrub	1	0.5124	0.21
	Annual Grassland	1	9.0569	3.67
	Coast Live Oak Savanna	1	5.6223	2.28
	Ruderal	2	2.188	0.89
	Southern Coast Live Oak Riparian Forest	88	36.524	14.74
	Canyon Live Oak Ravine Forest	2	1.0374	0.42
	Rhus integrifolia	9	4.4016	1.78

Appendix 4: Frequency and area of riparian vegetation community types on the bankfull channel geomorphic surface

Riparian Vegetation Community Type	Frequency	Acres	Hectares
Floodplain Sage Scrub	2	10.9245	4.43
Coastal Freshwater Marsh	31	90.7769	36.73
Southern Willow Scrub	14	4.1307	1.67
Mulefat Scrub	13	20.2269	8.19
Southern Sycamore Riparian Woodland	4	4.1379	1.67
Southern Arroyo Willow Forest	15	8.1504	3.31
Canyon Live Oak Ravine Forest	1	11.167	4.52
Eucalytus	1	0.311	0.13
Arundo donax	1	1.5366	0.62
Open Water	77	345.1278	139.66
Fluctuating Shorelines	9	4.7012	1.9
Spreading Grounds and Detention Basins	2	1.3844	0.56
Perennial Rivers and Streams	9	94.8533	38.39
Intermittent Streams and Creeks	15	37.8152	15.29
Flood Control Channels	5	1.6525	0.67

Appendix 5: Frequency and area of riparian vegetation community types on the active floodplain geomorphic surface

Riparian Vegetation Community Type	Frequency	Acres	Hectares
Floodplain Sage Scrub	29	58.0628	23.48
Southern Coast Salt Marsh	1	0.2072	0.08
Coastal Freshwater Marsh	38	49.4974	20.06
Riparian Herb	4	3.6798	1.49
Southern Willow Scrub	68	132.9698	53.77
Mulefat Scrub	149	363.1891	146.95
Southern Sycamore Riparian Woodland	48	114.6592	46.43
Southern Coast Live Oak Riparian Forest	42	33.948	13.7
Southern Arroyo Willow Forest	40	96.6111	39.08
White Alder Riparian Forest	6	24.9301	10.09
Canyon Live Oak Ravine Forest	4	19.688	7.96
Salix exiqua	1	1.2108	0.49
Rhus integrifolia	3	0.7114	0.29
Arundo donax	7	6.8709	2.79
Coast Live Oak Woodland	1	0.1372	0.06
Spreading Grounds and Detention Basins	1	20.328	8.23
Perennial Rivers and Streams	15	17.4226	7.06
Intermittent Streams and Creeks	56	264.4665	107.05
Ephemeral Drainages and Washes	1	0.5913	0.24
Flood Control Channels	8	26.733	10.82
Alkali Seeps	19	2.53	1.02

Appendix 6: Frequency and area of riparian vegetation community types on the non-floodplain riparian

Wetland Rating	Non-Riparian Vegetation Community Type	Frequency	Acres	Hectares
Rating 1	Coastal Freshwater Marsh	4	1.1099	0.46
Rating 3	Southern Willow Scrub	207	481.1696	194.76
	Mulefat Scrub	2	4.0563	1.64
	Southern Arroyo Willow Forest	41	64.7355	26.18
	Rhus integrifolia	1	3.9074	1.58
Rating 4	Mulefat Scrub	139	194.8897	78.89
	White Alder Riparian Forest	22	315.8313	127.81
Rating 5	Riparian Herb	13	22.0882	8.93
	Southern Sycamore Riparian Woodland	129	326.5637	132.15
Rating 6	Floodplain Sage Scrub	33	23.0479	9.31
	Annual Grassland	1	0.6444	0.26
	Ruderal	2	2.1612	0.88
	Southern Coast Live Oak Riparian Forest	556	2987.742	1209.1
	Canyon Live Oak Ravine Forest	32	233.6232	94.56
	Eucalytus	2	2.4986	1.01
	Rhus integrifolia	3	8.545	3.46
	Coast Live Oak Woodland	212	850.9426	344.42
	Coast Live Oak Forest	55	240.3252	97.28
	Canyon Live Oak Forest	35	197.6201	79.97
	Bigcone-Spruce-Canyon Live Oak Forest	36	582.4954	235.74
Rating 7	Mitigation	5	21.8437	8.84

Appendix 7. Aquatic Resources Delineation Figures.

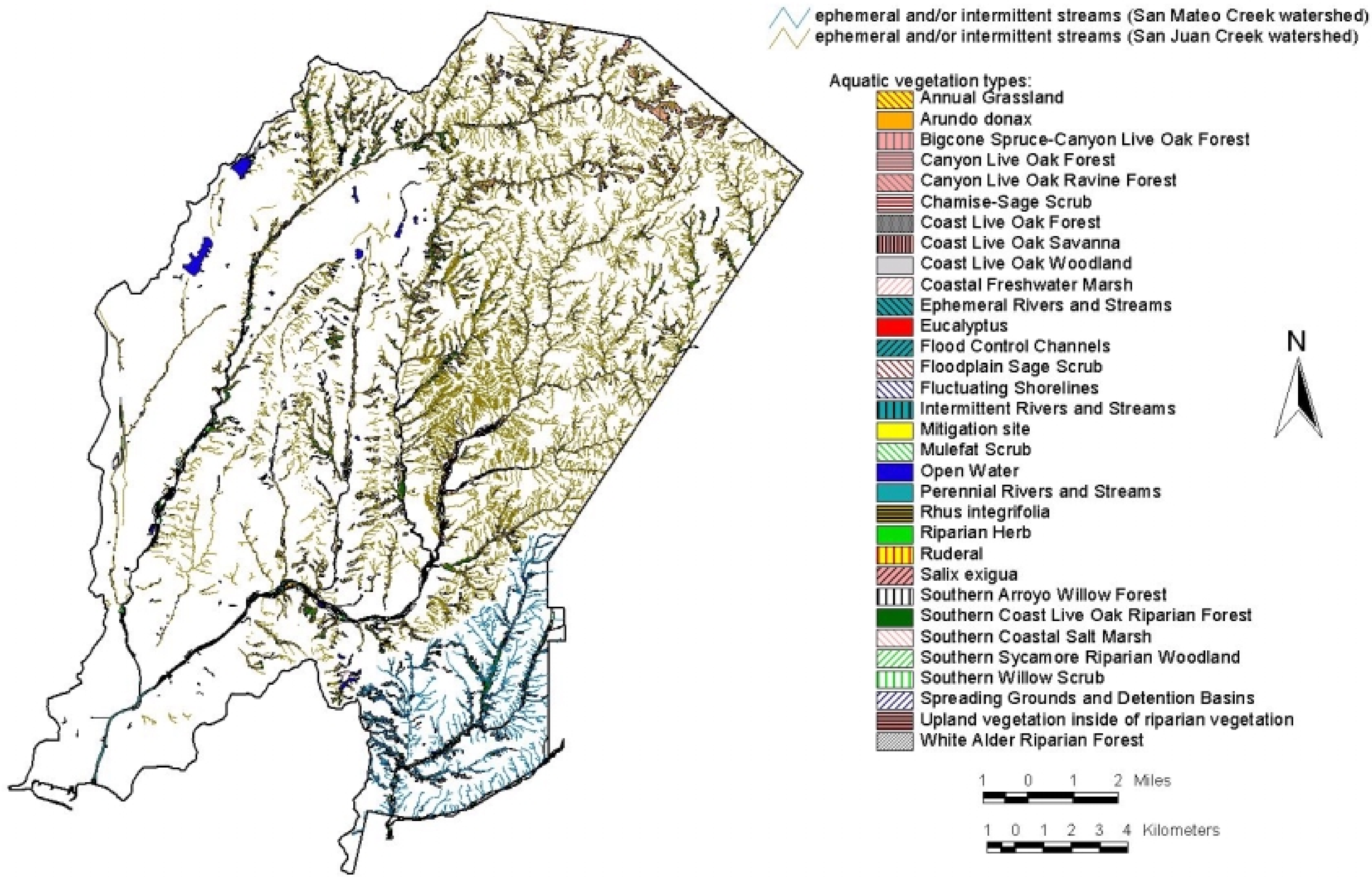


Figure 1. Vegetation in the San Juan Creek Watershed and portions of the San Mateo Creek Watershed

Figure 1-A. Vegetation in NW quadrant of the San Juan Creek Watershed.

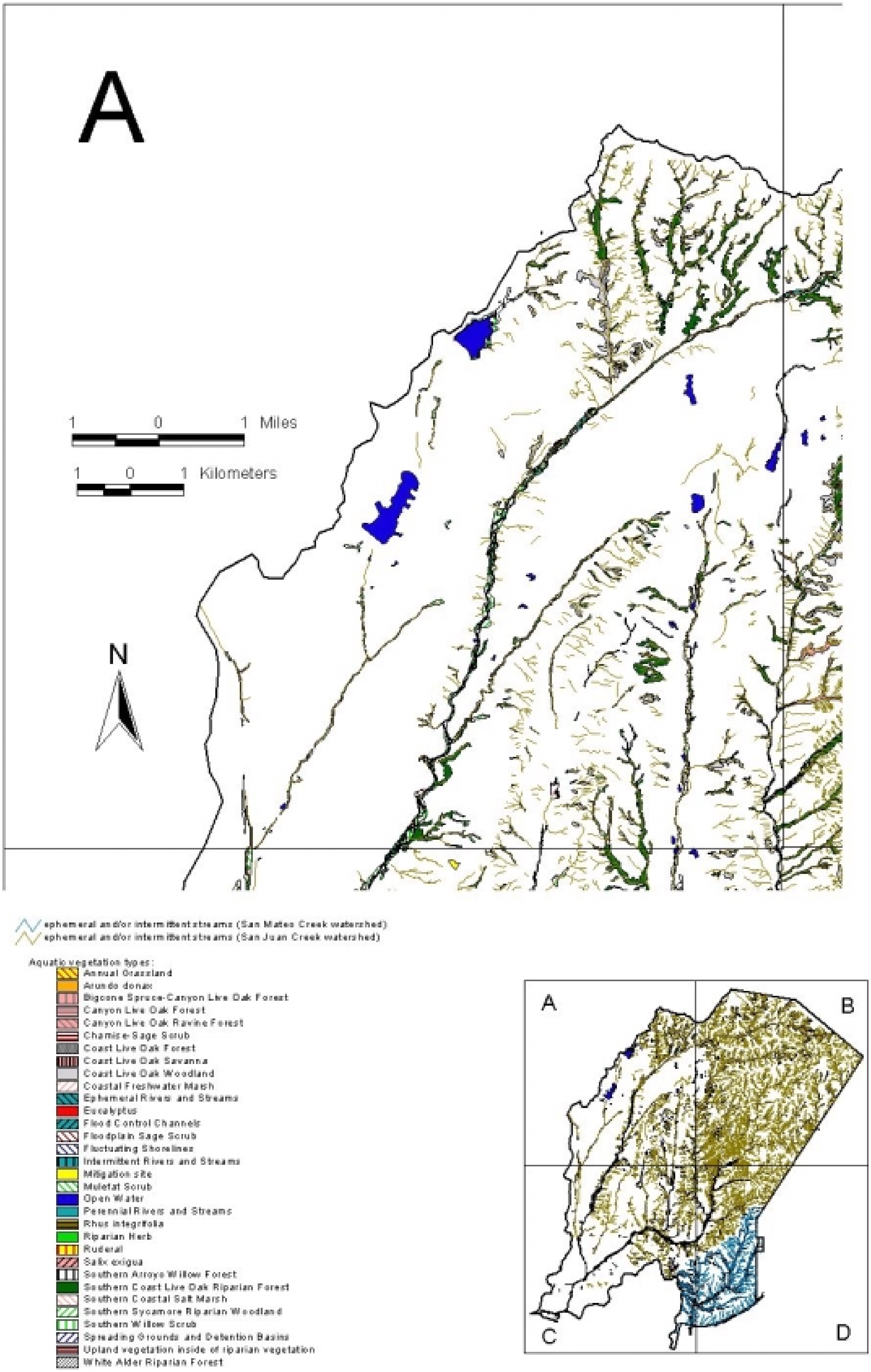


Figure 1-B. Vegetation in NE quadrant of the San Juan Creek Watershed.

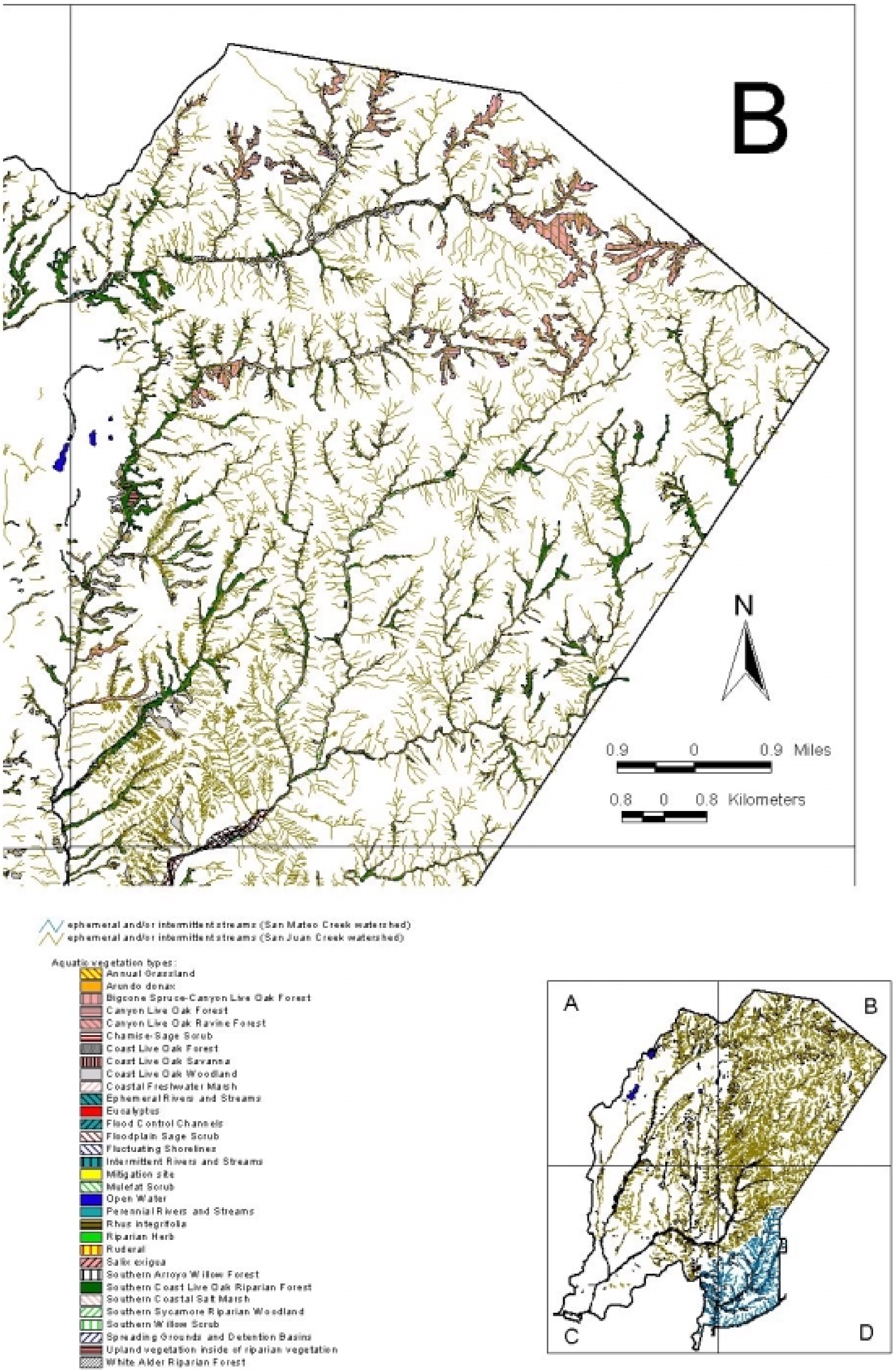


Figure 1-C. Vegetation in SW quadrant of the San Juan Creek Watershed and portions of the San Mateo Creek Watershed

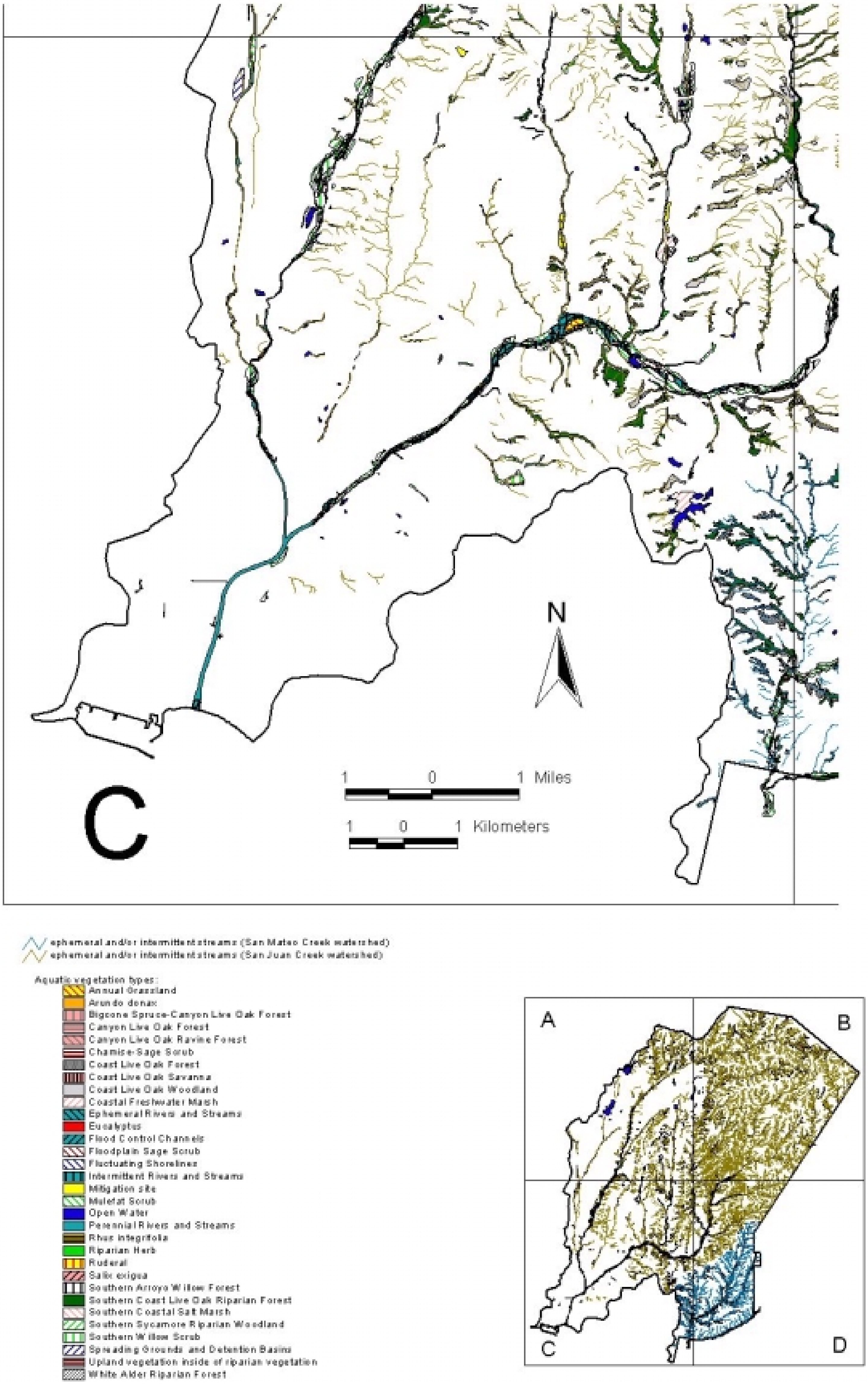


Figure 1-D. Vegetation in SE quadrant of the San Juan Creek Watershed and portions of the San Mateo Creek Watershed

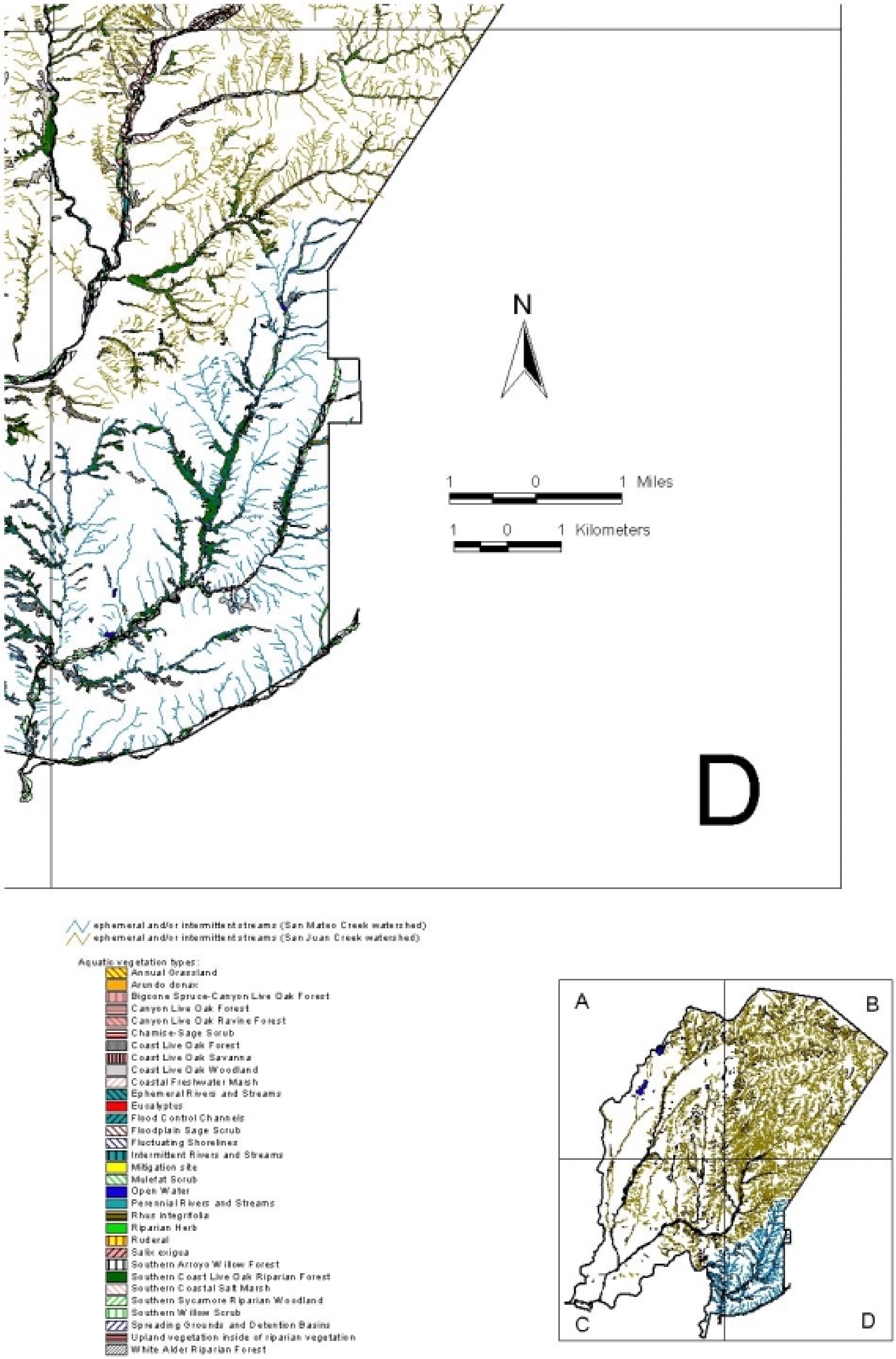
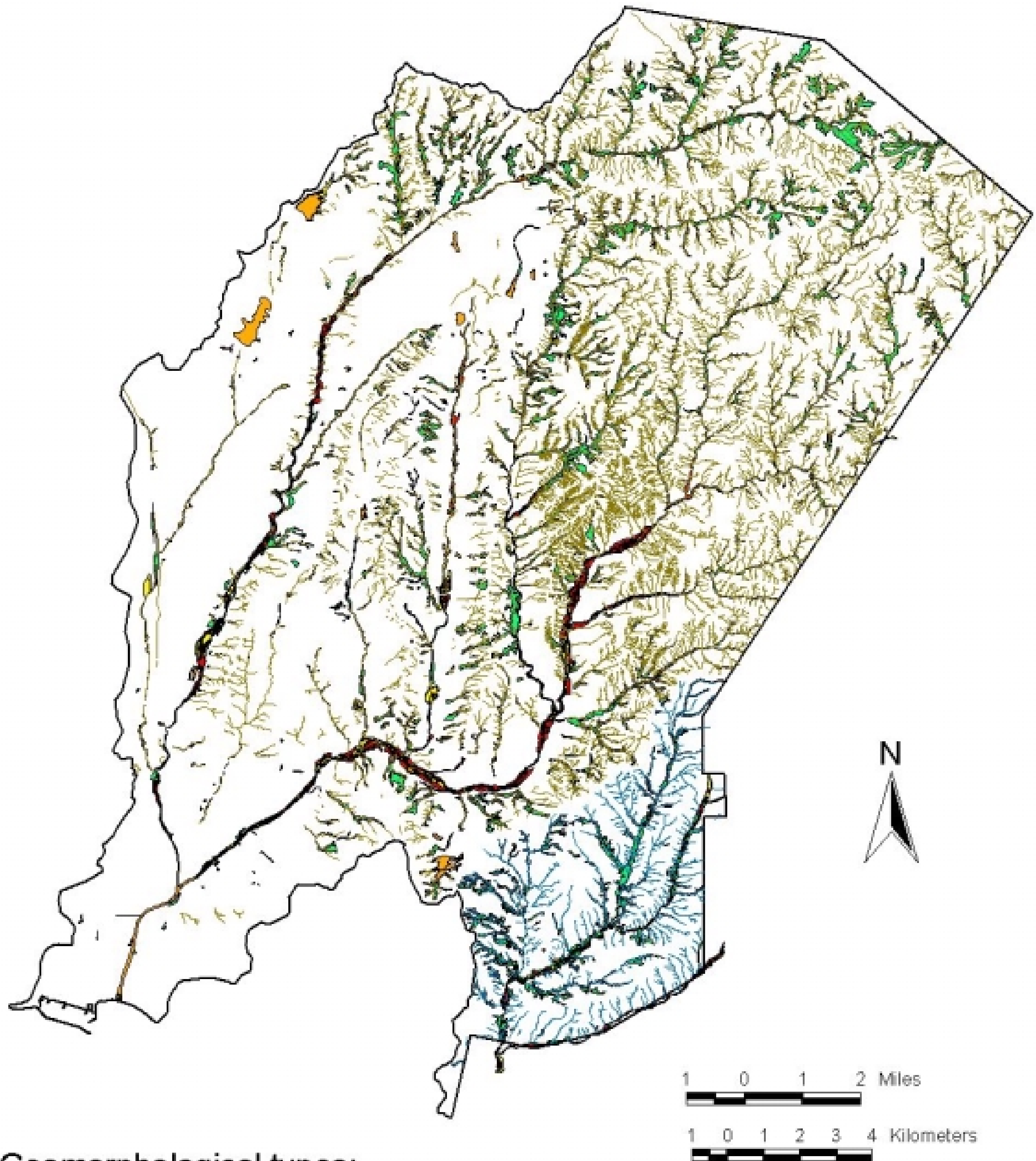


Figure 2. Geomorphological types in the San Juan Creek Watershed and portions of the San Mateo Creek Watershed



Geomorphological types:

- 100 year floodplain terrace
- Active floodplain or 2-10 year return
- Bank full or 1-2 year flood interval return
- Non-floodplain aquatic areas

ephemeral and/or intermittent streams (San Mateo Creek Watershed)
ephemeral and/or intermittent streams (San Juan Creek Watershed)

Figure 3. Rating types in the San Juan Creek Watershed and portions of the San Mateo Creek Watershed