

Ecological site R016XA001CA

Tidally-Influenced, Freshwater

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General information

Provisional. A provisional ecological site description has undergone quality control and quality assurance review. It contains a working state and transition model and enough information to identify the ecological site.

MLRA notes

Major Land Resource Area (MLRA): 016X–California Delta

MLRA 16 – California Delta Most of this area is in the California Trough Section of the Pacific Border Province of the Pacific Mountain System. A small part at the west edge of the area is in the California Coast Ranges Section of the same province and division. This MLRA was originally the conjoined flood plain along the Sacramento and San Joaquin Rivers. As sediment from these rivers built up in San Pablo Bay, a delta formed, creating many streams that divide this nearly level area into “islands.” Strong levees and drainage systems are needed to protect the islands from flooding. Elevation of the islands ranges from below sea level to slightly above sea level. This area is underlain by interbedded marine, estuarine, and fine-grained non-marine sediments transported to the delta by the Sacramento and San Joaquin Rivers as they flowed into San Pablo Bay. As the sediments built up, a delta formed and freshwater mixed with brackish water in marshes and on flood plains. As the marsh vegetation became covered with new sediments, the organic matter content in the soils built up to very high levels. When drained and exposed to the air, these peaty soils oxidize and shrink and then subside. Land resource unit (LRU) XA is influenced primarily by freshwaters fed from the Sierra Nevada watershed snow melts and rains, however in a large portion of the LRU it is still influenced heavily by the Delta tides.

Classification relationships

Using the December 2010 draft EPA ecoregion level IV: 7j, Delta polygon mostly closely overlaps with MLRA 16. MLRA 16 mostly aligns with the USFS (1997) ecological subsection 262AI, Great Valley, Delta.

Ecological site concept

This site is a patchwork of freshwater water-obligate and facultative wet plant communities influenced by the ocean tides. It is found in the lowest positions on the landscape within the LRU and it's primary water sources come from the Sierra Nevada watersheds, consisting of snow melt and rains. Soils are fine-textured, thermic histosols and cumulic mollisols with poor to very poor drainage. Salinity is limited and should not affect vegetation response; however there will be some mixing of ocean waters in parts of the ecological site that are closer to the western edge. It is dominated by vegetation that is adaptable to changing water levels and anaerobic soils conditions, primary species consist of Schoenoplectus species, Eleocharis spp., and in some areas Salix spp. Patches where there are less lengthy periods of anaerobic conditions. This site has extremely fertile soils and the histosols can very quickly lose their organic properties when either drained or suffering lengthy droughts. Therefore much of this ecological site has been converted to agriculture and altered significantly. Salinity is relatively high and will have significant impacts on vegetation and management response.

Associated sites

R016XA002CA	Freshwater, Stratified, Fluventic 016XA002 occurs on natural levees primarily in the northern half of the LRU.
R016XA004CA	Island Sandhills 016XA004 occurs on mineral soils on ancient sand dunes near Oakley CA.

R016XB001CA	Tidally-Influenced, Salt-Affected 016XB001 are organic soils more heavily influenced by salt water from tides as occurring most extensively in Suisun Bay and supporting more saline-adapted species.
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Similar sites

R016XB001CA	Tidally-Influenced, Salt-Affected 016XB001 appears to be a less productive site which following improvement for production agriculture favors salt tolerant species such as saltgrass and Phragmites.
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Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) <i>Salix</i>
Herbaceous	(1) <i>Schoenoplectus acutus</i> (2) <i>Schoenoplectus californicus</i>

Physiographic features

This site is located in the freshwater-influenced, eastern portion of the delta, and is primarily fed by snow melt from the Sierra Nevadas. Slope gradients are mainly less than 1 percent and range from 0.5 to 2 percent.

Table 2. Representative physiographic features

Landforms	(1) Delta (2) Flood plain (3) Marsh
Slope	0 %
Aspect	Aspect is not a significant factor

Climatic features

Soil moisture as influenced by water table fluctuations augment precipitation which is typically 100% rain as it is for the entire MLRA.

Table 3 Representative climatic features

Frost-free period (average)	290 days
Freeze-free period (average)	340 days

Precipitation total (average)	330 mm
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- (1) ANTIOCH PUMP PLT #3 [USC00040232], Antioch, CA

Influencing water features

Soil features

The soils associated with this ecological site can be subdivided into two groups, organic and mineral soils.

The organic soils are very deep and very poorly drained soils composed of herbaceous organic material derived from reeds and tules on reclaimed fresh water marshes on deltas. Some soils have mineral soil material derived from mixed alluvium below 20 to 40 inches from the soil surface.

Surface textures are typically muck, mucky silt loam and mucky clay loam. Subsurface textures vary from muck, silty clay loam, silty clay and clay.

The mineral soils are very deep, very poorly and poorly drained soils composed of herbaceous organic material derived from reeds and tules and mixed alluvium on flood plains on deltas.

Surface textures are typically silt loam, clay loam, silty clay loam and clay. Subsurface textures vary from stratified silt loam, clay loam, silty clay loam, silty clay and clay. . Electrical conductivity of the soil (EC) is less than 2 dS/m throughout.

These soils are very poorly drained with very slow to moderately rapid permeability. The high water table is root limiting for crops. Levees, drainage ditches and pumping of the water table alter the drainage of this soils. In un-drained areas roots are limited by the water table occurring from the surface to approximately 12 inches. Typically the water table is regulated to a depth of 3 to 4 feet below the soil surface. The soil moisture regime is aquic and the soil temperature regime is thermic.

These soils are subject to subsidence. The hazard of soil blowing is severe when the soil is dry.

The organic soils that are correlated to this ecological site are the Kingile, Shinkee and Webile (clayey, mixed, euic, thermic Terric Haplosaprists), Rindge (Euic, thermic, Typic Haplosaprists), Venice (Euic, thermic, Typic Haplohemists) and Shima (Sandy or sandy-skeletal, mixed Euic, thermis Terric Haplohemists).

The mineral soils that are correlated to this ecological site are the Egbert, Gazwell, Peltier (fine, mixed, superactive, thermic Cumulic Endoaquolls), Ryde and Scribner (fine-loamy, mixed, superactive, thermic Cumulic Endoaquolls), Valdez (Fine-silty, mixed, superactive, nonacid, thermic Areic Fluvaquents).

This ecological site has been correlated with the following mapunits and soil components in MLRA 16:

CA013; Contra Costa County soil survey area, California

Ea; Egbert mucky clay loam; Egbert; 85
 Kb; Kingile muck; Kingile; 84
 Rd; Rindge muck, 0 to 2 percent slopes, partially drained, MLRA 16; Rindge; 85
 Rh; Ryde silt loam; Ryde; 85
 Se; Shima muck; Shima; 85
 Vb; Venice muck; Venice; 85
 Wa; Webile muck; Webile; 85

CA067; Sacramento County Area, California

139; Egbert clay, 0 to 2 percent slopes; Egbert; 85
 140; Egbert clay, drained, 2 to 5 percent slopes; Egbert; 85
 141; Egbert clay, partially drained, 0 to 2 percent slopes; Egbert; 75
 142; Egbert clay, partially drained, 0 to 2 percent slopes, frequently flooded; Egbert; 85
 155; Gazwell mucky clay, partially drained, 0 to 2 percent slopes; Gazwell; 85
 200; Rindge muck, 0 to 2 percent slopes, partially drained, MLRA 16; Rindge; 85
 201; Rindge mucky silt loam, partially drained, 0 to 2 percent slopes; Rindge; 95
 202; Rindge mucky clay loam, 0 to 2 percent slopes; Rindge; 95

222; Scribner clay loam, partially drained, 0 to 2 percent slopes; Scribner; 85

CA077; San Joaquin County Area, California

146; Dello loamy sand, partially drained, 0 to 2 percent slopes; Dello; 85
147; Dello sandy loam, clayey substratum, drained, 0 to 2 percent slopes; Dello; 85
152; Egbert mucky clay loam, partially drained, 0 to 2 percent slopes; Egbert; 85
153; Egbert silty clay loam, partially drained, 0 to 2 percent slopes; Egbert; 85
154; Egbert silty clay loam, sandy substratum, partially drained, 0 to 2 percent slopes; Egbert; 85
155; Egbert-Urban land complex, partially drained, 0 to 2 percent slopes; Egbert; 50
190; Kingile muck, partially drained, 0 to 2 percent slopes; Kingile; 85
191; Kingile-Ryde complex, partially drained, 0 to 2 percent slopes; Kingile; 50
204; Peltier mucky clay loam, partially drained, 0 to 2 percent slopes; Peltier; 85
205; Peltier mucky clay loam, organic substratum, partially drained, 0 to 2 percent slopes; Peltier; 85
233; Ryde-Peltier complex, partially drained, 0 to 2 percent slopes; Peltier; 35
224; Rindge mucky silt loam, partially drained, 0 to 2 percent slopes, overwashed; Rindge; 85
225; Rindge muck, 0 to 2 percent slopes, partially drained, MLRA 16; Rindge; 85
191; Kingile-Ryde complex, partially drained, 0 to 2 percent slopes; Ryde; 35
230; Ryde clay loam, partially drained, 0 to 2 percent slopes; Ryde; 85
231; Ryde silty clay loam, organic substratum, partially drained, 0 to 2 percent slopes; Ryde; 85
232; Ryde clay loam, sandy substratum, partially drained, 0 to 2 percent slopes; Ryde; 85
233; Ryde-Peltier complex, partially drained, 0 to 2 percent slopes; Ryde; 50
243; Scribner clay loam, partially drained, 0 to 2 percent slopes; Scribner; 85
244; Scribner clay loam, sandy substratum, partially drained, 0 to 2 percent slopes; Scribner; 85
245; Scribner-Urban land complex, partially drained, 0 to 2 percent slopes; Scribner; 50
155; Egbert-Urban land complex, partially drained, 0 to 2 percent slopes; Urban land; 35
245; Scribner-Urban land complex, partially drained, 0 to 2 percent slopes; Urban land; 35
246; Shima muck, partially drained, 0 to 2 percent slopes; Shima; 85
247; Shinkee muck, partially drained, 0 to 2 percent slopes; Shinkee; 85
261; Valdez silt loam, organic substratum, partially drained, 0 to 2 percent slopes; Valdez; 85
263; Venice mucky silt loam, partially drained, 0 to 2 percent slopes, overwashed; Venice; 85
264; Venice muck, partially drained, 0 to 2 percent slopes; Venice; 85
273; Webile muck, partially drained, 0 to 2 percent slopes; Webile; 85

CA095; Solono County Area, California:

Eb; Egbert silty clay loam; Egbert; 85
Ec; Egbert silty clay loam, occasionally flooded; Egbert; 85
Ry; Ryde clay loam; Ryde; 85
Va; Valdez silt loam drained; Valdez; 85
Vc; Valdez silty clay loam; Valdez; 85

CA113; Yolo County Area, California:

Va; Valdez silt loam; Valdez; 85
Vb; Valdez silt loam, deep; Valdez; 85

Table 4. Representative soil features

Surface texture	(1) Silty clay loam (2) Clay loam
Family particle size	(1) Clayey
Drainage class	Very poorly drained to poorly drained
Permeability class	Very slow to moderately slow

Soil depth	150 cm
Surface fragment cover <=3"	Not specified
Surface fragment cover >3"	Not specified
Available water capacity (0-101.6cm)	7.62 – 30.48 cm
Soil reaction (1:1 water) (0-101.6cm)	4.5 – 8.4
Subsurface fragment volume <=3" (Depth not specified)	Not specified
Subsurface fragment volume >3" (Depth not specified)	Not specified

Ecological dynamics

Community Dynamics Section

This ecological site is a complex tidally-influenced riverine complex of marshes, seasonal wetlands and emergent wetland vegetation types. It is also the most extensive ecological site within the MLRA and making up approximately 54% of identified soils and comprising about 63% of the land resource unit. In the most general sense, this historically this site would be a series of islands subject to inundation by runoff and/or tidal waters several times each year.

This ecological site has been subject to some of the most extensive and intensive modification of any lands in the western US. In the late 1800s, agricultural interests initiated the construction of levees along some islands with most of these islands leveed by 1917. Following the leveeing, draining and burning of the hallmark organic soils (histosols) are legendary in the West for food production and having peat surface often exceeding 50' thickness.

The soils of this ecological site are relatively new arrivals to the landscape with some of the oldest and deepest histosols having been radiocarbon dated to approximately 6,500 years BP (USGS, 2001) and corresponding to increased sea levels at the tail end of the post-Ice Age melt-back. This period of increasing sea level transformed the underlying braided river networks of the current Delta into something more akin to a marine estuary. As a result of river waters meeting marine waters inland, fine sediment loads of the upper watersheds were increasingly deposited over the top of the old riverine system and these histosols developed as sediment and organic matter accumulated.

Under natural hydrology, this ecological site grades into the non-tidal aquoll ecological site. Within these two sites, inundation frequency varies dramatically. Only about half of the tidal extent was inundated by twice daily high tides, with the rest ranging from wetted (rather than actually overflowed) by daily tides to only wetted by spring tides (SFEI, 2012).

Organic soils support the freshwater emergent wetland (the buildup of organic material in peat occurs through anoxic conditions created by saturated soils). The mollic soils correlated to this ecological site likely similarly supported freshwater emergent species—this correlation was based on historical soil type descriptions that were reviewed for descriptions of soil properties, drainage characteristics, native vegetation, and agricultural uses indicative of perennial wetland or former wetlands (SFEI, 2012).

Soils of this ecological site are subject to subsidence due to oxidation of soil organic matter under the influence of soil aeration following historic and ongoing land treatments. At the lowest elevations of the ecological site, this has resulted in some areas subsiding well below

surrounding estuary water table levels and necessitating pumping of intruding waters. In such cases, unrepaired levee breaches may result in these soils being permanently inundated as in the cases of Franks Tract, Big Break, Mildred Island, and western Sherman Island (Sherman Lake).

Where constructed levees have been installed across the range of this ecological site, most of the preexisting natural channels and levees have been muted by land levelling but many are still apparent on LIDAR imagery. This is due in part to differential shrinkage of organic soils relative to the underlying material. Within channels where organic material failed to historically accumulate, oxidation and shrinkage apparently occurs more rapidly than in adjacent areas with deep (>30") peat substrates, thus exposing the underlying topography.

Narrow low elevation natural levees included in this ecological site were historically extensive within the San Joaquin portion of the MLRA. Occurrence of long-lived upland species such as walnut and oak was presumably rare while dominance by single aged stands of cottonwood and willow were more typical where those species could compete with cattail and tule. Such levees were typically a mixture of fine and coarse sediment but unlike the higher elevation levees associated with CA016XA002, these levees were typically subject to regular inundation by tidal waters and consolidation of sediment was largely localized and/or largely unpronounced due to frequent "washing" of the surface sediments and breaching of these levees. As a result of this tidal action, the height of many of these natural levees above the adjacent soils might have been as slight as a few inches or even be apparent only seasonally where tidal action was most influential.

The importance of natural levee height and channel sinuosity relative to vegetative pattern is not fully understood for this ecological site and the range of historic reports mainly focuses on dominant vegetation. However, it is conceivable that a great degree of variability in vegetation across the ecological site could be tied to island and channel hydrology as modified by position and elevation within the watershed. The likely pattern is that the closer to the headwaters an island occurred, the more likely that wider and more stable levees would develop. Considering an east to west cross section of the LRU, this would imply a likely decreasing potential for significant oak, sycamore and walnut presence as well as increased turnover of cottonwood in particular as large shallow-rooted trees in such soils eventually topple under their own weight if not by windthrow or force of floating debris.

Wetlands that support abundant freshwater rooted vegetation are classified as freshwater emergent wetlands. Salinities lower than 0.5 ppt generally characterize these wetlands (Cowardin et al. 1979). These marshes and swamps are associated with riverine floodplains (lands adjoining a channel that are subject to flooding every one to three years) and flood basins (extensive low-lying regions on the backside of natural levees) as well the upper regions of estuaries. Small freshwater emergent wetlands are associated with low-lying depressions and ponds, small channels, and localized areas of high groundwater. Freshwater wetlands are dominated by plant species such as bulrush or tule (*Schoenoplectus acutus*, *S. californicus*, *S. americanus*), cattails (*Typha* spp.), sedges (*Carex* spp.), spikerushes (*Eleocharis* spp.), rushes (*Juncus* spp.), smartweed (*Polygonum* spp.), and the common reed (*Phragmites australis*; Brandegee 1893-4, Jepson 1913, Atwater 1980, Barbour et al. 2007, Hickson and Keeler-Wolf 2007).

Vegetation assemblages vary depending on physical drivers. For instance, *S. californicus* was likely more dominant in the western Delta and along channels given its wind and wave resistant structure, while the taller *S. acutus* grows in more protected areas like those in the north Delta flood basins (Keeler-Wolf pers. comm.). Particularly in the western-central Delta, this habitat type includes woody shrubs such as willow (*Salix* spp., primarily *S. lucida lasiandra*) and ferns (*Athyrium felix-femina*) to make up a unique plant community, perhaps related to maritime influences (Atwater 1980, Keeler-Wolf pers. comm.). The wetland species are not precluded by seasonally dry conditions.

Freshwater emergent wetlands can be either tidal or non-tidal. Tidal freshwater emergent wetlands include those areas wetted at mean higher high water during low river stage and comprise what historical records often refer to as tidelands. Non-tidal freshwater emergent wetlands are not directly and predominantly affected by tidal action. However, tides may indirectly affect water table levels in freshwater emergent wetland and hydrological connectivity across landscapes during floods.

State 3 conceivably produces the most vegetative biomass due to agricultural inputs whereas the two preceding states are similar in overall productivity over long periods of time.

State and transition model

Figure 5. STM016XA001

Additional community tables

Table 5. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
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Table 6. Community 1.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
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Table 7. Community 2.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
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Table 8. Community 2.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
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Table 9. Community 2.3 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
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Table 10. Community 3.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
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Table 11. Community 3.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
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Other references

References Used:

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Contributors

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Acknowledgments

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Rangeland health reference sheet

Interpreting Indicators of Rangeland Health is a qualitative assessment protocol used to determine ecosystem condition based on benchmark characteristics described in the Reference Sheet. A suite of 17 (or more) indicators are typically considered in an assessment. The ecological site(s) representative of an assessment location must be known prior to applying the protocol and must be verified based on soils and climate. Current plant community cannot be used to identify the ecological site.

Author(s)/participant(s)	
Contact for lead author	
Date	

Approved by	
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. Number and extent of rills:

2. Presence of water flow patterns:

3. Number and height of erosional pedestals or terracettes:

4. Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):

5. Number of gullies and erosion associated with gullies:

6. Extent of wind scoured, blowouts and/or depositional areas:

7. Amount of litter movement (describe size and distance expected to travel):

8. Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):

9. Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):

10. Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:

11. Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):

12. Functional/Structural Groups (list in order of descending dominance by above-ground annual-production or live foliar cover using symbols: >>, >, = to indicate much greater than, greater than, and equal to):

Dominant:

Sub-dominant:

Other:

Additional:

13. Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):

14. Average percent litter cover (%) and depth (in):

15. Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):

16. Potential invasive (including noxious) species (native and non-native). List species which BOTH characterize degraded states and have the potential to become a dominant or co-dominant species on the ecological site if their future establishment and growth is not actively controlled by management interventions. Species that become dominant for only one to several years (e.g., short-term response to drought or wildfire) are not invasive plants. Note that unlike other indicators, we are describing what is NOT expected in the reference state for the ecological site:

17. Perennial plant reproductive capability:
