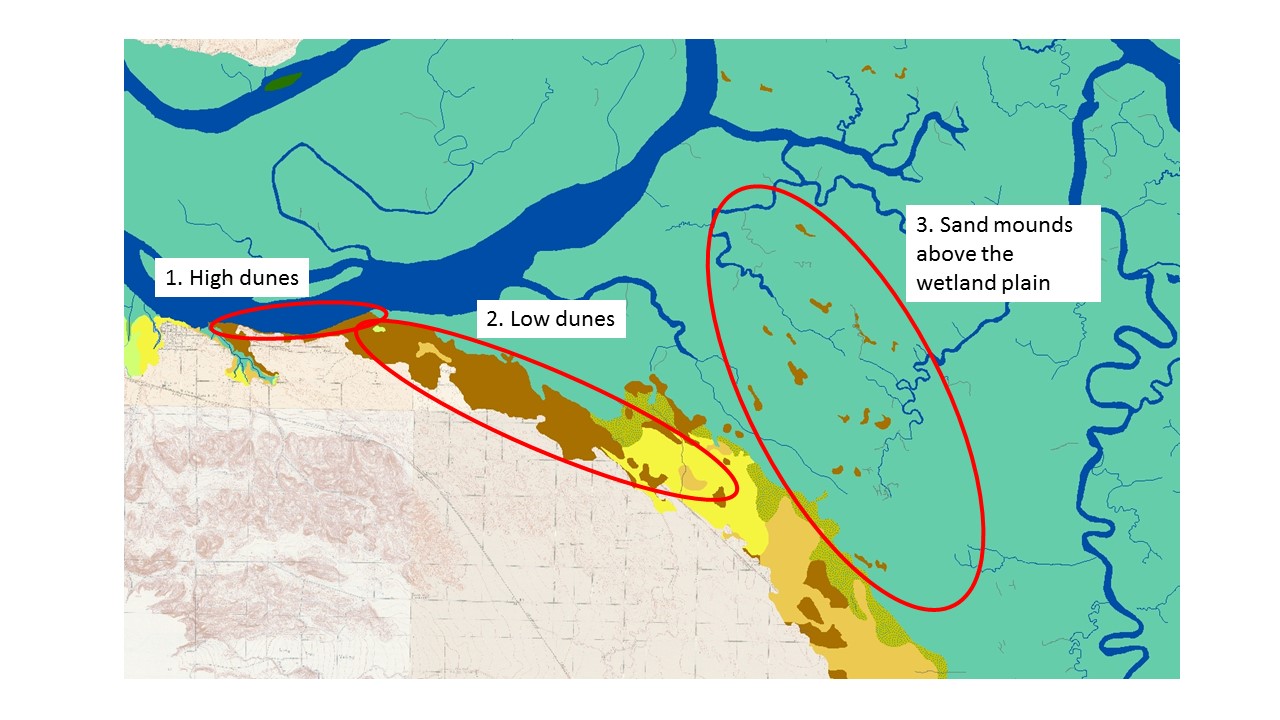
# Stabilized interior dunes

There are two areas within the interior dune habitat type that are distinct from each other and should be considered separately (See figure 1).

**A note on oaks** – all categories within this habitat type were recorded as having coast live oaks. These trees should be represented with a variety of sizes. Early accounts describe some oaks as being scrubby and small, while others were large and well developed, and GLO tree data supports a range of sizes from 3-60 inches in diameter (from the Contra Costa County Historical ecology report, Stanford 2011).

**A note on % composition for species specs** – In the sandy/dune areas, vegetation was not continuous and should be depicted as sparse, and interspersed with areas of open sand. Therefore, I have listed the species that were likely common, but for each, I have left the % composition as only 5%. This reflects our best guess for this habitat – while common species were probably dominant in terms of relative abundance, their total percent cover should still be low because the vegetation was sparse.



1. **High dunes:** In a narrow strip (100-200 meters in width and roughly 2 miles in length, see figure 2) along the San Joaquin river east of what is now the Antioch Dunes National Wildlife Refuge, there was a region of high dunes that historically reached 150-200 feet in height. The dunes were mined for their sand, and levelled after the 1906 earthquake in San Francisco, thus there is no place where they still remain. An early map (Figure 2) shows oaks growing along both the front and the top of the dune. I am including in a kmz file a highlighted area that shows where this section of high dunes should be located. The 100-200 feet elevation is not represented in the historic DEM, and therefore this feature should be built on top of (or added to) the DEM.

In this area, available evidence suggests that oaks were scattered on the front of the dune, and on the back of the dune. In the steepest area of the dune, the sand should appear more exposed, with no trees, and wildflowers and bush lupines interspersed in patches of vegetation intermixed with patches of sand. Because this habitat no longer exists, I am including some google earth locations from coastal dunes in California that I think depict what this mix of sand and sparse vegetation most likely looked like.

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High dune relief

Figure 2. An early USGS map (1908) showing the topography of the high dune region. The dunes were 100 m wide near the eastern and western edge, and roughly 200 m wide in the middle.



Oaks on back of dune

Oaks on front of dune

Figure 3. 1887 T sheet showing oaks on both front and back of 100-200 foot dunes. Oaks on front can be depicted as more sparse (around every 100 meters, for example), whereas oaks on the back of the dune appear slightly more dense, and could be shown every 30-50 meters scattered along the back of the dune.

**From the Delta HE report:** “A larger region of Oakley sands are found west along the edge of the San Joaquin River. This includes the current Antioch Dunes National Wildlife

Refuge (ADNWR) as well as what was once a prominent 2,800 acre (1,133ha) expanse of densely vegetated scrub surrounded by more sparsely vegetated areas with oaks in the vicinity of Oakley (most of which is outside the study area; Wackenreuder 1875, Carpenter and Cosby 1939, Stanford et al. 2011). The Antioch Dunes to the west were historically over 100 feet(30.5 m) in height (Davidson 1887).

1. **Low dunes:** in the low dune region, the dune height should be much lower, and should roughly follow the historic digital elevation model. Dunes can be depicted as low (10-15 feet) and forming a gently rolling terrain in this area. Historic vegetation in this area is not well documented. Therefore, our best informed guess is that the species composition should be roughly similar to that of the high dunes and sand mounds, but the vegetation should be slightly more dense, with more scrub (and more chaparral vegetation) and less exposed sand. In addition, an aerial photograph from 1939 from this area shows that some of the oaks were still present at that time. From this image, I calculated that oak densities would likely have been higher in this area, reaching densities of 35 oaks/ha (± SD 16.46 from 12 sample spots on the historic aerial). The chaparral type scrub vegetation mixed with sand would probably have looked somewhat like the contemporary landscape at Dillon Beach (highlighted on google earth as a reference).
2. **Sand mounds above the wetland plain**: Individual mounds rising above the tidal elevations were scattered across the wetland plane in the area south of the San Joaquin River (see Figure 1). Historic maps show that some of these mounds were over 15 feet above sea level, and ranged in size from 1 to 25 ha. The HE mapping includes only those larger than five acres. These sand mounds often contained oaks, and available evidence suggests they had vegetation very similar to that of the lower dunes along the wetland plain edge.