

Impacts of Increased Tidal Inundation on Coastal Marsh Communities: a case study along Buhne Slough

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Introduction

In 2015–2017, *Spartina densiflora* (dense-flowered cord grass) removal efforts occurred in a 2.5-hectare (6.2-acre) intertidal coastal marsh along Buhne Slough in King Salmon, California. The Buhne Slough coastal marsh is former tideland located behind a levee and a tide gate connecting Buhne Slough with Fisherman’s Channel of Humboldt Bay. Vegetative cover data was collected annually from 2015 to 2017 within the coastal marsh to measure the progress of the annual *Spartina densiflora* removal efforts. These annual surveys coincided with the decline and eventual failure of the nearby tide gate in winter 2015/2016. The tide gate failure resulted in an increase in saltwater intrusion and inundation duration on the once tidally-muted marsh as noted by the increased high tide line within Buhne Slough and inudation visible on aerial imagery.



Location of coastal marsh along Buhne Slough and the Fisherman’s Channel-Buhne Slough tide gate connection, King Salmon, CA. The two images illustrate the change in vegetative cover and tidal inundation between 2014 (left) and 2018 (right).

Photograph Series

Photopoint 1



May 2014, Tide 0.77 ft



August 2015, Tide 3.1 ft



July 2016, Tide 3.7 ft



July 2017, Tide 3.4 ft



April 2019, Tide 0.5 ft

Photopoint 2



Methods

To monitor *Spartina densiflora* in the survey and treatment area, up to 27 variable-length (20–300 ft) line-intercept transects were placed throughout the coastal marsh at even intervals after a random starting point. The extent of each plant species (i.e., canopy cover) along the transect was recorded to the nearest tenth of a foot as it was encountered along the transect. When plant cover was absent, the area was noted as bare ground or litter (e.g., thatch, decaying or dead plant matter). Cover by species was summed over all transects and expressed as a percent.



Results



Above photographs depict site conditions along a similarly located line-transect during the 2015 (left) and 2017 (right) surveys. Below images (Photopoint 3) show the expanded high tide line within Buhne Slough over the course of the monitoring suggesting the increase in tidal water influence and daily inundation to adjacent low-elevation areas.

In 2015, the survey area was primarily composed of emergent salt marsh vegetation (e.g., *Salicornia pacifica*, *Distichlis spicata*) however, due to the muted tidal regime associated with the nearby tide gate and levee (pre-1948), emergent brackish marsh species (e.g., *Juncus lescurii*, *Deschampsia cespitosa*) along with coastal scrub species (e.g., *Baccharis pilularis*), had established along the margins and in large patches throughout the marsh. Although emergent brackish marsh vegetation was a small portion of the survey area, 11 of the 19 documented species in the summer of 2015 were associated with this cover type. Monitoring results showed a decline in species richness over time that was mainly attributed to the die back of brackish marsh and coastal scrub species with lower salinity tolerances than salt marsh species.

The 2017 data indicated a substantial decrease in overall relative cover for both emergent brackish marsh and emergent salt marsh species and concurrently an increase in cover from litter (mostly noted as *S. pacifica* and *D. spicata* dead plant material). The decline of emergent brackish marsh species and the mortality observed in coastal scrub species in 2016 was assumed to be related to increased salt water intrusion resulting from the failure of the tide gate between 2015 and 2016 monitoring periods. Cover results indicate the initial increase

in emergent salt marsh cover in 2016 was related to salt marsh species growth and recruitment in areas previously occupied by brackish marsh species as well as in areas of bare ground. The substantial decrease in salt marsh cover and consequent increase of litter in 2017 was suspected to be associated with the long-term (>1 year) change in daily hydrologic conditions (i.e., longer salt water inundation periods) in the marsh. These changed conditions are resulting in increased water level depth at inundation and greater waterlogging stress on established salt marsh species.

As the monitoring coincided with the failure of the adjoining tide gate and the consequent increased tidal inundation duration and extent within the survey area, these results are indicative of how quickly low-elevation coastal marsh landscapes respond to increased tidal influence. In 2019, the site was revisited during low-tide events and, based on visual inspection, a large portion of the survey area is now open mudflat where vegetation continued to die back. Future planning for preservation of coastal marshes in the region should evaluate marsh elevation to avoid conversion to open mudflat with increased tidal inundation and sea level rise.

