Geologists provide evidence that a series of storms caused extensive erosion of the Carpinteria Salt Marsh

26 February 2018, by Julie Cohen

Carpinteria Salt Marsh Reserve is a unique estuarine ecosystem. Credit: University of California - Santa Barbara

Flooding isn't new to the Santa Barbara coastline. However, the inundation doesn't always come from the mountains as it did last month in Montecito.

Back in 1861-2, a series of large storms washed beach sand more than a quarter mile inland into what today is the Carpinteria Salt Marsh. Although historical accounts document the inland flooding, little has been known about how those storms impacted a now heavily developed California coast.

In a new paper in the journal *Marine Geology*, UC Santa Barbara geologists provide the first physical evidence of coastal erosion and inundation produced by these storms. In the upper meter of marsh sediments, they found a unique deposit—in fact the only such deposit to have happened over the past 300 or so years.

"The deposit is comparable in scale to those caused by moderate hurricanes or even small tsunamis," explained co-author Alex Simms, an associate professor in UCSB's Department of Earth Science. "The deposit suggests that the 1861-62 storm season was erosive enough to remove coastal barriers, allowing extensive coastal flooding in areas currently developed today."

The team conducted its work at the Carpinteria Salt Marsh Reserve, part of UCSB's Natural Reserve System.

Lead author Laura Reynolds, a graduate student in Simms' lab, and co-authors mapped the sand deposit within the Carpinteria marsh using 40 sediment cores, tubes of sediment up to 4 meters long. They confirmed the deposit's age using the presence of European crop pollen as well as tiny grains known as spheroidal carbonaceous particles, which are created by the burning of fossil fuels.

The researchers compared the candidate storm deposit to sand from modern stream, beach and dune environments. They determined that the sediments from the candidate storm deposit were most similar to modern beach sand in terms of mineral content and the size of the sand grains. This suggests the sand was brought into the marsh from the beach, not from streams.

The storms of 1861-62 are hypothesized to have resulted from atmospheric rivers, concentrated zones of water vapor high up in the atmosphere that produce intense precipitation and river flooding along coastlines on which they occur. Although ocean flooding from tsunamis and other large storms has happened throughout the past 200 years in Southern California, no other event is known to have washed beach sand into the Carpinteria Salt Marsh.

This suggests that the storm season was unusually destructive to the sandy barrier that separates the marsh from the ocean. Therefore, efforts to prepare for a recurrence of storms like those that occurred during that time need to address potential coastal impacts.

"This is particularly troubling considering coastal systems that once took the brunt of storm events—dunes, beaches and estuaries—are today some of the most degraded and developed environments in coastal regions around the world," Reynolds said. "Consequently, mitigation efforts for prolonged stormy periods should consider the effects of coastal erosion and inundation in addition to the effects of excess precipitation."

More information: Laura C. Reynolds et al. Coastal flooding and the 1861–2 California storm season, *Marine Geology* (2018). DOI: 10.1016/j.margeo.2018.02.005

Provided by University of California - Santa Barbara