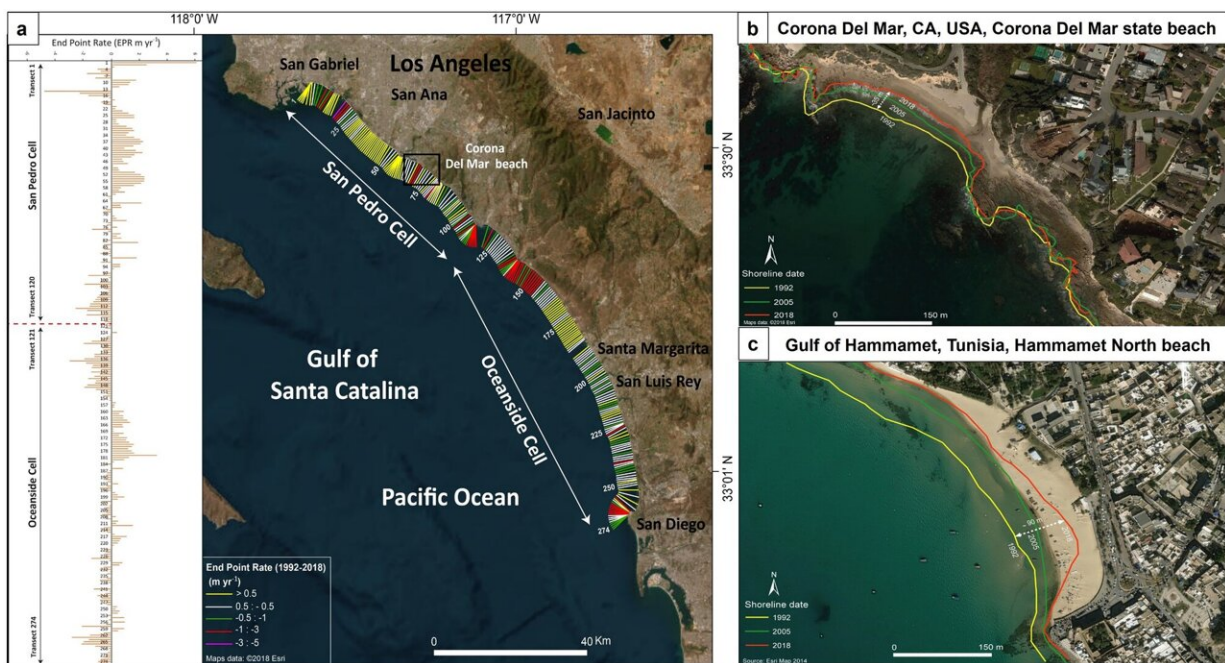


# Beach erosion will make Southern California coastal living five times more expensive by 2050, study predicts

May 22 2024, by Nina Raffio



Multi-date shoreline evolution analysis using the DSAS model. a Shoreline evolution analysis from 1992 to 2018 for the beaches of the Gulf of Santa Catalina in Southern California, U.S., projected over the 2014 ESRI scene. b Shoreline evolution in the validation site of Corona del Mar State Beach (CA, U.S.). c Shoreline evolution of the validation site of Hammamet North Beach, Tunisia. The net shoreline movement in both validation sites, from 1992 to 2018, is  $-35$  m for Corona Del Mar and  $-90$  m for Hammamet North Beach. Credit:

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Rising sea levels and urban development are accelerating coastal erosion at an alarming rate in Southern California with significant ripple effects on the region's economy, a USC study reveals.

The [study](#), published in *Communications Earth & Environment*, predicts that Southern California's coastal living costs will surge fivefold by 2050 as a direct result of beach erosion. This erosion will require more frequent and costly beach nourishment projects to maintain the state's treasured shorelines, consequently driving up the cost of living along the coast.

"Our study presents compelling evidence of the rapid deterioration of Southern California's coastal landscapes," said Essam Heggy, a geoscientist in the Ming Hsieh Department of Electrical and Computer Engineering/Electrophysics at the USC Viterbi School of Engineering and the study's corresponding author.

"The challenges facing Southern California mirror a growing threat shared by coastal communities worldwide. The environmental and economic implications of [coastal erosion](#) reach far beyond California's shores and demand interdisciplinary, global solutions," he said.

## **Coastal erosion: Cost of living sure to surge as sandy beaches disappear**

To predict future changes along California's sandy coastlines, the researchers focused on the Gulf of Santa Catalina, which stretches over 150 miles from the Palos Verdes Peninsula in Los Angeles County to the northern tip of Baja California in Mexico.

They used a combination of historical and recent satellite images as well as advanced algorithms to analyze coastline movement and predict future

erosion based on different trends and environmental factors.

The study predicts a tripling of erosion rates by 2050, increasing from an average of 1.45 meters per year to 3.18 meters by 2100. Consequently, the annual sand requirement for beach nourishment could triple by 2050, with costs rising fivefold due to the global increase in sand prices. This will exacerbate economic and logistical pressures on coastal communities.

Beach nourishment is adding sand to an eroded beach to rebuild it and create a wider barrier against waves and storms.

"Our investigation suggests that coastal problems start inland due to the rapid growth of cities along the coast, which compromise inland sediment replenishment of [sandy beaches](#)," said Heggy, whose research focuses on understanding water evolution in Earth's arid environments.

"As our beaches shrink, the cost of maintaining them will rise. Finding innovative solutions is key to securing a sustainable future for our shores and local economies," he said.

## **Coastal erosion in California: A case study for a global problem**

Coastal cities in Southern California and those in North Africa bordering the Mediterranean Sea face a common challenge: a semi-arid climate year-round coupled with the growing threats of rising sea levels and eroding shorelines.

A significant portion of Earth's landmass, roughly 41%, falls under arid or semi-arid classifications, and these areas support over a third of the global population.

To understand this global challenge, the researchers focused on two specific locations: Corona del Mar in Orange County, Calif.—an example of the typical Southern California coastline—and Hammamet North Beach in Tunisia. Both are densely populated and share similar climates, prone to increasing droughts, flash floods and unpredictable rainfall patterns. These characteristics mirror the challenges faced by countless coastal communities worldwide.

The findings showed that the average rate of shoreline retreat in these areas varies. In Southern California, beaches are receding between 0.75 and 1.24 meters per year. In Hammamet North Beach, the retreat rate ranges from 0.21 to about 4.49 meters annually.

"While beach nourishment can temporarily combat erosion, however, it presents significant challenges for developing countries," said Oula Amrouni, a sedimentologist at the National Institute of Marine Sciences and Technologies at the University of Carthage, Tunis, Tunisia, and one of the study's co-authors.

"The high cost of acquiring the right sand, with the specific grain size, quality and composition, and the technical complexity of extracting and laying it are major hurdles. Additionally, worsening erosion in previously stable areas compels more frequent nourishment projects, straining already limited budgets and leading to unplanned expenditures for many communities."

**More information:** Oula Amrouni et al, Shoreline retreat and beach nourishment are projected to increase in Southern California, *Communications Earth & Environment* (2024). [DOI: 10.1038/s43247-024-01388-6](https://doi.org/10.1038/s43247-024-01388-6)

Provided by University of Southern California

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