Sand dunes experience significant erosion due to sea-level rise and extreme storms

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Researchers monitor the impact of Storm Lorenzo on the dunes at Crantock, North Cornwall, in 2019. Credit: Lloyd Russell, University of Plymouth

Sand dunes on the northern coasts of Devon and Cornwall have been eroded by up to 15 meters in the past 15 years, according to new

research.

A study by members of the Coastal Processes Research Group at the University of Plymouth demonstrated that the vast majority of coastal dunes in the South West experience chronic erosion.

Using survey data from 25 dune systems they found that they have been retreating at an average rate of 0.5 to 1 m per year, with only a few dunes in relatively sheltered locations being stable or growing.

This equated to a total retreat over the 15-year period of anything between five and 15 m, with the three worst affected locations being Westward Ho! in North Devon, and Porthcothan and Porthkidney in North Cornwall.

Writing in the journal *Marine Geology*, the researchers say that for half of the retreating systems, the amount of sand within the dunes has actually increased.

This means sand from the dune face, as well as from the beach, is being transported over the top of the dunes by a combination of wind and waves, and causing the dune system to migrate landward.

This is referred to as "dune roll-over," and means there will be no immediate loss of dune habitat. However, if the dune is pushed back into coastal infrastructure or defenses it will be squeezed and that could reduce the dune area.

Gerd Masselink, Professor of Coastal Geomorphology at the University of Plymouth and the study's lead author, said, "Dune systems are natural forms of coastal defense. However, they are expected to exhibit increased erosion rates as a result of climate change, notably through sea-level rise and, potentially, increased storminess.

"It is really important to allow the dunes to migrate as this will preserve valuable coastal habitats and enhances coastal resilience. However, coastal authorities and communities are generally reluctant to allow the coastal zone to be pushed back and prefer to keep the coastal line where it is. We will have to get used to the idea that climate change will push our coastal systems slowly landward and we need to adapt to and not resist this, wherever we can."

The study is part of ongoing research by the University into the changes taking place along our coastlines as a result of climate change, and was carried out using both in-situ observations and a widely-used coastal retreat model. It found that the observed dune retreat rate was two to three times greater than that predicted by the model.

Researchers attributed this to the increase in winter wave heights and increased storminess, which increase the amount of time that the foot of the dune is subjected to wave action. It is under those conditions that dune retreat occurs.

By 2100, when sea levels are predicted by the Intergovernmental Panel on Climate Change to have risen by 0.75 meters, the researchers believe the dunes covered in this study could retreat anywhere between 20 and 75 meters.

Professor Masselink added, "This study shows that a combination of in-situ analysis and the application of dune retreat models can provide useful insights into future dune evolution. That information is crucial for coastal planners and managers to decide how to protect communities in both the short and long term. However, for coastal authorities and communities to fully prepare for and adapt to these changes, we still need to better understand and constrain what these future changes will be."

More information: Gerd Masselink et al, Coastal dune dynamics in embayed settings with sea-level rise—Examples from the exposed and macrotidal north coast of SW England, *Marine Geology* (2022). DOI: 10.1016/j.margeo.2022.106853

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