

THE STRAITS TIMES

S'pore coastlines more resilient against sea-level rise than previously thought: NTU study



Rising sea levels due to climate change often causes coasts to retreat, as structures like cliffs and shorelines are eroded over time. ST PHOTO: LIM YAOHUI



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SINGAPORE - Singapore's coastlines may not be threatened by sea-level rise quite to the extent previously thought, according to researchers here.

Rising sea levels due to climate change often cause coasts to retreat, as low-lying coastal areas become flooded and structures like cliffs and shorelines are eroded over time.

But researchers from the Nanyang Technological University's (NTU) Earth Observatory of Singapore (EOS) found that coastal areas in southern Singapore – where the Kallang River Basin is located – remained intact even at high rates of sea-level rise, owing to large amounts of sediment deposits.

Sediment deposits occur when heavy rainfall carries gravel, sand and silt to rivers from catchment areas to coastal areas like the Kallang River Basin.

Aside from retaining the natural shape and boundary of coastal areas, these sediments can replenish erosion and support the growth of habitats such as mangroves, which can keep pace with rising seas as they trap sediment in their roots.

The study, which was led by Research Assistant Professor Stephen Chua from EOS, was published in the scientific journal *Marine Geology* in September.

Dr Chua said on Tuesday that the team had chosen to study the Kallang River Basin as it contains Singapore's major river system, and is where key infrastructure such as the Central Business District and the stadium is located.



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However, rapid urbanisation has led to reduced sediment rates along coastlines, both in Singapore and globally, due to factors such as altered river courses, land reclamation and infrastructure development.

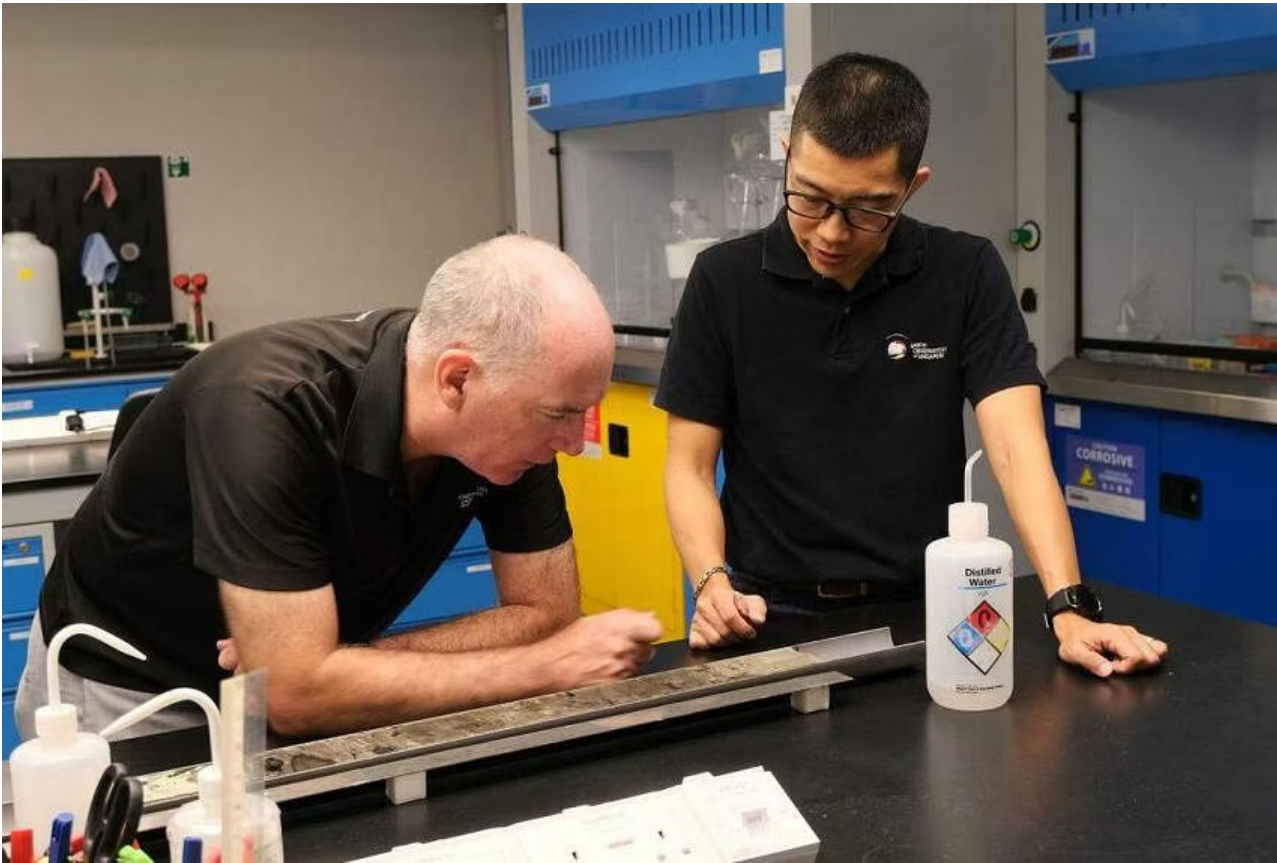
While the rates of sediment deposit in Singapore are still unknown, they have “definitely decreased” over the years as a result of urbanisation, Dr Chua added.

But frequent heavy rainfall is a mitigating factor as it increases the rate of surface run-off, thus channelling sediment to the coast, he said.

By analysing sediment samples collected from Marina South, the researchers discovered that Singapore's coasts were sediment-rich in the past; they were actually mangroves some 10,000 years ago.

As sea levels rose, the mangroves retreated and became estuarine.

Eventually, the landscape turned into a coastal area with a river delta, said Dr Chua. This occurred during a period of high sea-level rise – 5mm per year. Sea levels are currently rising at a rate of 4mm per year.



NTU Professor Adam Switzer (left), a principal investigator at EOS, and NTU Research Assistant Professor Stephen Chua from EOS examining a sediment core collected from Singapore's Marina South. PHOTO: NTU

The EOS study effectively shows that coasts with high sediment supply – such as Singapore's – can ultimately mitigate sea-level rise, said Dr Chua.

While urbanisation is inevitable, having a more in-depth understanding of sediment dynamics could help with better sediment management and assist in the design and construction of coastal protection infrastructure, said Professor Adam Switzer, a principal investigator at EOS.

For instance, coastal protection solutions should help enhance sediment retention, such as creating hybrid sea wall systems that incorporate artificial reefs.

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Another solution would come from mangrove forests that trap sediments and improve flood defences, said Prof Switzer, who focuses on coastal science.

Currently, Singapore is conducting eight islandwide site-specific studies covering more than 300km of coastline to determine suitable coastal protection solutions for each area.

Mean sea levels are expected to rise by 1m by 2100, although sea levels could go up by 4m or even 5m, if sinking land, storm surges (abnormally high tide due to a storm) and daily tidal activities are considered.

Around 30 per cent of Singapore's land area is less than 5m above mean sea level.

Dr Chua said the team will be looking to conduct further studies along the north-east, north-west and south-western coasts, as these areas have natural coastlines that have largely remained the same over millennia.

However, careful examination of each area is needed as different wave conditions and sediment types dictate different methods to protect the various coasts.

For example, the north-western coast off Sungei Buloh and Kranji experiences weaker waves and is muddier.

Weaker waves generally move less sediment from the shore face and muddier coasts tend to be better at reducing wave break.

“These are areas with more natural river and coastal systems, where nature-based solutions have been highlighted for coastal protection. Hence, our study on sediments can hopefully augment these efforts,” said Dr Chua.

The researchers will be engaging government agencies like national water agency PUB and the National Parks Board in their efforts.

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