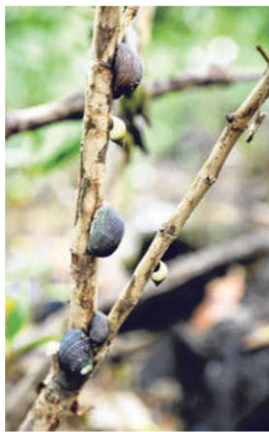


At the Kranji Coastal Nature Park, mangrove saplings sprout from cracks in a rock revetment wall. Mangroves, with their tangled roots that can trap sediment from the tides, can keep pace with sea-level rise. "Just five to six years ago, that area was covered in water," said Mr Lim Liang Jim (below), group director of conservation at NParks.

Bottom: Snails – such as the common nerite – and Onchidium – a genus of air-breathing sea slugs – have been spotted on the mangroves regenerating at Kranji Coastal Nature Park. They can serve as food for other wildlife, such as birds and fish.
ST PHOTOS: ONG WEE JIN



USING NATURE IN CLIMATE FIGHT

Healthy ecosystems are more resilient to climate change and provide life-critical services such as food and clean water. By restoring degraded ecosystems and effectively and equitably conserving 30 to 50 per cent of earth's land, freshwater and ocean habitats, society can benefit from nature's capacity to absorb and store carbon.



CLIMATE SCIENTIST HANS-OTTO PORTNER from the Intergovernmental Panel on Climate Change (IPCC)

In a sobering report released last month, the Intergovernmental Panel on Climate Change detailed how climate impacts were driving humanitarian crises, such as the spread of diseases, and food and water shortages. The report also urged countries to start adapting to climate impacts such as sea-level rise now, and to harness nature in the bid to do so. This week, *The Straits Times* highlights how cities around the world are preparing to deal with the symptoms of a warming planet.

Science Journals

FROM COAST TO COAST S'pore, England act to protect nature from climate impacts

Audrey Tan
Environment Correspondent

As the planet warms, ice sheets melt, and sea levels creep up, it is not just cities that are at risk of coastal flooding. Natural habitats, too, could be overwhelmed by the rising tides.

Singapore has already lost much of its wilderness to development, but a new study has found that the nation's mangroves and seagrass meadows could shrink by 20 per cent from current levels by the end of this century due to sea-level rise. The lead author of the study, Dr Nhung Nguyen from the National University of Singapore's (NUS) Reef Ecology Laboratory, said: "We found that the future land use plans have considerable impact on the ability of these habitats to shift landward."

As sea levels rise gradually, natural habitats like mangroves can re-

spond by migrating landward. But sea walls or other developments can block their landward crawl, causing them to shrink.

This is known as the coastal squeeze.

Said Dr Nguyen: "We are looking at about a 20 per cent reduction in the extent of mangrove forests and seagrass meadows throughout the century if Singapore's projected land use plans become reality."

For the study, published last month in the scientific journal *Landscape and Urban Planning*, the researchers used a geographic modelling approach to project how Singapore's coastal habitats could be impacted by rising sea levels.

Earlier estimates had projected that global mean sea level could rise by about 1m by 2100.

The researchers said their simulations were based on two land-use scenarios – one with the present land-use profile, and another with the future land-use profile out-

lined in the 2013 Land Use Plan, which gives scenarios to the year 2030 and beyond.

The results showed that as more coastal areas are being developed, mangroves and seagrass meadows on Singapore's coastlines are less able to adapt by moving inland, resulting in the loss of habitats.

"But we might be able to retain similar extents of these habitats by the end of the century if they are allowed to shift landward due to sea-level rise," Dr Nguyen added.

Indeed, cities can be protected from rising water levels with sea-walls and other hard structures. But this is less feasible for coastal habitats like mangroves, which are sustained by the ebb and flow of the tides.

Last month, the Intergovernmental Panel on Climate Change (IPCC) warned that climate impacts were driving humanitarian crises such as water and food shortages, and that people should start adapting to symptoms of a warm-

ing planet, such as rising sea levels and more frequent extreme weather events.

Adaptation strategies refer to actions that reduce the impact of climate change on societies, such as developing drainage systems to reduce flooding, or building sea walls against sea-level rise.

But the IPCC also said nature should not be left out of the picture.

"Healthy ecosystems are more resilient to climate change and provide life-critical services such as food and clean water," said climate scientist Hans-Otto Portner from the IPCC.

"By restoring degraded ecosystems and effectively and equitably conserving 30 to 50 per cent of earth's land, freshwater and ocean habitats, society can benefit from nature's capacity to absorb and store carbon."

The good news is that projects to help degraded areas recover are now under way in many parts of the world, including in Singapore and in Britain.

RESTORING KRANJI'S MANGROVES

At the Kranji Coastal Nature Park, located along Singapore's mangrove-rich north-western coast, mangrove saplings sprout from cracks in a rock revetment wall that had not been there until recently.

"Just five to six years ago, that area was covered in water," said Mr Lim Liang Jim, group director of conservation at the National Parks Board (NParks).

That segment of Singapore's shoreline was severely eroded by wave action, with water whittling away the land, to the extent that the mangroves on it could topple into the sea.

Mr Lim said the NUS-led study had indicated that one possible way for mangroves to cope with rising sea levels is to allow for their natural migration landwards.

"To achieve this, it would be important to safeguard buffer areas behind existing mangrove habitats to facilitate such migration," he said.

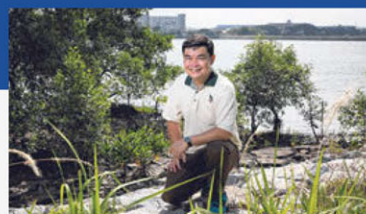
"NParks will also continue to restore and enhance these vulnerable habitats to strengthen their resilience to the impacts of future sea-level rise, improving their chances of survival in the long-run."

Mangroves play two roles in the fight against climate change.

They have the ability to capture more than three times the amount of carbon as dryland tropical rain forests, said Mr Lim.

"Mangroves can also help to protect coastlines during storm surges and shield seagrass beds and coral

Protecting nature from sea-level rise



SCAN TO WATCH



<https://str.sg/sea14>



Above and left: Wallasea Island in England once comprised low-lying farmland, protected from rising sea levels with sea walls. Now nature conservation charity RSPB, which has taken over management of the island, is planning to restore the island to its original wilderness by recreating intertidal coastal marshland. The return of the intertidal habitats has brought back the birds, with the RSPB reporting over 30,000 birds across the entire reserve annually. Among them are (from far left) the spoonbill, thought extinct in Britain in the 1600s, and the marsh harrier. PHOTOS: DAVID FOGARTY, RSPB

reefs from siltation."

But these habitats typically require low-energy environment with suitable soft substrate such as mud or sand, he added.

So at Kranji, NParks in 2018 moved to restore the mangrove habitats by building a gentle sloping rock revetment wall where land had dissolved into sea.

Mr Lim said: "This resulted in a calmer condition, and that has allowed for the accretion of sediments, organic matter, and encouraged mangrove propagules to come and re-establish themselves in between rock revetments."

Three years after the intervention was completed, effects are already starting to show.

The mangrove seedlings seen shooting up through the cracks in the rock revetment walls were all a result of natural regeneration, said Mr Lim. This means that they settled there on their own.

And with the calmer environment and flourishing habitat, wildlife started to move in – including snails and slugs that provide food for birds and fish.

NUS Assistant Professor Huang Danwei, who had supervised Dr Nguyen's study, said Singapore's natural coastal habitats may have declined sharply over the years, but they are still exceptionally diverse for their small areas.

"They continue to contribute valuable services such as coastal protection, marine productivity, carbon removal and recreation."

FROM FARMLAND TO NATURE RESERVE

In tropical Kranji, the cry of the white-bellied sea eagles was the dominant soundtrack. The English coastline was much gustier, but still the whistles of the European

wigeons filtered through the breeze.

The 740ha Wallasea Island is located along the Essex coast, which had once been a rich habitat for wildlife.

Over centuries, the low-lying island was gradually claimed for farmland and to rear livestock, but in the 1950s it was converted to one arable farm where mainly wheat was grown.

Seawalls were gradually installed around the island to make it suitable for farming, with the walls in some areas rebuilt against rising sea levels wrought by climate change.

In the 2000s, Britain's nature conservation charity RSPB bought over the land from the original landlord, Wallasea Farms, with the aim of restoring the land to the rich intertidal habitat it had been centuries ago.

One way to do that would be to breach the existing seawalls.

Explained Dr Malcolm Ausden, RSPB principal ecologist: "If the sea rises, and the deposition of sediment doesn't keep up with it, then naturally the intertidal habitats would move further inland."

"But if you keep the existing seawalls in place, this stops these habitats from moving further inland, and eventually you will end up with the sea permanently against the sea wall with no intertidal habitat left."

These refer to areas that are covered by seawater at high tide and exposed at low tide, allowing birds to peck away at the rich bounty of crustaceans, worms and other morsels burrowed in the mudflats.

But as the area was low-lying, RSPB needed fill material to raise the level of the inland areas before the sea walls were breached.

In 2008, RSPB partnered with Crossrail – a railway construction

project in London – to make use of the tunnelling material to build up the island.

After years of planning and seeking the necessary approvals, the first shipment of London clay and gravel from the Crossrail tunnels arrived on Wallasea Island in 2012.

There was enough fill material for just a roughly 170ha portion of the island – now named the Jubilee Marsh – where RSPB worked with engineers to design islands and creeks that will provide a variety of habitats for birds, allowing them to roost at high tide and feed on the mudflats at low tide.

In 2015, three segments of the original sea walls were breached, and seawater flooded parts of the Jubilee Marsh, the first time in over 400 years that seawater touched land on Wallasea Island.

RSPB said plans to raise the rest of the island would depend on when more fill material could be sourced.

In the meantime, however, a mix of saline lagoons, and coastal grazing marsh have been created to expand the wetland area behind the sea wall, said Ms Rachel Fancy, site manager of RSPB Wallasea Island.

Still, the return of the intertidal habitats within Jubilee Marsh also brought back the birds, with the RSPB reporting over 30,000 birds across the entire reserve annually.

During our visit last November, we also caught a glimpse of three spoonbills – birds that Dr Ausden told us had stopped breeding in Britain in the 1600s.

He said: "We've been seeing larger numbers of birds using this area which will, hopefully, continue to provide a good habitat for birds and other wildlife for a long time."

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