

Science for Environment Policy

Coastal wetlands can protect against rising sea levels and increasing storms

Coastal wetlands can substantially reduce erosion, property damage and human deaths in the face of rising sea levels and severe storms, recent research concludes. Understanding whether wetlands can provide effective coastal protection is essential to developing effective climate change adaptation strategies.

Over a third of the global population live in coastal areas, and the number of people at risk of flooding is predicted to increase by a factor of five in this century. Although wetland vegetation has been widely assumed to provide coastal protection, some small-scale studies have suggested that other coastal features, such as the structure of the shoreline's landscape, are more important protective factors, not the ecosystems themselves.

The researchers gathered information from a range of previous studies to gain a better understanding of wetland vegetation's protective role. Together, the results demonstrate that wetland vegetation is able to protect against coastal erosion both directly, as plants slow water speed and reduce turbulence, and indirectly, by trapping sediment and enriching soil with organic material.

For example, an experiment using a wave tank showed that erosion rates were between 33 and 82% lower for sediments with vegetation, versus those without. A much larger scale study, using satellite images of Thailand between 1967 and 1998, found that areas with mangrove forests had substantially lower erosion rates than those without. Importantly, this study also demonstrated that coasts where mangroves had been removed through deforestation eroded just as quickly as those where they had never been present. This suggests that it is the vegetation itself, not merely associated shoreline structure as suggested, that provides protection.

There is also evidence that coastal wetland ecosystems are able to protect, to some degree, against the rise in water levels associated with a storm. Observations of storm surges have shown reductions in water height of between 4.4 and 15.8 centimetres per kilometre of wetland covered. Research has also found that vegetation can substantially reduce the strength of waves as they hit the land.

Results from a study in India indicate that, without mangroves, a cyclone that struck in 1999 would have caused an additional 1.72 deaths per coastal village. The prevention of economic damage is also significant; the loss of 1 square kilometre of mangrove forest in Thailand was estimated to cost an average of US\$187,898 (€140,924) per square kilometre in subsequent storm damage.

Finally, the researchers discuss whether coastal ecosystems can continue to provide such ecosystem services in the future. Predictions of sea level rise, which could exceed 9 millimetres per year in this century, are worrying. However, coastal ecosystem resilience may be higher than expected due to increased trapping of sediment as water levels rise, and the boosted growth rates of underwater plants. The researchers also suggest that manmade infrastructure, such as artificial reefs, could also be used to help improve conditions for wetland ecosystems and ensure they can continue to protect the world's coasts.



19 March 2013
Thematic Issue
37: Ecosystem-based Adaptation

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Source: Gedan, K. B., Kirwan, M. L., Wolanski, E. *et al.* (2011). The present and future role of coastal wetland vegetation in protecting shorelines: answering recent challenges to the paradigm. *Climatic Change*. 106: 7–29. DOI: 10.1007/s10584-010-0003-7.

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To cite this article/service: "Science for Environment Policy": European Commission DG Environment News Alert Service, edited by SCU, The University of the West of England, Bristol.