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Opinion Article

Hazards and Risk Assessments of Coastal Erosion

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DESCRIPTION

The loss of coastal lands owing to the net removal of sediments or bedrock from the shoreline is known as coastal erosion (or shoreline retreat). Waves and currents, as well as mass wasting processes, are commonly responsible for erosion. Sinking and slopes (particularly on muddy coasts). Significant occurrences of Extreme weather occurrences are frequently linked to coastal erosion (storms, storm surges, and flooding) but also with tsunamis, both because of the natural disasters. Because the related waves and currents have a higher intensity, Inundation from a storm surge or tsunami may allow waves and currents to assault. Such processes on coastal headlands may result in the undercutting of cliffs and steep slopes, contributing to mass wasting. Furthermore, excessive rain can increase soil saturation, which leads to a reduction in the soil's shear strength and, as a result, an increased risk of slope failure. Coastal erosion is a natural phenomenon that happens when material transport away from the shoreline is not balanced by new material deposition on the beach. Many coastal landforms, such as beaches, dunes, and occasionally closed and open lagoon entrances, naturally experience quasi-periodic cycles of erosion and accretion on periods ranging from days to years.

Human activities, on the other hand, can have a significant impact on the erodibility of landforms. Coastal structures such as breakwaters, groynes (coastal barriers), and seawalls, for example, can alter coastal sediment transport routes, resulting in erosion in certain regions and accretion in others. Unintended erosion can be caused by the removal of sediments from the coastal system (dredging, sand mining) or a reduction in the supply of sediments.

When civilization fails to adapt to the effects of coastal erosion on people, the built environment, and infrastructure, it becomes a threat. Many human settlements are built in places prone to coastal erosion, with early estimates indicating that over 70% of the world's coastline is eroding. However, because coastal landforms and human settlements can vary dramatically over spatial scales of meters to kilo meters, it's difficult to precisely quantify the global distribution of hazard and risk, and current global scale data sets are insufficient for assessments at this scale. At these fine sizes, national scale assessments5 show that there is significant regional diversity in risk.

For assessing the risk of coastal erosion, a variety of approaches have been used. This could be a whole continent as part of a national evaluation, a regional analysis at the local government level, or a single sediment compartment to help with a specific erosion problem. Similarly, the duration of research can range from short-term (sub annual) to long-term (decadal) to better understand coastal behavior across the seasonal weather cycle and guide planning decisions. On coasts where sea-level rise is on-going due to natural subsidence (e.g. deltaic coasts such as those in the Gulf of Mexico) or on-going adjustments of land masses following deglaciation after the last ice age (e.g. eastern Canada and the north-eastern United States), geological timescales are also important.

A risk assessment is usually determined by integrating information of the hazard, the elements at risk (e.g. the built environment), and an understanding of their vulnerability. This susceptibility is frequently characterized in terms of damage classes, which range from "no damage" to "full damage" (e.g. total destruction of an asset). Buildings (residential, commercial, public, etc.) can be regarded uninhabitable or require complete replacement where their foundations are undermined in the case of coastal erosion.

If other elements at risk are considered in the risk assessment process, such as parts of the surrounding landforms and ecosystem (e.g., dunes, mangroves, saltmarsh), vulnerability models describing the level of harm to these elements must be developed. Coastal inundation threats could be incorporated in the risk assessment, which would necessitate the use of appropriate vulnerability models (a starting point could be to use flood damage models).

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