

## Coastal Zone Facing Climate Change: Knowledge Towards New Solutions

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**Keywords:** Coastal zone management; Submarine groundwater discharge; Coastal vulnerability; Climate change

### Introduction

Humanity's impact on the Earth system has become comparable to planetary-scale geological processes, such as ice ages. Consensus is growing that we have driven the planet into a new epoch, the Anthropocene, in which many Earth-system processes and the living fabric of ecosystems are now dominated by human activities. That the Earth has experienced large-scale, abrupt changes in the past indicates that it could experience similar changes in the future. This recognition has led researchers to take the first step to identify planetary and regional thresholds, and boundaries that, if crossed, could generate unacceptable environmental and social change [1]. Galvanized by the United Nations Conference on Environment and Development meeting of 1992, there has been a search for methods to build capacity of coastal nations and communities to manage their coastal and estuarine resources in a sustainable manner. Countries are now increasingly being affected mostly by hydro-meteorological hazards and disasters, namely, floods, mass movements (e.g. erosion, landslides and siltation), heat waves, wildfires, tropical cyclones, tsunamis, swells and dust storms [2,3]. Research now demonstrates that the continued functioning of the Earth system, as it has supported the well-being of human civilization in recent centuries is at risk. Without urgent action, we could face threats to water, food, biodiversity and other critical resources: these threats risk intensifying economic, ecological and social crises, creating the potential for a humanitarian emergency on a global scale. Nutrients are now the largest pollution problem in coastal marine ecosystems globally, and in the US, some 60% of estuaries are moderately to severely degraded, primarily from nutrients like nitrates and phosphates [4-7]. Developing economies tend to be dominated by resource-based activities with degrading and overexploitive uses of land, water and other coastal resources, with disruption of environmental processes through degradation of environmental quality and loss of critical terrestrial and aquatic habitats, leading to serious deleterious impacts on the health and productivity of coastal ecosystems. Studies have also showed that estuaries are particularly vulnerable to nutrient over-enrichment and trace metal contamination [8-12].

The principle of interdisciplinarity and an integrative approach of all the problems encountered in the coastal zone have to be implemented. The coastal zone should be viewed as one complex multidisciplinary entity with the various conflicting uses and activities taking place within the zone, and there is an urgent need to further protect sensitive marine and coastal areas besides salt marshes, coral reefs, such as wetlands, islets, sea grass beds and mangroves, and encourage the use of environmentally cleaner technology in industries, including the recycling of wastes. Existing coastal inventorying enabling coastal zone management can benefit from advancement in GIS application and coastal engineering.

There is now a need to synthesize and organize data into a common DPSIR framework, and manuscripts in the special issue in coastal engineering and management will focus on coastal vulnerability requiring climate change adaptation, which aim to cover observed

and expected changes of material fluxes from drainage basins/islands, including transboundary impact assessment considering the ocean and atmospheric inputs. Interconnected issues require interconnected solutions. Rapid scientific and technological progress can provide potential solutions—if adopted in timely manner—to reduce the risk of deleterious consequences for societies everywhere. But technological innovation alone will not be enough. We can transform our values, beliefs and aspirations towards sustainable prosperity. New mechanisms to facilitate an interactive dialogue on global sustainability among the various stakeholders and the policy-making community at different scales. Such interactions should be designed to bring societal relevance and trust to science-policy interfaces, and more effectively inform decision-making to keep pace with rapid global change.

### Conclusion

The Special Issue in the Journal of Coastal Development on Coastal Engineering and Management will deal with papers with land-sea interactions and human dimensions of change in specific and vulnerable coastal regions, and harmonizing with descriptions of diverse coastal and ocean stakeholders and social players filling existing gaps in knowledge with data collection and scientific inquiries towards new coastal solutions. It will also include papers on coastal engineering, ecological, socio-economic and governance aspects to include Integrated Coastal and Ocean Management (ICOM) indicators, fisheries depletion, navigational routes, new recreation points, waste disposal sites, remotely sensed data and GIS database to provide information for sensible policy-making in the coastal zone. Based on this kind of information, Integrated Coastal and Ocean Management should be seen as an adaptive process of resource management for environmentally sustainable development once implemented, ICOM should not be expected to remain static, but should form an iterative mechanism continuously evolving and evaluating and eventually redefining its internal milestones regularly to meet the dynamic goals deriving from temporal and spatial changes that have to be made to the management objectives subject to changing demand, legislation and climate change.

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Received September 04, 2013; Accepted September 06, 2013; Published September 12, 2013

Citation: Ramessur RT (2013) Coastal Zone Facing Climate Change: Knowledge Towards New Solutions. J Coast Dev 16: e103. doi: [10.4172/1410-5217.1000e103](http://dx.doi.org/10.4172/1410-5217.1000e103)

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**Citation:** Ramessur RT (2013) Coastal Zone Facing Climate Change: Knowledge Towards New Solutions. J Coast Dev 16: e103. doi: [10.4172/1410-5217.1000e103](https://doi.org/10.4172/1410-5217.1000e103)

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