# PACIFIC ISLANDS AND SEA-LEVEL RISE

CLIMATE AND OCEAN

## KEY POINTS

- Sea-level rise is already occurring (~19 cm since 1901) and is an added dimension of change to dynamic island systems. Rates of sea-level rise are increasing.[1]
- Rates of sea-level rise on some islands are four times greater than the global average.
- Coastal development and armouring affect the susceptibility and responsiveness to coastal changes, including sea-level rise.
- Coastal erosion, inundation, and infrastructural damage are related to human-induced changes and planning, not only sea-level rise. Integrated management that increases human and natural community resilience is vital.
- Responses to sea-level rise relying on ecosystem-based adaptation, rather than only on infrastructural, armouring solutions (such as seawalls), are more likely to increase long-term resilience and are more cost-effective.

## HOW ISSUE LINKS TO/IMPACTS SDGs BEYOND SDG14 LIFE BELOW WATER

- Poverty reduction (SDG1), food security (SDG2) and health (SDG3) in the Pacific depend on local agriculture and shoreline fisheries, at risk of salt-water intrusion and inundation.
- The use of shoreline resources and land ownership has gender dimensions (SDG5).
- Clean fresh water and sanitation (SDG6) are threatened by inundation and salinization.
- Resilient infrastructure (SDG9) and sustainable cities and communities (SDG11) rely on an understanding and, where possible, mitigation of sea-level rise.
- Responsible consumption and production (SDG12) and conservation of life on land and in water (SDG15, 14) rely on climate action (SDG13) to address sea-level rise.

## BACKGROUND

1. **Some Pacific island countries experience up to four times greater sea-level rise than the global average.**[2] The IPCC reports 12 mm sea-level rise per year in the tropical Western Pacific (Micronesia)[3]; rates of 7 mm per year have been observed for Solomon Islands between 1994 and 2014.[4] Some Pacific island countries are in tectonically active zones, with local sea level varying with island subsidence or lifting. Historically, the global rate of sea-level rise was a few tenths of mm per year. Between 1901 and 1990, the rate was ~1.5 mm per year. Between 1993 and 2010, the global rate was ~3.2 mm per year. The strongest contributors are thermal expansion as the ocean warms and the melting of ice from glaciers and ice sheets (IPCC 2013).
2. **Atoll nations in particular are at risk.** Many have a maximum elevation of only 2 to 3 metres above sea level, and lack meteorological and oceanographic forecasting ability. While easy to visualise, the image of "islands under water" is a disservice in many ways.[7] The impacts of sea-level rise include inundation but also complex changes affecting:
   a. **On-land resources, such as potable water and land suitable for agriculture**. Fresh water is always a limited commodity, and storm surges and sea-level rise are further constraining limited freshwater lenses and arable soils, with salt killing crop plants;
   b. **Infrastructure and property**, with particular links to disaster impact and response. Fixed infrastructure can increase costs and decrease adaptive capacity;
   c. **Boundaries and zones**, affecting maritime boundaries (set relative to low-water line as the baseline), land ownership, and subsistence use of coastal/shoreline resources, which is often led by Pacific women.[5]

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3. **Shoreline recession and build-up are natural processes for islands**[6,7], but threats to wetlands may destroy the source of new island-building materials and increase the wave energy that reaches shorelines[8]. Particularly in combination with increases in storm severity, sea-level rise can increase disaster risk. Hard engineering solutions may increase the already high costs of installation and maintenance. For example, seawalls support 23% lower biodiversity and 45% fewer organisms than natural shorelines.[9] Ecosystem-based solutions are the most cost-effective tools for increased resilience.[10]

4. Erosion and deposition are controlled by the ocean conditions (waves and water level) and the morphology (shape) of the coastal zone (from the reef slope to the backshore). **Human activities can severely affect the coastal zone morphology, as well as reef health, and disturb these natural processes.**[11] Management responses include land-use planning and preservation of ecosystems, such as wetlands which absorb wave energy and store carbon. The limited research on the responses of reef islands in the western Pacific shows that islands are very dynamic, and the coastal erosion and inundation that threaten infrastructure generally result from extreme events, human armouring of shorelines (e.g. seawalls) or inappropriate planning and development rather than sea-level rise alone.[4]

5. **Some Pacific communities have already relocated** e.g. in Fiji (3 villages) and Solomon Islands (2 villages).[4] The risks posed by sea-level rise and climate change prompted Kiribati's former president to call for a "migration with dignity" rather than waiting for islands to become uninhabitable. The implications of migration due to climate change have not been fully agreed upon by the UNFCCC and UNCLOS.


1 Carbon Brief. 2013. What the new IPCC report says about sea-level rise.

2 PACCSAP 2014. Sea level rise. CSIRO, Australian Aid, Australian Bureau of Meteorology

3 IPCC. 2014. AR5, WGII, chapter 29, 29.3.1.1.

4 Albert et al. 2016. Interactions between sea-level rise and wave exposure on reef island dynamics in the Solomon Islands. Environ Res Lett 11:054011

5 Stege et al. 2008. Land and women: the matrilineal factor. Pacific Islands Forum Secretariat

6 McLean & Kench. 2015. Destruction or persistence of coral atoll islands in the face of 20th and 21st century sea-level rise? WIREs Clim Change 6:445–463

7 Warne K. For National Geographic. 2015. Will Pacific Islands disappear as sea levels rise? Maybe not.

8 Ferrario et al. 2014. The effectiveness of coral reefs for coastal hazard risk reduction and adaptation. Nature Comm 5:3794

9 Gittman et al. 2016. Ecological consequences of shoreline hardening: a meta-analysis. BioScience 66:763–773

10 Lo V. 2016. Synthesis report on experiences with ecosystem-based approaches to climate change adaptation and disaster risk reduction. Technical Series No.85. Secretariat of the Convention on Biological Diversity, Montreal.106 pages.

11 SPC, Australian Government, Government of Kiribati. 2015. Bonriki Inundation Vulnerability Assessment.