Infrastructure and Settlements

Key findings for the Pacific from the United Nations **Intergovernmental Panel on Climate Change's** (IPCC) Sixth Assessment Report (AR6) on Impacts, Adaptation and Vulnerability

CHANGES

More heavy rainfall events and **severe tropical cyclones**
are impacting infrastructure

Projected increases in extreme sea level events
is putting critical infrastructure **at risk**

Adaptation options for

people

infrastructure

coastal ecosystems

can help save lives, livelihoods and ecosystems

RAISING
dwellings and key infrastructure
can reduce flooding impacts

Incorporating adaptation into national policies
can reduce infrastructure risk

Mangrove planting
and
beach nourishment
protects coastal infrastructure

PLANNED INLAND RELOCATION
of communities and infrastructure
will help to reduce future risk

ADAPTATION

Settlements and Infrastructure

Key findings for the Pacific from the United Nations **Intergovernmental Panel on Climate Change's** (IPCC) Sixth Assessment Report (AR6) on Impacts, Adaptation and Vulnerability

Adaptation options for infrastructure, people and coastal ecosystems will be required in both the near-term and long-term due to sea level rise.[1]***

WHAT IS HAPPENING

Changes in rainfall patterns have resulted in almost-annual flood events that damage major assets and threaten livelihoods. This has already occurred in urban areas of Fiji and Kiribati.[3]

Categories 4 and 5 tropical cyclones are increasing as a proportion of all cyclones and are severely impacting infrastructure in the Pacific. As an indication of future risk, destruction from tropical cyclone Winston in 2016 amounted to more than 20% of Fiji's current GDP. In Port Vila, Vanuatu, a combination of urbanisation and human-induced changes to the river exacerbated flooding in 2015 from tropical cyclone Pam.[4]

The success of adaptation solutions depends on how they are optimised for the local context. For example, urban structures, such as sea wall defences, rarely work on their own in settings where there is not adequate finance to maintain them and where nature-based solutions are more appropriate.

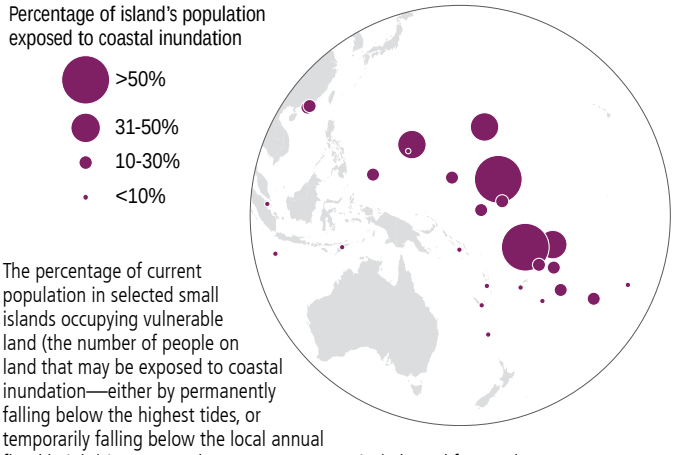
Water, sanitation and hygiene infrastructure are particularly vulnerable to climate change.[2]*

* = medium confidence
** = high confidence
*** = very high confidence

WHAT COULD HAPPEN FURTHER

Rising sea levels will continue to drive an increase in the frequency of coastal inundation, damaging coastal infrastructure and settlements.** Extreme sea level events causing widespread flooding that are currently expected just once every 100 years are projected to occur 20–30 times every 100 years, regardless of emission scenario.[5]** This is a critical issue for the Pacific, with most islands having a high percentage of infrastructure and economic assets in low elevation coastal zones. In Kiribati, Marshall Islands and Tuvalu, the vast majority of infrastructure is located in low-lying coast zones.[6]

Critical energy, transport, health and other infrastructure is at risk even at low levels of warming unless further adaptation is taken. Even islands with higher elevation are expected to be threatened, given the high amount of transport infrastructure located near to the coast, for example in Fiji.[7] Many airports in the Pacific are projected to be below mean sea-level in 2100 with 2°C of warming.[8] Furthermore, manufacturing and commercial operations are usually found in the lowest lying areas making this area of the economy particularly vulnerable to sea level rise.



The percentage of current population in selected small islands occupying vulnerable land (the number of people on land that may be exposed to coastal inundation—either by permanently falling below the highest tides, or temporarily falling below the local annual flood height) in 2100 under an RCP4.5 scenario (adapted from Kulp and Strauss (2019) using the CoastalDEM_Perm_p50 model).

1 SPM.B.6.1
2 See 'Water and Sanitation' Factsheet for more information
3 15.3.4.2
4 17.5.1.1.1
5 3.2.2.2
6 15.3.4.1
7 15.3.4.1
8 16.5.2.3.1

RESPONSE OPTIONS

Incorporating adaptation into national policies can reduce sectoral infrastructure risk. For example, developing appropriate planning guidelines for tourism development, coastal setbacks (prohibiting development in high-risk coastal areas) and environmental impact assessments. Enforcing building codes which consider impacts from sea level rise can also help make new developments less impacted by future climate-related risks.

'Accommodation'[9] measures such as the raising of dwellings and key infrastructure like coastal roads above ground level have been implemented to reduce the impacts of projected climate and disaster risks. For example, in the most populous islands of the Tuamotu atolls, French Polynesia, where between 48 and 98% of dwellings have already experienced flooding since the 1980s, elevated houses with floors built 1.5 m above ground level are already being implemented as an adaptation strategy.[10]

Beach nourishment (artificially adding sand to beaches) has been implemented in some small islands to reduce erosion or to protect critical assets (e.g., roads) that are in risk zones. This, plus nature-based solutions such as mangrove planting can serve as an alternative to hard protection (e.g. seawalls) for coastal protection. However, islands that have limited sand stocks and sediment extraction can aggravate risks and/or accelerate ecosystem degradation if implemented without the necessary precautions. Further, nature-based adaptation responses may become less effective as climate change progresses.[11]

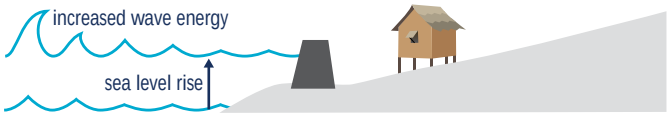
Migration, including planned resettlement, is increasingly occurring in small islands to intentionally respond to or prepare for climate change impacts. For example, Kiribati's "Migration with Dignity" strategy supports the planned relocation of citizens abroad. However, strong cultural connection to land and uncertainty about life in receiving countries means that many remain opposed to permanent migration. Migrant agency and choice in decisions about whether to move, where, when and how is an important determinant of success for this strategy. ** Furthermore, domestic relocation inland is often preferred over international migration. Two case studies of community relocation in Fiji highlight that including all social groups in the relocation planning process will strengthen adaptation outcomes. Government frameworks can also guide the relocation process and foster success as is seen in the Government of Fiji's relocation framework.

Future situation

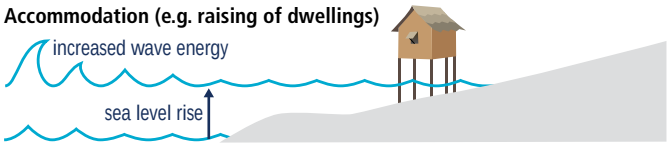
Reduced habitability due to increasing: sea level rise, wave strength, erosion, flooding and storm surges. Impacting on human populations and infrastructure [15.3.4.9.2]

Ecosystem-based measures

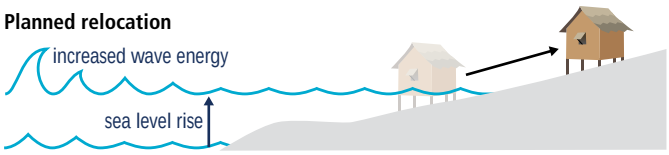
Hard protection



Accommodation (e.g. raising of dwellings)



Planned relocation



Reactive responses

The Fijian community of Vunidogoloa made the decision to relocate in response to regular inundation during high tides. After 'protect' strategies e.g. constructing seawalls, and 'accommodate' strategies e.g. Raising houses on stilts failed to prevent regular flood damage to buildings and the entire community eventually relocated as a 'last resort' adaptation measure to a site within customary land [15.3.4.6]

Proactive responses

The Navunievu community in Fiji has mandated that every young adult building their family home in the village should do so upslope rather than on the regularly flooded coastal flat where the existing village is located. Over the next few decades, this will result in the gradual upslope migration of the community, an example of autonomous adaptation. Such creative community-grounded solutions hold great promise for future adaptation on small islands, where they are undertaken inclusively. [FAQ 15.2]

9 Here, 'accommodation' refers to adaptation strategies where infrastructure is modified to co-exist with climate impacts, allowing communities to stay in flood-prone areas.

10 15.5.2

11 15.5.4

12 15.5.3