

Strategic Analysis Paper

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Climate Change Threats to Food and Water Security on Pacific Atolls

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Key Points

- Small Pacific island countries, many of which are only two to five metres above sea level at their highest point, are threatened by rising sea levels that are likely to weaken food and water security.
- As most of the region is already highly dependent on imported food, and agriculture plays a relatively small role in the formal economy, especially on atolls, climate change will have a larger effect on regional water security.
- Most of the region's built infrastructure is located close to the coast and faces greater flood risk than in the past.
- The most vulnerable Pacific Island countries, such as Tuvalu, are exploring options to adapt to climate change. Those options can only be feasible with external assistance, which could heighten geopolitical competition in the region.

Summary

The small, low-lying islands of the South Pacific are among the countries that are most threatened by climate change. The larger islands in Melanesia are in a better position to adapt to climate change than the smaller atolls in Polynesia and Micronesia. The [Boe Declaration on Regional Security](#), signed at the Pacific Islands Forum in 2018, updates an earlier regional security statement and declares that 'climate change remains the single greatest threat to the livelihoods, security and wellbeing of the peoples of the Pacific'. That sentiment was reiterated at the 2019 Pacific Islands Forum in the [Kainaki II Statement](#) where 'Leaders noted that escalating climate change impacts, coupled with the intensification of

geostrategic competition, is exacerbating the region's vulnerabilities.' Sea-level rise is the greatest climate-related threat to the region and is expected to weaken water security to a greater extent than food security.

Analysis

The Pacific Island Countries (PICS) are divided into three geographic subregions: Melanesia, Polynesia and Micronesia. Except for the outer islands, most Melanesian islands are large and mountainous with fertile soils and mineral resources. Polynesian and Micronesian islands are generally smaller volcanic islands or low-lying coral atolls. The territory of Kiribati, the Marshall Islands and Tuvalu is composed entirely of low-lying coral atolls.¹ That makes them more vulnerable to the effects of climate change than other countries in the region.

Sea-level rise (SLR) poses the greatest climate-related threat to South Pacific countries. While [other natural phenomena](#) – such as plate tectonics and trade winds – also affect island morphology, an increase in the rate of SLR is likely to destabilise Pacific atolls. The Intergovernmental Panel on Climate Change (IPCC) *Special Report on the Ocean and Cryosphere* also [states](#) that

Non-climatic anthropogenic drivers, including recent and historical demographic and settlement trends and anthropogenic subsidence, have played an important role in increasing low-lying coastal communities' exposure and vulnerability to SLR and extreme sea level events ... In low-lying coastal areas more broadly, human-induced changes can be rapid and modify coastlines over short periods of time, outpacing the effects of SLR.

It is likely that natural processes and anthropogenic drivers will interact to pose a threat to Pacific atolls and their inhabitants, but it is unknown which of the two drivers will play a larger role. The [report](#) suggests that

Coastal ecosystems are already impacted by the combination of SLR, other climate-related ocean changes, and adverse effects from human activities on ocean and land. Attributing such impacts to SLR, however, remains challenging due to the influence of other climate-related and non-climatic drivers such as infrastructure development and human-induced habitat degradation.

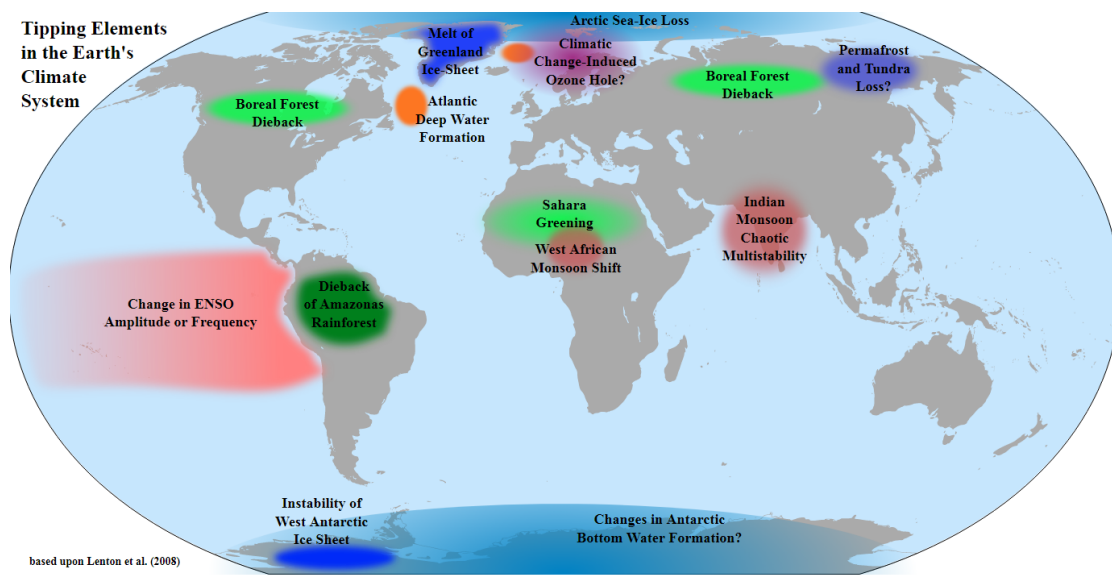
It also suggests that coastal environments could respond to SLR in unpredictable ways, which will shape the available adaptation options.

Sea levels are [rising at an accelerating rate](#), however, most probably because of the melting of ice in Antarctica and Greenland and the expansion of the oceans as the water warms. Sea levels are projected to be [70-100 centimetres](#) higher than today by the end of the century. If that occurs, extreme tidal events are likely to occur more often and with greater intensity,

¹ Jon Barrett, 'Climate Change and Food Security in the Pacific Islands', in John Connell and Kristen Lowitt (eds.), *Food Security in Small Island States*, (Springer Nature, Singapore: 2020), pp. 25-38, p. 26.

putting infrastructure, livelihoods and human life at risk. Unusually high tides are [reportedly occurring more frequently](#) on Pacific islands than in past decades. Those tides flood settlements, turn water supplies saline and destroy food crops. Even if the sea level rises by just 32 centimetres – less than one-third of that expected by the end of the century – the ecological and social systems of low-lying coral atolls could be made unviable.² There are [new arguments](#) that those projections are too conservative, however, and that the actual sea level rise over the course of the next 80 years will be much greater.

It is claimed that conservative projections of SLR ignore the possibility of climate tipping points that could lead to large changes in the Earth’s climate. A tipping point is most likely to occur as a result of large changes to major “[tipping elements](#)” of the Earth’s climate system, such as the collapse of Antarctic ice sheets or large-scale deforestation in the Amazon. If a tipping point is reached, climate change is expected to become self-reinforcing as it could set in motion a number of feedback loops that trigger other tipping elements. It is not known when those tipping elements will be affected or how they will interact, but the warmer the planet gets, the more likely it is that a tipping point will be reached.



based upon Lenton et al. (2008)
 By CodeOne (blank map), DeWikiMan (additional elements) - This file was derived from: WorldMap.svg The content is based upon fig. 2 in Kriegler et al. (2009) and Lenton et al. (2008)., CC BY-SA 4.0, <https://commons.wikimedia.org/w/index.php?curid=74405407>

Regine Hock, one of the authors of the IPCC report, told the [Financial Times](#) that ‘If part of the Antarctic ice sheet collapse, that has the potential to rise that figure way beyond 1m by the end of this century ... there are indications that that instability is going on, it has started.’ It is possible that ice sheets in Greenland and Antarctica will begin to irreversibly melt at a [lower temperature threshold](#) than previously thought. Piers Forster, another author of the IPCC report, [stated](#) that ‘Greenland ice sheet collapse is pretty improbable at 1.5C warming, or it would take centuries to melt’.

The signatories of the Paris Agreement pledged to limit the rise in global average temperature to no more than 2°C above the pre-industrial average. They also agreed that limiting temperature increases to less than 1.5°C gives the planet a better chance of avoiding

² *ibid*, p. 27.

tipping points. On the current trajectory, however, the world is not on track to meet the aims of the Paris Agreement and it is likely that the average global temperature will be [3°C warmer](#) than during pre-industrial times by the end of the century. As a result, it is expected that PICs will face increased flood risk from stronger wave activity and SLR, weaker agricultural productivity and insecure water supplies.

It is not just SLR that poses a threat to countries in the South Pacific. Waves are predicted to become [more powerful as a result of climate change](#), mainly because of warmer sea surface temperatures. The amount of energy carried by waves has increased most significantly in the Southern Ocean, followed by the Pacific. Increased wave energy is likely to have ramifications for coastal stability on the small islands of the Pacific and will affect regional infrastructure, particularly as it increases the risk of floods. An [assessment](#) of flood risk across the Pacific suggests that almost 60 per cent of the region's built infrastructure is located within 500 metres of the coast. If that infrastructure is damaged, it will likely cost about US\$22 billion (\$32 billion) to replace. Kiribati, the Marshall Islands and Tuvalu, which have more than 95 per cent of their built infrastructure within 500 metres of the coast, are most at risk.

Agriculture is a relatively small component of the formal economy of the Pacific islands and most farmers operate on a very small scale. Most Pacific Islanders depend on imported food that is supplemented with small-scale food production at a household or community level. According to Jon Barnett, primary industries account for less than 30 per cent of GDP in all PICs, and for most it accounts for less than 20 per cent.³ Food is generally shared in an informal economy that is built on social relationships and family networks. While the effects of climate change are likely to alter growing conditions and could contribute to lower crop yields, Pacific Islanders might be able to adapt accordingly. Under particularly severe conditions, they could be left with no option but to increase the importation of food. Doing so could weaken food security, however, as much of the food that is imported into the region is of [poor quality with limited nutritional value](#). Freshwater availability, however, is likely to be the main challenge for many countries, particularly those that consist only of low-lying atolls.

Many of the countries in the South Pacific rely on groundwater and on low-lying atoll islands freshwater lenses are often the only source of water. Freshwater lenses are usually [less than 15 metres](#) deep, are only naturally recharged by rainfall and float on top of denser seawater. They face threats from excessive water abstraction, coastal erosion, increased seawater infiltration, droughts and storm surges, all of which increase salinity or reduce the size of the lens. Some of those threats could be ameliorated by artificially recharging lenses with stored rainwater. Depending on the extent of seawater infiltration, however, water security might be better maintained by drawing water directly from rainwater tanks rather than trying to preserve traditional water sources.

PICs are left with no option but to try and adapt to the conditions they face. Many of those options are costly to implement and, given the financial limitations of atoll countries, would require development financing from abroad.

³ *Ibid*, p. 26.

Tuvalu has been [described](#) as the ‘canary in the coal mine for climate change’ due to its vulnerability to SLR and other effects of climate change. Several years ago, elders of the largest atoll in Tuvalu suggested that an artificial island could be built to help the country adapt to climate change. Kausea Natano visited Japan to try to secure funding for the project, which could cost up to US\$800 million (\$1.1 billion) and create five square kilometres of new land. The chief of Funafuti, the largest atoll and capital of Tuvalu, Siliga Kofe spoke to [Pacific Beat](#) about the project: ‘There’s nowhere else in Tuvalu to go to, to escape from the sea level rise. Going overseas, relocating abroad would cause a lot of problems: we’d lose our identity as a people; we’d lose our language, our culture; we will be merged into another country ... We have a 200 mile exclusive economic zone, which is a source of a lot of money for Tuvalu because of the tuna fishing.’ Pacific Islanders are generally opposed to abandoning their islands but, unless other countries are willing to fund other adaptation options, they might be left with few alternatives.

Chinese companies offered to build artificial islands in Tuvalu but, due to its desire to maintain diplomatic relations with Taiwan, Tuvalu declined. Simon Kofe, the Tuvaluan foreign minister, [stated](#) that ‘Tuvalu and Taiwan diplomatic ties are the strongest they’ve ever been.’ With a reference to the Marshall Islands, Palau and Nauru – all of which also recognise Taiwan – Mr Kofe further stated that ‘We believe in the power of grouping together and collaborating ... Together with our partners, we will be able to counter the influence from mainland China.’

Pacific leaders have stated that they favour closer relations with countries that are seen to be taking action on climate change. Similarly, Kausea Natano, the Prime Minister of Tuvalu and the current Chair of the Pacific Islands Forum, [stated](#) that the US would lose influence in the region if it withdrew from the Paris Agreement.

The US has given 12 months’ notice that it intends to withdraw from the Paris agreement, which is the minimum amount of time required to do so. Washington can now [officially leave the agreement on 4 November 2020](#), a day after the presidential election. If the Democrat candidate wins that election, the US will probably re-enter the agreement after a short absence.

Withdrawing from the agreement is unlikely to actually change much within the US, as businesses and states will probably continue to find ways to reduce emissions. Withdrawal will add credence to the perception that the US not taking climate change seriously, however, and it could also weaken international efforts to reduce greenhouse gas emissions.

It is not entirely clear what the exact effects of climate change will be on the low-lying atoll countries of the South Pacific, but it is likely that rising sea levels, driven at least in part by climate change, will weaken food and water security. As atoll island countries, such as Kiribati, Tuvalu and the Marshall Islands, produce very little of their own food and are highly dependent on imports the availability of food is unlikely to be severely affected. Climate change poses a greater threat to their water security and built infrastructure, which is only going to be ameliorated with external assistance.

Any opinions or views expressed in this paper are those of the individual author, unless stated to be those of Future Directions International.

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