10

CLIMATE CHANGE AND THE ISLAND STATES OF THE SOUTH PACIFIC: AN INSURANCE PERSPECTIVE ON HAZARDS, RISKS AND RESPONSES

Tim Grafton*

Among the many persuasive reasons for addressing climate change are its impacts on the south Pacific. This vast region is home to some of the world's smallest, most vulnerable countries who face the prospect that their very existence will be washed away by sea-level rise.

The hazards these countries face can exert a heavy toll on their economies. Insurance has a critical role to play in meeting the costs to sovereign states as well as to individuals and businesses. Some insurance solutions may be more cost-effective than other means of meeting these losses.

At the northern end of this region lies Kiribati, a very low-lying country comprising 32 atolls straddling either side of the Equator, which is no more than one metre above sea level, with a population of 118,000.

Tokelau (population of 1,500), a non-self-governing territory of New Zealand (see Figure 1), and Tuvalu (population of 11,000) are about two metres above sea level on average.

Figure 1: aerial image of the atoll of Nukunonu, Tokelau. Source: courtesy of Neville Peat.

* Chief Executive, Insurance Council of New Zealand.

Costi & Renwick (eds) *In the Eye of the Storm–Reflections from the Second Pacific Climate Change Conference* (SPREP, Te Herenga Waka—Victoria University of Wellington and NZACL, 2020)

Low-lying countries are also prone to erosion of their coastline from the actions of the sea, a process which is more pronounced with storm surges (Haddow, Bullock and Coppola, 2017). Storm surges and high tides make homes vulnerable to more frequent flooding due to climate change (see Figure 2).

Sea level rise makes what fresh water is available increasingly salinated and affects the crops that can be grown. Land erosion also limits the land available to grow crops. Long before the ocean washes over Kiribati, the country may become uninhabitable, creating climate change refugees in need of a new home.

Climate change will make the oceans more acidic. That is bad news for marine ecosystems including coral, a major tourist attraction and vital source of revenue for these fragile economies.

Figure 2: fale in the village of Fakaofa, Tokelau. Source: courtesy of Neville Peat.

If it is a year characterised by La Niña weather patterns, drought becomes a more significant challenge factor, while during El Niño patterns, the threat of destructive cyclones come more into play.[1]

Climate change will have a profound impact on the 2.5 million people who inhabit the south Pacific Islands. But the hazards it brings are not the only natural disasters they face.

Lying on the so-called "ring of fire", an area of high seismic activity that extends around the Pacific, the islands face the threat of large earthquakes capable of creating tsunami well over one metre high. In 2009, Samoa experienced a moment magnitude (M) earthquake of 8.1 M adjacent to the Kermadec-Tonga Subduction Zone that created a 4.5-metre tsunami devastating the shoreline and killing over 120 people (Earthquake Hazards Program, 2009).

Tonga was hit by a 7.6 M earthquake earlier the same year. And the Solomon Islands were hit by an 8.1 M earthquake in 2007 which also caused a tsunami with loss of life and property, and again in 2013 by an 8.0 M earthquake.

Several of these countries (Samoa, Solomon Islands and Vanuatu) also have active volcanoes that have all erupted in living memory.

Why is it relevant to talk about these seismic risks in the context of climate change? It is because we are more concerned about the devastating impacts of natural disasters on people, property, businesses and the national economy than what the cause was.

The focus is naturally on how to make these countries more resilient to the total array of risks that they face. With a small, remote, fragile economy heavily dependent on foreign aid and tourism, efforts to manage long-term climate change challenges could be pushed back years by a major earthquake, tsunami or volcanic eruption.

Much can be learned from the insurance sector about managing risk. Insurers take a long-term view of risk. They calculate the probability of an event occurring and the severity of the impact measured by the financial loss.

By looking at the range of natural hazards, climate change and seismic events, that could have a catastrophic impact, it is possible to calculate the annual average loss an economy might sustain. When thinking of catastrophes, it is important to remember that these refer to relatively rare events which bring heavy losses when they occur. So, more severe impacts occur less frequently.

It is possible, therefore, to estimate the losses that will occur for a range of credible scenarios, such as events that are likely to occur once a year and once every 50, 100 or 250 years. For each scenario, the dollar loss and what that represents as a proportion of the size of the island state's economy can be calculated as shown in Figure 3.

---

1 See Chapter 2 in this book.

This table is taken from data extracted from a 2015 report by the Pacific Catastrophe Risk Assessment and Financing Initiative (PCRAFI).[2] Six nations are listed and alongside each is a measure of the annual average loss (AAL) they can expect to experience from all-natural hazards in American dollars and what that represents as a percentage of their GDP.

Country	AAL	50 year	100 year	250 year
Fiji	USD 77 m	USD 610 m	USD 834 m	USD 1.2 b
	2.5 % GDP	20.3 % GDP	27.7 % GDP	39.6 % GDP
Samoa	USD 6.9 m	USD 79 m	USD 134 m	USD 268 m
	1.2 % GDP	13.9 % GDP	23.7 % GDP	45.6 % GDP
Cook Islands	USD 4.9 m	USD 57 m	USD 103 m	USD 198 m
	1.4 % GDP	16.8 % GDP	30.3 % GDP	58.4 % GDP
Solomon Islands	USD 5.8 m	USD 45 m	USD 64 m	USD 101 m
	1.3 % GDP	10.2 % GDP	14.7 % GDP	23.4 % GDP
Tonga	USD 9.5 m	USD 78 m	USD 126 m	USD 213 m
	2.2 % GDP	18.1 % GDP	28.9 % GDP	49.3 % GDP
Vanuatu	USD 37 m	USD 241 m	USD 311 m	USD 398 m
	5.0 % GDP	33 % GDP	43 % GDP	55 % GDP

Figure 3: the table above illustrates the challenge to their economies that island states face from all natural hazards. Source: data extracted from a 2015 report by the PCRAFI.

What the table starkly shows is that even on an annual loss basis, these countries can expect a hit to their GDP of anywhere from 1.2 per cent for Samoa, up to five per cent for Vanuatu.

Losses of this order for small developing economies are a significant deadweight on their growth. But these of course are the return periods of today. They do not reflect what the world will be like in

2 Pacific Catastrophe Risk Assessment and Financing Initiative *Pacific Catastrophe Risk Insurance Pilot. From Design to Implementation: Some Lessons Learned* (Japanese International Cooperation Agency (JICA) and the World Bank—Global Facility for Disaster Reduction and Recovery (GFDRR) Disaster Risk Financing and Insurance (DRFI) Program, 2015).

2050 or later in the century when climate change events will be more extreme, including the impact of sea level rise, and more frequent, such as extreme weather events (Seneviratne et al, 2012).

The threshold for a catastrophic event with a very large impact on the economy is low. A 100-year frequency event, for example, would have a massive impact of 43 per cent of the Vanuatu GDP and about a 30 per cent impact on the GDP of the Cook Islands, Fiji and Tonga.

To put this into perspective, an equivalent loss in New Zealand (30 per cent of GDP) would cost over USD 60 billion or about NZD 85 billion. Our largest ever natural disaster loss, the Canterbury earthquakes, cost about half that, and that was more like a 1:2,500 return period.

Losses in the order of 20 per cent plus of GDP can set the development goals of these island states back years. Taking an all-hazards approach to economic risk presents the scale of the risk management challenge. Only by first understanding the scale of the risk to be managed can well-informed decisions be made about how to avoid, control, transfer or accept the risk. If the right balance of these ways of managing risks are made, then they will support Pacific Island nations to survive and thrive.

Risk management starts by assessing what it is that needs to be avoided. Catastrophic economic loss is clearly well up the priority list. That will lead to considerations about whether such events will lead to increasing sovereign debt or protecting funds ear-marked for development projects.

Where risks pose such extreme levels of volatility, there is a critical role for insurance to play to match risk with capital. The rest of this chapter will examine this in more detail. It will also lead to thinking about specific risks like loss of life, damage to property or prolonged business interruption, for instance, if tourists do not come because of the devastation wrought by a cyclone.

Risk analysis requires looking at the likelihood of events occurring as Figure 3 has done for four scenarios. So, the analysis must consider the worst possible outcome both over the short and long term, noting that the lowest probability may well be the most catastrophic.

Scenario planning will inform the widest possible range of what could happen. It should draw on the best available science, but it will also require value judgments to be made. Such judgments should be explicit and open to scrutiny.

Once a full assessment of risk has been undertaken, the next step is deciding what can be done to reduce risks reflecting the resources available. There will be a range of adaptation measures such as requiring changes to construction methods, where buildings are located, relocatable housing, critical infrastructure protection, action to prevent coastal erosion, flood protection, water storage and desalination plants and the increased use of renewable energy that will feature.

Although small economies will be limited in what they can do, the economics of pre-disaster resilience is compelling. Every dollar invested in risk-reduction can save at least 5 dollars in post-disaster recovery costs (Hallegatte, Rentschler and Rozenberg, 2019). This is the business case to place before donor nations, the World Bank and other supporting institutions.

Disaster preparedness plans reduce losses when the worst happens, but risk can never be eliminated. If the risk analysis is done well, then the likely cost of a disaster will be known, which leads to decisions about how to obtain financial protection from these losses.

Critical to successful risk management is the availability of funds to meet recovery costs. So, insurance and reinsurance have a major role to play alongside adaptation initiatives that reduce risk. Risk reduction makes risks more attractive to insurers and more affordable for the insured because insurance simply transfers risk; it does not reduce it. Hence, insurance is only ever part of the solution.

In some circumstances, insurance cannot respond. Insurance protects the insured against the sudden and unexpected. It is not possible to insure what is certain and expected. It is, therefore, critical to understand that insurance will not cover sea level rise. So, the challenges that poses are solely reliant on an adaptation solution.

The availability of finance drives the speed of social and economic recovery after disaster strikes. Post-disaster recovery needs vary across the distinct phases that follow catastrophe.

There are the immediate short-term needs to provide the necessities of life to enable communities to survive, the medium-term loss of income from export crops or the absence of tourists. Long-term challenges arise when funds are required to enable reconstruction of infrastructure, housing and commercial buildings.

The sum of these costs is the total economic loss of a disaster. This can be reduced by insurance and the extent to which they are not is the protection gap, that is, the cost that will need to be borne by individuals, businesses or governments.

Figure 4 depicts, in the first column, the financial risks, in the second, who carries those risks, and the third one shows the kind of arrangements for transferring those risks.

Small island nations carry macro-risk, for example, the impact on the economy due to loss of public assets, emergency response costs and foregone government revenue, for instance, when the tourists do not come. These sovereign risks can be transferred to the reinsurance markets.

In contrast, businesses, homeowners and farmers who carry the risks to their own properties can seek to transfer these risks to traditional insurance pooling arrangements. Individuals on very low incomes who are at risk of losing all their income and property at these times are particularly vulnerable as social security systems are minimal. They may not ordinarily be able to afford traditional insurance products, so micro-insurance products tailored for those on very low incomes may be more appropriate means of transferring the risks they face.

On the right hand-side of Figure 4 are risk transfer solutions which are managed at the macro-level for nation states, through traditional insurance pooling and, at an individual level, micro-insurance specially designed for those on very low incomes. Micro-insurance differs from traditional insurance as it is tailored for specific risks like crop failure and income loss. Premiums are small and proportional to the likelihood and cost of the relevant risk.

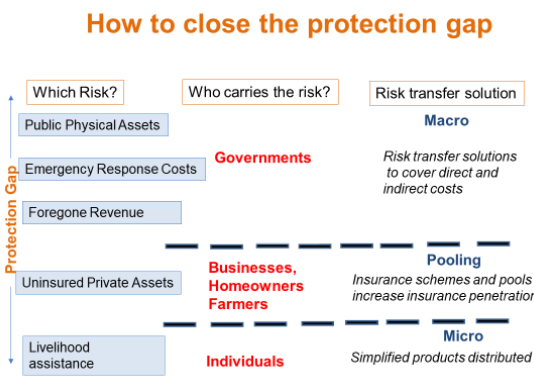

Figure 4: financial risks, risk bearers and possible arrangements for transferring those risks. Source: table inspired from references consulted by the author.

At the government level, trying to finance (that is, meet the costs of) disasters after they have struck is fraught with problems for any country, but magnified many times for small, fragile economies.

A government can raise taxes, but it takes time to collect the revenue and it will likely not be either politically or practically viable if a large swathe of the population has had its income cut because of a disaster.

Foreign aid can come either in the form of a direct financial injection or aid in kind. But how much aid and when that aid arrives is uncertain.

Governments can, of course, borrow. However, many of these countries have challenging debt-servicing costs, so they are not well placed to be negotiating debt terms after a disaster when revenue has been slashed. It is also possible to re-allocate current spending, but that presents risks to development programmes.

The other option for governments is to attempt to pre-fund the cost of disasters. Pre-funding the costs of disasters has the advantage of providing certainty about how much is available to fund recovery and ensures that it is available from the outset. It is an option best used to pre-fund the costs of frequent low costs events. This too, though, diverts funds that could otherwise have been deployed on development projects. So, it comes with opportunity costs.

Credit facilities can be negotiated before an event occurs. This has the advantage of being able to negotiate terms from a stronger position than after a disaster has occurred. This can be used to ensure funds are released immediately after a large event. On the other hand, obtaining this contingency funding will be dependent on current debt-servicing arrangements.

Transferring sovereign risk through an insurance arrangement, by contrast, carries many benefits other options lack. Possibly, the most significant of these in the region is provided by the Pacific Catastrophe Risk Insurance Company (PCRIC).

This was originally piloted by the PCRAFI as the first sovereign catastrophe risk transfer in the Asia Pacific region. PCRIC has now evolved into an arrangement for five island nations – the Cook Islands, the Marshall Islands, Samoa, Tonga and Vanuatu – and is based in the Cook Islands. It is a scheme that is backed by the World Bank, with support from donor countries – Germany, Japan, the United Kingdom and the United States of America – who have provided a capital injection to the fund under the G7's climate risk resilience initiative (PCRIC, 2020). Reinsurance companies also provide cover, enabling up to USD 45 million in funds to be available.

The scheme is like other regional schemes such as the African Risk Capacity and the Caribbean Risk Insurance facility. PCRIC provides what is called "parametric" cover[3] for cyclones, earthquakes and tsunami. Parametric cover releases funds, in this case within 10 days, of a threshold, such as 200 km/h winds or a 7.0 M earthquake occurring, being met.

For example, in February 2018, Tonga received USD 3.5 million in funds from PCRIC shortly after Cyclone Gita hit the island nation. The great advantage of the scheme is that the cash injection is not dependent on assessment of loss, which can delay the release of funds.

The scheme's inaugural Chief Executive David Traill is on record as saying he wanted to see the pool available to grow and for it to include as many Pacific nations as possible (PCRIC, 2018). He was also talking about expanding the range of perils it should cover to include flood and drought, reflecting the diversity of risks in the region.

Such schemes may at first glance seem limited by the trigger definition. For example, if the trigger is a 200 km/h cyclone and a damaging 199 km/h wind speed is recorded, there would be no response. This can easily be addressed by designing layers to the parametric so that, for example, there are automatic smaller pay-outs for 150-199 km/h winds.

Schemes like PCRIC bring several advantages for nation states.

The rapid release of funds enables quick and more substantial deployment of resources which will lead to a more efficient recovery. Access to the funds is guaranteed and saves governments the liquidity problems that they face after a major hit on their GDP.

It enables governments to budget ahead before an event because the premiums are fixed and there are no obligations to pay back lending institutions. This avoids the disadvantage of having a liability on the balance sheet if the country is dependent on debt-financing the recovery.

Perhaps most importantly, it reduces the pressure governments will have to divert funds from other important development projects after a disaster.

---

3 Parametric insurance is defined by three elements: a parameter (for instance, wind speed, earthquake magnitude); a geographic location where this must occur; and a payment if the first two conditions are met. See generally Morten Broberg "Parametric loss and damage insurance schemes as a means to enhance climate change resilience in developing countries" (2020) 20(6) Climate Policy 693.

Such schemes are designed for large losses. Standard insurance is more appropriate for property owners and businesses because it will cover small-scale frequent events as well less frequent, catastrophic events.

The advantage of standard insurance is that it pays out on all losses regardless of the size of the event – there is no trigger. The relative disadvantage is that the assessment of loss takes longer, so full payment is not immediate.

Innovative parametric products though can be developed to cover losses for businesses. One innovation that may have potential in the Pacific is one offered by Swiss Re, which is insuring 160 kms of reef on the Yucatan Peninsula in Mexico. The reef helps protect hotels on the shoreline as it reduces more than 90 per cent of wave energy during storms and it is also a drawcard for tourism (The Nature Conservancy, 2019).

A trust has been established by hotel owners, the government of the state of Quintana Roo and Mexico's National Commission of Natural Protected Areas, which collects and manages funds for reef maintenance and repair.

The trust has purchased parametric insurance for the coral reef. If wind speeds in excess of 100 km/h hit the pre-defined area, such event triggers an insurance payment that will be swiftly available to fund damage assessments, debris removal and initial repairs with funds available for longer-term restoration (The Nature Conservancy, 2019).

Parametric cover releases funds to repair the reef after a hurricane when fast action is required. The hotel owners pay the premiums instead of the government which as to now levied them for beach and reef protection work.

Reinsurance and insurance have a critical role to play once a major event has occurred. To keep this cover affordable and available when faced with an increasing risk profile requires the risk to be reduced. That can only be achieved by adaptation measures. It is estimated that adaptation can reduce post-disaster costs significantly (Mechler et al, 2014).

Adaptation options need to respond to specific local conditions, so they will vary across the Pacific. Discussions should be holistic and take place at the community level. This chapter has focused a lot on physical and financial capital at risk from climate change and other natural hazard events. Human, social and environmental capital lie at the heart of the culture of the islands and it is difficult to price their loss.

Decisions will need to be made about what is worth protecting. As adaptation brings a cost and because its benefit is over a long horizon, there is a tendency to prioritise spending on short-term issues.

This is short-sighted. Extreme events occur right now if the conditions are right. Every dollar invested in pre-event prevention saves five dollars in post-event costs, quite apart from minimizing the wider social and economic disruption: "CBA studies show that for every dollar spent on selected

flood risk reduction measures, an average of five dollars is saved through avoided and reduced losses."[4]

Investment can be incremental to lower up-front costs, so it is more affordable to undertake some work now. The earlier investment occurs, the less costly it will be later.

The impact of sea level rise on the lowest lying islands appears to leave no option other than eventual retreat. The global response to the 2015 Paris agreement[5] will determine how big the impact is.

Kiribati has already taken steps to purchase land in Fiji to relocate some of its population. That is possibly the most extreme adaptation to where it is no longer viable to live, but surviving and thriving demand all options be considered.

References

Broberg M "Parametric loss and damage insurance schemes as a means to enhance climate change resilience in developing countries" (2020) 20(6) Climate Policy 693-703.

Dateline Pacific "More disaster insurance being developed for Pacific countries" (19 March 2018) Radio New Zealand <https://www.rnz.co.nz/international/programmes/datelinepacific/audio/2018636735/more-disaster-insurance-being-developed-for-pacific-countries>.

Earthquake Hazards Program "M 8.1 – Samoa Islands region" (29 September 2009) USGS <https://earthquake.usgs.gov/earthquakes/eventpage/usp000h1ys/region-info>.

Haddow GD, Bullock JA and Coppola DP *Introduction to Emergency Management* (6th ed, Elsevier, Oxford, 2017).

Hallegatte S, Rentschler J and Rozenberg J *Lifelines: The Resilient Infrastructure Opportunity. Sustainable Infrastructure* (World Bank, Washington (DC), 2019) <https://openknowledge.worldbank.org/handle/10986/31805>.

The Nature Conservancy "Insuring Nature to Ensure a Resilient Future. The world's first insurance policy on a coral reef is now in place in Mexico" (3 September 2019) <www.nature.org/en-us/what-we-do/our-insights/perspectives/insuring-nature-to-ensure-a-resilient-future>.

Mechler R, Czajkowski J, Kunreuther H, Michel-Kerjan E, Botzen W, Keating A, McQuistan C, Cooper N and O'Donnell I *Making Communities More Flood Resilient: The Role of Cost Benefit Analysis and Other Decision-support Tools in Disaster Risk Reduction.* (White Paper, Zurich Flood Resilience Alliance, 9 September 2014).

---

4 Reinhard Mechler et al *Making Communities More Flood Resilient: The Role of Cost Benefit Analysis and Other Decision-support Tools in Disaster Risk Reduction* (White Paper, Zurich Flood Resilience Alliance, 9 September 2014) at 2.

5 Paris Agreement 55 International Legal Materials 743 (adopted 12 December 2015, entered into force 4 November 2016).

Pacific Catastrophe Risk Assessment and Financing Initiative *Pacific Catastrophe Risk Insurance Pilot. From Design to Implementation: Some Lessons Learned* (Japanese International Cooperation Agency (JICA) and the World Bank—Global Facility for Disaster Reduction and Recovery (GFDRR) Disaster Risk Financing and Insurance (DRFI) Program, 2015).

Pacific Catastrophe Risk Insurance Company – PCRIC "Tonga To Receive Record Insurance Payout Following Cyclone Harold" (press release, 29 April 2020) <https://www.preventionweb.net/files/submissions/71547_tcharoldpcricpressrelease29apr.pdf>.

Pacific Catastrophe Risk Insurance Company – PCRIC "Tonga Receives Record Insurance Payout Following Cyclone Gita" (press release, 20 February 2018) <https://reliefweb.int/sites/reliefweb.int/files/resources/TC%20Gita%20PCRIC%20Final%20Press%20Release%2020feb.pdf>.

Seneviratne SI, Nicholls N, Easterling D, Goodess CM, Kanae S, Kossin J, Luo Y, Marengo J, McInnes K, Rahimi M, Reichstein M, Sorteberg A, Vera C and Zhang X "Changes in climate extremes and their impacts on the natural physical environment" in CB Field, V Barros, TF Stocker, D Qin, DJ Dokken, KL Ebi, MD Mastrandrea, KJ Mach, G-K Plattner, SK Allen, M Tignor and PM Midgley (eds) *Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation. A Special Report of Working Groups I and II of the Intergovernmental Panel on Climate Change* (Cambridge University Press, Cambridge and New York, 2012) 109-230.