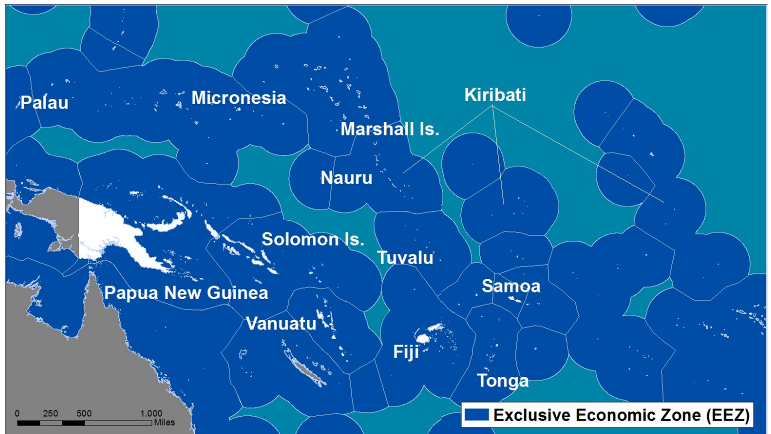
FROM THE AMERICAN PEOPLE

FACT SHEET

CLIMATE RISK PROFILE
PACIFIC ISLANDS

REGION OVERVIEW



EXCLUSIVE ECONOMIC ZONES OF THE PACIFIC ISLANDS

USAID's Pacific Islands region is comprised of twelve countries[1] spread across 3,500 miles in the Southern Pacific Ocean, all facing significant challenges from a changing climate. The region is vulnerable to events such as tropical storms, drought, and extreme rainfall, as well as longer term hardships related to sea level rise. Iconic for climate impacts both in collective consciousness and in the scientific community, the region's many low elevation atolls risk complete loss to rising sea levels. The highly visible impacts of climate change to both policymakers and residents ensure prioritization of climate resilience planning and adaptation. However, economic conditions in the region limit preventive measures. Human development indices vary throughout the region, with poverty rates ranging from the upper 30s to single digits. Islanders engage in subsistence agriculture (typically contributing one-fifth to half of household income) or otherwise live well outside of the cash economy. Gross national income per capita (GNI) ranges from $1,120 per year in Solomon Islands to $9,240 in Palau, with an average of $3,940 across the region. Economic drivers among the islands also vary; other than Palau, the Marshall Islands, and Nauru, the islands significantly rely on agriculture, with crop production comprising over a quarter of gross domestic product (GDP) for Vanuatu, Kiribati, and the Federated States of Micronesia (FSM), and over a third of GDP for the Solomon Islands. Industries, such as palm oil processing and mining, contribute 43% and 33% to the GDP of Papua New Guinea and Nauru, respectively. Most of the region relies heavily on tourism and related industries. Climate change also poses threats to the region's tourism industry through impacts on coastal infrastructure, coral reefs, and coastal ecosystems. (1,6,27,28,31)

CLIMATE PROJECTIONS

0.6– 1.4° C increase in temperatures by 2060

Increase in tropical storm intensity

17-38 cm rise in sea levels by 2050

KEY CLIMATE IMPACTS

Coastal Zones
Saltwater intrusion into habitats
Loss of ocean biodiversity
Damage to coastal infrastructure

Agriculture
Decreased crop yield and food security
Increased drought frequency/duration
Groundwater salinization

Health
Decreased water quality and availability
Decreased nutrition and food security
Shifts in infectious disease patterns

Livelihoods and Tourism
Decreased economic output
Reduced interest in ecotourism
Damage to coastal ecosystems

Water Resources
Salinization of drinking water sources
Decreased water availability for crops
Reduced hygiene and sanitation

Energy and Infrastructure
Increased energy costs
Damage to key infrastructure
Decreased economic output

[1] The Federated States of Micronesia, Fiji, Kiribati, Nauru, Palau, Papua New Guinea, Marshall Islands, Samoa, Solomon Islands, Tonga, Tuvalu, and Vanuatu

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This document was prepared under the Climate Integration Support Facility Blanket Purchase Agreement AID-OAA-E-17-0008, Order Number AID-OAA-BC-17-00042, and is meant to provide a brief overview of climate risk issues. The key resources at the end of the document provide more in-depth country and sectoral analysis. The contents of this report do not necessarily reflect the views of USAID.

CLIMATE SUMMARY

Climate risks and impacts vary considerably across the region, as do island topography, geology, and size. The steeply graded remnants of extinct volcanoes form "high islands" and sand deposits on shallow reefs form "low islands," each with their own distinct conditions and characteristics. High islands generally experience more precipitation and have greater inland erosion risk, while low islands have less precipitation and are more significantly impacted by shoreline erosion, sea level rise, and drought. All the Pacific Islands have tropical climates, though variation exists in the amount of temperature and precipitation change that occurs seasonally. Some countries, such as Kiribati and Tuvalu, experience little change in temperature between seasons, with monthly averages staying around 27.5°C to 28.5°C. Others, for example Vanuatu, see moderate changes in average temperature from 21°C to 27°C. Most islands have distinct wet and dry seasons that are linked to trade wind patterns. Islands located within or nearer the Pacific tropical cyclone basin, such as Fiji, experience relatively more storms than those farther away from this basin, such as Kiribati. Storms and year-to-year rainfall variability are strongly linked to the El Niño Southern Oscillation (ENSO), a natural cycle of the climate system. The El Niño phase of ENSO can increase tropical cyclone frequency and expansion of storms farther east into the region than under normal conditions. ENSO-related events can also result in drought, unusually high rainfall, and sea level changes sustained for weeks at a time. (6,10,24,25)

HISTORICAL CLIMATE

Climate trends include:

- Region-wide, average annual temperatures have increased at an average rate of 0.18°C per decade since 1961.[2]
- The number of hot days[3] and hot nights have been increasing across the region.
- There are no clear trends for average rainfall or extremes since 1950 for the region overall; over the past 30 years, islands in the central Pacific are generally becoming drier and islands in the northwest and southwest Pacific are generally becoming wetter.
- There is significant year-to-year variability in rainfall as well as decade-to-decade changes due to natural climate variability.
- Sea level rise in the region is around two to four times the global average, likely due primarily to natural cyclic phenomena, such as ENSO. Average sea levels have risen 10-15 centimeter (cm) region-wide and up to 20 cm in the northwest Pacific islands since 1990.
- Sea-surface temperatures have increased at a rate of between 0.07 and 0.23°C per decade since the 1970s, with variability across the region.
- While the overall frequency of tropical storms has remained level, occurrence of major tropical storms (Category 4 and 5) has generally increased. (2,3,6,24,25,27)

FUTURE CLIMATE

Climate projections include:

- Broadly across the region, an increase in average annual temperature of around 0.6°C-1.4°C by the 2050s is likely.
- Increase in the number of hot days and hot nights.
- Average annual rainfall is expected to increase slightly across most of the region, likely with more extreme wet seasons, extreme rainfall events, and floods
- Rainfall patterns are expected to become less predictable, and with more frequent and intense extreme events, including storms and droughts.
- Sea levels are likely to rise between 17 and 38 cm by 2050, though not uniformly across the region. They are expected to rise by at least the global average projection of over 1 meter by 2100
- Sea surface temperatures are expected to increase by 0.9°C-1.4°C by the 2050s.
- Tropical cyclones are expected to decrease in frequency, but increase in intensity (2,3,6,24,25,26,30)

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[2] Specific examples include overall increases of: 0.5°C-1°C since 1950 for Vanuatu; 0.4°C-0.8°C since 1970 for Tonga; around 1°C since 1970 for both Solomon Islands and Marshall Islands

[3] A "hot" day or night is defined as days where maximum temperature, or nights where minimum temperature, exceed the 90th percentile current climate of that region or season

SECTOR IMPACTS AND VULNERABILITIES

COASTAL ZONES AND ECOSYSTEMS

<table>
<tr><th colspan="2">Climate Stressors and Climate Risks
COASTAL ZONES AND ECOSYSTEMS</th></tr>
<tr><th>Stressors</th><th>Risks</th></tr>
<tr><td rowspan="7">Sea level rise

Increased storm surge

Increased sea-surface temperatures

Ocean acidification</td><td>Shoreline erosion</td></tr>
<tr><td>Saltwater intrusion into mangroves and aquifers</td></tr>
<tr><td>Loss of ocean and near inland biodiversity</td></tr>
<tr><td>Coral bleaching</td></tr>
<tr><td>Damage to coastal infrastructure</td></tr>
<tr><td>Economic loss</td></tr>
<tr><td>Population displacement</td></tr>
</table>

The Pacific Islands' coastal zones and ecosystems are likely to suffer significantly from impacts related to a changing climate. Population pressures, storm surge events, and subsequent loss of habitat will affect both human settlements and the natural environment. Rising sea levels, both on average and during extreme events such as storm surge, king tides, and wind-waves, have steadily degraded coastal areas for decades and are projected to increase. Mean sea levels are expected to rise between 17 and 38 cm by 2060. Once sea levels rise 20 cm above current levels, a coastal flooding event that historically occurred once every 100 years would occur, on average, every 10 years. Additionally, a 10 cm mean water level increase typically results in a threefold increase in extreme storm surge events. Even for countries such as Palau and Tonga, which are outside the normal range of tropical cyclones, changing sea-surface temperatures in concert with ENSO events and changes in wind speed can create strong storm surges and flood damage to coastal areas, including coastal mangroves, a main food source for many island inhabitants. Flooding and erosion of coastal areas are highly problematic, particularly for atoll islands that have very limited freshwater resources and are composed largely of highly permeable soft-sediments. Pacific Island tourism risks losing billions of dollars annually as climate impacts affect the natural resources and infrastructure that travelers come to enjoy. Coral bleaching due to rising ocean temperatures reduces the recreational appeal of coral reefs, while ocean acidification threatens long-term health of both corals and reef structures. At the same time, sea level rise and storm surges threaten tourism infrastructure. Although overall tropical cyclone frequency is expected to decrease, an increase in higher-intensity storms is likely, which can result in even greater damage when combined with rising sea levels and coastal development. High winds and high-precipitation events can damage coastal infrastructure and ecosystems. As coastal zones are forced to cope with these changing conditions, it is also likely that the fishing industry will suffer. Components of soft infrastructure associated with coastal settlements and related land tenure issues, such as access to fishing grounds and watercraft will make it more difficult for local populations to take advantage of traditional fisheries, both for economic gain and for subsistence activities. Additionally, distribution patterns of ocean species will likely be altered in response to changing sea-temperature and acidity levels, affecting and potentially reducing yields. (3,6,24,25,27)

AGRICULTURE AND FOOD SECURITY

<table>
<tr><th colspan="2">Climate Stressors and Climate Risks
AGRICULTURE AND FOOD SECURITY</th></tr>
<tr><th>Stressors</th><th>Risks</th></tr>
<tr><td rowspan="5">Sea level rise

Increased temperatures

Increased drought frequency and duration

Increased storm frequency and intensity</td><td>Soil erosion and soil fertility loss</td></tr>
<tr><td>Saltwater intrusion into aquifers and cropland</td></tr>
<tr><td>Reduced crop yields</td></tr>
<tr><td>Crop failures</td></tr>
<tr><td>Decreased nutritional health</td></tr>
</table>

For some Pacific Island nations, such as the Solomon Islands, agricultural output is a critical component of the economy, with exports including cocoa, coconuts, palm kernels, taro, fruits, vegetables, and bananas contributing 34% of GDP and employing 75% of the population in some form. Papua New Guinea and Fiji also have high proportions of the population engaged in agricultural activities, at 75% and 70%, respectively. For other nations, particularly countries such as Palau, low islands and atolls provide little arable land for export-scale agriculture, resulting in less agricultural activity. Accordingly, Palau and FSM have the lowest proportion of agricultural engagement in the region, at 1.2% and 1%, respectively. Rising seas would directly flood near inland agricultural areas and saltwater would infiltrate already limited supplies of groundwater. On high islands, the amount of land that is flat enough for large-scale settlement and agriculture is limited, but freshwater resources are relatively more plentiful. However, populations tend to be concentrated in low-lying coastal areas, which offer more arable land, but where sea level rise and coastal climate change impacts are more significant. Crop yields are already in regular danger from drought and tropical cyclones, and these threats will become more pronounced as climate conditions change. Additionally, land tenure issues in Pacific Island countries endowed with rich natural resources often dampen potential for a thriving agricultural industry. As a result, subsistence agriculture is extremely prevalent. In Papua New Guinea, agriculture provides a subsistence livelihood for 85% of the population, and many other countries in the region share similar conditions. With food security closely tied to inhabitants' ability to grow crops and utilize traditional fishing grounds, changing climate conditions will likely lead to increased food security risk. Such changes will likely impact malnutrition rates, which are already high for countries with low per capita income, such as Papua New Guinea and the Solomon Islands, where chronic undernutrition rates are already over 40% and between 30% and 39%, respectively. Inhabitants will likely be required to make significant adjustments in agricultural practices, adopting more water conservation practices and making use of marginal lands. However, these actions will be difficult in the development and regulatory context of most Pacific Island nations, where land tenure issues and limited financial flexibility can contain citizens' ability to make adjustments quickly. (3,6,24,25,27)

HEALTH

Human health can be negatively affected through multiple, complex pathways related to climate change impacts. In most cases, climate change amplifies existing health problems rather than introducing new ones. Direct health impacts, such as injury and death from increasingly frequent and or severe storms and heat exhaustion, will affect most Pacific Island nations, particularly for young children, older persons, and those in poverty. Indirect impacts related to water and food security are likely to affect all countries in the region to varying degrees. Increased frequency and intensity of storms can lead to worsening floods, which can damage infrastructure critical to health service delivery (e.g., hospitals, roads, clean water, and electricity). Additionally, flooding of coastal plains and mangroves and increases in extreme rainfall events could result in a corresponding increase in vector-borne illness, such as dengue fever. Decreased water supplies during drought periods may impact the effectiveness of sanitation systems, leading to increases in water-borne infections, such as typhoid fever and diarrheal illness. For example, in Fiji, in months following drought conditions, the likelihood of dengue and diarrhea outbreaks increase by 5% and 9%, respectively. Climate change is expected to threaten limited freshwater reserves, particularly on atoll islands, which are already being strained by rapidly growing demand, deforestation, urbanization and tourism. Impacts on already deteriorating water availability and quality could have significant health impacts. For example, salinization of potable water sources may exacerbate hypertension, which is already a concern in the region and can increase maternal and child health risks during pregnancy. Finally, in countries such as FSM, safe seafood eating practices will need to be adopted to avoid fish poisoning from increased occurrence of algal blooms. (1,3,5,6,29)

Climate Stressors and Climate Risks HEALTH

Stressors	Risks
Increased temperatures **Increased drought frequency and duration** **Increased storm frequency and intensity**	Shifts in vector- and waterborne diseases
	Decreased nutrition and food security
	Reduced availability or increased disruption of health services
	Reduced water quality and availability
	Difficulty maintaining sanitation systems and practices

LIVELIHOODS AND TOURISM

Climate Stressors and Climate Risks LIVELIHOODS AND TOURISM	
Stressors	**Risks**
Increased storm frequency and intensity	Loss of ocean biodiversity
	Reduced interest in ecotourism
Increased air and sea-surface temperatures	Diversion of funds to cover costs incurred during extreme weather
Increased drought frequency and duration	Damage to hard and soft infrastructure
	Reduced export revenues from agricultural sector
Ocean acidification	Reduced water availability

Many island economies are resource-constrained and rely heavily on coastal ecosystems for tourism and fishing industry revenue. Where other climate impacts vary considerably between high and low islands, the impacts on coastal and shallow water ecosystems pose a great threat to nearly all Pacific Island nations because they will almost certainly result in decreased tourism revenue. Travelers come to enjoy the unique and isolated environments these islands offer, and tourism factors heavily into the GDP of most countries. Storm damage to transportation and energy infrastructure, as well as to hotels and other buildings, has the potential to limit interest in the tourism sector. Additionally, tourism is an extremely water intensive activity, and with water delivery and sewage infrastructure already being a limiting factor for many Pacific Island countries, the climate impacts to these systems could amplify one another. On high islands, increased risk of flooding and erosion could also impact the tourism industry, as conditions become potentially unsafe for months at a time during ENSO events. While many Pacific Island economies revolve around the tourism industry and seek to expand revenue in this sector, as much as 90% of profits typically leaves local economies. Because of this, the true impact of the tourism sector on local economies is unclear, and livelihoods tied to subsistence agriculture and fishing remain critical for island populations. Both subsistence activities and livelihoods that are replacing them, such as cash cropping, will often be affected by the same climate change impacts. For example, a large emphasis has been placed on sugar cane production in Fiji, with farmers reporting poor crops in recent years thought to be related to saline groundwater. Livelihood risks have the potential to increase due to poor land tenure policy, particularly in the face of increased focus on tourism. Lands that were previously utilized for subsistence activities may be converted to accommodate travelers. (2,3,4,5,6,7,27)

WATER RESOURCES

Climate Stressors and Climate Risks WATER RESOURCES	
Stressors	**Risks**
Increased evapotranspiration	Damage to drinking and storm water infrastructure
	Saltwater intrusion into aquifers and cropland
Sea level rise	Reduced water availability for agriculture
Increased drought frequency and duration	Changes in species numbers and distribution
Increased storm frequency and intensity	Difficulty maintaining sanitation systems and practices
	Increased adverse health effects

Whereas high islands receive higher rainfall that channels down mountains into extensive networks of streams and rivers, low islands lack such resources and are often entirely reliant on shallow and limited groundwater lenses[4] and rainwater catchments as fresh water sources. On average, both annually and for one-time events, precipitation falls in smaller amounts on low islands, making them highly vulnerable to drought of any severity. Additionally, low islands face significant risk from storm surge and coastal flooding, both with potential impacts on water resource availability and quality. Having adequate freshwater reserves is also a challenge for high islands, as they also rely on rainfall to balance out groundwater discharge. Climate change is expected to affect both surface water availability and groundwater quality, particularly with respect to salinity. While the region overall is expected to experience slightly higher annual rainfall, there is great variability between islands, and the rainfall changes are not expected to be distributed evenly throughout the year. Droughts associated with ENSO events are projected to increase both in frequency and duration across the region, likely affecting Solomon Islands and Tuvalu most severely. High islands also have greater flood risk during cyclone and other high precipitation events with potential to damage already fragile and limited water infrastructure, and these events are predicted to increase in frequency and severity. For example, in Fiji, a 1 in 20-year rainfall event is currently defined as any 24-hour period of more than 245 millimeter (mm); by 2050, this threshold will increase to 300 mm. For all nations in the Pacific Islands, contamination of freshwater sources from human activity and saltwater intrusion from rising sea levels are primary threats to supply. The presence of an adequate supply of freshwater has critical health implications, being necessary to maintain sanitary conditions in population centers. Given the importance of groundwater as a potable water source, particularly for low islands, increased salinity from rising sea levels could have a strong impact on drinking water availability. As coastal wetlands and mangroves become more saline and are flooded more often by storm surge, habitat loss is expected to affect island biodiversity, harming ecosystem functioning and potentially leading to additional impacts on the tourism industry. Reduction in the supply of freshwater will also have a major effect on the agricultural sector, as many export crops, such as sugar cane and cacao tend not to produce in saline conditions. (3,6,7,27,30)

INFRASTRUCTURE AND ENERGY

Though some countries, such as Fiji, have a more diversified energy mix that includes hydroelectric, solar, and wind generation, most energy in the region comes from imported fossil fuels. The import of these fuels relies on coastal infrastructure, which will be under increased stress from both sea level rise and tropical storm activity, placing the region under significant risk of climate related disturbance in fuel transportation and subsequently limiting energy supplies. Island economies rely heavily on coastal infrastructure under serious threat from shoreline erosion including ports, bridges, roads, water systems, and electricity systems. During tropical storms, damages to this infrastructure will impede provision of emergency relief and basic services. Additionally, high wind events during storms have the potential to damage solar and wind energy infrastructure, and changes in rainfall amounts and patterns may lead to decreased or more unreliable hydroelectric output. Between 1950 and 2011, extreme weather and related events, such as residual flooding, caused around $3.2 billion in damages to island infrastructure. It is projected that costs to address coastal infrastructure risks will be highest for Pacific Islands, both compared to other regions and other sector risks within the region. For example, coastal infrastructure protection and adaptation costs for Fiji and Solomon Islands are projected to reach over 320 million dollars annually by 2040, including the costs from residual damages. Increases in flooding and storm intensity are also expected to impact energy, water and sanitation, transportation, and basic service infrastructure. Across the region, projected costs to protect these infrastructure elements from changes in rainfall and temperature range from 2% to 20% of overall adaptation investment, with the high island nations of Fiji and Vanuatu at the lower end of that range. A large portion of these projected expenditures in Solomon Islands and Samoa (greater than 90%) is to address climate change impacts to roads. In the face of temperature and humidity increase, the ventilation and cooling systems of buildings will also need to be upgraded. (2,3,5,18,30)

Climate Stressors and Climate Risks
ENERGY AND INFRASTRUCTURE

Stressors	Risks
Increased storm frequency and intensity	Reduced tourism industry
	Increased energy costs
Coastal erosion	Damage to transportation and import/export infrastructure
Increased frequency and height of storm surge	Reduced commercial development
	Reduced economic output
	Reduced access to services

POLICY CONTEXT

In terms of climate change impacts and risks, the nations of the Pacific Islands have been highly visible to the international community. All nations in the region have published dedicated climate plans, and all have contributed a national communication in compliance with the United Nations Framework Convention on Climate Change (UNFCCC), with many also contributing a second.

INSTITUTIONAL FRAMEWORK

Many nations in the region have been dealing directly with climate impacts for decades, particularly sea level rise, groundwater salinization, and cyclones. Policymakers from atoll countries have been highly visible in the international climate change community, with national policies being developed to directly address the threats facing these islands. However, these initiatives have been largely unsuccessful in catalyzing the legislative and regulatory actions needed to prepare for and mitigate the impacts of climate change. Large distances between countries, different climate conditions, and different development practices make a focused regional plan challenging. Countries commonly list the difficulties of sharing information and financial capacity as main barriers to creating effective policy. However, development efforts are becoming more closely linked to climate resilience as international donors are prioritizing capacity building, increasing potential for localized programs to succeed. (3,5,6,18)

STRATEGIES AND PLANS

- Papua New Guinea - National Climate Compatible Development Management Policy (2014)
- Republic of Fiji National Climate Change Policy (2007)
- Palau Climate Change Policy For Climate and Disaster Resilient Low Emissions Development (2015)
- Solomon Islands National Climate Change Policy (2012-2017)
- Tonga Climate Change Policy A Resilient Tonga by 2035 (2016)
- Government of Samoa National Policy of Combating Climate Change (2007)
- Vanuatu Climate Change and Disaster Risk Reduction Policy 2016-2030 (2015)
- Micronesia Climate Change Policy (2009)
- Kiribati Joint Implementation Plan for Climate Change And Disaster Risk Management (KJIP) (2014)
- Republic of Nauru Framework for Climate Change Adaptation and Disaster Risk Reduction (RONAdapt) (2015)
- Tuvalu Climate Change Policy (2012)
- Republic of the Marshall Islands National Climate Change Policy Framework (2011)

KEY RESOURCES

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SELECTED ONGOING EXPERIENCES

Below are selected projects focused on climate change adaptation, or some aspect of it, in the Pacific Islands region.

Selected Program	Amount	Donor	Year	Implementer
USAID Climate Ready	$24 million	USAID	2017-2022	AECOM
Disaster Preparedness for Effective Response (PREPARE)	$67 million	USAID	2013-2018	International Organization for Migration
Pacific-American Climate Fund (PACAM)	$24 million	USAID	2013-2018	Partners for Global Research and Development/AECOM
The Oceans and Fisheries Partnership (USAID Oceans)	$20 million	USAID	2015-2020	TetraTech ARD, Inc., U.S. Department of Interior, U.S. National Oceanic and Atmospheric Administration
Project Assistance Agreement for Environmental Programming	$3.05 million	USAID	2016-2021	Government of Papua New Guinea's Department of National Planning and Monitoring
Coastal Community Adaptation Project (C-CAP)	$18 million	USAID	2012-2016	Development Alternatives, Inc.
Institutional Strengthening in Pacific Island Countries to Adapt to Climate Change (ISACC)	$5 million	USAID	2015-2020	The Pacific Community (SPC)
Pacific Catastrophe Risk Insurance Pilot	$1 million	World Bank	2014-present	Pacific Island Governments
Pacific Catastrophe Risk Assessment and Financing Initiative Phase 3 - (RETF)	$1.1 million	World Bank	2013-2016	Pacific Islands Applied Geosciences Commission (SOPAC)
Pacific Resilience Program	$9.4 million	World Bank	2016-2020	Pacific Islands Applied Geosciences Commission (SOPAC)