

Papua New Guinea

This climate fact sheet summarizes the available information on the climate of Papua New Guinea and the impact of climate change on humanitarian activities in-country. Each fact sheet in the series was written using information from peer-reviewed academic papers, government publications, and other documentation from international non-governmental organizations.

1. Climate overview

Average annual temperature: In Papua New Guinea, temperatures are relatively steady across the country; for example, mean temperatures in Port Moresby range from 26–28°C.

Average annual rainfall: Papua New Guinea is one of the wettest countries in the world, with annual rainfall exceeding 4,000mm in the highlands and New Britain. The average monthly rainfall ranges between 250–350mm.

Main driver of climate variability: 1. El Niño–Southern Oscillation (ENSO); 2. western Pacific monsoon (Australian monsoon); 3. South Pacific Convergence Zone (SPCZ); 4. Intertropical Convergence Zone (ITCZ).

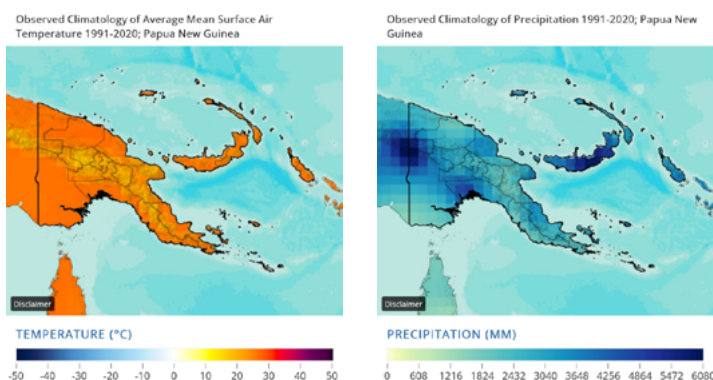


Figure 1: Observed climatology of (left to right) mean temperature and mean precipitation over 1991-2020 (from the World Bank Climate Change Knowledge Portal).

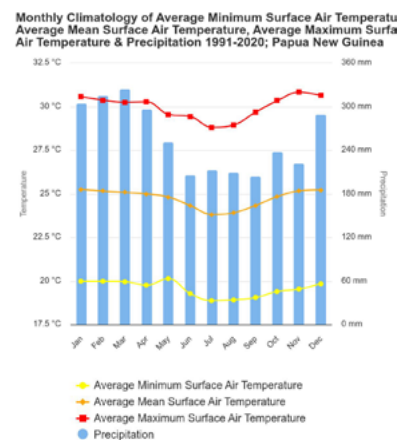


Figure 2: Observed average monthly climatology between 1991 and 2020 (from the World Bank Climate Change Knowledge Portal).

Short overview

Papua New Guinea (PNG) is predominantly made up of a tropical rainforest climate with small areas in the south-west comprising tropical monsoon and tropical savannah climates. Topography is an important factor shaping climate of Papua New Guinea, with locations in the central highlands experiencing near-freezing nighttime temperatures at times. The climate is predominantly hot, humid and tropical year-round, with two distinct seasons differentiating the wet (December to March) and dry (June to September) periods (PNG, 2020).

Papua New Guinea is home to one of the wettest climates of the world and annual rainfall in many areas of the country exceeds 2,500mm, with the heaviest events occurring in the highlands. Temperatures are relatively steady across the country, and mean temperatures in Port Moresby range from 26–28°C. The climate in this part of the Pacific is governed by a number of factors, including the trade winds and the movement of the South Pacific Convergence Zone (SPCZ) – a zone of high-pressure rainfall that migrates across the Pacific Ocean, south of the Equator. Year to year variability in climate is also strongly influenced by the El Niño conditions in the south-east Pacific, which bring drought conditions to Papua New Guinea, especially in the drier areas of the country (World Bank, 2022).

1.2 Climate change in Papua New Guinea

Historical climate	Projected climate
Temperature	
<ul style="list-style-type: none"> Mean annual temperatures over PNG have increased at a rate of approximately 0.2°C/decade in 1961–2015 (Gutiérrez <i>et al.</i>, 2021b). The frequency and intensity of hot extremes have increased, and cold extremes have decreased (Seneviratne <i>et al.</i>, 2021). Sea surface temperatures have increased by 0.6–1°C since 1910, with the most significant warming observed after the 1970s (GFDRR, 2011). 	<ul style="list-style-type: none"> Mean temperatures over the region are projected to rise until 2050 by at least 1.5–2°C for a high greenhouse gas concentration scenario (SSP5–8.5) and by 1–1.5°C for a low greenhouse gas concentration scenario (SSP2–4.5) (Gutiérrez <i>et al.</i>, 2021a). Maximum and minimum temperature will increase, and heatwaves will intensify in duration and peak temperatures for every increase in global warming levels above the pre-industrial values. In line with rising mean annual temperatures, the annual number of very hot days (above 35°C) is projected to rise and with high certainty (Gutiérrez <i>et al.</i>, 2021b; Ranasinghe <i>et al.</i>, 2021; Seneviratne <i>et al.</i>, 2021).
Precipitation	
<ul style="list-style-type: none"> While overall trends in mean annual rainfall are unclear, there have been increases in rainfall observed in most regions during the wet season since 1950 (World Bank, 2022). The frequency and magnitude of extreme rainfall events has increased (Seneviratne <i>et al.</i>, 2021). 	<ul style="list-style-type: none"> Mid-century (2040–2060) estimates under both low and high emissions scenarios project precipitation increases between 10–15 per cent. Uncertainty over future precipitation patterns for PNG remains high (Gutiérrez <i>et al.</i>, 2021b). The frequency and intensity of heavy precipitation events are projected to increase with potential impacts of flooding and soil erosion (Seneviratne <i>et al.</i>, 2021).

2. Priorities of the Red Cross Red Crescent Movement under climate change

2.1 Scale up climate-smart disaster risk reduction (DRR), early action and preparedness

Observed hazard	Projected risk
<p>Flooding</p> <p>River flooding is a threat across PNG. Using a compilation of models, Lange <i>et al.</i> (2020) simulated that 0.2 per cent of the land area and 0.14 per cent of the population of PNG is exposed to at least one river flood per year. A recent example of river flooding was in 2021 when continuous rainfall led to flooding along the Fly and Strickland Rivers, which led to impacts on access to drinking water and an increase in waterborne diseases. Over 150,000 US dollars were needed to address immediate needs such as emergency food, water and medical supplies (ECHO, 2021).</p> <p>Urban flooding poses a particular risk to densely populated areas of PNG where sanitation, access to water and diseases become a greater threat from both coastal and river flooding events. The Adaptation Fund (2012) estimates that flooding is the most critical climate-related hazard for the north coast and island regions of PNG, home to approximately 2.6 million people (Adaptation Fund, 2012).</p>	<p>Droughts and floods</p> <p>The combined impacts of El Niño and La Niña, along with the impacts of climate change, could affect hazards in compounding ways (UNDRR, 2019). With the increasing intensity of El Niño and La Niña events, increased precipitation could exacerbate flood risk across the country, or conversely droughts may become prolonged or more intense. The impact of compounding hazards will severely impact economic development, infrastructure and human life, as well as disrupting ecological systems and habitats (<i>ibid</i>).</p> <p>The Government of PNG projects that the intensity and frequency of extreme heat events are projected to increase (Government of PNG, 2018). Extreme flood events and associated impacts are projected to increase, while the proportion of the population affected by flooding is also expected to increase. The figures put on this are between 20–50 per cent (35,000–56,000 more people impacted) by 2035–2044 (World Bank, 2021).</p>
<p>Droughts</p> <p>PNG often faces the threat of drought which correlates with the El Niño–Southern Oscillation. Droughts have a significant impact on the population of PNG as the vast majority of the population rely on subsistence agriculture.</p>	
<p>Landslides</p> <p>The risk of landslides in PNG is categorized as high. An example that has been cited as the world’s second largest landslide (Tanyas <i>et al.</i> 2022) occurred after the 2018 earthquake. The earthquake was thought to have triggered over 10,000 landslides in an area extending over 145km².</p>	<p>The World Bank (2022) highlights how an increase in landslide events is projected (World Bank, 2022). CMIP6 modelling by the World Bank shows the potential for high intensity rainfall events and rainy days to increase, leading to conditions for landslides (World Bank, 2022). Coupled with increased land use change and deforestation, landslides could pose a major threat in the future.</p>

Observed hazard

Projected risk

Sea level rise

Coastal flooding: A recent Human Rights Watch report (2021) described how rising sea levels along the vast coastline of PNG have led to an increase in the reach of king tides. Approximately 53,000 people have already been displaced because of the higher tides experienced across the region (HRW, 2021). In this case, the risks posed by climate change were likely exacerbated by an active La Niña phase, which often leads to a temporary rise in sea level. Such cumulative threats are increasingly important for the country to consider.

Sea level rise has been measured at 7mm between 1993–2010; however, the influence of interannual variations in sea level, partly driven by ENSO, is likely to influence this figure (Kiele *et al.*, 2022). It is predicted that sea level rise will continue at an increasing rate, with estimates ranging between 40–150mm by 2030 dependent on the emission scenario (Kiele *et al.*, 2022). This will have a significant impact on the low-lying island areas of PNG, causing the potential for displacement and livelihood changes as well as the need for significant adaptation.

Cyclones

Cyclones are classified as a high-level hazard. This means there is more than a 20 per cent chance of potentially damaging winds occurring in the next 10 years (ThinkHazard!, 2022). Particularly high vulnerability zones are the northern, central and Milne Bay areas which all have a high hazard level attributed to them. In 2014, Cyclone Ita hit the south-east area of Milne Bay, causing destruction across the region which lasted for well over nine months.

There are projected increases in average tropical cyclone wind speeds and associated heavy precipitation along with the proportion of category 4–5 tropical cyclones (Seneviratne *et al.*, 2021). The UNDRR (2019) estimates that by 2100, the impacts of cyclones in PNG could lead to an increase in economic losses in the range of 14.2 per cent for the lowest emission scenario to 66.3 per cent for the worst-case climate scenario. Such losses could total on average around 24 million US dollars annually by mid-century (UNDRR, 2019).

It is important to note that many of these hazards are interrelated and produce compound risks in the same areas and communities. In addition, risk must be understood as the interplay between hazard, exposure and vulnerability which makes certain individuals, communities and sectors more impacted by the hazards. All project design should take such compounding risks into account.

Disaster risk management strategies

The country faces several challenges in effectively implementing its DRR system (UNDRR, 2019). These are centred around limited funding and programme resources. For example, in 2006–2012, the country’s National Disaster Centre (NDC) worked within a budget of 1.3 million US dollars annually – a significant increase from the 500,000 US dollars per year that it had to work with previously (UNDRR, 2019). In addition to restricted budgets, a number of Provincial Disaster Committees are also heavily indebted which puts pressure on their functions. Additionally, coordination is made more difficult by the country’s varied geography and dispersion.

UNDRR (2019) reports that as climate change increases disaster risk, there is a need to upscale the country’s interventions towards more proactive, robust and sustainable options (UNDRR, 2019). This could be made up of investment in disaster-resilient infrastructure, improving recovery mechanisms and exploring long-term strategies for relocating displaced populations. Working on enhancing climate monitoring, forecasting capacity and the dissemination of early warning mechanisms would also be beneficial. Finally, UNDRR (2019) reports that DRM in Papua New Guinea is currently heavily dependent on development partners in terms of both technical assistance and financial support.

Legal and policy framework for DRR

- Following the [Disaster Management Act 1984](#) the NDC was established to act as the national focal point for DRM.
- Papua New Guinea's most current DRR plan is the [National Disaster Risk Reduction Framework 2017–2030](#) that is aligned with the Sendai Framework for Disaster Risk Reduction and outlines seven nationally agreed upon targets to be achieved by 2030.

2.2 Reduce health impacts of climate change

The impacts of climate change on the health sector of Papua New Guinea are linked to food and nutrition, waterborne and vector-borne diseases, and mental health concerns resulting from forced relocations from hazard- or sea level rise-prone areas.

There are strong links between climate change, food and nutrition related non-communicable diseases in the Pacific Island Countries and Territories (Savage *et al.*, 2020). Changing agricultural yields will lead to undernutrition and a potential shift away from traditional production and consumption patterns to reliance on imported foods which could be less healthy (*ibid*). Climate change impacts on crop yield and fisheries is likely to result in declined food and nutrition security with increased cases of undernutrition and increased risk of diet-related non-communicable diseases later in life (*ibid*).

Forced relocation due to sea level rise could have marked impacts on mental health outcomes including stress and trauma responses (Schwerdtle *et al.*, 2018). Increased malarial prevalence has been reported across Papua New Guinea and it is projected to increase in the coming years (Imai *et al.*, 2016). Papua New Guinea is a malaria endemic country, where all four species of the malarial vector circulate in the population with varying distribution. Climatic changes are projected to increase the incidence of malaria in highland areas (Park *et al.*, 2016). [Waterborne diseases pose a major challenge to the health of people across Papua New Guinea](#) (UNICEF, 2021). Increased flooding and storm surges occurring as a result of climate change could exacerbate these challenges.

2.3 Ensure sustainable water supplies

Water, Sanitation and Hygiene (WASH)

Papua New Guinea receives significant amounts of water annually, and with the high, steep mountain ranges and abundant rainfall, most of the country benefits from the runoff rainwater. Despite this, access to safe drinking water is unevenly distributed; climate change is expected to exacerbate this challenge.

By 2070, some regions of Papua New Guinea could see annual water shortages of 124mm in their water supply (ADB, 2013). Climatic-induced droughts combined with poor water infrastructure for collection and storage will lead to increased vulnerability and difficulty in meeting household water needs in some areas of Papua New Guinea (Columbia Law School, 2019). A significant proportion of the country's population, especially those living in highland areas and in the town of Porgera have limited or no access to clean water or sanitation services (Oxfam, 2022). Climate change-induced water deficits could severely impact the health and wellbeing of people as well as agricultural output. Finally, coastal flooding has already begun to seriously impact the availability of safe drinking water for communities across Papua New Guinea, especially in the low-lying atolls (Luetz & Havea, 2018). Increasing temperatures will increase the land area and population exposed to at least one river flood per year in Papua New Guinea. With a 2°C increase in global temperatures, the land area and population exposed to at least one river flood per year will increase from 0.2–0.31 per cent land area and from 0.14–0.22 per cent of the population, respectively (Lange *et al.*, 2020). Sea level rise will have impacts on drinking water, sewage systems, habitability of land and marine and coastal biodiversity (Kiele *et al.*, 2022).

Infrastructure and electricity

Papua New Guinea – as with the rest of the Pacific region – is moving towards more integrated energy approaches driven by climate change and a dependence on fossil fuels (Sharma *et al.*, 2021). Papua New Guinea is one of the Pacific countries with lowest access to energy – only 13 per cent of the population is connected to electricity. In Papua New Guinea, nearly 40 per cent of total installed electricity capacity was generated from hydroelectric schemes, while the remainder is sourced from thermal power stations relying on diesel, gas and heavy oils. To address the low electrification development challenge, Australia, Japan, New Zealand and the USA have partnered for the Papua New Guinea Electrification Partnership which aims to provide electricity to 70 per cent of Papua New Guinea's population by 2030 (*ibid*).

2.4. Enable climate-resilient livelihoods and economic security

Increased climatic impacts, population increase and land use change will affect the agricultural production and fisheries in Papua New Guinea with direct consequences for food supply, incomes and nutrition (Bourke, 2018).

Between 85–90 per cent of the country's population depends on subsistence or semi-subsistence agriculture and the Government has not intervened very much in the development of water and irrigation for agriculture (FAO, 2011, Bourke, 2018). Shifting climatic conditions have resulted in changes in soil fertility and arable land, especially in the low-lying island atolls of Papua New Guinea (ICRC, 2019). Rising sea levels, combined with an increasing population will put pressure on fisheries, impacting people who depend on fish as a source of income and nutrition (Barange *et al.*, 2018). The decline in fisheries could have significant impacts on food security, health and livelihoods. Carbon dioxide emissions and changes to coral reefs and other fish habitats are likely to reduce harvests from small-scale coastal fishing by up to 20 per cent by 2050 and 50 per cent by 2100 under a high emissions scenario in the Western and Central Pacific fisheries (Barange *et al.*, 2018). Ocean acidification and a rise in sea surface temperatures will lead to coral bleaching, affecting the breeding grounds of fish, from the smaller ones to those high up in the food chain (World Bank, 2021), causing economic and livelihood challenges for Papua New Guinea.

2.5 Address climate displacement and protection

Current and future displacement challenges

In 2021 climate disasters triggered twice as many displacements as in 2020, with 7,200 people displaced in East Sepik due to extremely high tides in December, which destroyed thousands of coastal homes (IDMC, 2022). Papua New Guinea has approximately 41,000 internally displaced persons (IDPs), 70 per cent of whom were displaced over five years ago due to either violence or disasters (*ibid*).

'In future, up to 30,969 displacements per year, resulting from sudden-onset hazards, are projected (IDMC 2022). Floods form the major driver of this statistic, with 23,774 people projected to be displaced for different lengths of time as a result of flooding in Papua New Guinea in 2024 (*ibid*).

Papua New Guinea's land ownership structure – with 97 per cent of land customarily owned – means that adaptation strategies such as planned relocation will be difficult and may trigger conflict and disputes (World Bank, 2021). It is recommended that policy measures facilitate voluntary migration from low-lying island communities through comprehensive financial support and labour migration schemes (*ibid*).

Rural–urban migration is projected to increase due to both sudden- and slow-onset disasters which limit or destroy rural populations' subsistence farming livelihoods. Most of the country's subsistence farmers have limited ability to safeguard assets and livelihoods from climate-induced natural disasters (World Bank, 2021). Increased drought is projected to increase migration (ESCAP, ILO & UNDP, 2014). The highlands of country, which are among the most densely populated areas, are particularly affected by El Niño events and experience both drought and extreme frost; which, at times, significantly reduces agricultural production (*ibid*) and will likely lead to further out-migration to lower elevations.

Potential needs of migrants and displaced people

The needs of migrants and displaced people are very high in Papua New Guinea as the country is ranked as having the world's 11th lowest coping capacity to climate change (World Bank, 2021).

The projections of increased disaster displacements, coupled with limited land for formal resettlement, mean that an increasing number of people per year could find themselves in situations of protracted displacement; living in makeshift shelters, vulnerable to future disasters, with low access to healthcare and often separated from their families. Poor planned development is another key risk factor (*ibid*).

Migration law and policies

- Papua New Guinea has a Migration Act (1978) that has been updated and amended over the decades.
- Papua New Guinea took part in a [2020 Regional Policy Dialogue](#) to discuss climate change, migration and human security (IOM/ESCAP, 2020), but it is unclear whether a regional approach to address these issues has been further developed.
- The DRR framework seeks to empower local authorities to support populations, including IDPs and migrants, to engage in DRR at the local level and 'support policies and programmes addressing disaster-induced human mobility/displacement to strengthen the resilience of affected people' (NDC, 2017).

2.6. Policy

Relevant information from the [Nationally Determined Contribution \(NDC\) \(2020\)](#)

Greenhouse gas emissions reduction target: Focus on energy and land use. PNG strives to achieve carbon neutrality within the energy sector by 2030 along with a 25 per cent reduction in annual deforestation and annual degradation. The country will additionally take action to improve reporting in these sectors.

Area of focus on adaptation: Agriculture, health, infrastructure and transport.

Inclusion of DRR: Yes, DRR is an explicit part of the NDC with a focus on vulnerable populations. It includes enhancement of information systems, activities related to floods and cyclones, response to climate extremes, and increased resilience of food and water security, health and well-being in PNG.

National designated entity: Climate Change and Development Authority.

Key stakeholders: Climate Change and Development Authority, Minister of Climate Change, NDC Partnership members.

Other national policies on climate

- The **National Vision for 2050** aims to set 'the overall direction for the country to attain our dream to be a smart, wise, fair, healthy and happy society by 2050', diversifying from the mining industry (Government of PNG, 2009).
- The **Climate Change Management Act** sees the establishment of the Climate Change and Development Authority as well as the bases for the creation of institutions, legal frameworks, and financing to move towards a low carbon economy. This includes the National Climate Change Board, a Screening Committee and the Climate Change and Green Growth Trust Fund (Government of PNG, 2015).

Climate finance

National Societies cannot apply directly for climate finance from the [Green Climate Fund \(GCF\)](#), but they can be an implementing partner for an accredited entity (Climate Centre, 2022a).

National Societies can explore options for accessing climate funds through smaller funds, such as the [GEF's Small Grants Programme](#) or the [FFEM's Small Scale Initiatives Program](#). Other funding from bilateral donors, national climate funds, or multilateral climate funds like the Adaptation Fund, CREWS, or GCCA+ could be explored (Climate Centre, 2022a).

Engaging in national climate adaptation planning is vital for accessing climate finance.

Additional resources

Climate Centre. (2022a). *Fact sheet on climate finance*. Red Cross Red Crescent Climate Centre. <https://www.climatecentre.org/wp-content/uploads/Fact-Sheet-on-Climate-Finance.pdf>

Climate Centre. (2022b). *Entry points for National Societies on climate finance partnerships*. Red Cross Red Crescent Climate Centre. <https://www.climatecentre.org/wp-content/uploads/Entry-Points-for-Climate-Finance-Partnerships.pdf>

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