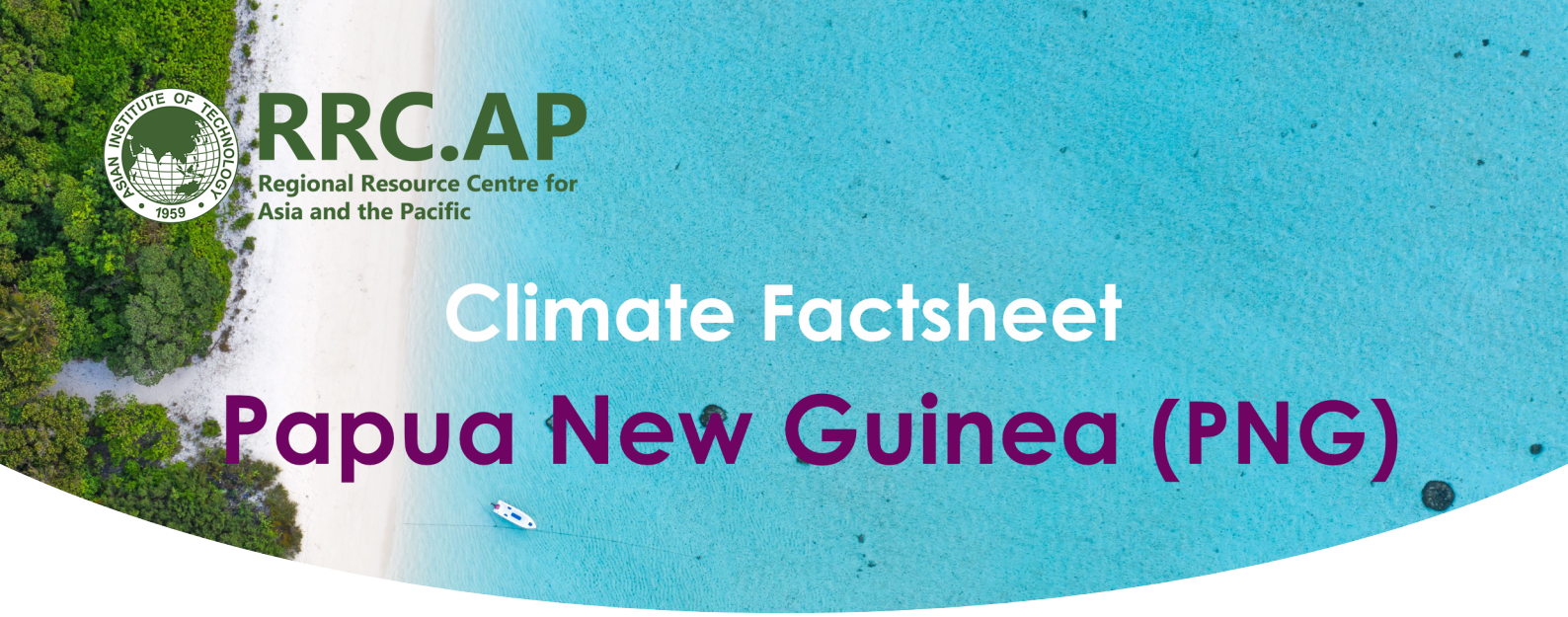

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Climate Factsheet

Papua New Guinea (PNG)

People and Geography

» Papua New Guinea (PNG) is an island country located in the western Pacific and is the largest country of the Pacific island states, with an area of 463,000 km². It occupies the eastern half of the island of New Guinea with three additional islands and over 600 smaller islets and atolls to the north and east.[2,3]

» Papua New Guinea is situated between the stable continental mass of Australia and the deep ocean basin of the Pacific.[4]

» The island nation of PNG lies south of the equator, in the western south Pacific Ocean, between 2 - 12°S latitude and 141 - 156°E longitude.[1,2]

The total population of Papua New Guinea is[5] 8 million

The population of PNG is young and the population growth trajectory alongside the abundance of resources in the country indicate a great opportunity to economically engage with Asia.[22]

» However, the young population is susceptible to limited formal job opportunities, environmental management, political fragmentation, and social exclusion.[22]

The climate of the country is highly influenced and driven by

the El Niño Southern Oscillation (ENSO)

The South Pacific Convergence Zone (SPCZ) also influences the climate to some extent.[1,2]

PNG has a large area of tropical forests, one of the largest remaining in the world, however, these are under threat due to increased logging and agricultural practices.[1]

» The country has an area of 3 million km² of Exclusive Economic Zone (EEZ) containing marine resources, and 2.4 million km² of EEZ containing a zone for fisheries.1PNG has a total of 5,152 km of coastline.[21]

» The coral triangle in PNG is the world's highest marine biodiversity area and contains about 10% of fish species known globally.[1]

» Fallow systems are practices in PNG, which involve cutting and clearing of forests, burning of felled vegetation, and 3-5 years of cultivating the same crops to leave it abandoned for 25 years or longer to let the site regenerate.[1]

» The major crops grown include tuber, fruits, and nuts; however, new crops and varieties such as vegetables, potatoes, rice, and sugar cane have also been introduced.[1]

» Much of PNG's vast and rich biodiversity still needs to be surveyed to close gaps in scientific knowledge.[1]

» Whereas the abundance of natural resources represents great potential for tourism development, the rugged terrain and high costs of infrastructure development limit investments.[1]

» Challenges to economic development include the inability to provide security to Foreign Direct Investments (FDIs), restoring integrity to state institutions, and promoting economic efficiency.[1]

» The mountain chain in PNG extends from the northwest to the southeast, elevations from 4,000 meters peaking the highest at Jaya peak which is 4,884 meters in elevation.[20]

» The COVID-19 crisis is forecasted to harm the country's Gross Domestic Product (GDP) growth, with a 4.2 percentage point decline.[22]

There are two dominant economic sectors in the country:[22]

The majority of the labor force is engaged in agriculture, forestry, and fishing

A major part of GDP is supplemented by exports from minerals and energy extraction

» PNG's Green House Gas (GHG) emissions, both absolute and per capita, are negligible. Despite having minimum emissions, Papua New Guinea aims to mitigate emissions in the land-use change and forestry sectors through reduced deforestation and increased forest conservation.[18]

» PNG intends to transition to 100% renewable energy electricity generation by 2030.[18]

» Subsistence agriculture accounts for 25% of the GDP of the country and is the main support for over 80% of the population through informal economy.[1,23,24]

» The impacts of climate change are expected to adversely affect the country's agricultural activity.[23,24]

» 40% of the population of the country live below the poverty line with an income of less than USD 1.90 per day.[23,24]

1 of 10

most vulnerable countries globally to the impacts of climate change

PNG is ranked among the top 10 most vulnerable countries globally to the impacts of climate change.[25]

Climate

» The country has two distinct seasons, a dry season from May to October, and a wet season from November to April; there is a little variation in annual average maximum and minimum temperatures.[1]

» The tropical cyclone season in the PNG region is between November and April and occurrences outside of this period are rare.[3]

» Year-to-year natural climate variability is high in PNG and explained by the El Niño Southern Oscillation (ENSO).[5]

» There are significant correlations between ENSO indices and both rainfall and air temperature in PNG.[7]

Rainfall

Average rainfall in Kavieng (3150 mm) is much higher than Port Moresby (1190 mm).[9]

» In Port Moresby, the dry season and wet season tend to be cooler during El Niño years and warmer in La Niña years.[6]

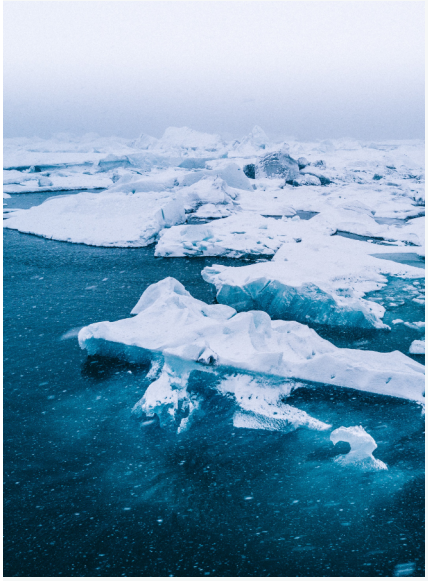
» The seasonal climate varies across the country. In the south (Port Moresby) the west Pacific monsoon is responsible for 78% of the rainfall in the wet season and in the north (Kavieng), rainfall is more consistent year-round due to the influence of the Inter-Tropical Convergence Zone (ITCZ) and, to a lesser extent, the south Pacific convergence zone.[8]

» In Kavieng, during El Niño, wet seasons are wetter and warmer than usual.[9]

» Generally, El Niño years (the warm phase of ENSO) are drier than average while La Niña years (the cool phase of ENSO) are wetter than average.[12]

» In both Port Moresby and Kavieng, the wettest years receive up to three times the amount of rainfall than the driest years.[16]

Global Climate Change



Temperature

» As of 2019, the same year was the second warmest in the 140-year record globally.[28]

» Global land and ocean surface temperature departure were +0.95°C (+1.71°F) above the long-term average11, which is only 0.04°C (0.07°F) less than the record high value of +0.99°C (+1.78°F) set in 2016 and 0.02°C (0.04°F) higher than the now third-highest value set in 2015 (+0.93°C / +1.67°F).[28]

» The five warmest years in the 1880–2019 record have all occurred since 2015, while nine of the 10 warmest years have occurred since 2005.[28]

» The year 2019 marks the 43rd consecutive year (since 1977) with global land and ocean temperatures, at least nominally, above the 20th century average.[28]

Sea Level Rise

» Global mean sea level has risen about 21–24 centimeters (8–9 inches) since 1880, with about a third of that coming in just the last two and a half decades.[11]

» The rising water level is mostly due to a combination of meltwater from glaciers and ice sheets and thermal expansion of seawater as it warms.[11]

» In 2019, the global mean sea level was 87.61 mm centimeters (3.4 inches) above the 1993 average andthe highest annual average in the satellite record (1993-present).[11]

» From 2018 to 2019, global sea levels rose 6.1 mm (0.24 inches).[11]

» The rate of sea-level rise has doubled since 1993 compared to the 20th century average.[11]

Ocean Acidification and Temperature

» Oceans are absorbing about 25% of the carbon dioxide emitted to the atmosphere.[12]

» The world's oceans have absorbed about 93% of the excess heat caused by greenhouse gas-induced warming since the mid-20th century.[13]

» Ocean heat content has increased at all depths.[13]

» Increasing sea surface temperatures, rising sea levels, changing patterns of precipitation and winds, and ocean circulation are contributing to the overall decline in ocean oxygen concentrations.[10]

Regional Climate Change

» Averaged for Oceania, as of 2019, the same year was the warmest year in the region's 140-year record.[11]

» Much warmer than average temperatures occurred in the equatorial western pacific encompassing the geographic area containing PNG.[18]

» In the Pacific region, land-surface temperatures have been rising at the rate of +0.17°C (0.31°F) per decade since the 1980s, slightly ahead of the global trend.[5]

» Warming trends of a similar magnitude are evident in both annual and seasonal mean air temperatures in Port Moresby (1950-2009) with the strongest trend found in the wet season mean air temperature (+0.32° C per decade).[4]

» Ocean temperatures have risen gradually since the 1950s with the rate increasing over time and since the 1970s the rate of warming has been approximately 0.13°C per decade.[3]

Future Climate Projections

» Temperatures in the Pacific are projected to increase between 1.4 and 3.1°C.[7]

» Increased surface air temperature between 1.0—4.17°C in the northern Pacific and 0.99—3.11°C in the southern Pacific by 2070, resulting in increases in sea surface temperature of 1.0—3.0°C.[4]

» Rainfall increases or decreases from -2.7% to +25.8% in the northern Pacific, and -14% to +14.6% in the southern Pacific, worsening floods or droughts; despite large uncertainty surrounding rainfall projections. Future El Niño-related events are likely to drive many of the changes in rainfall while the experience with El Niño may be used as a proxy for considering future changes in climate.[17]

» Surface air temperature and sea-surface temperature are projected to continue to increase (very high confidence).[12]

» Annual and seasonal mean rainfall is projected to increase (high confidence).[2]

» The intensity and frequency of days of extreme heat are projected to increase (very high confidence).[19]

» The intensity and frequency of days of extreme rainfall are projected to increase (high confidence).[3]

PNG is projected to have an increased number of hot days and warm nights, inconsistent droughts, and higher intensity rainfalls.[1]

» It is projected that PNG might likely face a decreased number of tropical cyclones.[1]

PNG is vulnerable to 4 – 15 cm of sea-level rise by 2030, which is expected to lead to greater impacts through storms.[1]

Impacts of Climate Change

» Surface temperatures have increased in PNG.[2]

» Rainfall in PNG has fallen by up to 15% in some reported areas.[2]

» A majority of infrastructure developments and socio-economic activities are in coastal areas and are vulnerable to climate change.[1]

» The main impacts of climate change have been listed as:[1]

- Increased coastal flooding, mainly on the north shores
- Increased inland flooding in valleys and wetlands, both in lowlands and highlands
- Erratic precipitation with increased risks of landslides

- Malaria could become endemic in higher mountain areas which are up till now malaria-free
- Decreased agricultural productivity of important climate-sensitive crops (i.e., sweet potato, coffee, cocoa) due to changes in climate (e.g., temperature and rainfall)
- Coral reef bleaching due to increase in sea surface temperature and acidity

» Extreme weather events will lead to the loss of the country's wetlands, destroy fisheries, pollute clean water sources, and heighten the risk and spread of water-borne diseases.[5]

» Increasing temperatures and persistent droughts hamper agricultural processes at the cornerstone of PNG's economy and the population's livelihood.[8]

» Sea-level rise is affecting the resettlement and relocation of climate refugees.[17]

The Office of Climate Change and Development of PNG has identified following areas in PNG for climate change risk management:[18]

Coastal flooding and sea level rise
Inland flooding
Food insecurity caused by crop failures due to droughts and inland forests
Climate-induced migration
Coral reef damage
Malaria and vector-borne diseases
Water and sanitation
Landslides

» Coastal flooding, inland flooding, and landslides cause damage to life, assets, and infrastructure.[12]

» The average annual rainfall is expected to increase through to 2100 and result in frequent and severe flooding.[23]

» Flooding, both coastal and inland, is the largest climate change risk in PNG and is expected to contaminate freshwater sources, which is likely to further induce the spread of water-borne diseases.[23,24]

Nearly 18% of PNG's
total landmass is permanently inundated or regularly flooded.[24]

» A flood in 2017 swept away more than 150 homes and displaced more than 500 people in the Morobe province.[24]

» The lack of water impoundments and/or water reticulation schemes increase the vulnerability of the largely agrarian communities, and economic centers especially in coastal regions.[28]

Mitigation and Adaptation to Climate Change

» PNG's Climate Change Adaptation Policy aims to build the resilience of people and sectors to the impacts of climate change through the implementation of appropriate adaptation measures and incorporating the use of a risk management approach.[8]

» PNG's Climate Change Mitigation Policy aims to build a climate-resilient and carbon-neutral pathway for climate-compatible development, and to reduce emissions from land-use change and forestry.[10]

» As one of the most underdeveloped regions of the world, the government of PNG launched a 40-year development strategy "PNG Vision 2050" to transform the mindset and attitude to align people, institutions, and systems into an educated, healthy and prosperous society.[18]

The roadmap for "Papua New Guinea Vision 2050"

shifts the country's current emission-intensive growth to a more sustainable pathway and emphasizes mitigation over adaptation.[18,24]

» The PNG Government pioneered the Climate Change Bill in May 2015 in the Pacific region to reduce climate change impacts from infrastructure development.1[8]

» The CO_{2eq} emissions of the nation in 2010 were calculated to be 0.7 tonnes per capita, the estimate likely excluding the indigenous oil and gas production sector which has since been accounted to produce additional emissions.[18]

» Green House Gas (GHG) emissions in PNG in 2014 were estimated to be around 1.4 tonnes CO_{2eq} per capita per year; it should be noted that these estimations are still uncertain.[18]

» Various studies and economic projections suggest that GHG emission levels could increase by 3-4% annually and result in about 8 Mt per year by 2030.[18]

» A Business As Usual (BAU) scenario suggests that emissions could increase to 18 Mt CO_2 per year.[18]

The main areas for mitigation opportunities are[18]

Forestry
Electricity supply
Energy efficiency
Transport sectors

» PNG currently lacks a framework for systematic collection and review of climate information, a central repository on climate-related vulnerabilities, and/or medium to long-term climate scenarios for the country.[24]

» There is no monitoring and evaluation framework in place for adaptation activities to provide feedback capturing best practices and valuable lessons.[24]

» The total net GHG emission of the nation increased from -14,179 Gg CO_{2eq} in 2000 to 15, 193 Gg CO_{2eq} in 2015.[25]

89% of report net emission

are sourced from Agriculture, Forestry, and Other Land Use (AFOLU), and the energy sector combined.[25]

» GHG emissions from PNG's energy sector increased from 5,532 Gg CO_{2eq} in 2000 to 11,806 Gg CO_{2eq} in 2015.[25]

» The Land Use, Land Use Change, and Forestry sector (LULUCF) constitute the biggest GHG emitter in PNG, accounting for net emissions of 1,717 Gg CO_{2eq} in 2015 compared to -21, 636 Gg CO2 eq in 2000, suggesting potential in REDD+ activities for mitigation.[18,25]

» The enhanced Nationally Determined Contribution (NDC) of 2020 targets its actions towards the energy and LULUCF sectors, with opportunities in the transport sector as well.[25]

» The enhanced NDC aims to reduce emissions from the energy sector through:[25]

- Reducing energy demand
- Increasing the levels of renewables in the energy mix
- Establishing a framework for fossil fuel emission offsetting
- Enhancing data collection

» The enhanced NDC aims to reduce emissions from the LULUCF sector by a 25% reduction in the area of forests deforested or degraded annually, and through increased forest tree planting.[25]

The NDC focuses on four development sectors for climate change adaptation:[25]

Agriculture
Health
Infrastructure
Transport

» Through climate change adaptation the National Adaptation Plan (NAP), along with the NDC, aims to achieve:[25]

- 100% of PNG's population benefitting from introduced health measures to respond to malaria and other climate-sensitive diseases
- 6 million people (70% of the population) benefitting from improved early warning information to respond to extreme events
- 10% of the total population (0.8 million beneficiaries (25% are women)) with increased food and water security, access to healthcare, and well-being
- The equivalent of USD 1.7 billion in transport, building, and utility infrastructure and assets built or rehabilitated according to climate-resilient codes and standards

» The PNG Development Strategy 2010-2030 gives directives to advance PNG to a middle-income country by 2030, which also includes strategies for the energy sector to consider environmentally sustainable methods to contribute to PNG's efforts to reduce GHG emissions while simultaneously benefiting from industrial growth through access to renewable energy.[27]

The PNG Development Strategy 2010-2030 also talks about

"investment climate development", and not compromising on the health of the environment.[27]

» Lake Kutuba, the second largest lake in PNG, is a designated Ramsar site for its ecological importance and is also known to be vital to climate change mitigation.[2]

» PNG has a Climate Change Management Act 2015 that outlines and expands on the constitutional requirements, institutional arrangements, climate change board and their duties and responsibilities, the financial management arrangements, and the measuring, reporting and verification processes for climate change adaptation activities.[26]

» Additional documents for further information:

- National Strategy for Responsible Sustainable Development for Papua New Guinea (StaRs, 2014)
- National Climate Compatible Development Management Policy (NCCDMP, 2014)
- National Food Security Policy (2016-2025)
- PNG's Nationally Determined Contributions (NDC, 2016)
- Climate Change (Management) Act
- Initial National Communication (2000)
- Second National Communication (2014)
- Framework for the National Climate Change Strategy and Action Plan (2010)

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