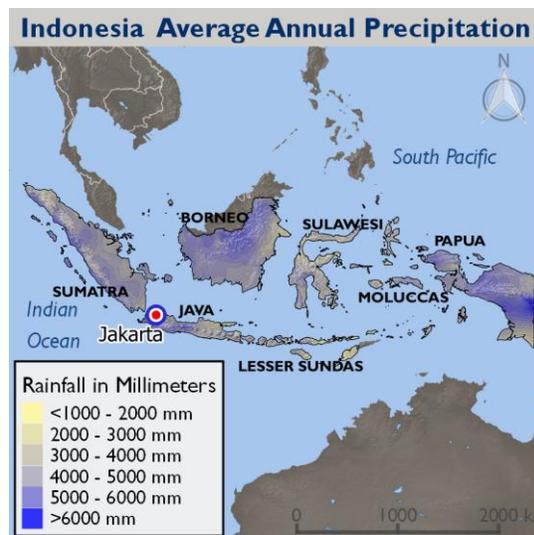




# CLIMATE RISK PROFILE INDONESIA

## COUNTRY OVERVIEW

Indonesia is a vast tropical archipelago with more than 17,000 islands, a population of 257.6 million, and Southeast Asia’s largest economy. Impressive economic growth over the past few decades has reduced the poverty rate to 11 percent, concentrated on the island of Java and in the more remote eastern islands. Climate variability and change increasingly threaten Indonesia’s coastal population and infrastructure, as well as the country’s ecologically and economically important tropical forests and coastal ecosystems. With 81,000 km of coastline and 42 million people living on low-lying land less than 10 meters above sea level, Indonesia is among the world’s most vulnerable countries to sea level rise. Rising seas are projected to submerge 2,000 of the country’s smaller islands by mid-century, and 5.9 million people annually are estimated to be affected by coastal flooding by 2100. High urbanization rates (projected to reach 68 percent by 2025) have led to dense, unplanned settlements in coastal areas susceptible to flooding and landslides. Indonesia is vulnerable to other weather-related disasters such as forest and land fires, landslides, storms and drought that have destroyed infrastructure and degraded forest and coastal ecosystems, leading to loss of life, property, ecosystem services and livelihoods. For example, heavy rainfall in January 2013 inundated Jakarta, causing \$550 million in loss and damage. (7, 9, 15, 18, 23, 25)



## CLIMATE PROJECTIONS



0.8–2.0°C increase in temperature by 2050



Increased frequency and intensity of heavy rainfall events



150–450 mm rise in sea levels by 2056

## KEY CLIMATE IMPACTS

### Agriculture



Reduced rice productivity  
Increased damage to crops from flooding, drought and salinization

### Water



Reduced water supplies  
Decreased water quality  
Increased salinization of coastal aquifers

### Human Health



Increased mortalities and displacement from floods and landslides  
Increased incidence of vector- and waterborne diseases

### Coasts and Fisheries



Reefs and mangroves destroyed/damaged  
Increased erosion of coastlines  
Decreased marine fish populations

### Forests and Biodiversity



Increased risk of forest fires  
New or expanded range of pests  
Loss of habitat for endemic and/or endangered species

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## CLIMATE SUMMARY

Indonesia is tropical; its climate zones are primarily differentiated by rainfall levels, ranging from 1800–3200 mm in the lowlands to 6000 mm in some high mountain areas. Temperature varies little by season and only slightly by elevation – average annual temperature ranges from 23°C in high mountainous areas to 28°C on the coastal plains. Climate is strongly influenced by the El Niño Southern Oscillation, which brings warmer, drier weather in El Niño years and colder, wetter weather in La Niña years. Indonesia’s three main climate regions are: 1) South Central Region – monsoon rainfall with a distinct dry season (June–Sept) and a wet season (Nov–March); 2) Northwest Region – more consistent rainfall, with peaks in April and October; and 3) Maluku and northern Sulawesi – a localized rainfall pattern with higher annual rainfall, a wet season (April–Sept) and a less severe dry season (Oct–March). (4, 5, 7, 11, 12, 17)

### HISTORICAL CLIMATE

Historical climate trends include:

- Increased temperature of 0.04°C per decade (1985–2015).
- Increased frequency of days (+88 days) and nights (+95) considered “hot” since 1960, especially July–September.
- Decreased average annual precipitation of 3 percent every 30 years (1901–2013), but a reverse trend of a 12 percent increase from 1985–2015; greatest decreases in the dry season and greatest increases in the north.
- Sea level rise of 2–10 mm per year (1993–2012).
- Decreased extent of tropical Papua glaciers by 78 percent from 1936 to 2006.

### FUTURE CLIMATE

Projected climate changes by 2050 include:

- Increased temperature of 0.8–2.0°C, with greater warming over large western islands (i.e., Sumatra, Java, Borneo).
- Increased duration of heat waves.
- Projections for rainfall differ, but point to increased rainfall during the wet season.
- Slight increase in duration of dry spells (+ 2 days).
- Increased frequency (3–23 percent) and intensity (2–7 percent) of heavy rainfall events.
- Sea level rise of 150–450 mm by 2056.
- Disappearance of Papua glaciers.

## SECTOR IMPACTS AND VULNERABILITIES

### AGRICULTURE

Increased flooding, drought, sea level rise and heat stress threaten Indonesian agriculture, particularly its staple crop of rice, which comprises about half of calories consumed nationally. Agriculture accounts for nearly 14 percent of GDP and the livelihoods of 42 percent of the working population, including more than half of poor households. Flooding and drought already impact agriculture; from 2003–2008 flooding damaged 15 percent of cultivated rice lands and drought damaged 17 percent, leading to economic losses of \$671.2 million for producers. Sea level rise is expected to negatively impact rice and maize cultivation through inundation and salinization (already common in low-lying agricultural land such as in Indramayu District in West Java). In some rural coastal districts of Java, inundation is expected to reduce rice production by 95 percent. Overall, climate change impacts could reduce the value of agricultural production by 10 percent by 2050. Rice is particularly sensitive to changes in temperature; an increase of 1°C could reduce rice production by

Climate Stressors and Climate Risks	
AGRICULTURE	
Stressors	Risks
Increased temperatures	Reduced rice production due to heat stress
	Increase in crop pests and diseases, such as bacterial leaf blight in rice due to heat and humidity
Increased heavy rainfall events	Increased flood damage to cultivated land from heavy rainfall
Sea level rise	Increased salinization and inundation of cultivated land
Increased drought/dry conditions	Increased crop loss and failure due to drought, particularly for rainfed agriculture

10–25 percent countrywide. Rice experiences heat stress during key growth stages, and warming temperatures are likely to change pest and disease dynamics, including expansion of the rice bacterial leaf blight. Drying and drought are a concern for areas highly reliant on rainfed agriculture. (2, 5, 6, 8, 10, 18, 19, 25)

## WATER RESOURCES

Indonesia generally has an abundance of water resources (mainly from surface resources), but shortages are common during the dry season due to the country's limited capacity to store water. Increased dry spells and reduced rainfall in some regions are likely to increase the risk of drought and exacerbate water shortages during the dry season. In 2015, the government declared 20 of the country's 34 provinces under severe drought. This led to socioeconomic impacts such as those in Timor Tengah Selatan, where 13 percent of households switched to unimproved water sources and 39 percent reported walking longer distances to access water. Water quality steadily declined over the last decade due to poor management; Indonesia has 2 of the top 10 most polluted sites in the world – the Citarum River in West Java and the rivers in Kalimantan. Increases in heavy rainfall will likely

## COASTAL RESOURCES AND FISHERIES

Indonesia is home to the world's largest mangrove forest and the largest and most biodiverse coral reef area in Southeast Asia, providing habitat for 90 percent of the country's coastal fishing catch and livelihoods for millions of Indonesians. Warming ocean waters, particularly during El Niño events, directly threaten coral reefs through coral bleaching. Bleaching in 2016, for example, led to mortality in 30 percent of reefs in Bunaken National Marine Park, Sulawesi. Reef mortality continued into 2017 during the world's most damaging bleaching event to date. Mangroves are also sensitive to changing sea temperatures and are under threat of submersion by sea level rise. Loss of reefs and mangroves, which protect coasts by buffering against strong waves, will accelerate erosion of coastlines (40 percent of Indonesia's coasts already experience erosion). Fisheries, already suffering from overfishing, will be

## FORESTS AND BIODIVERSITY

Indonesia has the largest rainforest in Asia, with an estimated 94 million ha of forest cover, and the world's largest tropical peatlands (lands that support unique biodiversity and significant carbon and water storage). Increased dry conditions, particularly in the south, are likely to increase the risk of forest and peatland fires, which destroy habitat, pollute watersheds, reduce biodiversity and increase air pollution. In 2015, forest fires cost the country more than \$16 billion in losses. Warming temperatures increase the risk of forest pests and diseases. Forest loss and degradation in turn drive loss of critical

### Climate Stressors and Climate Risks WATER RESOURCES

Stressors	Risks
Increased temperatures	Reduced water supplies for domestic consumption and agriculture, particularly during the dry season
Increased dry conditions	Decreased water quality due to flooding
Increased heavy rainfall events	Increased salinization of coastal groundwater and freshwater sources
Sea level rise	

exacerbate water quality problems as flooding overwhelms drainage systems and washes pollutants into water systems. Saltwater intrusion is already occurring in areas of heavy groundwater extraction (e.g., Jakarta) and sea level rise will likely exacerbate salinization of coastal groundwater and freshwater resources. (1, 2, 6, 9, 17)

### Climate Stressors and Climate Risks COASTAL RESOURCES AND FISHERIES

Stressors	Risks
Warming ocean temperatures	Increased coral bleaching and degradation/loss of mangroves
	Decreased marine biodiversity and fish populations
	Increased rate of coastal erosion
Sea level rise	Decreased productivity of aquaculture such as seaweed, milkfish and shrimp
	Decreased viability of fishing livelihoods

directly impacted by increased ocean temperatures, which induce species to shift to cooler waters. Research suggests a 23 percent decline in catch potential by 2055 (baseline 2005) would severely diminish a critical part of the Indonesian income base and diet (fish is the primary source of protein nationally). (3, 5, 13, 18, 20, 21)

### Climate Stressors and Climate Risks FORESTS AND BIODIVERSITY

Stressors	Risks
Increased temperatures	Increased frequency and extent of forest fires
	Increased risk of pests and disease
Increased dry conditions	Decreased biodiversity (including endangered species) and viability of forest-dependent livelihoods

habitat for endangered species, such as Sumatran tigers, Javan rhinos and Bornean orangutans, along with numerous endemic species. (3, 7, 22, 24, 25)

## HUMAN HEALTH

Projected increases in heavy rainfall events will lead to a higher incidence of flooding and landslides, increasing the risk of human injury and death in Indonesia. Flooding is already a deadly natural disaster; from 1980 to 2014 flooding killed an average of 210 people per year, and severe flooding in 2013 affected 590,000 people countrywide. Indonesia is highly susceptible to landslides – 188 occurred in 2014 alone, leaving 171 dead. Rising temperatures increase the risk of heat-related mortality, expected to increase from less than 1 per 100,000 to up to 25 per 100,000 by 2050. Increased overall rainfall combined with warming is likely to increase transmission of dengue (by 9.5 percent) and malaria (by 52.5 percent) by mid-century, with the greatest increases projected in Java, Sulawesi, Nusa Tenggara, Maluku and Papua. Flooding also diminishes water quality, increasing the risk of

## POLICY CONTEXT

### INSTITUTIONAL FRAMEWORK

Indonesia is addressing climate change through presidential commitments and legislation. The National Medium Term Development Plan for 2015–2019 identifies a green economy as the foundation for the country's development program, including focus on increasing climate resilience. The Directorate General of Climate Change in the Ministry of Environment and Forestry coordinates climate change policies and international positions. The National Development Planning Agency (BAPPENAS) mainstreamed climate change into national planning through the Climate Change Sectoral Roadmap. A Climate Change Trust (ICCTF), established in 2010, is facilitating financing.

## Climate Stressors and Climate Risks HUMAN HEALTH

Stressors	Risks
Increased heavy rainfall	Increased flood- and landslide-related mortalities
Increased temperatures	Increased incidence of waterborne diseases such as diarrhea, typhoid and cholera
Increased dry conditions	Increased incidence of vector-borne diseases such as malaria
	Increased heat-related mortality
Sea level rise	Increased risk of food insecurity

diarrhea and typhoid (two of the largest causes of under-five mortality), as well as cholera. Disruptions in food production due to climate impact (such as the 2015–2016 drought that left more than 1.2 million in need of food aid) could exacerbate already high malnutrition rates; 36 percent of children under five are stunted. (1, 2, 7, 14, 16, 21, 22, 24)

### NATIONAL STRATEGIES AND PLANS

- [Law on Ratification of Paris Agreement and Nationally Determined Contribution](#) (2016)
- [Guidance on Climate Change Adaptation Action](#) (2016) issued by the Ministry of Environment and Forestry for implementation of climate action by the central and local government
- [National Adaptation Action Plan on Climate Change](#) (RAN-API) (2012), a precursor to a National Adaptation Plan
- [Initial](#) (1999) and [Second](#) (2011) National Communications to the UNFCCC; a Third National Communication is under development
- [Climate Change Sectoral Roadmap](#) (2009)

### KEY RESOURCES

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## SELECTED ONGOING EXPERIENCES

Selected Program	Amount	Donor	Year	Implementer
<a href="#">Adaptasi Perubahan Iklim dan Ketangguhan (APIK)</a>	\$19 million	USAID	2015 – ongoing	DAI
<a href="#">Coral Reef Rehabilitation and Management Program - Coral Triangle Initiative (COREMAP-CTI)</a>	\$60 million	WB	2014–2019	Ministry of Marine Affairs and Fisheries
<a href="#">LESTARI</a>	\$47 million	USAID	2015–2020	Tetra Tech ARD
<a href="#">Jakarta Urgent Flood Mitigation Project</a>	\$190 million	WB	2012–2017	Government of Indonesia, Government of Jakarta
<a href="#">U.S. Coral Triangle Initiative</a>	Not listed	USAID	2007–ongoing	Tetra Tech ARD, U.S. Department of Interior, NOAA and WWF
<a href="#">Biodiversity and Climate Change</a>	\$5.2 million	Germany's International Climate Initiative	2012–2017	GIZ, Ministry of Environment and Forestry
<a href="#">Building a Marine Protected Area Network Covering the Lesser Sunda Islands Ecoregion</a>	€2.9 million	Germany's International Climate Initiative	2013–2017	The Nature Conservancy
<a href="#">Sustainable management of agricultural research and technology dissemination (SMARTD)</a>	\$47.4 million	World Bank	2012–2019	Indonesian Agency for Agricultural Research and Dissemination (IAARD)
<a href="#">Climate Services Supporting Adaptation in the Indonesian Food Crops System</a>	Not listed	USAID	2012–ongoing	Engility/International Resources Group, Indonesia Agency for Meteorology (BMKG), Indonesia Agency for Handling Disasters (BNPB)
<a href="#">Strategic Planning and Action to Strengthen Climate Resilience of Rural Communities in Nusa Tenggara Timor province (SPARC)</a>	\$5.1 million	Special Climate Change Fund (SCCF)	2012–ongoing	Indonesia Regional Body for Planning and Development (BAPPEDA), Ministry of Environment, UNDP
<a href="#">Third National Communication to the United Nations Framework Convention on Climate Change</a>	\$4.5 million	Global Environment Facility (GEF5)	2014–ongoing	UNDP, Ministry of Environment
<a href="#">Indonesian Forest and Climate Support Project (IFACS)</a>	\$40 million	USAID	2010–2015	Tetra Tech ARD
<a href="#">Indonesia Marine and Climate Support (IMACS)</a>	\$22 million	USAID	2010–2015	Chemonics, Ministry of Marine Affairs and Fisheries
<a href="#">Adapting to Climate Change in Eastern Indonesia</a>	Not listed	USAID	2010–2013	World Neighbors working with local NGOs and CBOs