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Regional Resource Centre for Asia and the Pacific

Climate Factsheet
Indonesia

People and Geography

» Indonesia is the largest archipelago in the world with over 17,000 islands stretching more than 5000 km over the equator.[1]

» The country covers an area of 790 million hectares with 81,000 km long coastline including the land territory of about 720 million hectares.[9]

» Indonesia has five large islands (Sumatra, Java, Kalimantan, Sulawesi, and Irian Jaya).[9]

Population of the Indonesia is

270.6 million

Indonesia is the fourth most populous country in the world with a total population of 270.6 million.[8]

» The majority of the population lives in low-lying coastal areas making Indonesia one of the most vulnerable countries to sea level rise.[1,2,7]

» Rapid unplanned urbanization and high population density in coastal cities increase vulnerability to floods and landslides.[1,2]

» Indonesia is also vulnerable to weather-related disasters like forest fires, land fires, storms, and droughts.[1]

» Indonesia is the largest economy in southeast Asia.[1]

» The 11% poverty rate of the country is mainly concentrated on the island of Java and other eastern islands.[1]

» The main focus of the government is to reduce the poverty rate of the country.[7]

» The impacts of climate change are expected to cost Indonesia an estimated 2.5 – 7% of its Gross Domestic Product (GDP) by 2100.[2]

The livelihoods of the people of Indonesia depend on the production of agricultural products including[2]

- Rice
- Cassava
- Palm oil
- Cocoa
- Sweet potatoes
- Soybean

» Indonesia is heavily dependent on rice production for food security.[2]

» Unpredictable rainfall, increased temperature, saltwater intrusion, and shorter growing seasons are expected to exacerbate food security and water availability in the country.[2]

» Out of 200 million ha of land territory, about 50 million ha are used for various agricultural activities according to Badan Pusat Statistik (BPS).[9]

» The agricultural sector contributes 14% to the country's GDP and accounts for 42% of the working population.[2]

» 17.9% of the total agricultural productivity per unit area in Indonesia is estimated to decrease by 2080.[2]

» 60% of the total population lives within 50 km of the shoreline, spread across 42 cities and 182 districts.[9]

» Indonesia ranked as the 10th highest Green House Gasses (GHGs) contributor to global GHG emissions in 2013.[2]

» Indonesia ranks 98th out of 181 countries based on per capita GHG emissions.[2]

» The GHG emissions from land-use change and forestry contributed 65.5% of the country's total GHG emissions in 2013.[2]

» Jakarta, the capital city of Indonesia, tops the list of the most vulnerable cities in southeast Asia with major floods recorded in 1960, 1996, 2007, 2013, and 2020.[3]

» Central Jakarta, western and southern Sumatra, and western and eastern Java are mainly vulnerable to climate change (primarily to flooding).[3]

» Indonesia ranks 12th out of 35 countries to face high mortality risks; 40% of the Indonesian population is exposed to risk due to multiple hazards such as landslides, droughts, earthquakes, tsunamis, and floods.[2]

105 out of 181 Countries

Indonesia ranks 105th out of 181 countries based on vulnerability to climate change.[2]

» Indonesia ranks as the 74th least ready country in terms of readiness to climate change adaptation.[2]

Climate

» Indonesia is generally dominated by a tropical rainforest climate as the temperature of the country remains almost constant throughout the year - 28ºC in coastal plains, 26ºC in mountainous areas, and 23ºC in higher mountains.[1,2]

» The average relative humidity of the country ranges between 70-90%.[5]

Rainfall

in the country varies spatially, temporally, and with elevation. In lowlands, rainfall averages between **1800 and 3200mm.**[1,2]

» Rainfall increases with an increase in elevation with some mountain areas receiving up to 6000mm rainfall.[2]

» The monsoon circulation patterns have annual and semi-annual cycles that influence the country's rainfall in most areas.[3]

» The wet season starts in November up to April with rainfall peaking in January and February.[2]

» The dry season starts in May and ends in October with July, August, and September being the driest months.[2]

» Indonesia has three main climate regions:

› The south central region follows a monsoon rainfall pattern with a dry season from June to September and a wet season from November to March following a monsoon rainfall pattern.[1]

› The northwest region receives consistent rain fall with a peak in April and October.[1]

› The Maluku and northern Sulawesi follow a localized rainfall pattern with a wet season from April to September and a less severe dry season from October to March.[1]

» The El Niño and La Niña greatly determine and influence the weather in Indonesia as El Niño years are warmer and drier while La Niña years are colder and wetter.[1,3]

» While El Niño has been associated with drought events, La Niña is not associated with floods.[3]

» The Indian Ocean dipole also has its influence over the inter-annual rainfall variation of the country during the wet season.[3]

» Positive dipole mode is expected to decrease rainfall while negative dipole mode is associated with the opposite.[3]

» Severe droughts could result if and when the phenomenon of El Nino and positive dipole moment coincide.[3]

» The meteorological disturbances caused due to such phenomena are termed “Intra-Seasonal Variation (ISV)” and studies have shown that ISV can trigger extreme meteorological events in the country.[3]

» Convective cloud activity determines the variation in the daily weather pattern, especially in the afternoon and evening on land, and over the ocean at night until morning.[3]

» While each atmospheric oscillation period has seen to lasts between 10-12 years, more explanations are still being sought to identify the relationships of such phenomenon with rainfall.[3]

» Climatic conditions over the Indonesian oceans have also been proven to be influenced by the Asia-Australia monsoon circulation.[3]

» Based on historical data:

› The temperature in Indonesia has increased by 0.04ºC per decade between the years 1985-2015.[1,2]

› The increase in surface temperature during the 20th century was seen to be 1.0ºC.[3]

› Local temperatures in urban spaces were seen to be influenced by the urban heat island effect.[3]

› The number of hot days has increased in frequency by +88 days and hot nights by +95 days since 1960, the number of hot days and hot nights were especially noted in July, August and September.[1,2]

› The average annual precipitation has decreased by 3% every 30 years between 1901-2013 and this decrease was found to be greatest in the dry season.[1]

› However, a 12% increase in average annual precipitation was seen between the years 1985-2015.[1]

› 2-10 mm/year sea-level rise was noted between the years 1993-2012.[1]

› The glaciers in the Papua region were noted to have decreased by 78% between 1936-2006.[1]

» Variations in precipitation trends have been reported by many studies with each season and each months.[3]

» Rainfall was noted to increase significantly in January by about 100mm in the 1970s than the 1990s, which decreased again in the 2000s after which the February rainfall was noted to increase.[3]

» Precipitation has shown an increasing trend in March and December for areas like Sulawesi, Borneo, and Sumatra.[3]

» Precipitation has shown a decreasing trend in the months July through October. This was observed in Papua and Sumatra.[3]

» Precipitation was seen to increase in all Java and eastern Indonesia during December, January, and February.[3]

» Rainfall was noted to be in a downward trend during the months June, July, and August, except in areas like Western Java, South Sulawesi, Papua, and Moluccas.[3] Overall, trends in precipitation varied spatially.

Sea Surface Temperature (SST)

SST was seen to increase at the rate of 0.7ºC per century which is slightly higher compared to the global average and tropic average.[3]

» SST in the Pacific Ocean is noted to be higher than the Indian Ocean with the highest SST noted in the north of Papua island.[3]

» SST of Java, Banda, and Arafura Seas is relatively higher than that compared to the South China Sea.[3]

» SST reaches above 28ºC in January and below 27ºC in August.[3]

» SST is also influenced by ocean currents and the vertical upward and downward motion of sea water.[3]

» The sea level rises in January and decreases in August.[3]

» The sea level was also seen to decrease with El Niño and increase with La Niña events due to the trade winds in the Pacific Ocean.[3]

» Decadal variation in Sea Level Rise (SLR) was also observed between 1860 to 2010.[3]

» SLR was noted to increase by 7mm/year since 1993.[3]

87% of the disasters in Indonesia were noted to be hydro-meteorological in nature.[3]

Global Climate Change

» The global average surface temperature in 2019 was recorded to be 1.1°C above pre-industrial average.[18]

» The global annual temperature has increased by 0.07°C per decade since 1880.[18]

» The global average carbon dioxide concentration in the atmosphere reached an all-time high of 415 ppm in 2019 which is very high as compared to the annual average of 280 ppm in the 1700s.[17]

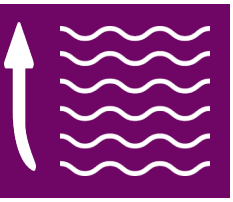
» Between 1880-2019, the five warmest years occurred since 2015.[18]

» As of 2019, the same year was the second warmest year on record.[18]

» As of June 2020, the sea ice extent average was recorded at 10.58 million sq. km. declining at a rate of 64,300 sq. km. per day which is 20% faster than the average recorded between 1981-2010.[19]

» In 2014, the global sea-level rise was noted to increase by 2.6 inches than the average recorded in 1993.[20]

Sea level rise has been noted to continue **rising by 1/8th of an inch per year.**[20]



» 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.[23]

» 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.[23]

» In 2019, the global mean sea level was 87.61 mm (3.4 inches) above the 1993 average the highest annual average in the satellite record (1993-present).[23]

» From 2018 to 2019, the global sea level rose 6.1 mm (0.24 inches).[23]

» The rate of sea level rise has doubled since 1993 compared to the 20th century average.[23]

Regional Climate Change

» As of 2019, Asia experienced its third-warmest year on record with temperatures 1.68°C above the 1910–2000 average.[18]

» The minimum and maximum temperatures in the southeast Asia region have been observed to increase and are projected to increase.[4]

2.4 - 4.5°C

South Asia and southeast Asia are projected to experience **increased warming of 2.4 – 4.5°C** compared to other regions in Asia.[4]

» The Pacific region is projected to face a 2-3 °C rise in temperature by 2100.[4]

» Change in precipitation trends has been varied. Projections by climate models also give varying precipitation patterns both in intensity and frequency, spatially and seasonally.[4]

» Annual rainfall is projected to decline in southeast Asia.[4]

Extreme events

Extreme events such as tropical storms, heat extremes, floods, storm surges, and tropical cyclones are projected to increase both in intensity and frequency.[4]

» Sea level rise is expected to increase by 1-3mm/ year in southeast Asia. Along with it, saltwater intrusion is also going to make the region vulnerable.[4]

Future Climate Projections

Surface Temperature

- Until 2030, the surface temperature is projected to increase in a uniform linear trend in all three scenarios B1, A1B, and A2.[3]
- Until 2050, the average surface temperature is projected to rise by 0.8º-1ºC compared to the 20th century.[3]
- The large western islands (Sumatra, Java, Borneo) are expected to face greater warming.[1,2]
- The temperature is projected to increase at a rate of 0.2-0.3ºC/decade up to 2100.[5]

Precipitation

- The climate models project varied precipitation patterns, both temporally and spatially, for Indonesia.[3]
- The annual rainfall is projected to increase both in intensity and frequency at the national level except in the southern regions by 2100.[1,2,5]
- Large variations in the seasonal precipitation are expected and the unpredictability of rainfall has increased.[2,5]
- Based on historical data, the climate models have shown a significant trend in precipitation change up to 2020, however, the climate models did not show any significant changes between 2020-2050.[3]
- The precipitation is projected to increase during the wet season for the islands of Java and Nusa Tenggara while the exact opposite is projected for other islands.[1,3]
- The annual rainfall have decreased by 2-3% since 1990.[5]
- Southern parts of the country have noted an increase in the average rainfall in the wet season, but the total annual rainfall has decreased.[5]
- By 2100, the region is projected to face a 15% decline in rainfall and a delay of up to 30 days in the wet season.[2,5]
- By 2050, the probability of the 30-day delay in the onset of the wet season is high and expected to increase significantly by 30-40%.[2]
- By 2050, rainfall is projected to increase by 10% in the months April through June2. However, the months July through September might face decreased rainfall by 10-25% (could peak up to 75%).[2]

Area	Rainfall Projection
Eastern-most islands	15% increased rainfall by 2090
Borneo	10-30% increased rainfall by 2080
Southern islands (Java, Bali, Nusa Tenggara)	5-15% decreased rainfall (mainly in the dry season) by 2100; delayed rainfall; wetter wet seasons and drier dry seasons
Sumatra	Varying projections; decrease in the length of the rainy season

Sea Surface Temperature and Sea Surface Height

» The sea surface temperature is projected to increase by 1-1.2ºC by 2050 compared to 2000 SST.[3]

» The influence of El Nino and Indian Ocean dipole mode is expected to bring varying changes to the Indonesian waters.[3]

Year	Sea Level Rise
2030	SLR is projected to reach 22.5cm (±1.5cm).[3]
2050	SLR is projected to increase by 35-40 cm relative to 2000.[3]
2080	SLR is projected to reach 60cm (±4.0cm).[3]
2100	SLR might reach a maximum of 175 cm.[3]

» As Indonesia has the longest coastline in the world, those living on land less than 10 meters above sea level are highly vulnerable.[2,5]

» 405,000 hectares of land is expected to be inundated in the case of a 1-meter increase in SLR[2,5], particularly in areas of northern Java, eastern Sumatra, and southern Sulawesi.[2]

» According to projections, sea levels in Indonesia are increasing by 5mm every year[2] and could rise by 27.5-40cm by 2050, and 60-80cm by 2100 compared to the sea level in 2000.[5]

» 2,000 of the country's smaller islands are vulnerable to immersion due to sea-level rise by 2050, placing 5.9 million people at risk of coastal flooding by 2100.[1]

» A 50 cm sea-level rise could completely immerse Jakarta underwater permanently.

Extreme Weather and Climatic Events

» Based on historical data, no significant change in trend has been noted for heatwaves and no change in trend is projected until 2050.[3]

» The duration of these heat waves is projected to increase by 2050.[1]

» An increasing trend has been noted for extreme weather events.[2]

» Recent data report that droughts now occur every 3 years.[2]

» Jakarta, Medan, and Bandung are urban areas that have already faced extreme hydro-meteorological events like floods, landslides, and mudslides.[5]

» Studies have been unable to project the possible intensity and frequency of future events.[5]

» Southern regions of the country are expected to face extreme events such as droughts and floods that are especially expected to aggravate during El Niño and La Niña events respectively.[2]

» Tropical cyclones are projected to increase in intensity but decrease in frequency.[2]

Glacier Melting

» The glaciers in Papua are projected to disappear by 2050.[1]

Impacts of Climate Change

Food Security

» South Sumatra and Lampung, East Kalimantan, and Papua have reported food deficit due to climate change.[2]

» A food deficit of 90 million tons of husked rice due to increased temperature is estimated by 2050.[2]

» The increase in temperature is also going to increase the number of crop pests and diseases.[1,2,4]

» The number of cold nights during the rice plantation season is projected to decrease which in turn is going to significantly affect the production of rice.[2]

» Intense rainfall will provide a challenge in preserving crops and seeds.[2] Severe flood events are a great risk to food production.[2,4]

» Sea level rise and increase in sea surface temperature will result in decreased availability of fish for consumption and it will also result in disruption of prawn farming.[2,6]

» Change in the distribution of marine species will make it difficult to catch fishes.[6]

» It is expected that Indonesia will face the highest decline in marine fish stocks by 23% between 2005 and 2055.[2]

» The growing aquaculture sector in the country is not expected to be able to make up for this loss due to declined marine fish stocks.[1,2]

» The production of rice is bound to decrease by 4% every year resulting in a total loss of 16.5% between the years 2000 and 2080.[2]

» Each 1ºC increase in temperature is expected to negatively affect the rice quality and could also result in yield loss of 10-25% of the total production.[1,2]

» Sea level rise of 60 cm will greatly reduce rice yield by 300,000 tons due to inundation in Java.[2,6]

» Coastal districts of Java are also expected to face decreased rice production by 95%.[1,2]

» A 30-day delay of the wet season might also prevent farmers from planting two consequent rice crops.[2]

» Production of consumption crops such as fruits, maize, oil palm, coconut, cassava, and vegetables are also projected to decline.[2,5]

» Maize and wheat yields are expected to decline by 50% and 36.3% respectively by 2080.[2]

Water Availability and Water Quality

» Bali and east Nusa Tenggara are already facing challenges in water availability due to climate change.[2]

» Dry spells and decrease in rainfall are going to increase drought risk, aggravating water shortage situations during the dry season.[1]

» Saltwater intrusion is a major issue aggravated due to sea-level rise and extensive groundwater extraction in coastal areas, especially in Jakarta. Due to this reason, the availability of freshwater is projected to decline.[1,2,5,6]

» The reduced flow of river water due to climate change is also expected to affect the amount of freshwater available, which in turn might promote saltwater intrusion.[2]

» During the dry season, rainfall is projected to decline, and evapotranspiration rates are expected to be high, which will result in limited water availability.[2]

» Decreased rainfall will lead to a lack of water recharge in soil/surface water/groundwater that could, in turn, result in a lack of drinking water and irrigation water.[2]

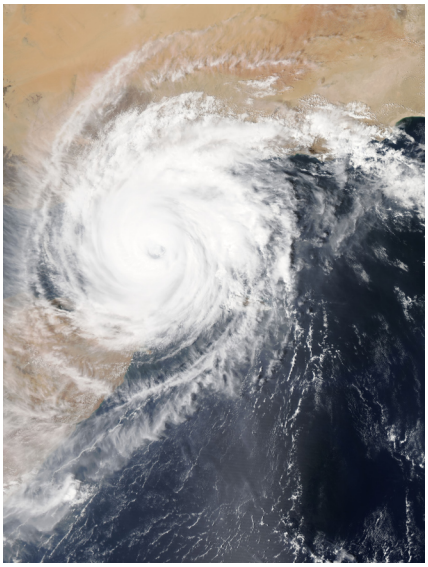
» During the rainy season, rainfall is projected to increase.[1,2]

» Lack of water storage mechanisms will not allow balancing the water availability for the dry season.[1,2]

» Heavy rainfall is likely to negatively alter the quality of water as drainage systems and water systems are expected to be overwhelmed.[1]

» Decreased water availability will also affect the availability of water for urban and agricultural areas.[3,6]

» The Java and Bali region produces 55% of the total rice produced in the country and are at high risk of declined water availability.[2,6]



Extreme Weather Events

» While intense rainfall can result in flooding and landslides, decreased rainfall might result in drought and decreased water availability as well.[3]

» Unpredictable rain decreased the duration of rainfall, and increased unpredictability of rainfall increases the risk of crop failure.[1,2]

» The increase in intensity and frequency of drought events will greatly affect food production, especially in the southern regions of the country.[1,2]

» Between 2003-2008, 15% of the cultivated rice lands were damaged due to flooding and 17% due to droughts, which resulted in an economic loss of $671.2 million.[1]

» Extreme weather events will also impact human settlements and infrastructure, including energy, transport, and communication systems.[3,4]

» Retention areas, coastal cities, riverbanks, and low-lying areas around water bodies are at high risk of flooding.[6]

» Areas such as central-southern Java-Bali, western-central Sumatra, most of Nusa Tenggara; Sulawesi, and central part of Papua, are at a high risk of landslide.[6]

Human Health

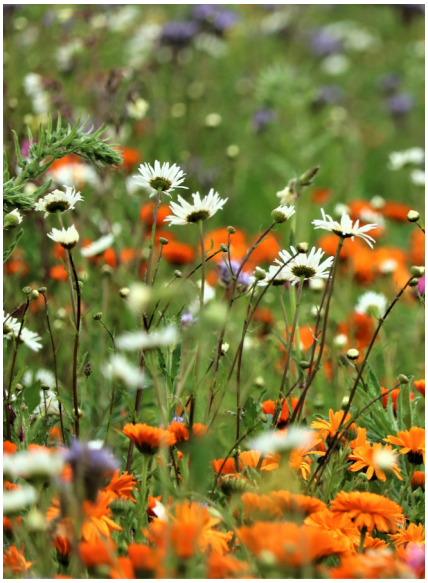
» Decreased food security, lack of food nutrients, lack of water availability, and increase in pests and diseases can all impact human health indirectly.[2]

» Extreme weather events and increased temperature can directly impact human health in the form of heat stroke and mortality due to extreme weather events.[1,4]

» Compromised water (contaminated with saltwater) has negative implications on human health.[5]

» An alteration in parameters such as temperature, rainfall, humidity, and weather events have resulted in an increased risk of malaria, dengue, typhoid, and diarrhea.[1,6]

» Papua, Maluku, Sulawesi, and Nusa Tenggara are at a high risk of malaria; eastern Indonesia, Papua New Guinea and Nusa Tenggara are at moderate to high risk to dengue fever; Papua New Guinea, Sumatra, Borneo, Sulawesi, and Nusa Tenggara are at high risk to diarrhoea.[6]



Biodiversity

» Increased temperature is expected to result in increased evapotranspiration in plants and forests. Accompanied by a decrease in rainfall, there is an increased risk of forest fires.[3,6]

Year	Area burned (hectares)
2015	2.6 million
2013	163,000
1997-1998	2-5 million

Figure 1: Area burned in forest fires (Data source: Edwards, 2020)

» Increased temperature is also expected to result in greater and faster breeding of insects.[3]

» Extreme weather events can damage and destroy areas rich in biodiversity - coral reefs, mangroves, forests.[4]

» Indonesia is home to the most biodiverse coral reef in southeast Asia.[1] Coral reefs are also vulnerable to coral bleaching due to the increased sea surface temperature and change in ocean currents.[1,3,6]

» Change in ocean currents, along with increased ocean temperature, is also expected to alter the migration patterns of fish in the sea to cooler waters.[1,3,6]

» By 2055, the catch potential could decrease by 23%.[1]

» Decreased catch potential makes the livelihood of fishermen more vulnerable.[3,6]

» Indonesia is also home to the biggest Mangroves which are also sensitive to the increase in sea temperature and sea level rise.[1]

» Indonesia has lost more than 800,000 hectares of Mangroves in 30 years.[17]

» Coral reefs studied in Indonesia showed that increased sea surface temperature led to an increased percentage of dead corals.[15]

» The coral reefs in Nusa Penida lost 14% of its coral reefs between 2012 and 2016.[15]

» Loss of Mangroves and coral reefs due to strong ocean currents can aggravate coastline erosion.[1]

» Indonesia is also home to the largest rainforest and tropical peatlands in Asia which supports unique biodiversity and are crucial in mitigating emissions through carbon storage.[1]

» As these crucial biodiversity face increased risk of forest and peatland fire, endangered species, their habitats, and biodiversity are bound to be destroyed resulting in economic loss.[1,5]

» Forest fires in 2015 lead to an economic loss of $16 billion.[1,14]

Economic Loss and Vulnerable Groups

» The economic losses due to direct and indirect impacts of climate change are estimated to reach 2.5% of the GDP of Indonesia by 2100 which is four times greater than the average global GDP loss due to climate change.[3]

» According to studies by the World Bank and Asian Development Bank (ADB), this amount could reach up to 7% if the chances of disaster due to climate change are considered.[3]

» The increased temperature during the day is expected to result in an increase in the use of air conditioners and thus, energy consumption.[3]

- The coastal population which makes up 70% of the country's total population is especially exposed to the risks of seawater inundation, saltwater intrusion, and coastal erosion due to sea level rise.[3,6]
- Small scale farmers are the most vulnerable among the country's population due to their dependence on natural resources, limited access to advanced technologies, and limited alternative livelihood options.[2,3]
- The poor population is expected to be the most vulnerable to climate change due to decreased capacity to adapt to the impacts of climate change.[2,21]
- The rural population, which makes up 45% of the country's population, has limited access to advanced climate smart-technologies and finance which decreases their adaptive capacity to climate change.[2]
- Increased food price is also expected to greatly affect the poor.[2]
- The islands of Java, Bali, and Sumatra are exposed to increased climate risk due to non-climatic factors such as demographics, geography, and infrastructure.[3,6,9]
- The island of Java houses 2/3rd of the country's poor with decreased adaptive capacity.[2]
- SLR is expected to affect those groups of people that are dependent on fish and prawns for their livelihood, especially in the Krawang and Subang districts.[21]
- 60% of the people of the country live in coastal areas that are low-lying and thus, exposed to sea level rise.[21]

Gender

- Women in Indonesia face unequal economic rights, access to credit, wages, work benefits, and ownership and inheritance of physical assets.[22]
- The extent of women's participation in the Indonesian labor force and income levels are unequal to men's.[22]

Mitigation and Adaptation to Climate Change

Table1: Indonesia's GHG emissions (Data Source: NDC)

Year	National GHG Emission	Difference from the baseline (2000)	Source of GHG	
2005	1.8 GtCO2e	+0.4 GtCO2e	63%	Land Use Change and Forestry, Peat fire, Forest Fire
			19%	Fossil Fuel Combustion
2012	1.453 GtCO2e	+0.452 GtCO2e	47.8%	LUCF, Peat fire, Forest Fire
			34.9%	Energy

» Indonesia is the fourth largest GHG emitter.[10,13]

» To stay under the 2º C maximum threshold of the Paris Agreement, Indonesia has made two pledges:

- To reduce emissions by 26% (independently) and 41% (international support) against the Business As Usual (BAU) scenario by 2020.[7]
- To reduce emissions by 29% (independently) and 41% (international support) against the BAU scenario by 2030.[7,13]

» According to projections based on the BAU scenario, the country's emissions is are expected to reach 2868 GtCO2e in 2030.[7]

» The GHG inventory was published as a part of a policy instrument alongside the Nationally Determined Contributions (NDC).[7]

Poverty line

An estimate of **11%** of Indonesia's population lives below the poverty line. Therefore, promoting economic development to reduce the poverty rate to below 4% by 2025[7] is a key focus of the Government of Indonesia.[7]

» According to the National Development Planning Agency, between 2007-2014, a total of USD 17.48 billion was spent on activities related to climate change mitigation and adaptation.[7]

55.01 billion

Between 2015-2019, a total of USD 55.01 billion was allocated for climate change activities.[7]

» Indonesia acknowledges the importance of highlighting best practices and aims to scale up traditional knowledge and innovation.[7]

» The 2015-2020 period was planned to provide an enabling environment for post-2020 climate targets that are dedicated to ensuring an easy transition towards a low-carbon future and more ambitious goals.[7]

» The Directorate General serves as the national focal point to the UNFCCC and facilitates programmes implemented by various government ministries and stakeholders.[7]

Transparency Framework

» Indonesia has established an Integrated National Transparency Framework, under which the following are included:[7]

- National Registry System (NRS) for mitigation and adaptation
- National GHGs Inventory System (SIGN-SMART);
- Monitoring, Reporting, and Verification (MRV) system
- Safeguards Information System for REDD+ (SIS-REDD+)
- Information Systems on Vulnerability (SIDIK)
- Joint Adaptation and Mitigation at the Village Level (PROKLIM)

Mitigation

» The National Medium-Term Development Plan for 2020-2024 is expected to fully integrate the de-carbonization of the economy.[7]

» Indonesia is considering studying the peak time of national GHG emissions.[7]

Land Use Sector

» The Government of Indonesia instituted a moratorium on the prohibition of clearing of primary forests and conversion of the remaining forests through reduced deforestation and degradation, restoration of ecosystems, and sustainable forest management.[7]

» The Government also calls for the management of forests through the practice of social forestry that requires the active involvement of the Small and Medium Enterprises (SMEs), private sector, civil society organizations, women, local communities, and the indigenous communities in the planning and implementation stages.[7]

» To ensure better benefits from the landscape-scale and ecosystem management approach, the Government has emphasized the role of national jurisdictions as critical.[7]

» A major component of the NDC document and target is the REDD+ program from the land-use sector. The Government of Indonesia submitted a Forest Reference Emission Level (FREL) to the UNFCCC secretariat in December 2015. The FREL used a reference period of 1990-2012 and covered deforestation, forest degradation, and peat decomposition. It will be used as the benchmark for emissions between 2013-2020 to evaluate the REDD+ performance. The FREL was set at 0.568 Gt of CO2e/yr.[7]

» Policies relevant to the Agriculture, Forestry, and Other Land Use (AFOLU) sector:[7,13]

- National Forestry Plan 2011-2030 (RKTN)
- Indonesian Oil Palm Industry toward 100 years (GAPKI),
- The Roadmap of Indonesia's Forest Business Association (APHI) 2050
- Strategic Plan for Plantation/estate crops
- Introduction Study on RPJMN 2015-2019 (BAPPENAS, 2013)

» Other policies relevant to mitigation in AFOLU sector:[13]

- The Electricity Supply Business Plan (RUPTL) from PT PLN (Persero)
- Government Regulation No.79 Year 2014 on National Energy Policy
- Presidential Regulation No. 1 Year 2016 on Peat Restoration Agency
- Presidential Instruction No. 6 Year 2017 on Forest Moratorium
- Presidential Decree No. 16 Year 2015 on Ministry of Environment and Forestry
- National Medium-Term Development Plan (RPJMN)
- Presidential Regulation of the Republic of Indonesia No. 61 Year 2011 on The National Action Plan for Greenhouse Gas Emissions Reductions (RAN-GRK)

Energy Sector

» Indonesia has a mixed energy use policy.[7]

» As a national policy directive, it has established the development of clean energy sources.[7]

» The National Energy Policy has set two time periods (2025 and 2050) as targets until which they aim to transform their primary energy supply mix as follows:[7]

23% of new and renewable energy share in 2025, 31% in 2050
25% reduced oil share in 2025, 20% less in 2050
A minimum of 30% coal in 2025, 25% in 2050
A minimum of 22% gas in 2025, 24% in 2050

- Policies relevant to the energy sector:
  - NationalEnergyPolicy(KEN)2014
  - Electricity Supply Business Plan (RUPTL) 2016-2025
  - National Energy Plan (RUEN) 2016.

Waste Management Sector

- The Indonesian Government has committed to reducing emissions from the waste management sector.[7]
- A comprehensive strategy is set to be developed to achieve better institutional and policy capacity at the local level.[7]
- Urban waste and wastes in landfills are managed better and utilized for energy production through the promotion of the 3Rs – Reduce, Reuse, Recycle.[7]
- Policies relevant to the waste management sector:[7]
  - Act No. 18 (2008) Solid Waste Management
  - Government Regulation No. 81 (2012) Management of Domestic Solid Waste.

Adaptation

- The framework provided by the RAN-API (Indonesia's National Action Plan on Climate Change Adaptation) has been mainstreamed into the country's National Development Plan.[3,7]
- The national policy documents prepared to address climate change impacts are as follows:[3]
  - National Action Plan for Climate Change Adaptation
  - Indonesia Climate Change Sectoral Road Map
  - Sectoral Adaptation Plans by the Ministries/Institutions
  - Strategic Document for mainstreaming adaptation in national development planning
- By 2030, the mid-term goal of the country's adaptation strategy is to reduce the risks that development sectors face.[7]
- The studies for Risk Assessment and Adaptation to Climate Change (KRAPI) concludes that potential risks have increased over the years for development sectors.[3]
- To strengthen institutional capacity, improve adaptation information systems, and promulgate climate change sensitive policies and regulations by 2020, the Government of Indonesia has mapped the regional vulnerabilities of the country.[7]
- The pre-2020 policies were aimed to facilitate an easy transition towards implementing the NDC targets. They are listed as follows:[7]

- SIDIK / Vulnerability Index Data Information System: This nationwide climate vulnerability index data information system allows the public to access information in the system website. (http:/ditjenppi.menlhk.go.id)
- Ministerial Regulation No. P.33/2016: Guideline for the development of National Adaptation Plan
- National Action Plan on Climate Change Adaptation formulated in 2014

» Other policies related to environment and socioeconomic areas:

- Law No. 37/2014 on soil and water conservation for sustainable agriculture and land use[7]
- Government Regulation No. 37/2012 on watershed management for enhanced watershed carrying capacity[7]
- Community-Based Forest Management to improve community income and reduce deforestation and forest degradation[7]
- PROKLIM (Joint Adaptation and Mitigation/JAM): A bottom-up approach for climate resilience programme at the local level to curb emissions both pre and post 2020[3][7]

» The National Medium-Term Development Plan is a national commitment that aims to lead the country to a low carbon and climate change-resilient development pathway.[7]

Institutional Mechanism

» Climate change policies and international positions are coordinated by the Directorate General of Climate Change in the Ministry of Environment and Forestry.[3]

» To facilitate financing for climate change actions, a climate change trust was established in 2010.[3]

Implementation Mechanism

» To facilitate coordination among ministries, institutions, and relevant stakeholders, the decree of the Minister of Planning/Head of Bappenas No. Kep.38/M.PPN / HK/03/2012 was issued to establish the climate change management coordination team which consists of six work groups.[3]

» As the impacts of climate change are felt at the local scale, action plans and strategies are based on local conditions at the local level.[3]

» The RAN-API acts as a guide for the provincial government to plan and implement a strategic action plan for climate change adaptation at the provincial level by coordinating with the Ministry of the Interior and relevant technical offices following the local development priorities and the regional budget.[3]

Adaptation Funding Mechanism

» The State budget provides the internal funding for RAN-API and is its main funding source for implementation. Funding is also sourced from the regional budget (APBD), Indonesia Climate Change Trust Fund (ICCTF), private investment, and Corporate Social Responsibility (CSR).[3]

» Funding from international sources is also widely used, mainly in the form of capacity building and pilot project financing.[3]

» The issue of funding through state budget mechanisms has been prioritized in the medium-term plans.[3]

Monitoring, Evaluation, Review, and Reporting Mechanisms

» The process of monitoring and evaluation (M&E) of RAN-API is considered necessary to ensure that the set targets and adaptation goals are achieved.[3]

» The relevant Ministries/Institutions conduct M&E periodically and report it to the Ministry of National Development Planning/Head of Bappenas who will then conduct the integrated evaluation process and periodic review according to the latest global development.[3]

Disaster Risk Reduction (DRR)

» The RAN-API also connects the National Action Plan (RAN) and Regional Action Plan (RAD) for Disaster Risk Reduction for those disasters that are caused or are associated with climate change.[3]

» Under the Hyogo Framework that Indonesia adopted in 2005, disaster risk reduction and climate change adaptation has been incorporated into the national development system.[3,12]

» The country also aims to develop its early warning systems and ramp up disaster preparedness programs as a part of social and livelihood resilience.[7]

Challenges to Adaptation

» The key climate change adaptation challenges identified for Indonesia include the following:[5]

Issues related to lack of data and information
Research gaps
Need for additional climate information that can be easily integrated into decision-making
Need for more regional vulnerability assessments
Need for capacity building; especially in integrating climate information into programming
Early warning system for DRR

REDD+

» Indonesia's REDD+ aims to be able to support the achievement of Indonesia's GHG emission reduction target (decreasing 29 - 41% GHG emissions by 2030) in the forestry sector.[7,13]

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Appendix

Special Report on Emissions Scenarios (SRES):

A1	Rapid economic growth; New and efficient technologies; Population peaks and then declines
A2	Heterogenous world; focus on local issues with less international coordinated approaches; Continually increasing global population; regionally oriented economic development; slow technological growth
B1	Sustainable economic growth; Clean and efficient technologies; Population peaks and then declines; Coordinated approaches with global support
B2	Intermediate economic development; Continually increasing global population but at a lower rate than A2; focus on local issues with less international coordinated approaches; less rapid and diverse technological growth

Figure 2: SRES (Data source: *IPCC, 2000*)

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