INDONESIA'S ADAPTATION COMMUNICATION

A report to the United Nations Framework Convention on Climate Change

October 2022

Indonesia's Adaptation Communication

This Adaptation Communication (ADCOM) for Indonesia is submitted to the United Nations Framework Convention on Climate Change (UNFCCC) by the Ministry of Environment and Forestry of Indonesia, as the national focal point for climate change in Indonesia. This document contains priorities, implementation and support needs, and adaptation planning and action in Indonesia.

This publication (and any materials included) should be attributed as: Adaptation Communication, Directorate General of Climate Change, Ministry of Environment and Forestry, Republic of Indonesia, October 2022.

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REMARKS

Indonesia, as the largest archipelagic country in the world, is one of the most vulnerable countries to the adverse impacts of climate change. The impacts have disrupted the balance of various fields, such as increasing disaster risk, health and ecosystem disturbances, as well as food, water, and energy instability which resulted in potential economic losses and contributed to the decline in the National GDP. The United Nations Framework Convention on Climate Change (UNFCCC) recognizes adaptation as a critical option that countries should commit to minimize the adverse impacts of climate change.

The Adaptation Communication (ADCOM) which is established by Article 7, paragraphs 10 and 11, of the Paris Agreement requires Parties to submit and update the document periodically based on the progress and target in the country. This will enable the increase in visibility and profile of adaptation alongside its balance with mitigation, strengthen adaptation action and support for developing countries, provide input to the global stock take, assess progress made in achieving the Global Goal on Adaptation (GGA) and enhance learning and understanding of adaptation needs and actions.

Indonesia's ADCOM has been developed by stakeholder involvement and participation. Related information on climate change adaptation gathered from relevant stakeholders, i.e., ministries and agencies, sub-national governments, private sector, academia, civil society organizations, non-governmental organizations (NGOs), and development partners, are included into this ADCOM. Indonesia’s ADCOM is developed by thorough consideration of the country’s policies, plans and programs related to climate change adaptation.

Indonesia’s ADCOM as the first adaptation communication document to be prepared and submitted, already captured adaptation priorities, strategies, policies, plans and goals refers to the enhanced NDC and its roadmap. The ADCOM identified gaps, priorities, needs and financial mechanisms to implement climate change adaptation in the country.

I would like to thank all stakeholders who have contributed in the preparation of this document. Hopefully this document will be a reference for the stakeholders to work together with the government to address the impacts of climate change.

Jakarta, October 2022

Siti Nurbaya

Minister of Environment and Forestry (MoEF)

FOREWORD

The enhanced NDC (2022) document has been submitted to update the update NDC (2021) as a state commitment in responding to climate change. The Indonesia's first Adaptation Communication (ADCOM) takes responsibility for what has been implemented and what has been achieved on adaptation action with regards to the targets on economic, social and livelihood, and ecosystem and landscape resilience. The ADCOM also informs existing gaps and needs that should be addressed moving forwards.

This ADCOM is prepared to provide the country's information on adaptation priorities, strategies, policies, plans, goals, and actions which are committed as the guidance for enhancing climate change adaptation in Indonesia. The document provides the current adaptation progress, results, and efforts to communicate the support needs and opportunities. This ADCOM also explores the barriers, challenges, and gaps in the planning of further commitments and more ambitious actions that ensure climate-resilient sustainable development across sectors and contexts at multiple levels.

While significant progress and results continue to be made, the country still needs much more efforts and supports to respond to the adverse impacts of climate change. There is a need for more proactive and coordinated adaptation actions which refers to commitments on NDC. Proper planning and funding requirements to support adaptation efforts on a long-term basis remain a challenge that needs to be addressed to assure the sustenance of current momentum to reduce vulnerability levels and to build adaptive capacity and resilience of the country in managing the climate change risks.

Finally, I would like to thank you for the participation and cooperation of various stakeholders so that the ADCOM document can be well-structured. Hopefully this document provides source of information on the progress of country's commitments in responding to the impacts of climate change through policy directions and climate change adaptation strategies. Thus, the target of NDC can be materialized and achieved.

Jakarta, October 2022

Ir. Laksmi Dhewanthi, M.A. IPU

Director General of Climate Change/ National Focal Point of UNFCCC

ACRONYMS AND ABBREVIATIONS

ADB	Asian Development Bank
AF	Adaptation Fund
AFOLU	Agriculture, Forestry, and Other Land Use
AMAN	*Aliansi Masyarakat Adat Nusantara* Indigenous Peoples Alliance of the Archipelago
APBN	*Anggaran Pendapatan dan Belanja Nasional* Nasional Revenue and Expenditure Budget
ARI	Acute Respiratory Infections
ASEAN	Association of Southeast Asian Nations
ATENSI-LU	*Asistensi Rehabilitasi Sosial Lanjut Usia* Elderly Social Rehabilitation Assistance
BAU	Business as Usual
BIG	*Badan Informasi Geospasial* Geospatial Information Agency
BMKG	*Badan Meteorologi, Klimatologi, dan Geofisika* Meteorological, Climatological, and Geophysical Agency
BNPB	*Badan Nasional Penanggulangan Bencana* National Disaster Management Agency
BPDLH	*Badan Pengelola Dana Lingkungan Hidup* Environmental Fund Agency
BpfA	Beijing Declaration and Platform for Action
BPS	*Badan Pusat Statistik* Central Statistics Agency
BRGM	*Badan Restorasi Gambut dan Mangrove* Mangrove and Peatland Restoration Agency
BRIGE	Building Resilience through the Integration of Gender and Empowerment
BRIN	*Badan Riset dan Inovasi Nasional* National Research and Innovation Agency
BRWA	*Badan Registrasi Wilayah Adat* Registration Agency for Customary Territory
CCH	Climate Change Hotspot
CEDAW	Convention on the Elimination of All Forms of Discrimination Against Women
COP	Conference of the Parties
CRPD	Convention on the Rights of Persons with Disabilities
CSA	Climate Smart Agriculture
CSO	Civil Society Organization
CSR	Corporate Social Responsibility
DESTANA	*Desa Tangguh Bencana* Disaster Resilient Village
DFI	Development Finance Institution
DIBI	*Data Informasi Bencana Indonesia* Indonesian Disaster Information Data
DJF	December-January-February
DRPPA	*Desa ramah Perempuan dan Peduli Anak*

	Women Friendly and Child Care Villages
DRR	Disaster Risk Reduction
DTKS	*Data Terpadu Kesejahteraan Sosial* Social Welfare Integrated Data
EbA	Ecosystem based Adaptation
EBT	*Energi Baru Terbarukan* New and Renewable Energy
EFT	Environmentally Friendly Technologies
ENSO	El-Nino Southern Oscillation
ETF	Enhanced Transparency Framework
EWS	Early Warning Systems
FAO	Food and Agriculture Organization
GCF	Green Climate Fund
GCRI	Global Climate Risk Index
GDI	Gender Development Index
GDP	Gross Domestic Product
GEF	Global Environment Facility
GERILYA	*Gerakan Inisiatif Listrik Tenaga Surya* Solar Initiative Movement
GERMAS	*Gerakan Masyarakat Hidup Sehat* Healthy Living Community Movement
GESI	Gender Equality and Social Inclusion
GHG	Green House Gas
GII	Gender Inequality Index
GoI	Government of Indonesia
HDI	Human Development Index
HDR	Human Development Report
ICCSR	Indonesia Climate Change Sectoral Roadmap
IDR	Indonesian Rupiah
IFAD	International Fund for Agricultural Development
IKEG	*Indeks Kualitas Ekosistem Gambut* Peat Ecosystem Quality Index
IKLH	*Indeks Kualitas Lingkungan Hidup* Environmental Quality Index
IKTL	*Indeks Kualitas Tutupan Lahan* Land Cover Quality Index
IKU	*Indeks Kualitas Udara* Air Quality Index
INC	Initial National Communication
INFORM	Index for Risk Management
IOD	Indian Ocean Dipole
IPCC	Intergovernmental Panel on Climate Change
JPODI	*Jaringan Pegiat dan Organisasi Disabilitas Indonesia* Indonesian Disability Activists and Organizations Network
KATAM	*Kalender Tanam* Integrated Planting Calendar
KLA	*Kota Layak Anak* Child-Friendly Cities
KPA	*Kawasan Pelestarian Alam* Nature Conservation Areas
KPPIP	*Komite Percepatan Penyediaan Infrastruktur Prioritas* Committee for the Acceleration of Priority Infrastructure Provision
KSA	*Kawasan Suaka Alam*

	Nature Reserve Areas
KSP	*Kantor Staf Presiden* Office of the Presidential Staff
KWT	*Kelompok Wanita Tani* Women Farmers Group
LTS-LCCR	Long-Term Strategy for Low Carbon and Climate Resilience
MEMR	Ministry of Energy and Mineral Resources
MJO	Madden-Julian Oscillation
MNDP	Ministry of National Development Planning
MoA	Ministry of Agriculture
MoEF	Ministry of Environment and Forestry
MoF	Ministry of Finance
MoH	Ministry of Health
MoHA	Ministry of Home Affairs
MoMAF	Ministry of Marine Affairs and Fisheries
MoSA	Ministry of Social Affairs
MoT	Ministry of Trade
MoVDDRT	Ministry of Village, Development of Disadvantaged Regions, and Transmigration
MoWECP	Ministry of Women Empowerment and Child Protection
MPWH	Ministry for Public Works and Human Settlements
MRV	Monitoring, Reporting, and Evaluation
NDC	Nationally Determined Contribution
ND-GAIN	Notre Dame Global Adaptation Initiative
NEK	*Nilai Ekonomi Karbon* Carbon Pricing
NFP	National Focal Point
NGO	Non-Governmental Organization
NSPC	Norms, Standards, Procedures and Criteria
ODP	Office of Disability Programmes
PANTURA	*Pantai Utara Jawa* Northern Coastal Area
PBI	*Pembangunan Berketahanan Iklim* Climate Resilience Development
PHBS	*Pola Hidup Bersih dan Sehat* Clean and Healthy Lifestyle
PKK	*Pemberdayaan dan Kesejahteraan Keluarga* Empowerment and Family Welfare
PN	*Prioritas Nasional* National Priority
PODES	*Potensi Desa* Village Potential
POKJA	*Kelompok Kerja* working group
POSYANDU	*Pos Pelayanan Terpadu* Integrated Health Post
PoU	Prevalence of Undernourishment
PPP	Public-Private Partnerships
ProKlim	*Program Kampung Iklim* Climate Village Program
PUG	*Pengarusutamaan Gender* gender mainstreaming
PwD	Persons with Disabilities
RAN API	*Rencana Aksi Nasional Adaptasi Perubahan Iklim*

	National Action Plan for Climate Change Adaptation
REDD+	Reducing Emissions from Deforestation and Forest Degradation
RIPB	*Rencana Induk Penanggulangan Bencana*
	Master Plan for Disaster Management
RPJMN	*Rencana Pembangunan Jangka Menengah Nasional*
	National Mid-Term Development Plan
SBS	*Stop Buang Air Sembarangan*
	prohibit open defecation
SC	Steering Committee
SDG	Sustainable Development Goals
SFDRR	Sendai Framework for Disaster Risk Reduction
SIDIK	*Sistem Informasi Data Indeks Kerentanan*
	Climate Change Vulnerability Index and Data Information System
SNC	Second National Communication
SRN-PPI	*Sistem Registri Nasional Pengendalian Perubahan Iklim*
	National Registry System for Climate Change
STBM	*Sanitasi Total Berbasis Masyarakat*
	Community-Based Total Sanitation
SUSENAS	*Survei Sosial Ekonomi Nasional*
	National Socio-Economic Survey
TNC	Third National Communication
TSBD	*Tim Siaga Bencana Desa*
	Village Disaster Preparedness Team
TSBK	*Tim Siaga Bencana Kabupaten*
	District Disaster Preparedness Team
UNCBD	United Nations Convention of Biological Diversity
UNCCD	United Nations Convention to Combat Desertification
UNDESA	United Nations Department of Economic and Social Affairs
UNDP	United Nations Development Programme
UNDRIP	United Nations Declaration on the Rights of Indigenous People
UNFCCC	United Nations Framework Convention on Climate Change
UNICEF	United Nations Children's Fund
USD	United States dollar
WEF	World Economic Forum
WFP	World food Programme
WHO	World Health Organization

GLOSSARY

Climate change	:	Climate change refers to a change in the state of the *climate* that can be identified (e.g., by using statistical tests) by changes in the mean and/or the variability of its properties and that persists for an extended period, typically decades or longer. Note that the *Framework Convention on Climate Change (UNFCCC)*, in its Article 1, defines climate change as: 'a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods.' The UNFCCC thus makes a distinction between climate change attributable to human activities altering the atmospheric composition and climate variability attributable to natural causes (IPCC SR15 Global Warming of 1.5 ºC).
Climate change adaptation	:	In *human systems*, the process of adjustment to actual or expected *climate* and its effects, to moderate harm or exploit beneficial opportunities. In natural systems, the process of adjustment to actual climate and its effects; human intervention may facilitate adjustment to expected climate and its effects (IPCC SR15 Global Warming of 1.5 ºC).
Climate change hotspot	:	Areas characterized by high vulnerability and responsive climate conditions to climate change.
Climate change impact	:	Losses or benefits due to climate change in a form that can be measured or calculated directly, either physically, socially, or economically.
Climate scenario	:	Representations of future climatic conditions based on the outputs of climate models built to study the consequences of anthropogenic effects of climate change and are often used as inputs for climate impact models.
Extreme weather events	:	An extreme weather event is an event that is rare at a particular place and time of year. Definitions of rare vary, but an extreme weather event would normally be as rare as or rarer than the 10th or 90th percentile of a probability density function estimated from observations. By definition, the characteristics of what is called extreme weather may vary from place to place in an absolute sense. When a pattern of extreme weather persists for some time, such as a season, it may be classed as an extreme climate event, especially if it yields an average or total that is itself extreme (e.g., drought or heavy rainfall over a season) (IPCC SR15 Global Warming of 1.5 ºC).
Gini Ratio Index	:	A statistical measure of economic inequality in a population.
Hydro-meteorological disasters	:	A process or phenomenon of atmospheric, hydrological or oceanographic nature that may cause loss of life, injury or other health impacts, property damage, loss of livelihoods and services, social and economic disruption, or environmental damage. Hydrometeorological disasters include: floods, debris and mud floods, tropical cyclones, storm surges, thunder/hailstorms, rain and wind storms, blizzards and other severe storms; drought, desertification, wildland fires, temperature

		extremes, sand or dust storms, permafrost, and snow or ice avalanches. Hydrometeorological disasters can be single, sequential, or combined in their origin and effects.
Program Kampung Iklim (PROKLIM)	:	A nationwide programme managed by the Ministry of Environment and Forestry in order to increase the involvement of the community and other stakeholders to strengthen adaptation capacity to the impacts of climate change and reduce greenhouse gas emissions as well as to provide recognition for climate change adaptation and mitigation efforts that can improve welfare at the local level in accordance with regional conditions.
Resilience	:	The capacity of social, economic, and environmental systems to cope with a hazardous event or trend or disturbance, responding or reorganizing in ways that maintain their essential function, identity, and structure while also maintaining the capacity for adaptation, learning, and transformation (Arctic Council) (adapted from IPCC SR15 Global Warming of 1.5 ºC).
Risk	:	The potential for adverse consequences for human or ecological systems, recognizing the diversity of values and objectives associated with such systems (IPCC SR15 Global Warming of 1.5 ºC)". The International Strategy for Disaster Reduction (UNISDR) defines risk as: "The potential loss of life, injury, or destroyed or damaged assets which could occur to a system, society, or a community in a specific period of time, determined probabilistically as a function of hazard, exposure, vulnerability, and capacity.
Roadmap	:	Guidelines in carrying out the preparation and evaluation of the implementation of climate change adaptation programmes, policies and activities in an effort to achieve Indonesia's NDC.
Sustainable development	:	Development that meets the needs of the present without compromising the ability of future generations to meet their needs.
Sustainability	:	A dynamic process that guarantees the persistence of natural and human systems in an equitable manner (IPCC SR15 Global Warming of 1.5 ºC).
Trend	:	A series of track records of a condition (e.g., weather and climate, economy, and number of disease events) in the form of a graph with a tendency to point up (uptrend) or down (downtrend).
Vulnerability	:	The propensity or predisposition to be adversely affected. Vulnerability encompasses a variety of concepts and elements including sensitivity or susceptibility to harm and lack of capacity to cope and adapt (IPCC SR15 Global Warming of 1.5 ºC).

CONTENTS

FIGURE

TABLE

National Circumstances, Institutional Arrangements, and Legal Frameworks

Context • Commitment • Policies • Authorities

1. National Circumstances, Institutional Arrangements, and Legal Frameworks

1.1 Indonesian Context

Indonesia is the largest archipelagic country in the world consisting of approximately 16,766 islands including the five main Islands of Sumatra, Java, Kalimantan, Sulawesi, and Papua [1]. The total area of Indonesia is about 1.9 million km^2. Indonesia is also known as the second mega-biodiversity country in the world after Brazil. Indonesia is a pluralistic country in one unitary state. As Indonesia's motto is Bhinneka Tunggal Ika, it is diverse but still one. Indonesia's pluralism can be seen in the diversity of ethnic groups, languages, religions, and customs. According to statistical data [2], there are about 1,300 ethnic groups in Indonesia. The Javanese are the largest ethnic group, with a total population of 95.2 million people, or more than 40% of Indonesia's population. There are 2,500 regional languages spoken in Indonesia, this number exceeds the number of ethnic groups in Indonesia [2]. Indonesia is also known as a country rich in spices and all kinds of food. In fact, several Indonesian culinary delights are considered UNESCO world cultural heritage. Various natural beauties such as mountains, volcanoes, coral reefs, tropical forests, protected areas, coastlines, and glaciers can be seen in Indonesia. Details of Indonesia's context are available in Figure 1.

> *"Climate change is recognised as one of the most complex, multi-faceted, and severe threats to humanity. Guided by the common but differentiated responsibilities and respective capability principle of the UNFCCC Convention, the actual response to the climate challenge is determined by the ability of individual countries to adapt or build resilience to a changing climate, while contributing to the global greenhouse gas mitigation effort as indicated through Parties'"*
>
> **President Joko Widodo**
> *In the foreword of LTS-LCCR 2050 of Indonesia*

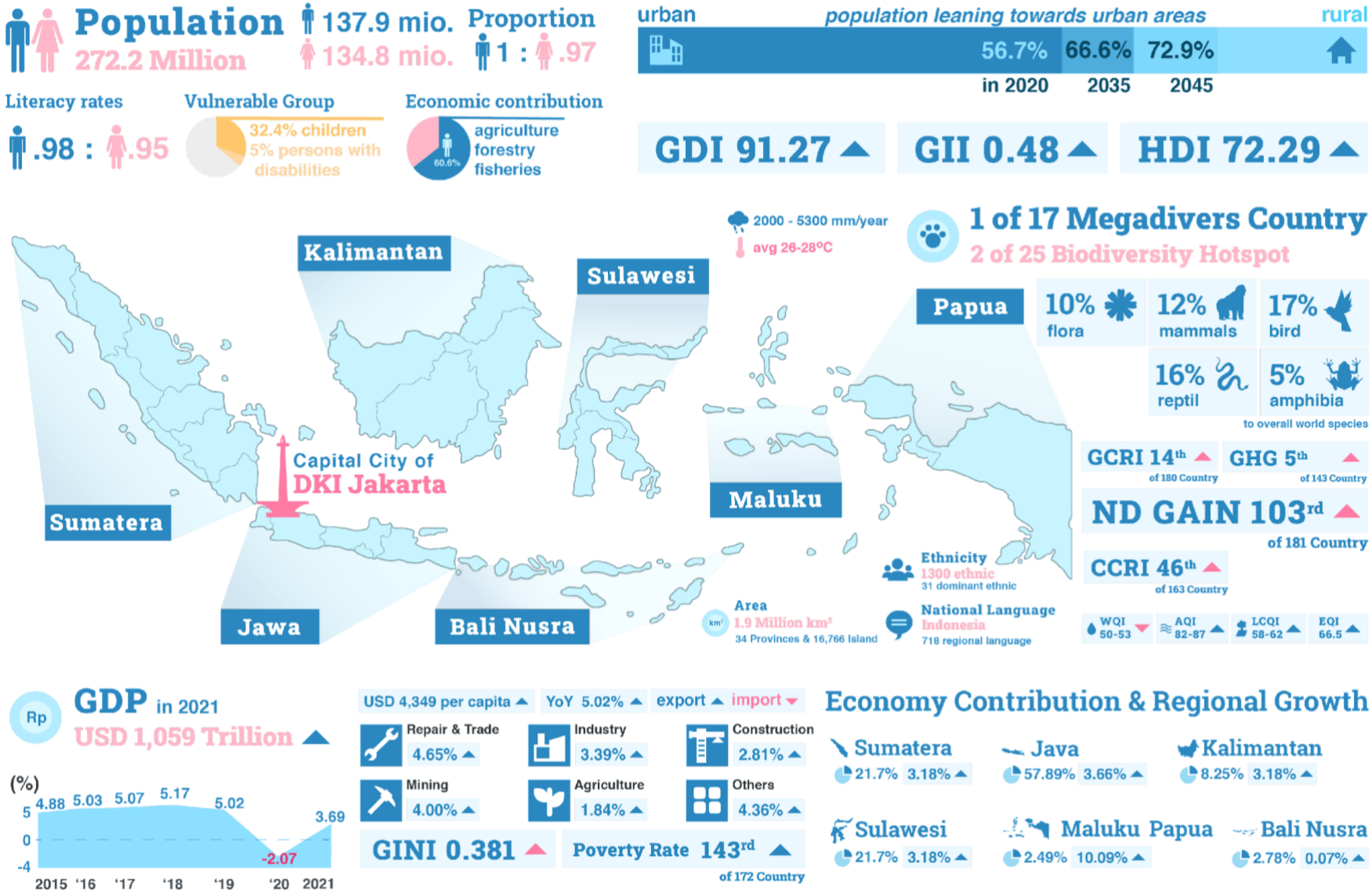


Figure 1 Indonesian Context. This figure shows a summary of Indonesia's profile, starting from the condition of the population, region, climate, and ecosystem to Indonesia's economic condition. The figure includes the maps of Indonesia accompanied by ethnicity and national language and 15 indices measuring Indonesia's socio-economic condition. The top section contains the total population of Indonesia and the literacy rate. The most vulnerable groups are children, as much as 32.4% of the total population of Indonesia. Most of the population's (60.6%) income comes from the agricultural sector (i.e., agriculture, forestry, and fisheries). In the upper right, the highest population density is in urban areas with a pattern showing a steady increase until 2045. The quality of Indonesia's population can be measured by 3 indices: the Gender Development Index (GDI), the Gender Inequality Index (GII), and the Human Development Index (HDI) which shows an increase from the previous year. The right side of the map contains information on the high biodiversity in Indonesia. Eight indices measure environmental conditions (including ecosystems and climate) in Indonesia: Global Climate Risk Index (GCRI), GHG, ND GAIN, Children's Climate Risk Index (CCRI), Water Quality Index (WQI), Air Quality Index (AQI), Land Cover Quality Index (LCQI), and Environmental Quality Index (EQI). The information at the bottom shows Indonesia's economic conditions. Indonesia's GDP has reached USD 1.059 Trillion in 2021 with an increasing trend compared to 2021 (GDP trend graph is below). The specific proportion of GDP gains the most considerable contribution from the repair and trade sector (4.65%). In addition to GDP, Indonesia's economic condition can also be seen from the GINI ratio and the Poverty Rate which shows that there is still economic inequality among the population, especially the poor. Economic contribution and regional growth charts at the bottom right show that Java Island provides the most considerable contribution to the Indonesian economy. The highest economic growth is still in Java Island. Source: BPS[1][2][6], BMKG, and other sources detailed in Table 1.

1.1.1 Bio-geophysical Characteristics

Indonesia is geographically located at 6°N-11°S Latitude and 95°-141°E Longitude with varied topographical terrains (Figure 2), ranging from sea and coastal systems to peat swamps and montane forests [3]. The Indonesian archipelago is located between the continents of Asia and Australia and between the Indian and Pacific oceans. The country resides on the Ring of Fire, which is the confluence of three world tectonic plates, namely the Indo-Australian Plate, the Eurasian Plate, and the Pacific Plate [1]. The Ring of Fire, also known as the Circum-Pacific Belt, is a 40,000 km long chain of volcanoes and seismically active sites stretching across the Pacific Ocean.

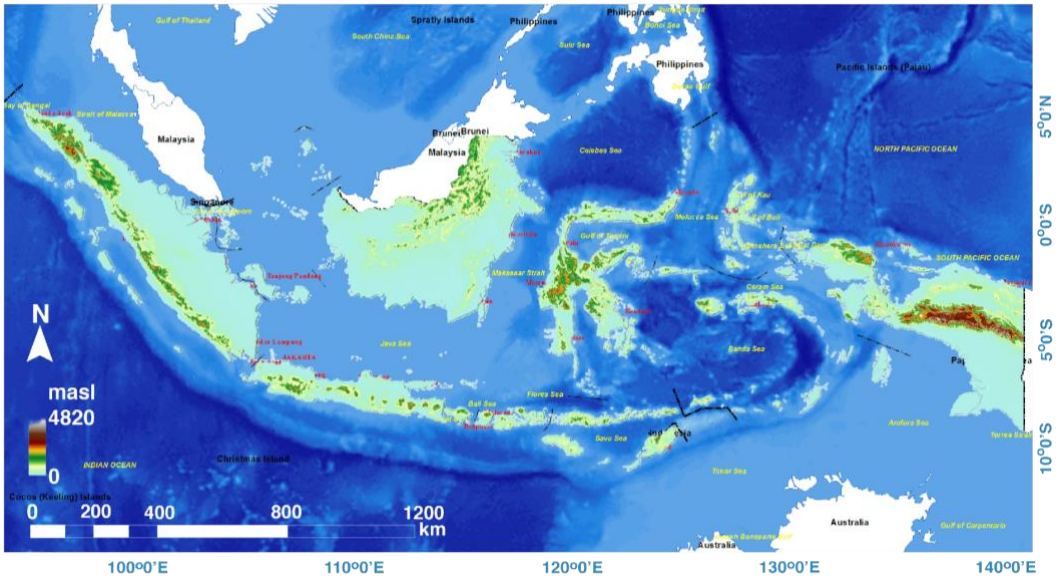


Figure 2 Topography of Indonesia. Source: Indonesian Geographical Map released by BIG

1.1.2 Climate Condition

Indonesia's climate is influenced by tropical monsoons affecting the rainy season and the dry season. The country lies along the range of the Inter-Tropical Convergence Zone (ITCZ) where the northeast and southeast trade winds penetrate the doldrums. According to the Agency of Meteorology Climatology and Geophysics (*Badan Meteorologi, Klimatologi, dan Geofisika/*BMKG), Indonesia is classified into three climate regions: monsoon, equatorial, and local [4]. The division of this region is based on the type of rainfall that occurs. Monsoon regions have their rainfall peak in December, January, and February, whereas there is a dry season in June, July, and August, with the remaining six months as a transitional season. The dominant areas that have a monsoon climate are the island of Java, some areas on the island of Sumatra, and the island of Kalimantan. Equatorial regions have two peaks of rainfall that occur in March and October or at the equinox. Areas that have an equatorial climate include the western part of Sumatra Island, northern Kalimantan, and parts of Papua. Regions with the local type pattern differ from the monsoon and equatorial types.

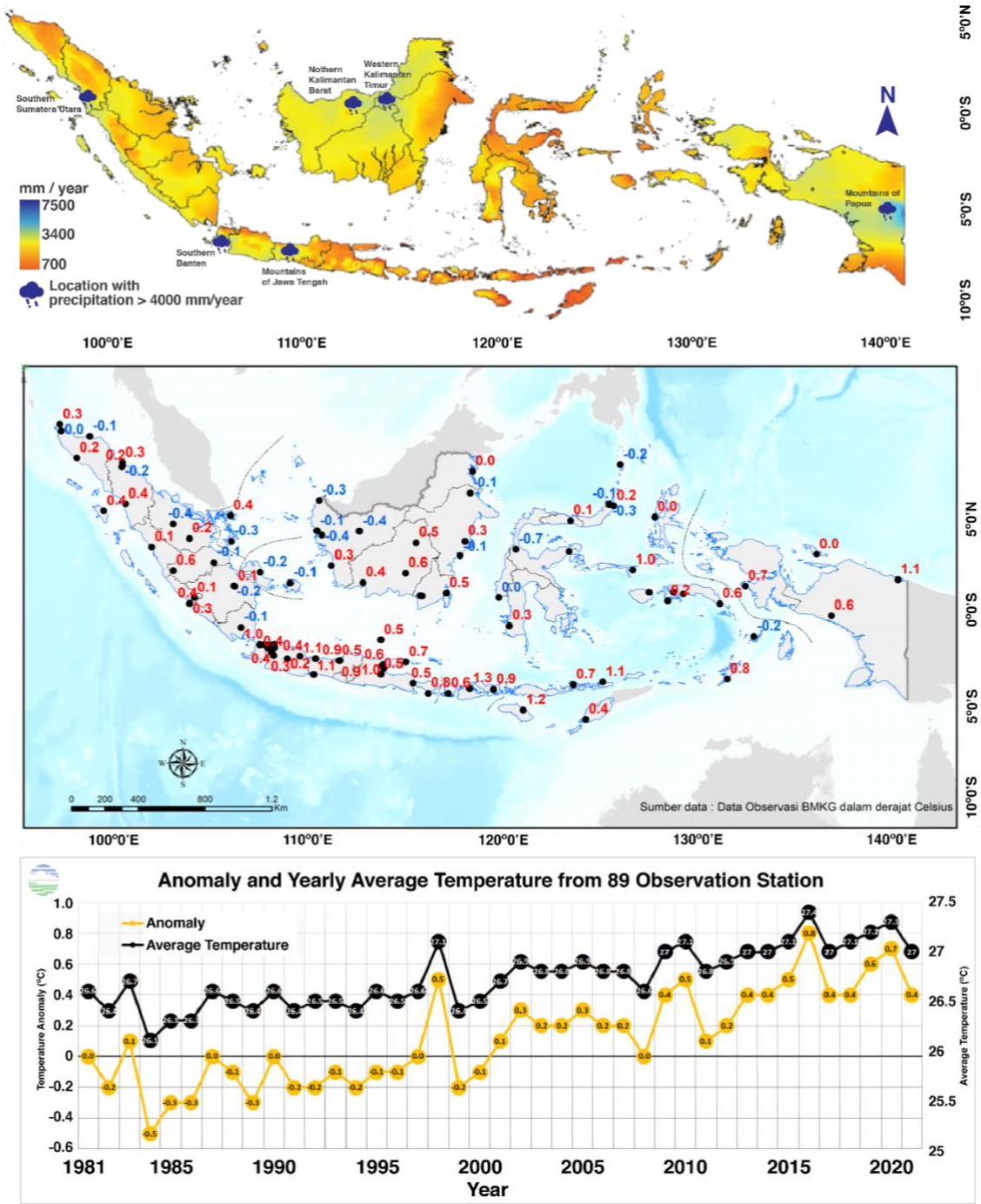


Figure 3 Climate condition of Indonesia; historical precipitation from 1991-2020 (above), mean temperature anomaly between August 2022 and 1991-2020 (middle), mean temperature anomaly from 1981-2021. Source: compiled from BMKG map and graphic, and WorldClim data.

Furthermore, Figure 3 shows that the average annual rainfall in the lowlands is around 1,800 mm to 3,200 mm, which is lower than in mountainous areas where the total rainfall can reach 6,000 mm. In contrast to rainfall, the average monthly air temperature in Indonesia tends to be constant, ranging from 25 °C-26 °C. However, the air temperature varies according to altitude and is around 23 °C in mountainous areas and 28 °C in coastal areas. Indonesia as a tropical country gets solar radiation throughout the year. Modes of

climate variability such as the El-Nino Southern Oscillation (ENSO) also greatly affect Indonesia's climate, causing drier conditions during El-Nino and wetter conditions during La-Nina [5]. Indonesia's climate is also affected by other climatic phenomena such as the Indian Ocean Dipole (IOD), Tropical Cyclones, Monsoons, and the Madden-Julian Oscillation (MJO)[6]. Extremes that frequently occur in Indonesia are high temperatures, low visibility, heavy rainfalls (> 50 mm/24 hours), cyclones, strong winds, and hailstorms.

1.1.3 Demographics

Indonesia is recognized as having the 4th largest population in the world. In 2020, the country's population was about 270.2 million, with an annual population growth of about 1.25% from 2012 to 2020. The total population is projected to reach 335 million by 2050, with the growing population leaning towards urban areas. The population in urban areas reached 56.7% in 2020, with a steady increase in urbanization from 2010 to 2020. The population projected to live in urban areas can reach about 66.6% and 72.9% by 2035 and 2045, respectively [6] (Figure 4). This projection could also be related to the potential migration of coastal communities (with the coastal and small island populations estimated at 120 million people by 2022 [7].

The total number of Indonesian children (aged 0-19 years) [8] is approximately 32.81% or equivalent to over 80 million people. Most Indonesian children (~52.2%) live in Java, and the rest (~47.8%) are spread across provinces outside Java. The gender aspect shows that Indonesia had a Gender Development Index (GDI) of 91.27 in 2021 [9], recognizing that the development of men and women in Indonesia is getting closer to equality. However, Indonesia ranked 107th out of 167 countries with a gender development score of 0.940. For the Gender Inequality Index (GII), Indonesia ranked 121st out of 162 countries [10], which means that Indonesia has a reasonably low gender inequality compared to other countries. Based on 2020 data from the Central Statistics Agency (*Badan Pusat Statistik*/BPS), the number of people with disabilities in Indonesia reaches around 5% of the total population.

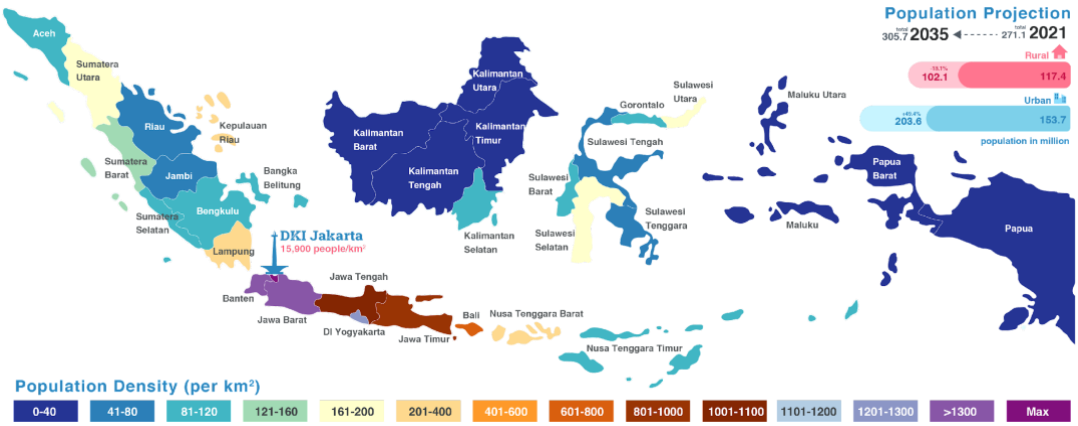


Figure 4 Population density and ratio between urban and rural. Source: illustrated from BPS [1]

1.1.4 Socio-Economic Condition

Indonesia is the 10th largest economy in terms of purchasing power parity worldwide. Based on BPS, Indonesia's Gross Domestic Product (GDP) categorized it as a 'lower-middle-income' country in 2020 and 2021, referring to the World Bank classification [11]. In 2016, the manufacturing industry was the sector that contributed most to GDP, followed by Wholesale and Retail Trade, Agriculture, Forestry and Fisheries, Construction, and Mining and Quarrying [1]. In 2021, the Indonesian economy grew by 3.69%, whereas in 2020, Indonesia experienced a growth contraction of 2.07%. In production, the highest growth occurred in the Health Services, Social Activities, and Business Field at 10.46%. Meanwhile, in terms of expenditure, the Export Component of Goods and Services achieved the highest growth at 24.04% [12]. The Gini ratio index of Indonesia is 0.384 which is categorized as low income disparity [13]. The indicators measuring the country's socio-economic condition are compiled in Table 1.

Table 1 The compilation of indicators measuring the socio-economic condition of Indonesia

Indicator	Value	Source	Note
Gross Domestic Product	USD 1,058 Trillion (2020) USD 1,059 Trillion (2021)	Statistics Indonesia (BPS) [14]	An increase in GDP indicates an increase in the economy
Gini Ratio Index	0,384 (March 2022)	Statistics Indonesia (BPS) [13]	1 = income inequality 0 = income equality
National Human Development Index (*Indeks Pembangunan Manusia*/IPM)	72,29 (2021)	Statistics Indonesia (BPS) [15]	IPM > 80 = Very high IPM 70-79 = High IPM 60-69 = Moderate IPM < 60 = Low
Urban Population as % of Total Population	56,7% (2020)	Statistics Indonesia (BPS) [16]	A higher percentage means more people live in urban areas
Poverty headcount ratio at	10,14% (March 2021)	Statistics Indonesia (BPS) [17]	A higher percentage means more people live in poverty

national poverty lines	9,71% (September 2021)		
Infant Mortality Rate (Between Age 0 and 1)	1,9% (2015-2020)	UNDESA [16]	A higher percentage means more infant deaths in 1000 births
Under-5 Mortality Rate	23 per 1000 live births (2020)	UN IGME [18]	Higher numbers indicate more under-five deaths in 1000 births
Population Undernourished	9,0% (2017-2019) 6,5% (2019)	FAO, IFAD, UNICEF, WFP, WHO [16] World Bank [19]	A higher percentage means more people are undernourished
Stunting Prevalence	24,4% (2021)	Indonesian Nutrition Status Survey (SSGI) (Kemenkes) [20]	Higher percentage means more population is experiencing stunting
Gender Inequality Index (GII)	0,480 (Rank 121 of 162) (2019)	HDR Report (UNDP) [10]	1 = Gender inequality 0 = Gender equality The first rank shows the country with the highest inequality
Gender Development Index (GDI)	91,27 (2021) 0,940 (Rank 107 of 167) (2019)	Statistics Indonesia (BPS) [21] HDR Report (UNDP) [22]	The closer to 100 (BPS) or 1 (UNDP), the more equal the development between women and men
Global Climate Risk Index	Rank 14 of 180 (2019)	Germanwatch [23]	The first rank shows the country with the highest climate risk
ND-GAIN Country Index	Rank 103 of 181 (2020)	University of Notre Dame (2020) [24]	The first rank shows the least vulnerable country

Children's Climate Risk Index	Rank 46 of 163 (2021)	UNICEF [25]	The first rank shows the country with the highest climate risk for children

1.1.5 Infrastructure

Infrastructure is one of the main sectors driving economic growth in Indonesia. Based on the Global Competitiveness Report 2019 [26] compiled by the World Economic Forum (WEF), Indonesia ranks 72th out of 141 countries in terms of infrastructure development. In the 2020 WEF report [27], Indonesia is included among the countries enforcing for an economic transformation through their infrastructure (Figure 5). Based on the distribution map of priority projects of the Committee for the Acceleration of Priority Infrastructure Provision (*Komite Percepatan Penyediaan Infrastruktur Prioritas*/KPPIP), infrastructure development is still concentrated in Java and Sumatra, particularly in urban areas. The most rapid infrastructure development occurs in Java, especially in the western part, with various types of infrastructure. Meanwhile, the most infrastructure development projects in Sumatra are electricity as well as roads and bridges. In Kalimantan, most of the infrastructure developments are electricity and energy. Meanwhile, in Papua and Maluku, the focus of infrastructure development is telecommunications and electricity. In Sulawesi, development projects are concentrated in North and South Sulawesi. The Nusa Tenggara and Bali regions are the areas with the fewest infrastructure development projects [28]. Meanwhile, regarding green infrastructure, the government focuses on green development in large urban areas with zoning covering housing, pedestrian paths, green open space, institutional and commercial, suburbs, new development areas, and agricultural land [30,31].

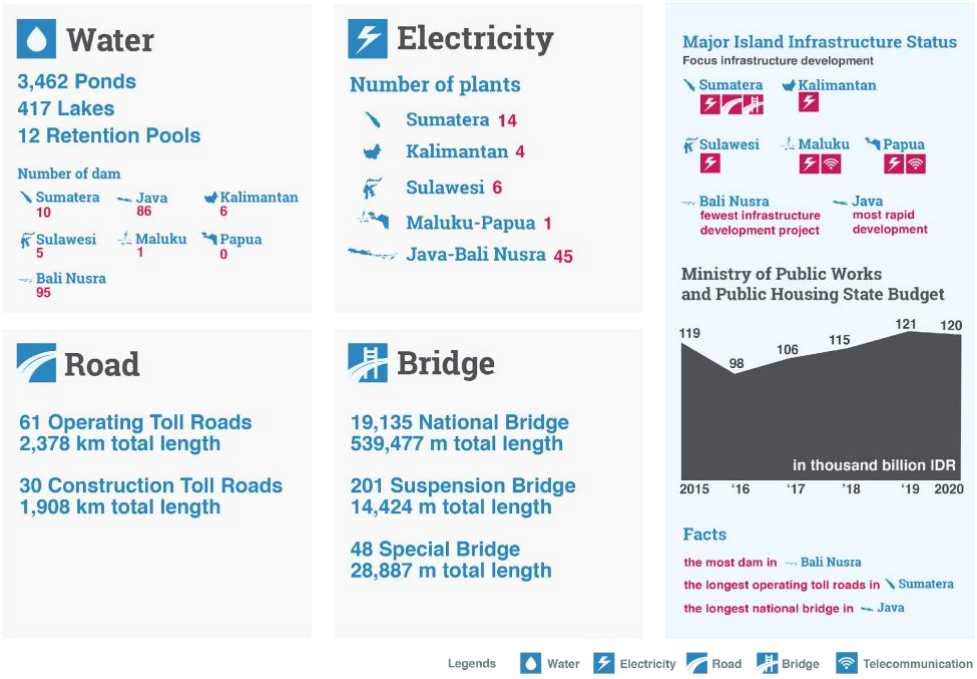


Figure 5 Infrastructure situation In Indonesia. The information box on the right shows the focus on infrastructure development in the five (5) Big Islands and the large budget allocated by the MoPWPH until 2020. Source: Illustrated from KPPIP priority project distribution map

The Government of Indonesia has established infrastructure development as one of the directions in the Vision of Indonesia 2045 [31]. From 2015 to 2022, the infrastructure budget grew by an average of 12.7% per year [32] (Figure 5). Infrastructure tends to be built in urban areas because urban development will have a positive economic impact nationally. Meanwhile, many cities in Indonesia are located on the coast and act as the backbone of the national economy, such as the 3 urban agglomeration areas DKI Jakarta, Pekalongan, and Semarang which are located in the northern coastal area (Pantura) of Java Island [31]. The economy in this area contributes more than 20% of Indonesia's GDP [31]. Due to its location, this area has experienced various environmental and disaster problems such as sea level rise, tidal flooding, and land subsidence due to massive development [31]. Therefore, the development of disaster resilience infrastructure in this coastal area is one of Indonesia's major projects for 2020-2024, i.e. the project "Coastal Security in 5 Urban Areas in Java's Pantura" to overcome the tidal flood disaster in DKI Jakarta, Semarang, Pekalongan, Demak, and Cirebon [31]. Meanwhile, in other vulnerable coastal areas, the focus of the Government of Indonesia is more on infrastructure for handling abrasion [31].

1.1.6 Information on Adaptive Capacity

Indonesia is a country with high vulnerability and exposure to climate-related hazards (e.g., floods, landslides, drought) and extreme weather. This can be seen from Indonesia's ranking in the Global Climate Risk Index (GCRI) in 2020: 14th position out of 181 countries [23]. The GCRI measures risk levels and ranks a country based on the risks. This indicates

that the community must have a good adaptive capacity to deal with climate risks. Some indicators regarding Indonesia's adaptive capacity based on economic, social, and environmental resilience are described below.

Economic Resilience

Based on BPS data, the Indonesian economy continues to grow, even with the risk of a weakening global economy and rising inflationary pressures [33]. This can be seen from the economic growth in the second quarter of 2022 which reached 3.72% compared to the previous quarter [12]. GDP at basic prices in the second quarter of 2022 reached Rp 4,919 trillion [12]. This shows that Indonesia has a fairly good recovery capacity. Indonesia has a low expenditure inequality with a Gini Ratio of 0.384 in March 2022. This means that economic development in Indonesia involves the participation of the wider community[34]. Indonesia's poverty rate after the pandemic (per March 2022) also fell by 0.17% from September 2021 and 0.6% from March 2021 to 9.54% [35]. These figures show that economically, Indonesia is quite resilient in facing the crisis and recovering from the crisis.

Social Resilience

In Indonesia, the urban population already exceeded half of Indonesia's total population (56.7%) in 2020 and is expected to continue to increase [6]. High urbanization is one of the factors that can make people living in cities socially vulnerable [36]. The impacts of climate change in Indonesia also make children vulnerable. Indonesia is in the 46th position out of 163 countries with the highest climate risk for children (according to the Children Climate Risk Index/CCRI 2021) [25]. The Infant Mortality Rate from 2015 to 2020 was low (1.9% or 19 per 1000 live births) [16], while the Under-5 Mortality Rate in 2020 was categorized as moderate (23 per 1000 live births) [18]. The stunting rate is still quite high in Indonesia (reaching 24.4% in 2021) [20]. Human development in Indonesia is categorized as high (according to the HDI Index by BPS at 72.29 in 2021), with an increase in the three basic dimensions of human development (decent standard of living, long and healthy life, and knowledge) after being depressed in 2020 due to the Covid-19 pandemic [37]. The percentage of the undernourished population is also categorized as low (9% in 2017-2019 and 6.5% in 2019). Regarding gender, the development of men and women in Indonesia is getting closer to equality (GDI of 91.27 in 2021) [21]. This can also be deducted from the gender inequality rate in Indonesia which is quite low compared to other countries (GII of 0.48 in 2019, rank 121 out of 162) [10].

Environmental Resilience

Based on the 2020 ND-Gain Index, Indonesia is the 76th most vulnerable country and the 103rd most ready country to combat climate change [24]. The vulnerability and readiness scores are 0.451 (~0 is better and indicates a low level of vulnerability) and 0.387 (~1 is better and indicates a high level of readiness), which means Indonesia is on the road to responding effectively to climate change, but the adaptation needs and urgency to act are greater [24]. Regarding the environment, Indonesia already has an Environmental Quality Index (*Indeks Kualitas Lingkungan Hidup*/IKLH), whose components consist of the Water Quality Index (*Indeks Kualitas Air*/IKA), Air Quality Index (*Indeks Kualitas Udara*/IKU), Land Cover Quality Index (*Indeks Kualitas Tutupan Lahan*/IKTL), Seawater Quality Index (*Indeks Kualitas Air Laut*/IKAL), and Peat Ecosystem Quality Index (*Indeks Kualitas Ekosistem Gambut*/IKEG; specifically for provinces with peatlands) [38]. IKLH is usually used to describe and evaluate the condition and quality of the environment in Indonesia. Based on the IKLH value, the quality of Indonesia's environment seems to be getting better every year. The IKLH score for 2021 is 71.4 (~100 indicating excellent environmental quality), a significant increase from 2019 with a score of 66.5 [39]. This indicates the rising awareness of the importance of managing the environment. The country already reinforced its commitment to combat global climate change affected the environmental condition as articulated in the submitted Enhanced NDC in 2022 [44].

1.2 Commitment to Global Climate Change

Indonesia's commitment to addressing climate change has been demonstrated through Indonesia's active role in every climate change agenda. Indonesia's commitment began when the Government of Indonesia adopted the results of the Stockholm Conference, Sweden, 1972 (**1st decade, 1972-1982**) [40]. In the next decade (**2nd decade, 1982-1992**), Indonesia ratified various international conventions related to the environment, such as the Law of the Sea, the Protection of the World Cultural and National Heritage, the International Plant Protection Convention, and the ASEAN Agreement on the Conservation of Nature and Natural Resources. In the third decade (**3rd decade, 1992-2002**), Indonesia participated in the Earth Summit in Rio de Janeiro, Brazil (1992). The two conventions resulting from the Rio Conference (the Convention on Biological Diversity/CBD and the United Nations Framework Convention on Climate Change/UNFCCC) were ratified by Indonesia through Law No. 5/1994 and Law No. 6/1994. As a party to the UNFCCC (Non-Annex I countries), Indonesia continues to participate in the Conference of the Parties (COP), which is the annual meeting of the parties to the UNFCCC. Furthermore, Indonesia agreed to adopt the Kyoto Protocol as a result of the COP-3 1997. In 1999, Indonesia submitted the Initial National Communication (INC) as a UNFCCC mandate to state parties.

In the **4th decade (2002-2012)**, Indonesia participated in the Johannesburg Declaration, which was the result of the World Summit on Sustainable Development in Johannesburg, in 2002. Furthermore, Indonesia hosted COP-13 in 2007 in Bali and produced a Bali Action Plan regarding the important role of Indonesia's forests through the REDD+ scheme. In this decade, climate change has also been included in the environmental management law in Indonesia and Indonesia has submitted the Second National Communication to the UNFCCC in 2011.

Indonesia's commitment to addressing climate change was further strengthened in the **5th decade, (2012-2022)**. Indonesia adopted and ratified the Paris Agreement as the main result of COP-21 in Paris in 2015 through Law No. 16 of 2016. In accordance with the Paris Agreement to achieve the goal of reducing global average temperatures to under 2 °C, Indonesia submitted its first Nationally Determined Contribution (NDC) outlining Indonesia's transition to a low-emission and climate-resilient future to the UNFCCC in 2016. Indonesia's commitment to adaptation is to increase economic resilience, social and livelihood resilience, as well as ecosystem and landscape resilience. This commitment is then translated into a viable concept: the NDC Roadmap on Adaptation (2020). Besides, the Government of Indonesia has also successfully submitted the Third National Communication in 2018. In 2021, the commitment of the Indonesian Government to respond to global issues of future climate change was strengthened by submitting the Updated NDC [41] and the Long-Term Strategy for Low Carbon and Climate Resilience 2050 [42] which generally describes Indonesia's commitment to increase the resilience of ecosystems and livelihoods in the face of current and future impacts of climate change.

Furthermore, in 2022, Indonesia's commitment is continued by submitting the Enhanced NDC document to the UNFCCC.

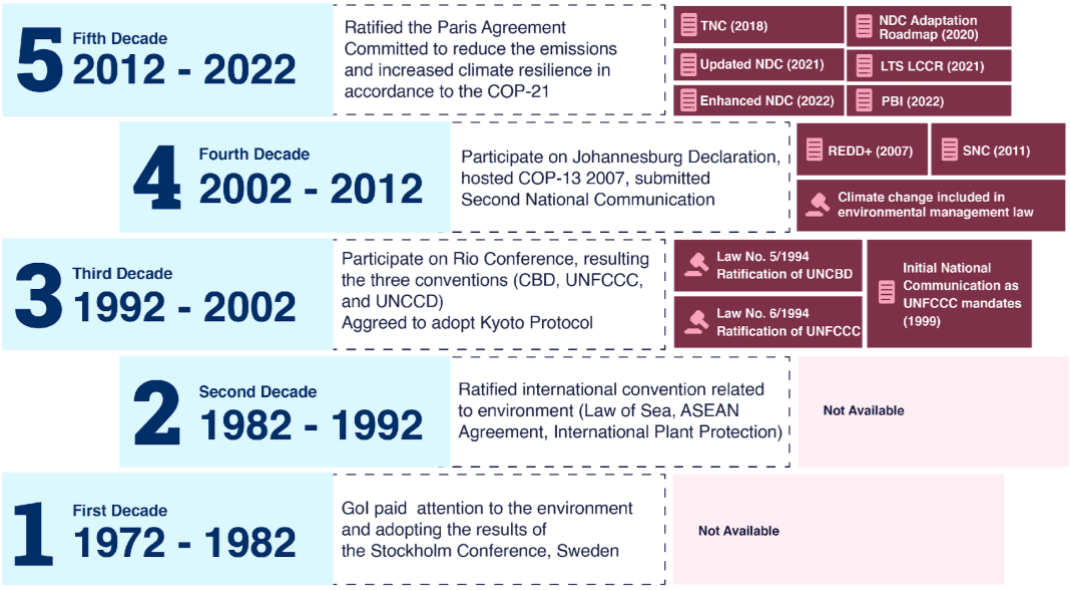


Figure 6 Commitment to address global climate change in Indonesia

1.3 Current State of Climate Change Policies

1.3.1 National Policy Framework and Regulation

Climate change reports issued by the IPCC since the 1990s—starting from the IPCC First Assessment Report, FAR (1990) to the last IPCC Sixth Assessment Report, AR6 (2022) — are scientific references for responding to climate change. The Government of Indonesia through the Ministry of National Development Planning/MNDP (*Badan Perencanaan dan Pembangunan Nasional*/Bappenas) has published the Indonesia Climate Change Sectoral Roadmap, ICCSR (2010) and the National Action Plan for Climate Change Adaptation, RAN API (2014). The Ministry of Environment and Forestry/MoEF (*Kementerian Lingkungan Hidup dan Kehutanan*/KLHK) has also submitted the Second National Communication (SNC 2011) and the Third National Communication (TNC 2018), and published the Climate Change Vulnerability, Risk, Impact, and Adaptation Progress Report (2017) which summarizes various adaptation initiatives across ministries and agencies.

With the ratification of the Paris Agreement in 2016 as the main legal framework for climate policy in Indonesia, Indonesia has submitted the 1st NDC in 2016, the Updated NDC in 2021, and the Enhanced NDC in 2022. In the Enhanced NDC document, it is stated that key programmes and strategies to achieve adaptation goals in NDCs must also have strong linkages with international conventions/agreements, including the Rio Convention, the Wetlands Convention, the Sendai Framework, and Sustainable Development Goals (SDGs). The synergies are described below [43]:

a) UNCBD is the UN Convention on Biological Diversity. Increasing conservation areas under CBD commitment has a strong linkage with adaptation efforts particularly in achieving ecosystem and landscape resilience which will positively affect economic resilience as well as social and livelihood resilience.
b) UNCCD is the UN Convention on Combating Desertification. Implementing the UNCCD 2018-2030 Strategic Framework that by 2030 combats desertification, restores degraded land and soil including land affected by desertification, drought and floods, and strives to achieve a land degradation-neutral world and other interrelated SDGs is closely linked with adaptation efforts for social and livelihood resilience and positively affects economic resilience as well as ecosystem and landscape resilience.
c) RAMSAR convention is an international agreement for the conservation and sustainable use of wetlands. RAMSAR convention has a strong connection with adaptation in terms of conserving and managing wetlands as well as addressing the drivers of wetland loss and degradation which will positively affect ecosystem and landscape resilience.
d) Sendai Framework is an international document about disaster risk reduction. The implementation of SFDRR creates strong synergies with adaptation efforts in the reduction of risks and loss caused by natural disasters, through enhanced climate literacy, risk management, and disaster preparedness which will positively affect social and livelihood resilience as well as ecosystem and landscape resilience.
e) The 13th SDG goal, the implementation of climate change conventions (from UNFCCC to the Paris Agreement), addresses all aspects of the SDGs.

In addition, in the National Mid-Term Development Plan (RPJMN) 2020-2024, disaster resilience and climate change have become National Priority (PN) 6. As a guideline for creating national climate resilience, MNDP has launched a Climate Resilience Development document (*Pembangunan Berketahanan Iklim*/PBI) in 2021. This PBI policy is an implementation of the Sustainable Development Goals/SDGs (*Tujuan Pembangunan Berkelanjutan*/TPB), Low Carbon and Climate Resilience Strategy, the Sendai Framework, and the fulfilment of the Paris Agreement targets [44].

1.3.2 Climate Change Regulation

Climate change adaptation in Indonesia is directed to reduce current and future risks following the mandate of Law No. 16/2016 concerning the Ratification of the Paris Agreement in 2015. Several policies, especially policy documents, can serve as linkages for addressing climate issues in various sectors. The recent release of Presidential Regulation No. 98/2021 on the Implementation of Carbon Pricing established the national priorities on Climate Change Adaptation and the mandates are food, water, energy, health,

and ecosystem security. In addition, the policies, regulations, and national strategies are released to support the requirements for climate resilience in Indonesia (Figure 7).

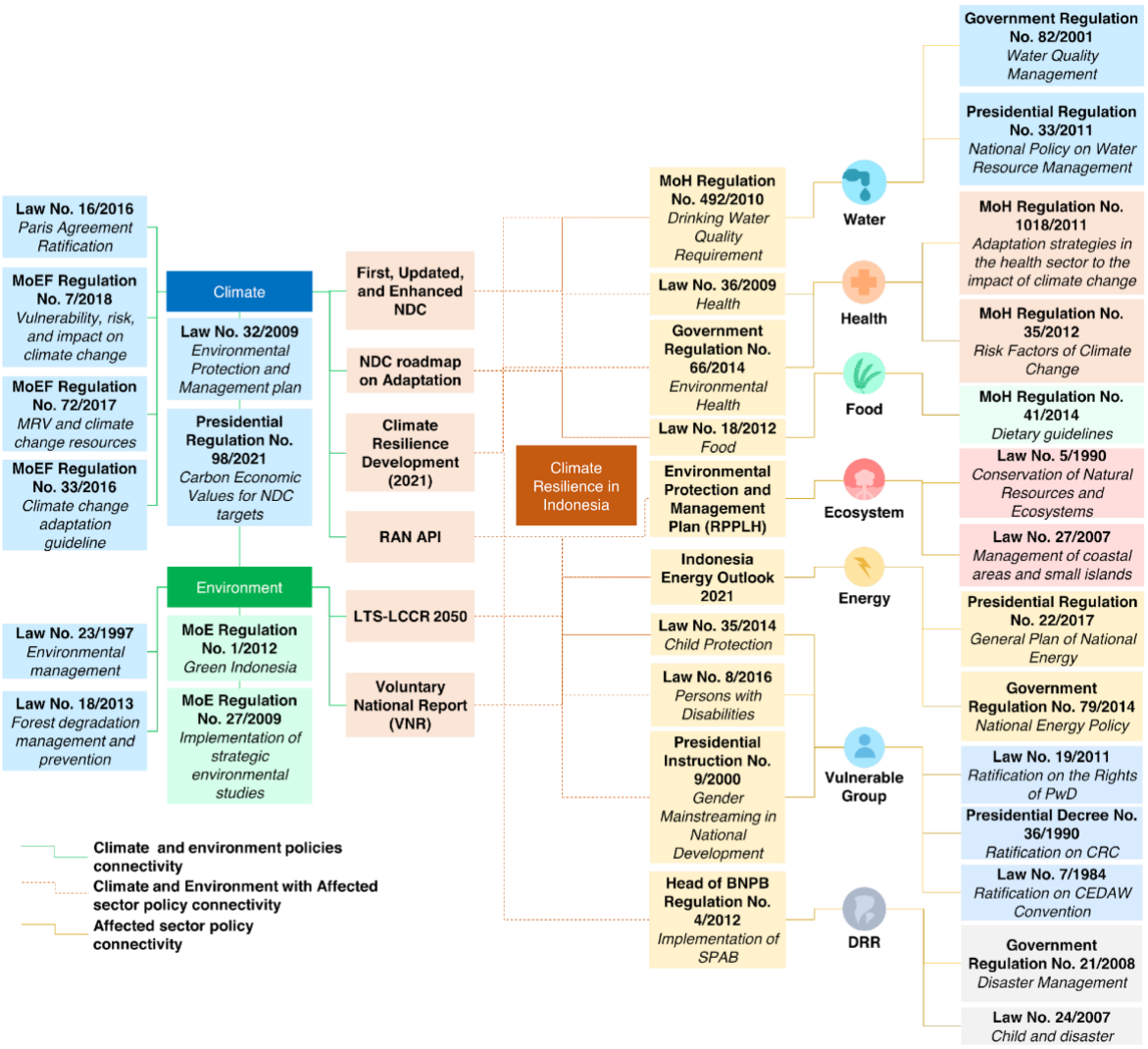


Figure 7 The connectivity between climate policies (the left side of the brown box of the Climate Resilience) and the other policies of affected sectors (the right side) grouped by the nexus of food, water, energy, health, ecosystem, disaster risk reduction (DRR), and vulnerable group.

1.4 Institutional Arrangement and Authorities

Indonesia has participated in various global commitments as well as issued national directives and local implementations in efforts to adapt to climate change through the establishment of various institutions with related tasks and functions. There are a number of national institutions and private organizations in Indonesia that play leading roles in climate change issues in the country. These include the national government (Ministries/Agencies), the subnational government, the private sector, universities, non-governmental organizations, and development partners. The institutional arrangement is developed based on the Presidential Regulation No. 98/2021 Article 84 on Carbon Pricing, the Institutional Arrangement for Climate Resilience (BAPPENAS 2021) and the

stakeholder participation on the Adaptation Roadmap for NDC (KLHK 2020), to integrate and strengthen the capacity of the institutions to manage climate-related challenges.

a) National Steering Committee on Climate Change: The implementation of the adaptation action in Indonesia is involved in the National Regulation on Carbon Pricing which is strategically guided and led by the Steering Committee (SC) from coordinating ministries. The Chairman of the SC is the Coordinating Ministry for Maritime and Investment Affairs and the deputy chairman is the Coordinating Ministry for Economic Affairs.
b) National Coordinators: The Ministry of Environment and Forestry (MoEF) is responsible for the coordination of UNFCCC-led policies and programmes as the national focal point (NFP). The Ministry of Finance (MoF) coordinates involved institutions in adaptation planning and budgeting through fiscal substance and financing. Regional and local adaptation strategies and actions are coordinated by the Ministry of Home Affairs (MoHA) through Governmental Regulation No. 8/2008. In addition, the Ministry of National Development Planning coordinates in designing implementation of SDGs including SDG goal No. 13 (Climate Action).
c) Involved ministries and institutions as members: Climate change is a cross-sectoral issue and needs a collaborative effort to address it. About 20 ministries are involved in the climate change adaptation plans and actions, led by the national focal points and national steering committee. Those Ministries/Agencies have the duties and responsibilities to mainstream climate change adaptation into development planning and implementation in various adaptation sectors (food, water, energy, health, ecosystem, and disaster).
d) Subnational governments: Regarding regulations and actions the subnational governments have a well-defined and decentralized structure in place which provides coordination and innovation in the mainstreaming of climate change adaptation. The institutions are also connected with the national governments in implementing programmes on climate change adaptation.
e) Private Sector: The private sector plays an important role in achieving the sustainable development goals (SDGs) agenda and pursuing the NDC target. This includes its contribution to adaptation planning, financing, implementation and action as well as monitoring and evaluation.
f) Civil society organizations (CSOs): The adaptation process in Indonesia actively engage the community in planning, advocacy, education and awareness raising, evidence-based research, and implementation, as well as monitoring and evaluation of adaptation efforts at various levels in the country.

g) Universities: Universities play a key role in improving the quality and quantity of research in Indonesia, especially regarding climate change and sustainable development.
h) Development partners: Indonesia's adaptation process recognizes the role of the international community, especially development partners, as critical for resource mobilization, and capacity development as well as technology development and transfer for current and future adaptation action. Specifically, Indonesia will harness support from multilateral agencies, bilateral donors and south-south cooperation for in-country adaptation action and resilience building.

The institutional framework for climate change adaptation in Indonesia was developed based on Indonesia's commitments at the global level as well as various national and sub-national regulations. These global commitments are documents submitted to the UNFCCC with various updates to adjust the target agreement and the substance of Indonesia's adaptation from time to time. At the national level, these commitments are translated into strategic and technical documents by adjusting priority areas, key programmes, and national development plans. Therefore, Indonesia—through MoEF as the national focal point—developed an adaptation NDC roadmap to translate commitments into technical regulations and adaptation implementation at the national and local levels.

This **adaptation communication** (**ADCOM**) was prepared based on a synthesis of information from various key documents related to climate change adaptation commitments supported by available information from the stakeholders. Some of the main documents include the Enhanced Nationally Determined Contribution (NDC) document which has been submitted to the UNFCCC in 2022 to increase ambitions of NDC, following previous submissions of the updated NDC in 2021 and the 1st NDC in 2016. In addition, the other main document which served as the basis for the preparation of this **ADCOM** is the National Communication document which has been submitted three times to the UNFCCC. The preparation of this document also considers strategies, key programmes, and various directions for climate change actions based on the synthesis of the NDC Roadmap (2020) on Adaptation, Climate Resilience Development (2021), and the 2020-2024 National Medium-Term Development Plan (RPJMN) documents (Figure 8).

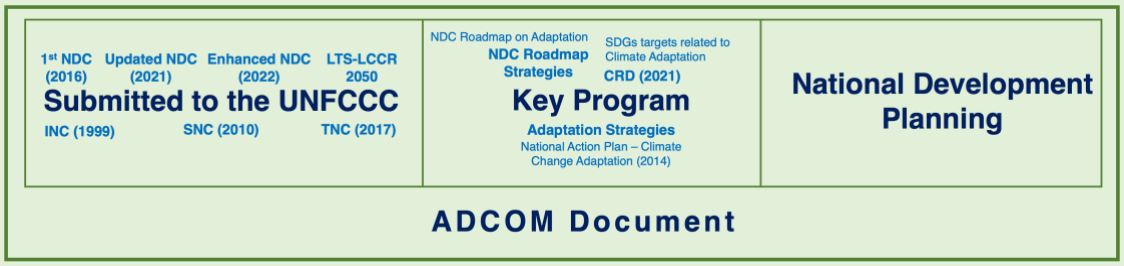


Figure 8 Main references on or related to climate change adaptation in Indonesia employed to prepare the first Adaptation Communication (ADCOM) of Indonesia.

The priority areas for adaptation that are stated in detail in the NDC Adaptation Roadmap document are a joint commitment that must be carried out by the stakeholders. Relevant Ministries/Agencies become national coordinators and form active working groups in the development of climate change adaptation. These institutions also play a role in strengthening national policies and directions for implementation and action as well as monitoring, reporting, and evaluation mechanisms. Implementation of adaptation actions and programmes that are integrated with village development plans focus on strengthening village capacity. The outputs of these various activities and programmes are expected to contribute to the achievement of national adaptation targets through economic, social, and livelihood resilience as well as ecosystem and landscape resilience.

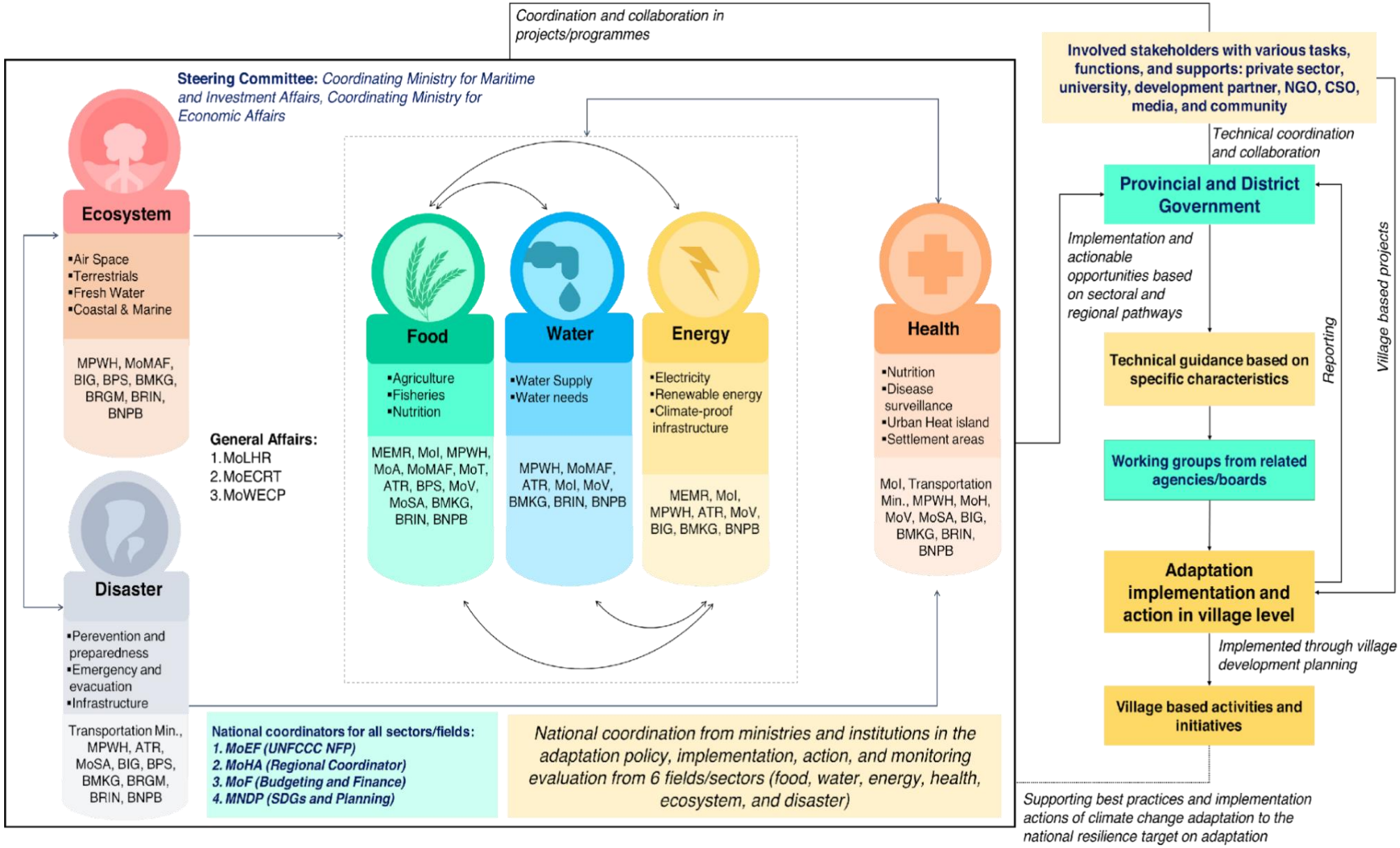


Figure 9 Designed operationalization of implementing adaptation actions from the national to the local level, including the involved stakeholders by specific tasks and functions in mainstreaming the climate change adaptation on the six (6) fields (food, water, energy, health, ecosystem, and disaster). Source: Modified from the Roadmap NDC Adaptation [46]

Climate Change Impact, Risk, and Vulnerability Assessment

Overview • Sectoral Impact • Vulnerability

2. Climate Change Impact, Risk, and Vulnerability Assessment

2.1 Climate Trend and Projection

2.1.1 Climate Trend

The trend of both minimum and maximum air temperatures in Indonesia is increasing according to historical data from the BMKG from 1981 to 2018. The variation in the rate of increase across locations is around 0.01°C-0.06°C per year, with an average of 0.03°C per year. In general, the average air temperature has increased by about 0.9°C in the last 30 years [45]. Based on rainfall data for the 1981-2018 period, Indonesia's rainfall trend tends to decrease for each category, indicating that rainfall is decreasing. This condition happened in most of the islands of Sumatra, the entire island of Java, most of the island of Kalimantan, the island of Lombok (West Nusa Tenggara), and the northern part of the island of Papua. However, some areas such as East Nusa Tenggara, Bali Island, southern Sulawesi, and Maluku have positive trends of varying magnitudes (which can be influenced by the type of rainfall, local rainfall) (Figure 10).

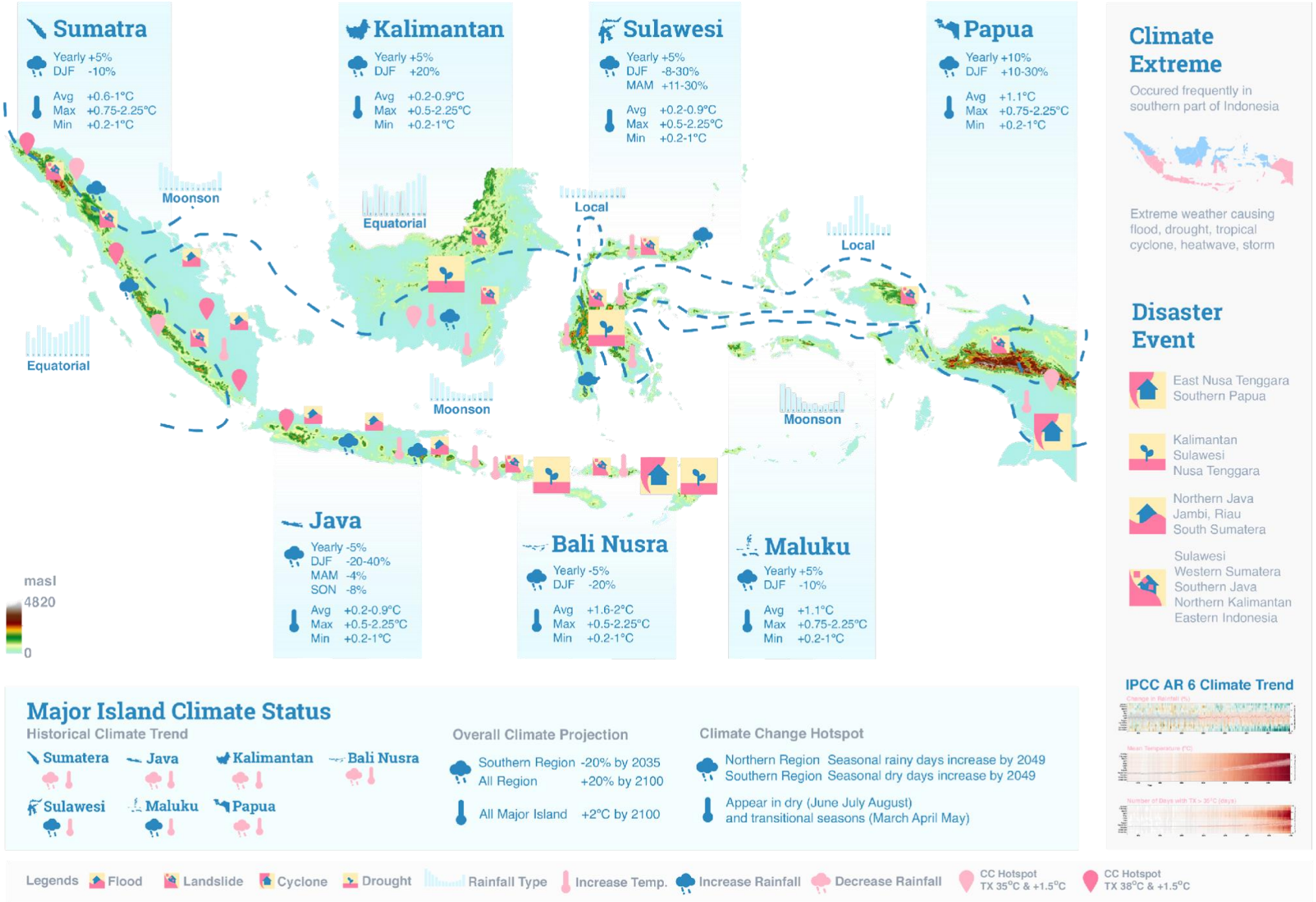


Figure 10 Indonesia Climate Profile. This map contains information on extreme events mapped per province of Indonesia and highlighted with information on the type of rainfall, historical rainfall, and temperature in the five (5) major islands of Indonesia. The information box below the map contains information on regional climate conditions, which consists of historical climate trends of the five (5) major islands showing an increase/decrease in rainfall and temperature, average climate projections in 2035 and 2100, and climate change hotspots. The information box on the right of the map contains information on extreme climates, which are dominant in southern Indonesia, disaster events in each province, and global climate trends. The meaning of the symbols can be found in the legends at the bottom. Source: compiled from BMKG projection [45], Roadmap NDC Adaptation [46], IPCC AR 6 [48], and DIBI of BNPB [49])

2.1.2 Climate Projection

Based on the Climate Projection 2020-2049 of BMKG, the average air temperature on every major island in Indonesia is increasing. According to the BMKG, the projection of diurnal temperature changes for the period 2020-2049 compared to 1976-2005 shows that the highest diurnal temperature changes occur in most areas of southern Sumatra, Java, especially the eastern part, Bali and Nusa Tenggara Island, most areas of central and southern Kalimantan, most of Sulawesi, except North Sulawesi, and most of southern Papua [45]. According to the 2021-2050 Climate Projection, Indonesia will experience an increasing trend of rainfall in several areas, especially in North Sumatra, West Sumatra, East Java, Central Kalimantan, and North Sulawesi. In general, the 2021-2050 climate projection shows a 5% increase in annual rainfall for Sumatra Island but a 10% decrease in the months of December-January-February (DJF) It can be said that there is a shift in rain time. In the island of Java, annual rainfall shows a downward trend of 5%, the DJF trend decreases by 20-40%. On the island of Kalimantan, there is an increase in the annual rainfall trend of 5% and a DJF increase of 20%. In the islands of Bali and Nusa Tenggara, annual rainfall shows a downward trend of 5% and the DJF trend also decreases by 20%. On the island of Sulawesi there is an increasing rainfall trend of 5% and a downward DJF trend of 8-30%, which means that there is a shift in rainfall time. On the island of Maluku, the rainfall trend increases by 5% but decreases by 10% for DJF. In the island of Papua, the annual rainfall trend increases by 10% and the DJF trend also increases by 10-30% [45]. This is in line with the IPCC's Sixth Assessment Report of 2022.

2.1.3 Climate Change Risk

The IPCC in its Sixth Assessment Report AR6 (2022) [45] defines areas characterized by high vulnerability and where the climate conditions of the region respond to climate change (change in temperature and rainfall) as climate change hotspots. In this section, climate change hotspots are seen as risks that are likely to arise due to changes that reach a certain level. Referring to the global temperature reduction target of below 2 °C, the distribution of Indonesia's climate change hotspots (based on the temperature) is mapped based on regional conditions that could increase by 0.75 °C, 1 °C, 1.5 °C, and 2 °C from baseline conditions so that the air temperature in the future can reach more than 35 °C and 38 °C [46]. An air temperature of 35 °C was chosen as the threshold that has an impact on food, water, and ecosystems due to climate change. An air temperature of 38 °C will potentially interfere with the health of living things. The effects of increasing temperatures are different in each region. For example, an increase in temperature of 2 °C will have a very negative impact on human health in an area with a current maximum condition of 36 °C but this increase does not necessarily have a direct impact on human health in an area that

currently has a temperature of 32 °C because it is still below the human body temperature [46]. Unfortunately, there is no clear threshold regarding the risks that may arise due to certain rainfall values.

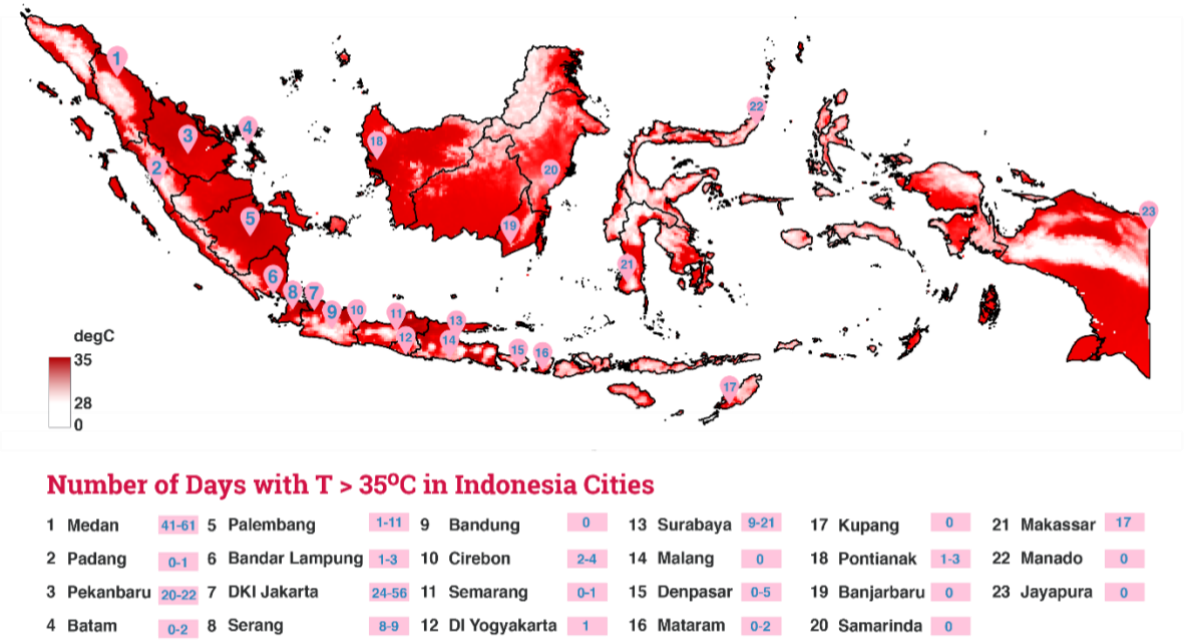


Figure 11 Potential areas and cities with a maximum air temperature of 35 ˚C in the future. The numbers in the legend show the projected counts of days with a maximum air temperature above 35 ˚C for the projection period of 2021-2050. Note: the total days for the 30 years is ~10,950 days.

According to the Roadmap NDC for Adaptation, climate change hotspots defined solely based on warming conditions mostly appear in the dry (March-April-May) and transitional seasons (June-July-August). Climate change hotspots based on temperature are more common in the western part of Indonesia. Areas with a maximum temperature of 35 °C and a temperature increase of >1.5 °C are identified in North Sumatra, West Sumatra, South Sumatra, Bengkulu, the western part of Java, the southern part of Central Kalimantan, and Papua. Meanwhile, areas with a maximum temperature of 38 °C and a temperature increase of >1.5 °C are identified at several points in Aceh, Lampung, South Sumatra, West Sumatra, and West Java [46]. Unfortunately, the climate change hotspot threshold for rainfall does not yet exist to complete the temperature-based analyses. However, based on the change in rainfall, the largest decrease reaching 20% is projected to occur in most areas of Sumatra, Java, Bali, Nusa Tenggara, as well as the southern part of Sulawesi in the 2016-2035 period [47]. Meanwhile, the largest increase in rainfall reaching 20% is projected to occur in most areas of Kalimantan, the northern part of Sulawesi, and Papua [47]. According to the climate change projection by BMKG [45], the number of seasonal dry days for the period 2020-2049 compared to the period 1976-2005 increases by >25% in South Sumatra, Central Kalimantan, Central Sulawesi, Southeast Sulawesi, Maluku, and West

Papua. This prediction is in line with the IPCC projections on the IPCC WGI Interactive Atlas. Meanwhile, the number of seasonal rainy days in the same period only increases by 5-10% in the northern part of Sumatra, Kalimantan, Sulawesi, and Papua as well as North Maluku. Most of southern Indonesia will experience a decrease in the number of rainy days [45]. Indonesia also often experiences extreme events, such as tropical cyclones, heavy rains (usually with a direct impact on the occurrence of flooding), and droughts [48]. Extreme events for the 2010-2021 period are most often concentrated along the southern part of Sumatera and on the islands of Java, Bali, Nusa Tenggara, South Kalimantan, South Sulawesi, Southeast Sulawesi, and the southern part of Papua Island [49] because these areas are heavily affected by the monsoon [50].

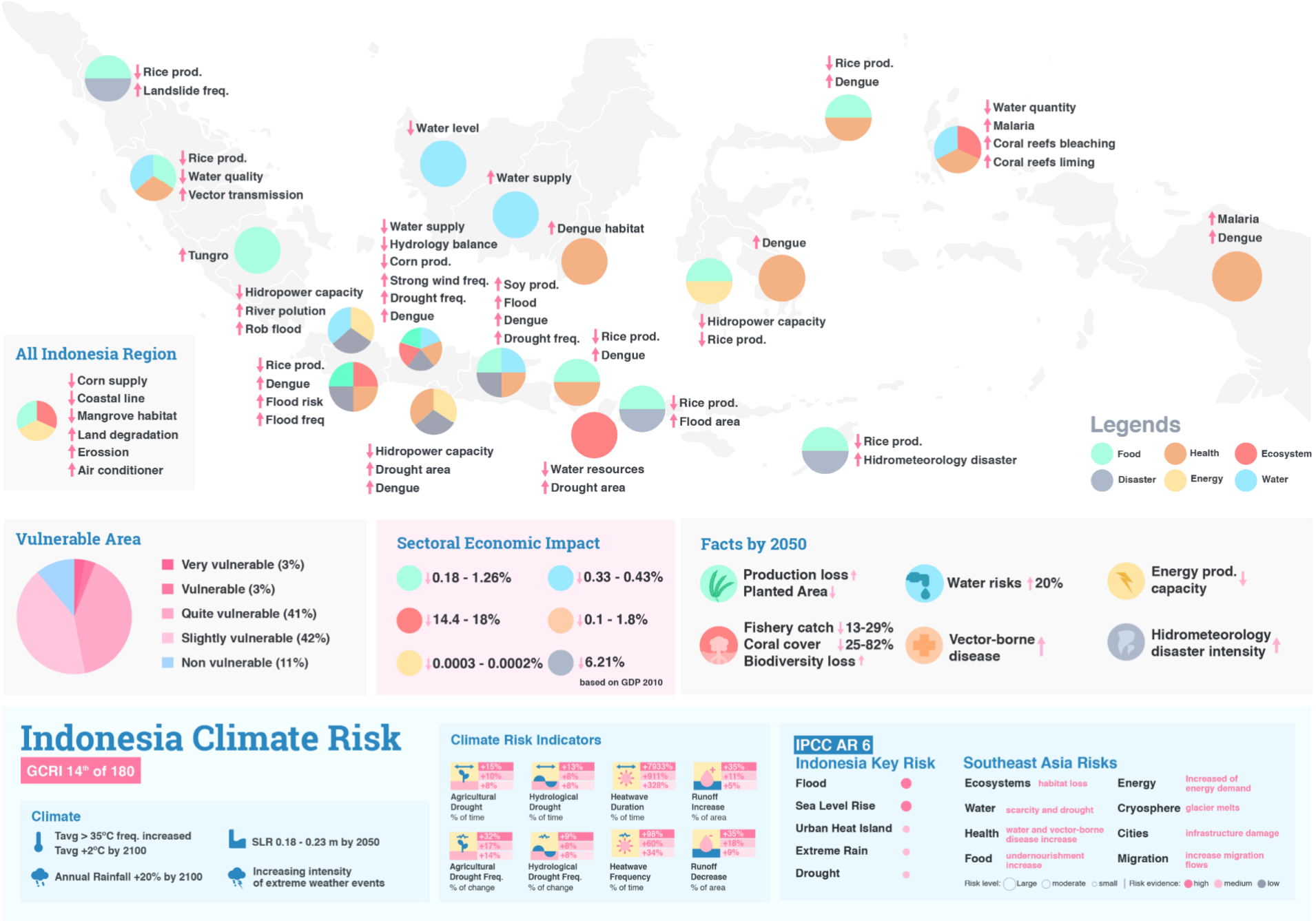


Figure 12 Indonesian climate risk and sectoral impact assessment (different risks are presented from various areas in Indonesia based on the six (6) fields). The map shows the distribution of climate change impacts for each specific sector in each province. The colours in the circle indicate the six priority sectors affected: food (green), water (blue), energy (yellow), health (orange), ecosystem (red), and disaster (grey). The left side of the map provides information on the impacts of climate change that occur throughout Indonesia. The information below the Indonesia map on the left contains the percentage of vulnerable areas in Indonesia, of which some areas (42%) fall into the slightly vulnerable category. The middle section shows information on the impact of the economic downturn obtained from the impact of each sector. The right side shows the information on climate change impact analysis in each sector by 2050. Indonesia's climate risk is given in the bottom box, along with the forming events. The lower right section shows how IPCC AR6 categorizes the impact of climate change in Indonesia as "high risk" with high-intensity events, such as floods and sea level rise. Source: Roadmap NDC Adaptation [46], IPCC AR 6 [48], and SIDIK [52])

2.2 Indonesia's Climate Risk

2.2.1 Country Climate Impact

Climate change will result in a decrease in water availability, changes in crop productivity, and loss of biodiversity which is an invaluable asset owned by Indonesia. Climate change will have an impact on health, mortality, food security, migration patterns, natural ecosystems, and economic well-being, both at local and national levels [47]. Climate change has the potential to affect almost all aspects of ecosystems such as physiological and behavioural responses, life cycles, competitiveness, community structure, productivity, and nutrient cycles. The climate risk for water is projected to increase by 20% by 2025 and by 31% by 2050. Climate change could lead to a reduction of around 13 to 29% in the total potential fishery catch in Indonesian waters by 2050, depending on the emission scenario. This increases to 18% and 63% respectively by the end of the century [51]. By 2100 Indonesia could lose between 25-82% of its coral cover and most of the coral reef-based tourism could be lost. If viewed from the forest and biodiversity sector, one study reported a potential decline in bird populations of up to 60% by 2050 in Sulawesi. Another study, based in Kalimantan, projects that 11-36% of mammal species could lose more than 30% of suitable habitat by 2080 as a result of climate change, likely driving significant population declines. Climate change is also projected to impact palm oil, a significant crop for Indonesia, with the climatic suitability of growing oil palm in the region gradually decreasing by 2030 and becoming more pronounced by 2100. Indonesia is also vulnerable to the impacts of sea-level rise. In the health sector, climate change projections show an increase in infectious and vector-borne diseases. At least 308 million people (out of a projected population of 340 million) in Indonesia could be at risk of malaria in 2070, from a baseline of around 160 million for 1961-2000. Similarly, dengue vector capacity is expected to increase in 2070 [5].

2.2.2 Regional Adaptation Pathway

In Indonesia Long Term Strategies for Low Carbon and Climate Resilience (LTS-LCCR) 2050 [42], the Regional Pathway focuses on priority areas to implement adaptation actions based on several basic necessities (food, water, energy, and environmental health), taking into consideration the following aspects: climate, climate-sensitive, non-climate sensitive, and social economy. Adaptation actions under the Sectoral Pathway are also based on the same basic necessities as the Regional Pathway. Based on Vulnerability Index Data Information System (*Sistem Informasi Data Indeks Kerentanan*/SIDIK) data [52], 3% of villages in Indonesia (*Potensi Desa*/Podes data source, 2011) fall into the "Very Vulnerable" category, 3% into the "Vulnerable" category, 41% into the "Quite Vulnerable" category, 42% into the "Slightly Vulnerable" category, and only 11% into the "Non-Vulnerable" category.

2.2.3 Sectoral Adaptation Pathway

Climate change events contribute to the deterioration of the national economy. The Asian Development Bank (ADB) project reported that climate change in Indonesia could impact up to 3.5% of the National GDP by 2100. For example, losses to the agricultural and coastal sectors due to climate change in 2100 are estimated at around 2.2% of the total GDP [53]. The increasing frequency of disasters due to climate change also contributed to a loss of the national economy of 0.3% of GDP [53]. The results of the PBI study show that the potential economic losses of the four priority sectors (marine & coastal, water, agriculture, and health) due to climate change will reach IDR 102.36 trillion in 2020, equivalent to 0.61% of the 2020 GDP target and can reach 115.53 Trillion in 2024 [54].

Food

The impact of climate change on the food sector can lead to a decrease in food production in developing countries by up to 11% [55]. Extreme weather causes floods and droughts, pest and disease attacks, and damage to agricultural infrastructure. The impact on food crop production can hamper food supply and increase imports. The decline in rice productivity has an impact on the GDP of the agricultural sector of (-4.71%)-(-32.36%) and on the National GDP of (-0.18%)-(-1.26%) with an average of (-0.68%) [46].

Water

Climate variability can affect the sustainability of water resources through the increased risk of flooding and drought. Reduced water discharge and an increasing population [56] can jeopardize the stability and sustainability of the water supply [57]–[59]. Climate change can cause four main hazards in the water sector: decreased water availability, floods, landslides, and droughts which are generally caused by rainfall parameters and climatic events and extreme weather. The loss of water resources caused by the disruption of the water balance in the territory of Indonesia is equivalent to (-0.33%)-(-0.43%) of the National GDP. The average value of losses in the water resources sector is around (-0.38%) of the National GDP [46].

Energy

Increasingly intense weather events, higher air and water temperatures, changes in rainfall and river flow patterns as well as future sea level rise can affect the energy system with both an impact on energy demand and supply [60]. The supply of electrical energy can be disrupted due to a decrease in generating capacity. Power plants need more water for cooling due to warmer temperatures in the future but water supplies may decrease due to reduced rainfall. Climate change will also affect the accessibility of energy sources. Extreme weather can disrupt the coal mining process. Rising sea levels can hamper coal

transportation by sea. Rising sea levels and high tides can also damage coal barges. Extreme weather that can cause floods, fires, and hurricanes has the potential to damage energy infrastructure such as pipelines, electricity transmission, ports, and gasification terminals. Electrical losses may also occur due to temperature changes that affect transformation and electrical conductivity [61].

Health

Changes and environmental damage due to rain and flooding have the potential to increase disease-causing vectors and of course, increase disease transmission. Infectious diseases that will appear and spread during the rainy and flood seasons are acute respiratory infections (ARI), dengue fever, diarrhoea, leptospirosis, malaria, skin diseases, and possibly bird flu [62]. The beginning of the dry season will increase the risk of diarrhoea [63]. Meanwhile, air pollution caused by carbon emissions causes the death of more than 7 million people/year globally and also causes 26% of deaths due to systemic liver disease [64]. The results of the analysis project that losses in the health sector due to climate change in Indonesia will affect the value of the National GDP by 0.10%. If climate change were to trigger catastrophic events simultaneously, the impact on National GDP is estimated to be 1.8% [46].

These values of the economic impact of climate change on the fulfilment of the basic needs (food, energy, health, and water resources) of local residents in Indonesia add up to (-0.66%)-(-3.45%) of the National GDP, with the average impact estimated to reach -2.87% of National GDP in 2030 [46].

Ecosystem

Climate change affects forest, freshwater, coastal and marine ecosystems. The inability of forest biophysics to support the growth of certain plant species and shifts in the rainy season can cause obstacles to forest and land rehabilitation efforts. In addition to the potential impacts of climate change, environmental degradation in watershed areas such as vegetation coverage in upper catchment areas can increase hydrometeorological disasters. Forest degradation in the upstream areas causes flash floods and landslides (Floods in Bohorok, Wasior, Agam, and Way Ela) [46]. This degradation occurs due to the conversion of forest areas into plantations (oil palm and rubber), which reduces water absorption and increases river discharge during the rainy season, thus, causing floods.

Global land use change from 1997 to 2011 has resulted in the loss of global ecosystem services of around 5.69% to 26.75% of Indonesia's National GDP. Biomes assessment shows that a decrease in the area of terrestrial biomes might cause a loss of 14.4% of Indonesia's GDP in 2010, whereas a decrease in the area of marine biomes may represent

a loss of 0.079% (for seagrass) and 18% (for coral reefs) of Indonesia's GDP in 2010 [46]. Climate change can cause Indonesia's seawater to experience an increase in temperature of 0.2 ˚C to 2.5 ˚C so it has the potential to have a negative impact on 50,000 km^2 of coral reefs (including coral bleaching) in Indonesia or about 18% of the total area in the world, which in turn will have an impact on the availability of fish resources and fishermen's income [65]. Regarding mangrove ecosystems, various studies compiled by the Ministry of Marine Affairs and Fisheries (MoMAF) until 2018 show that mangroves in Indonesia are threatened and experience the fastest rate of damage in the world; up to 40% of mangroves in Indonesia have been lost in the last three decades [66]. Deforestation of mangrove forests is estimated to account for around 6% of Indonesia's total forest loss [67]. Based on this, about 637,624 ha or 19.26% of mangrove areas in Indonesia are in critical condition [68].

Disaster

Many disaster events in Indonesia are triggered by changes in weather and climate extremes, for example, high air temperature and low rainfall can cause drought and forest fires. Based on the 2022 INFORM Risk Index, Indonesia ranks third in terms of countries with the highest climate risks, with very high exposure to climate-related disasters such as floods and tropical cyclones [69]. The DIBI data of the National Disaster Management Agency (*Badan nasional Penanggulangan Bencana*/BNPB) also indicated that floods and cyclones were the most frequent disasters from 2010 to 2021 [49]. During this period, the incidence of disasters also continued to increase, with the highest number reaching 4977 events in 2020 [49]. All of these disasters can reduce the quality of the environment and endanger important sensitive sectors such as agriculture, water availability, and health as well as marine and coastal ecosystems. They can even have an effect on other sectors [46]. Given that every disaster event can cause a domino effect in other areas of life, it is very necessary to make efforts to reduce the risk of disaster events. Every year, losses due to disasters can reach 30.83% of Indonesia's National GDP with an average of 6.21%.

2.3 Population Vulnerability

2.3.1 Law and Policy: No One Left Behind

Indonesia has adopted the 2030 Agenda for Sustainable Development through Presidential Regulation No. 59/2017. That way, Indonesia is committed to leaving no one behind in the implementation of the SDGs. The Paris Agreement which was ratified by the Government of Indonesia through Law No. 16/2016 also mandates that climate change is a common concern of humankind, so that, when taking action to address climate change, the stakeholders should respect, promote, and consider their respective obligations on human rights, the right to health, the rights of local communities, migrants, children, persons with disabilities, and people in vulnerable situations, and the right to development as well as gender equality, empowerment of women, and intergenerational equity. To support the rights of vulnerable groups such as women, Persons with Disabilities (PwDs), children, and local communities, Indonesia has ratified various conventions and issued various related regulations, which are described below.

Women and Gender

Indonesia has realized the importance of gender equality in human development and supports women's rights by ratifying the Convention on the Elimination of All Forms of Discrimination Against Women (CEDAW) through Law No. 7/1984. Indonesia also adopted the Beijing Declaration and Platform for Action (BPfA) in 1995 which supports gender mainstreaming as the main global strategy for promoting gender equality. National gender mainstreaming in Indonesia is mandated through Presidential Instruction No. 9/2000 which requires all government agencies at the national and regional levels to mainstream gender into the planning, implementation, monitoring, and evaluation of all policies and programmes. In its implementation, some improvements have been made from the 2015 policy (RPJMN 2015-2019) to the RPJMN 2020-2024. Gender mainstreaming covers aspects of (i) gender equality and justice in education, (ii) life expectancy, (iii) health, (iv) workforce, (v) economy, (vi) political representation in parliament, (vii) eradication of domestic violence, and (viii) addressing climate-related challenges (access to water, energy, and sanitation as well as the capacity to deal with food scarcity and disasters) [42].

Regarding climate change, the MoEF (as the national focal point for climate change) and the Ministry of Women Empowerment and Child Protection/MoWECP (*Kementerian Pemberdayaan Perempuan dan Perlindungan Anak*/KPPPA) have signed the memorandum of understanding (MoU) No. 22A/-KPP-PA/ROREN/XII/2016 concerning the Acceleration of the Implementation of Gender Mainstreaming, Women's Empowerment, and Child Protection in the Environment and Forestry sector and Controlling Change Climate in 2016. In support of this acceleration, the Guidelines for Implementing Gender

Mainstreaming in the Environment and Forestry Sector were issued through the MoEF Regulation No. 31/2017. The Gender Mainstreaming Strategy in this regulation guarantees that the development of various climate activities that have been planned provides access, participation, control, and benefits for women and men.

Persons with Disabilities

Indonesia supports the rights of Persons with Disabilities (PwDs) by adopting the Convention on the Rights of Persons with Disabilities (CRPD) which was ratified through Law No. 19/2011. This convention mandates that PwDs should be seen as "subjects" with rights, who are capable of claiming those rights and making decisions for their lives based on their free and informed consent as well as being active members of society. Law No. 8/2016 also concerns Persons with Disabilities and mandates Disability Service Units in various government agencies. This law addresses the interaction between disability and the environment and how the environment facilitates protection (Disaster Protection Rights). Furthermore, the Government issued Government Regulation No. 70 of 2019 concerning the Planning, Implementation, and Evaluation of the Respect, Protection, and Fulfilment of the Rights of Persons with Disabilities. The National Action Plan for Human Rights (Presidential Regulation No. 53/2021) focuses on strengthening regulations as well as accommodation rights and legal rights, increasing access to basic services, and improving data collection systems for PwDs. Regarding climate change, PwDs are still generally addressed as part of a vulnerable group. As a follow-up to strengthening regulations, Indonesia created the National Action Plan for Persons with Disabilities 2021-2025.

Children

Indonesia supports children's rights by adopting and ratifying the Convention on the Rights of the Child through Presidential Decree No. 36/1990. This regulation states that the best interest of the child shall be the primary consideration in all actions concerning children, which means that children must be considered in every action, including climate change actions. Generally, child protection in Indonesia is regulated by Law No. 23/2002 and amended by Law No. 35/2014. Regarding climate change, children have a very strategic role. The MoWECP already endorsed the dual function of children as "Initiators" and "Informers" (*"Pelopor" and "Pelapor"*), which then support the notion of "children as the agents of change" for fostering climate change action.

Local Communities

As the largest archipelagic country in the world, Indonesia has a very wide variety of tribes and cultures, as well as indigenous peoples or in Indonesia is acknowledged as local communities [70]. Indonesia is one of the countries that supported and signed the Declaration on the Rights of Indigenous People (UNDRIP) in 2007. Nationally, Indonesia recognizes the existence of Indigenous People as Customary Law Societies or hereafter known as ***local communities*** which is stated in the body of the 1945 Constitution after the amendment, namely in Article 18B paragraph (2) which states that "The state recognizes and respects customary law community units and their traditional rights as long as they are still alive and in accordance with the development of society and the principles of the Unitary State of the Republic of Indonesia, which are regulated by law". To support the culture and traditions of every society, Indonesia already has Law No. 5/2017 on the Advancement of Culture. Regarding climate change, local communities are also generally addressed as part of a vulnerable group. However, local communities are a very important group regarding efforts to reduce gas emissions into the atmosphere through forest maintenance [71].

Poor and Rural Communities

The poor are usually identified as people who live in rural areas (although there are also poor people who live in urban areas). This group is affected by climate change due to their limited capacity regarding various social and economic aspects. Meanwhile, for their daily lives, they are very dependent on the agricultural sector which is very sensitive to climate change [72]. As stated in the body of the 1945 Constitution after the amendment, the government is obliged to prevent and reduce poverty. Because of this mandate, the Government has issued Law No. 13/2011 on handling the poor. The government has also issued Presidential Regulation No. 15/2010 concerning the Acceleration of Poverty Reduction, as amended through Presidential Regulation No. 96/2015, and Presidential Regulation No. 166/2014 concerning the Programme for the Acceleration of Poverty Reduction. Regarding the regions, there is the Ministry of Home Affairs Regulation No. 53/2020 to regulate work procedures and the institutional development of human resources coordination teams for poverty reduction in provinces and districts/cities. In addition, specifically for villages, the government protects and empowers village areas through Law No. 6/2014. This law encourages the improvement of the welfare of rural communities and the quality of human life as well as poverty alleviation which can be done through the fulfilment of basic needs, the development of village facilities and infrastructure, the development of local economic potential, and the sustainable use of natural resources and the environment. These regulations can serve to encourage the resilience of poor and rural communities to climate change.

Elderly

'Elderly' is defined as the population aged 60 years and older. Regarding climate change, the elderly group is increasingly vulnerable because of their decreasing physiological and cognitive functions [73]. Due to their vulnerable condition, Indonesia regulates the welfare of the elderly through Law No. 13/1998. In the law, efforts to support the elderly are directed at increasing their empowerment in development and increasing their social welfare to extend their life expectancy and productive period. Following that, the government issued Government Regulation No. 43 of 2004 concerning the Implementation of Efforts to Improve Social Welfare for the Potential Elderly. The Ministry of Social Affairs has issued the Minister of Social Affairs Regulation No. 5/2018 on the National Standard for Elderly Social Rehabilitation to ensure that the elderly is prosperous and able to properly carry out their social functions in community life.

2.3.2 Profile of Vulnerability in Indonesia

Until 2021, Indonesia's population was around 272.7 million people. Society consists of 137.9 million men and 134.8 million women [1]. The productive age group (15-64 years) is the largest group with about 69.2%. The rest are unproductive populations with those aged under 15 years by far more (24.3%) than those aged over 64 years (6.5%) [1]. The economically active Indonesian population is dominated by men, which make up around 60.6%. Meanwhile, women dominate the non-labour force/economically inactive category with around 72.5%, the highest proportion taking care of the household [1]. The main jobs recorded in Indonesia are in the agriculture, forestry, and fisheries sectors. Based on the level of education in 2021, both women and men already have almost equal access to and levels of education (9 years on average). However, female literacy rates tend to be lower (95%) than male ones (98%). Regarding the region, the literacy rate in rural areas is lower (92% female and 96% male) than in urban areas (97% female and 99% male) [1].

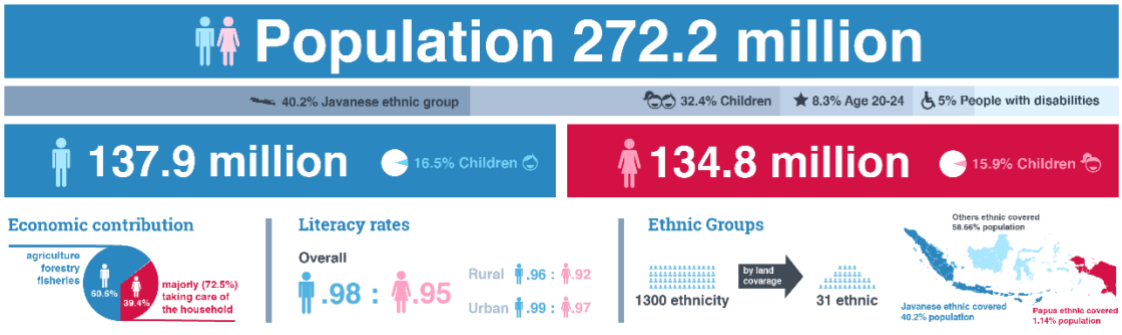


Figure 13 Population of Indonesia. Source: illustrated from multiple data and information by BPS[1][2][8][74], MoEF [71], MNDP [75])

The population in urban areas is higher than the population in rural areas. However, poverty rates are recorded to be higher in rural areas. It can be said that currently, more than 60%

of the poor live in rural areas [72]. As of March 2022, it was noted that the poverty rate in rural areas was 12.3% and in urban areas 7.5% [76]. There are some areas with poverty rates much higher than the Indonesian average, generally in eastern Indonesia such as Papua, Maluku, Gorontalo, and NTT. This is one of the driving factors for urbanization, which in turn causes greater inequality in urban areas. This can be seen from the Gini Ratio of urban areas until March 2022 which is greater (0.403) than that of rural areas (0.315) [77].

The share of Indonesian children (aged 0-19 years) [8] of the total population is 32.4% (51% boys; 49% girls), which is equivalent to about 88 million people [1]. Children in rural areas tend to have a higher poverty rate than children in urban areas [8].

Based on the 2020 BPS census data [74], the number of Persons with Disabilities (PwDs) in Indonesia reached 22.5 million or around 5% of the total population. In general, the most common types of disabilities in Indonesia are visual impairments, which account for around 64% of the total number of disabilities. Meanwhile, there are only relatively few emotional or behavioural problems and disabilities in taking care of oneself and using hands/fingers[75]. PwDs are also grouped based on the number of disabilities: single disability (PD) and PwDs with 2 or more types of disability (PMD). PMD account for almost half (48.7%) of PwDs in Indonesia [75]. Regarding their age group, PwDs tend to be in the elderly population, in line with the decline in physical and mental/emotional functions as a result of the ageing process [75].

In general, ethnic groups in Indonesia are determined based on lineage. Overall, the number of ethnic groups in Indonesia reaches more than 1300. Due to the large geographical distribution, ethnicities in Indonesia are grouped into 31 ethnic groups [2]. This also extends to certain local communities. Although there are not many ethnicities, the Javanese are the largest ethnic group with a population of about 95.2 million people or about 40.2% of the Indonesian population according to the 2010 population census [2]. Local communities are closely related to the environment and its resources. Climate change that has an impact on the environment and resources will therefore have a major impact on local communities. However, they are part of the solution for climate change adaptation and mitigation actions because they have the knowledge of how to maintain and utilize the natural resources in their habitat [71]. Despite signing the UNDRIP in 2007, the Law on local communities is still being drafted by the Government of Indonesia. The organization that oversees the local communities is Indigenous Peoples Alliance of the Archipelago (*Aliansi Masyarakat Adat Nusantara*/AMAN).

In 2021, the percentage of the elderly population (>60 years) in Indonesia reached 10.8%.

This means that Indonesia has entered the phase of ageing population structure, which is marked by the proportion of the population aged 60 years and over reaching 10 per cent of the total population [73]. By 2045, the elderly population is expected to reach 20% [73]. The rapid growth of this age group is also due to the demographic transition, where Indonesia is currently at the stage of low birth and death rates [73]. However, the elderly population is still very vulnerable because they are no longer economically productive, are prone to health problems, and often need companions as caregivers. Thus, the elderly depend on the productive age group [73]. Most of the elderly (43.2%) are also in a poor economic situation (belonging to the expenditure group of the bottom 40%) [73].

Potential Vulnerability

Potential vulnerabilities can vary depending on the conditions of the region and its people. For example, SIDIK data shows that the areas with the most vulnerable and highly vulnerable villages are Papua, Kalimantan, Maluku, and West Sulawesi. Meanwhile, these provinces are inhabited by many local communities who are still very dependent on forests and natural resources [2]. Based on DIBI, Java Island is the most frequently affected by disasters related to climate change [49]. Meanwhile, more than half of Indonesia's population lives on Java Island. Even the majority of Indonesian children live on Java Island [1]. Coastal areas are very vulnerable to various climate threats such as tidal flooding, extreme weather, rising sea levels, etc. Meanwhile, coastal areas, especially on the North Coast of Java, are the backbone of the national economy [31]. With these vulnerabilities, well-designed human resources management and development are needed to address intergenerational issues and issues relating to people in vulnerable situations including children, local communities, and persons with disabilities. Indonesia's Hundred Years Vision (Vision Indonesia 2045) has placed human resource development on the first pillar with science and technological advances in order to improve the quality of human resources by promoting education and strong cultural values, improving health and quality of life, increasing productivity, and advancing science and technology capacities as well as widening employment opportunities [31].

Distribution of Socio-demographic Index Values Based on Province

BPS uses the Index method to measure local communities' social and economic conditions. BPS usually publishes these indices in the form of updated tables annually. Some of the indices used to determine the socio-economic conditions of the community are poverty rate, HDI, access to drinking water, access to sanitation, access to health facilities, and prevalence of undernourishment. The results of each index per province are described in the following illustration (Figure 14).

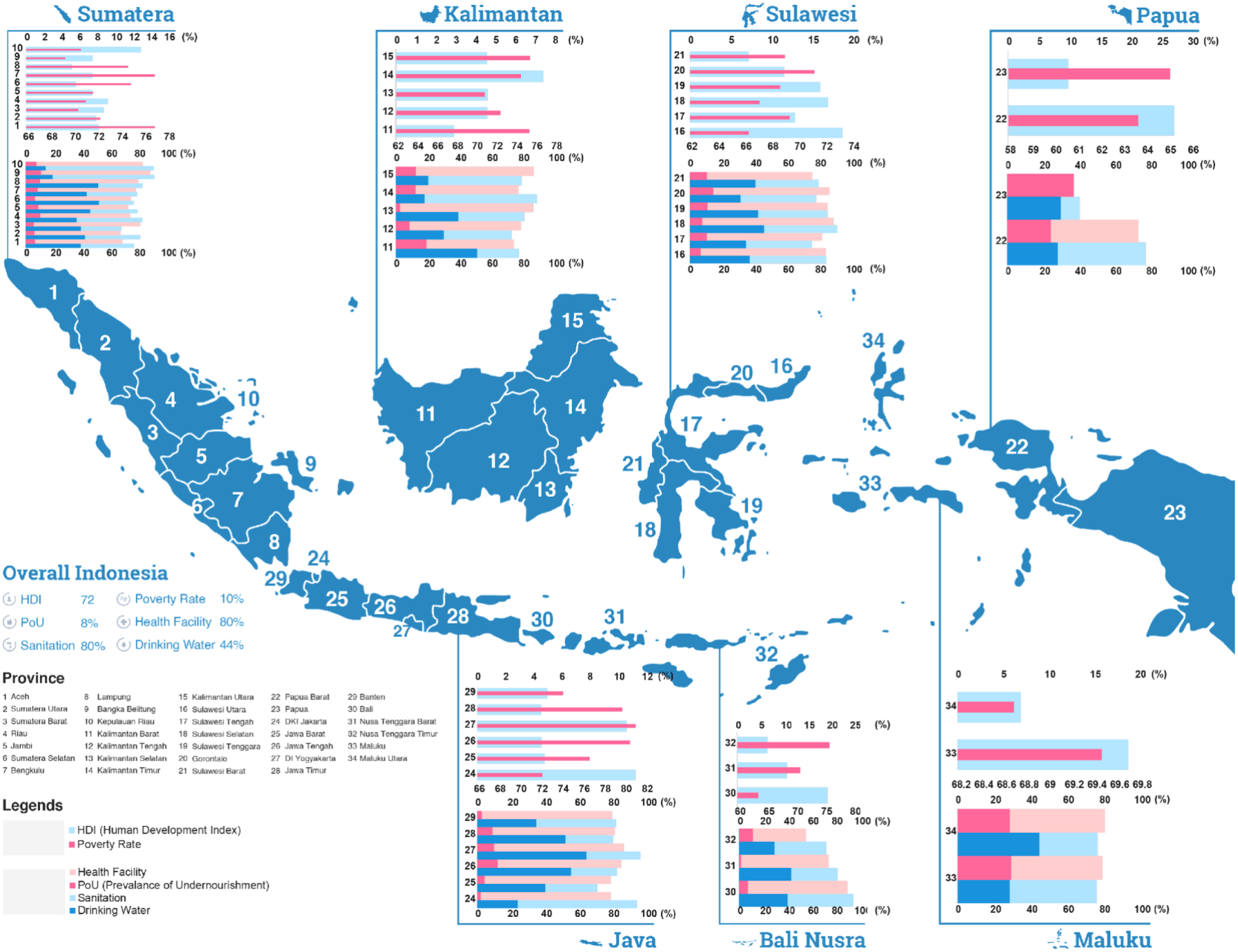


Figure 14 Indonesian Profile of Social Vulnerability. The profile of social vulnerability in the picture is grouped into two parts (social and health aspects), so two graphs are displayed per Big Island in Indonesia. The upper graph shows the social aspect of HDI (light blue) and poverty rate (dark pink). The lower graph shows the health aspect which consists of the percentage of Health Facility (light pink), Prevalence of Undernourishment (PoU) (dark pink), Sanitation (light blue), and Drinking Water (dark blue). In each graph, the x line shows the province code in each island (the code explanation is at the bottom left), while the y line shows the percentage value of each index. Social vulnerability profiles for all parts of Indonesia are shown next to the map. Sources: drawn from various sources compiled in Table 1.

All indices in Figure 14 use percentages. However, large percentages are not always desirable. For example, the poverty rate and the Prevalence of Undernourishment (PoU) show the percentage of poor people and people who have food insufficiency compared to the total population of the province. That means, the smaller the percentage, the better. As Figure 14 shows only the poverty rate and access to health facilities exceed the target in the Government Work Plan. The national HDI is close to the target, some regions already have an HDI >80% such as Jakarta and Yogyakarta [71]. Access to sanitation nationally is also close to the target, Yogyakarta has almost reached an index of 100% [78]. The index of access to drinking water is very far from the target. This is also in line with the 2021 Water Quality Index (IKA) from IKLH which only reached 52.7, far from the RPJMN target of 55.2 [39]. The PoU is also close to the target, but the PoU in several eastern provinces such as Papua and Maluku still has a very large value (>20%) [79]. This means that many people in these areas are still experiencing insufficient food supply.

Gender Vulnerability Study

Gender issues cannot be separated from climate change. In Indonesia, Presidential Instruction No. 9/2000 requires all government agencies at the national and regional levels to mainstream gender into the planning, implementation, monitoring, and evaluation of all policies and programmes, including climate change. To assess whether a project is gender-responsive or not, Gender Equality and Social Inclusion (GESI) ensures that a climate project and programme is not only beneficial for climate action and the economic aspects of the community but also for social aspects and social protection [80]. MoEF as the national focal point for climate change also has regulations related to gender mainstreaming (i.e., MoEF Regulation No. 31/2017). In this regulation, the Planning Bureau is the Coordinator of the gender mainstreaming (*Pengarusutamaan Gender*/PUG) of the MoEF Working Group. MoWECP released the General Guidelines for Gender-Responsive Climate Change Adaptation and Technical Guidelines for Gender-Responsive Climate Change Adaptation in Regions (2015). The targets of the gender-responsive climate change adaptation strategy in the document are focused on the food/agriculture, energy, and clean water sectors [81]. Due to the importance of a gender perspective, BNPB issued head Regulation of BNPB No. 13/2014 on Gender Mainstreaming in the Field of Disaster Management. This regulation is issued to ensure that the fulfilment of the rights and needs of men and women is carried out in a fair and humane manner. In implementing climate change adaptation in the regions, gender working groups and Family Welfare Empowerment (*Pemberdayaan Kesejahteraan Keluarga*/PKK) are also often involved [82]. Most of the gender studies conducted in Indonesia cover aspects related to the women's vulnerability to climate change, the extent to which gender mainstreaming is carried out, and how to increase local

capacity [83]–[86].

Persons with Disability Study

Indonesia already has various regulations and policies that are concerned with Persons with Disabilities (PwDs). This support is shown in the form of ratification of conventions, special laws for PwDs, and the existence of various infrastructures for PwDs. For example, due to the vulnerable position of PwDs during a disaster, BNPB has issued the Head regulation of BNPB No. 14/2014 concerning the Handling, Protection, and Participation of Persons with Disabilities in Disaster Management. To support the role of PwDs, there have been various groups or organizations of PwDs in the regions that have become forums for increasing the capacity of PwDs. For example, the Wahana Inclusive Indonesia Foundation focuses on developing the potential of PwDs and promoting inclusive education in Indonesia. However, in relation to climate change, PwDs are still generally seen as part of a vulnerable group. Studies related to climate change and disability are also still rarely conducted. This has an impact on climate change adaptation and mitigation actions that have not focused on addressing the problems raised by disability groups [87]. Due to the rarity of studies related to PwDs, MNDP published the book Disability Study: An Overview of Improving Access and Living Standards of Persons with Disabilities in Indonesia in 2021. The disability studies that have been carried out focused on disability profiles, regulations related to PwDs in the regions, exploration of the needs of PwDs, and proposed innovations to address unmet needs [75], [88], [89].

National Adaptation Priorities, Strategies, Policies Plans, Goals, and Actions

Overview • Sectoral Impact • Vulnerability

3. National Adaptation Priorities, Strategies, Policies, Plans, Goals, and Actions

Indonesia has developed several policy and strategy initiatives which, if implemented properly and in accordance with regional conditions, can serve as adaptive and mitigation co-benefits in reducing the impact of climate change. The main references among Indonesia's adaptation policy initiatives are the Roadmap Nationally Determined Contribution (NDC) on Adaptation [46], Updated NDC [41], Climate Resilience Development [90], Indonesia Long-Term Strategy on Low Carbon and Climate Resilience (LTS-LCCR) 2050 [42], and Enhanced NDC submitted to UNFCCC in 2022 [43]. In this section, the adaptation priorities, strategies, plans, goals, and actions in the above policies are discussed, with details per sub-chapter as follows (Figure 15):

a) Priorities: This section will explain the criteria for determining regional and sectoral priorities in Indonesia.

b) Strategies: This section will describe the existing national adaptation strategies in Indonesia to decrease climate change impact.

c) Policies: This section will describe Indonesia's regulations that can support the existing adaptation strategy.

d) Plans: This section will explain the procedure for planning adaptation actions in view of priorities and strategies.

e) Goals: This section will explain the targets that the implementation of the adaptation strategy is to achieve.

f) Actions: This section will describe the results of the identification of adaptation actions based on action plans.

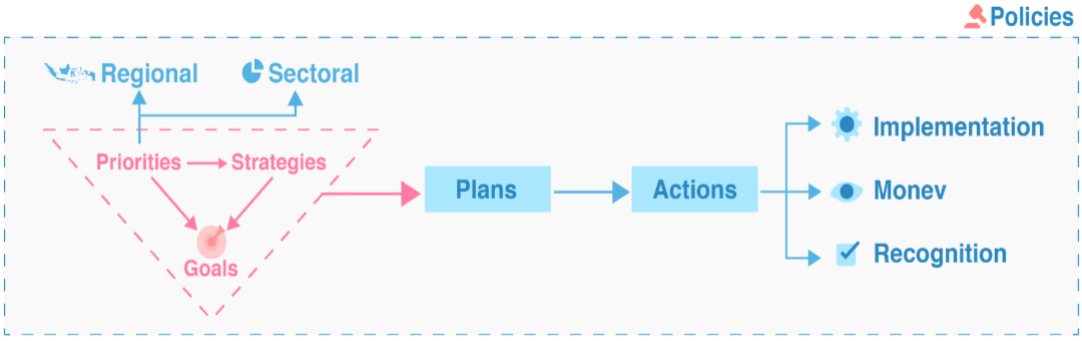


Figure 15 Connection flow between priorities, strategies, policies, plans, goals, and actions

The Government of Indonesia (GoI) has committed to changing its current development path towards low-carbon development and climate resilience (economic, social, and livelihoods resilience, also regarding ecosystems and landscapes) in the face of climate change and other environmental challenges with a phased approach and the principle of leaving no one behind [43, 44, 47]. The application of climate resilience emphasizes the principles of equity and sustainability which require a transformation process. The NDC, as a guide in the preparation of the NDC Adaptation Roadmap formulates key strategies which broadly consist of Investment, Human Resource Capacity/Green Job Opportunities, and Land and Seascape Management with a focus on 6 priority sectors (water, food, energy, environmental health, ecosystem, disaster). With RPJMN 2020-2024 [31] the issue of climate change has become National Priority (PN) No. 6 and receives funding priority through the National Revenue and Expenditure Budget (*Anggaran Pendapatan dan Belanja Negara*/APBN) mechanism. Through the Enhanced NDC [43], the GoI has formulated adaptation actions for each resilience target based on the strategy that is derived from the key programme (Figure 16).

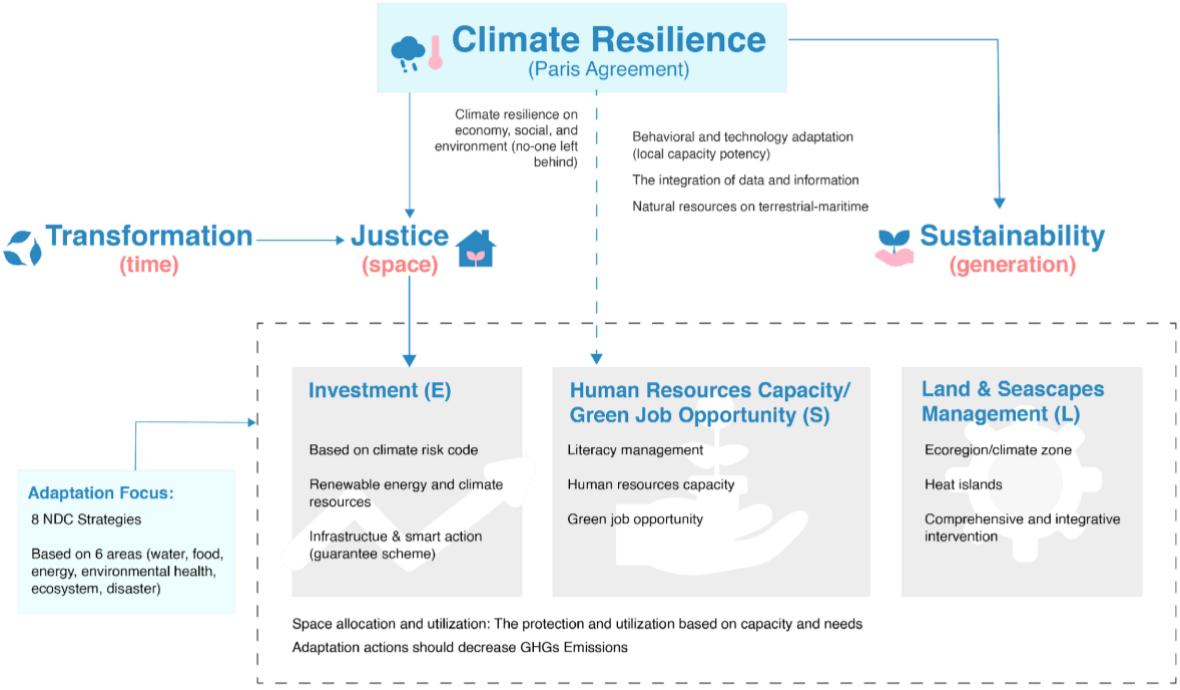


Figure 16 The components to achieve climate resilience as the main target of climate change adaptation extracted and illustrated from the LTS-LCCR 2050 [42]

3.1 Priorities

3.1.1 Prioritiy Areas

Indonesia uses two (2) approaches in priority areas, the regional and the sectoral approach (Figure 17) [42]. The regional approach is used to determine priority areas for the implementation of adaptation actions by considering climate aspects (such as climate

change hotspots) and regional conditions (biophysical and socio-economic), resulting in areas with a high potential to be affected by climate change. The sectoral approach is used to identify sectors most affected by climate change in priority areas.

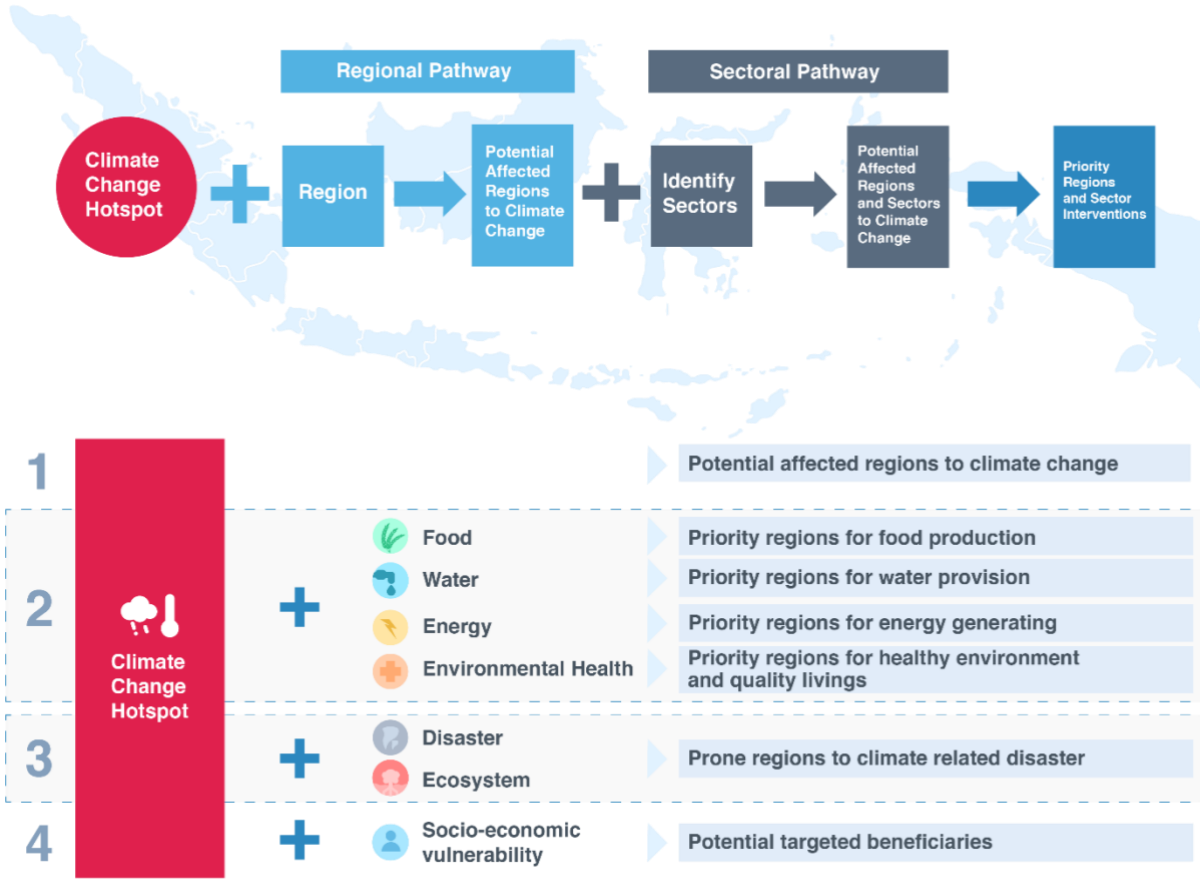


Figure 17 Climate change adaptation pathways. Source: LTS-LCCR [42]

Indonesia introduced the Climate Change Hotspot (CCH) map to provide direction for intervention activities in areas potentially affected by climate change. CCHs in Indonesia are now limited to regions that have the potential to experience a temperature increase of 2 ˚C from the baseline condition, thus, identifying areas whose future temperatures will rise to more than 35 ˚C [46]. This CCH map should be further developed in the future to include other climate variables such as changes in rainfall totals, intensities, and days. Upon determining priority areas, the next step is to identify the sectors most affected by climate change so that actions can be more specifically targeted. In the Enhanced NDC and the NDC Roadmap on Adaptation, the sectors affected by climate change are grouped into six fields: basic needs (i.e., food, water, energy, and health) and enabling conditions (i.e., ecosystems and disasters).

a) Food (related to food production): indicates priority areas for action interventions that relate to decreasing food production due to the threat of climate change, such as crop failure and losses.

b) Water (related to water supply): indicates priority areas for action interventions that relate to decreasing clean water supply due to the threat of climate change, such as drought and polluted water.

c) Energy (related to power generation activities): indicates priority areas for action interventions that relate to decreasing electricity production due to the threat of climate change, such as disruption of power generation activities (destruction of equipment) due to extreme weather.

d) Health (related to a healthy environment and quality of life): indicates priority areas for action interventions that relate to increasing disease incidence due to the threat of climate change, such as increasing numbers of mosquito larvae and increasing water and air pollution.

e) Ecosystems (related to ecosystem services): indicates priority areas for action interventions that relate to the restoration of ecosystem services.

f) Disaster (related to hydrometeorology): indicates priority areas for climate-related disaster response and vulnerability reduction actions after major disasters in a region.

In addition, the determination of area priority is also determined using vulnerability index data. CCHs overlaid with vulnerability maps can be employed to define the potential targeted beneficiaries. The vulnerability index (SIDIK) [52] is constructed using flood and drought risk maps, socioeconomic data, and environmental infrastructure.

3.1.2 Priority Actions

Planning and implementation of adaptation in sectoral pathways are used to determine priorities for adaptation actions in the six fields. The LTS-LCCR document has defined key programmes and actions for each field.

a) Food: Directed at agriculture, aquaculture, and nutrition so that it can increase food commodity production, intensify food growing, and meet demand from vegetables, animals, and fisheries.

b) Water: Directed at water supply and demand so that it can expand water storage capacity, climate-proof water building infrastructure, and expand water distribution networks (water hubs).

c) Energy: Directed at electricity generators, renewable energy, and climate-proof infrastructure so that it can invest in climate resources (wind, solar radiation, rainfall, geothermal) and create opportunities for green jobs related to climate resources.

d) Health: Directed at nutrition, disease surveillance, urban heat islands, and settlement areas so that it can establish surveillance systems for climate-sensitive disease, build risk codes for environmental health and well-being, and preserve a healthy environment and quality livelihoods for disease risk reduction and/or urban heat islands.

e) Ecosystems: In ecosystem management, it is directed at air space, terrestrial, freshwater as well as coastal and marine ecosystems so that it can build eco-climate zoning for managing ecosystem functions and services, pursue Ecosystem-based Adaptation (EbA), and include public participation in sustainable ecosystem management.

f) Disaster: In the field of disaster management, it is directed at prevention and preparedness, emergency and evacuation, and response and recovery so that it can improve the governance for climate change and disaster, strengthen the police on climate-related disaster management, promote climate-proof infrastructures, and improve guarantee/risk transfer schemes and mechanisms.

The summary of the directions for each field (i.e., food, water, energy, health, ecosystems, and disaster) is illustrated in Figure 18. The cross-cutting requirements are also added to complement the directions.

Figure 18 Sectoral pathway of the six (6) fields. Source: LTS-LCCR [42])

3.2 Strategies

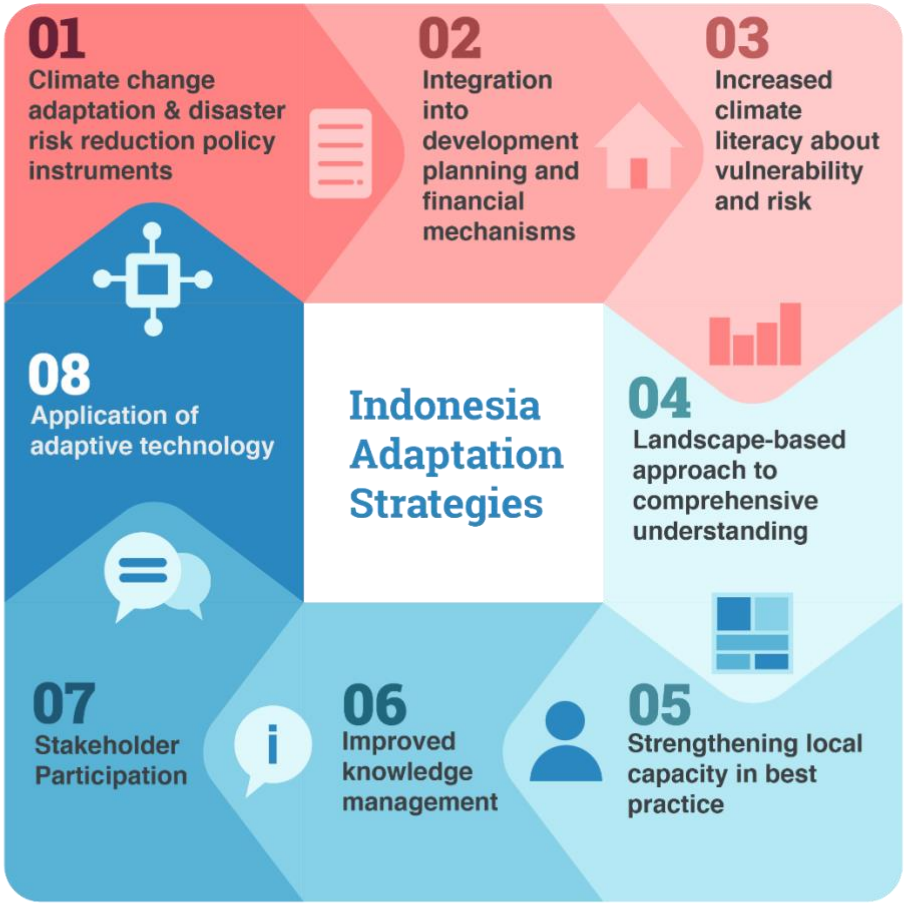
The NDC Roadmap on Adaptation clearly states adaptation priorities and provides strategic guidelines for their achievement. It does so by highlighting Indonesia's key climate-sensitive sectors, associated vulnerabilities and the needed adaptation actions. The Eight Pillars of the Adaptation Strategy (Figure 19) are carefully designed to ensure coordinated adaptation actions are carried out in a timely and budgeted manner. The pillars of the adaptation strategy are described as follows:

1. Strengthening policy instruments for climate change adaptation and disaster risk reduction. The first strategy aims at encouraging the implementation of soft intervention actions by strengthening policy instruments in the form of multi-sectoral collaboration, policy coherence, data compilation, and communication and policy coordination.
2. Integration into development planning and financial mechanisms. The second strategy aims at strengthening action commitments by integrating them into the Development Programme Plan Policy (*Kebijakan Rencana Program*/KRP) and mainstreaming them in strategic sectors. To support it, a financial mechanism was formed with multi-stakeholder financing, investment, and increasing adaptation funding for mitigation co-benefits.
3. Improving climate literacy on vulnerability and risk. The third strategy aims at understanding the impacts of climate change in the form of potential vulnerabilities and risks, at raising awareness for taking adaptation actions based on climate change vulnerabilities and risks, and at encouraging research and publication of existing good

practices. In addition, standard action criteria and environmental risk standards in development activities are needed to avoid maladaptation.

4. Landscape-based approach for comprehensive understanding. The fourth strategy aims at taking a landscape-based approach in order to generate a comprehensive understanding of the integration of land and spatial planning development by considering the risk levels of a region regarding the threats of climate change impacts.
5. Strengthening local capacity by best practices. The fifth strategy aims at strengthening local capacities for implementing adaptation actions. Capacity building aims at the development of climate resilience communities by strengthening culture and gender-based approaches, increasing socio-economic and livelihood capacities, and fostering local capacity in managing resources.
6. Improving knowledge management. The sixth strategy aims at improving knowledge management so that existing information is easy to understand by means of the development of a web-based information service system and administration as well as the systematic integration of information and data on climate and disaster risks. In addition, a reporting system and monitoring and review guidelines are needed to measure the success of actions that have been carried out.
7. Increasing stakeholder participation. The seventh strategy aims at making the implementation of the action programme more effective and efficient by increasing the participation of stakeholders as the decision-makers as well as drivers of the actions. The strategies include raising awareness of all stakeholders regarding adaptation, building a multi-sectoral platform and synergies, and building communication frameworks and networks.
8. Application of adaptive technology

   The eighth strategy aims at streamlining the implementation of action programmes through the application of adaptive technology, in an effort to minimize development risks and promote mitigation co-benefits. It is necessary to build standardization of adaptive technology, implementation, monitoring, and review of the application of adaptive technology.



Detailed Strategies

- Build multi-stakeholder and cross-generational agreements
- Building a conducive policy coherence (enabling environment)
- One climate change data policy
- Coordination of communication in policy formulation and communication

- Integration of policies, plans and programs
- Multi-stakeholder financing mechanism
- Risk code-based business investment in various strategic economic areas
- Increase funding for adaptation co-benefit mitigation
- Mainstreaming of climate change adaptation into strategic sectors

- Fostering a communal understanding to take action based on vulnerability to climate change risks
- Determination of standard criteria for climate change adaptation action in various development activities
- Determination of environmental risk standards in various development activities (structure and infrastructure)
- Encourage research and publication of best practice

- Establish landscape-based and administrative information service systems
- Integration of information and data related to climate and disaster risks (Inarisk, SIDIK) systematically
- Adaptation action reporting system integration with risk codes
- Development of monitoring and review guidelines

- Build a climate resilient community that is integrated in various resilience programs
- Gender-based human resource capacity building
- Strengthening Indonesian culture in climate change adaptation practices
- Improving socio-economic and livelihood capacities
- Community capacity building in managing resources

- Integration of land and coastal and marine spatial development policies
- Development of a development investment scheme mechanism based on a climate change risk code
- Avoid conversion of productive land to other uses and rehabilitation of critical land.

- Build a multi-stakeholder mechanism through a 'no one left behind' approach for site level
- Build multi-stakeholder and cross-sector synergy for implementing local action
- Building a multi-stakeholder communication framework and network to achieve implementation effectiveness and efficiency
- Increase awareness of all stakeholders regarding adaptation

- Building adaptive technology standardization
- Application of adaptive smart technology in an effort to minimize development risks
- Implementing, monitoring, and reviewing the application of adaptive technology
- Improve adaptive technology that has the co-benefit of mitigation

Figure 19 The eight groups of climate change adaptation strategies (above) and the detailed descriptions (below) in Indonesia. Source: derived from the Indonesia Roadmap on Adaptation [47]

3.3 Policies

Several regulations in the form of national regulations and documents have been issued by Indonesia to strengthen existing priorities and strategies for climate change adaptation action. The Determination of regional priorities and actions has been regulated in MoEF Regulation No. 33 of 2016 concerning Guidelines for Preparation of Climate Change Adaptation Actions and MoEF Regulation No. P7 of 2018 concerning Guidelines for the Assessment of Vulnerability, Risk, and Impact of Climate Change. Regional priority directions and actions have also been found in the NDC Roadmap [46] and the PBI Policy Document [90]. The strategy pillar in the previous sub-chapter is the 2021 NDC Roadmap, compiled from the Directives in NDCs and Updated NDC in 2021, and Enhanced NDC in 2022. The legal basis for the preparation of NDC and PBI includes Law No. 32 of 2009 concerning Environmental Protection and Management, Law No. 16 of 2016 concerning the Ratification of the Paris Agreement, Government regulations No. 46 of 2016 concerning Procedures for Conducting Strategic Environmental Studies, and MoEF Regulation No. P72 of 2017 concerning Guidelines for Implementation, Measurement, Reporting, and Verification of Climate Change Actions and Resources. In addition, Presidential Decree No. 98 of 2021 concerning the Implementation of the Carbon Pricing (*Nilai Ekonomi Karbon*/NEK) in national development is also intended to support the NDC strategy, especially regarding reducing GHG emissions and increasing climate resilience. An existing good practice to increase climate resilience is the Climate Village Programme (PROKLIM) which has been regulated in the MoEF Regulation No. P84 of 2016. Based on the respective publication year, regulations in Indonesia related to climate change are illustrated in Figure 20.

Figure 20 Regulations related to climate change in Indonesia

3.4 Plans

Adaptation planning in Indonesia has met the standards, starting from the determination of priority fields/areas to be targeted to the definition of objectives for implementing adaptation (Figure 21). The targets and objectives of the various areas within the NDC are elaborated through various key programmes for priority sectors. Key programmes will be reduced to adaptation strategies and pillars in the appropriate NDC roadmap. Furthermore, the strategic pillars of the roadmap can be used as directions for planning adaptation programmes contained in multi-sectoral actions. These actions should be implemented to achieve climate resilience by 2030.

Figure 21 The flow direction of implementing adaptation actions in Indonesia

In multi-sectoral action, a governance mechanism is required as a form or manifestation of the responsibilities of various relevant stakeholders, especially the administrative authority, funding, and policies in each agency. In general, the existing governance mechanism for the NDC Adaptation Roadmap is divided into 6 important stages: policy formulation, policy implementation, formulation of Norms, Standards, Procedures and Criteria (NSPC), coordination of various stakeholders, technical guidance and supervision, and implementation of monitoring, evaluation, and reporting (Figure 22).

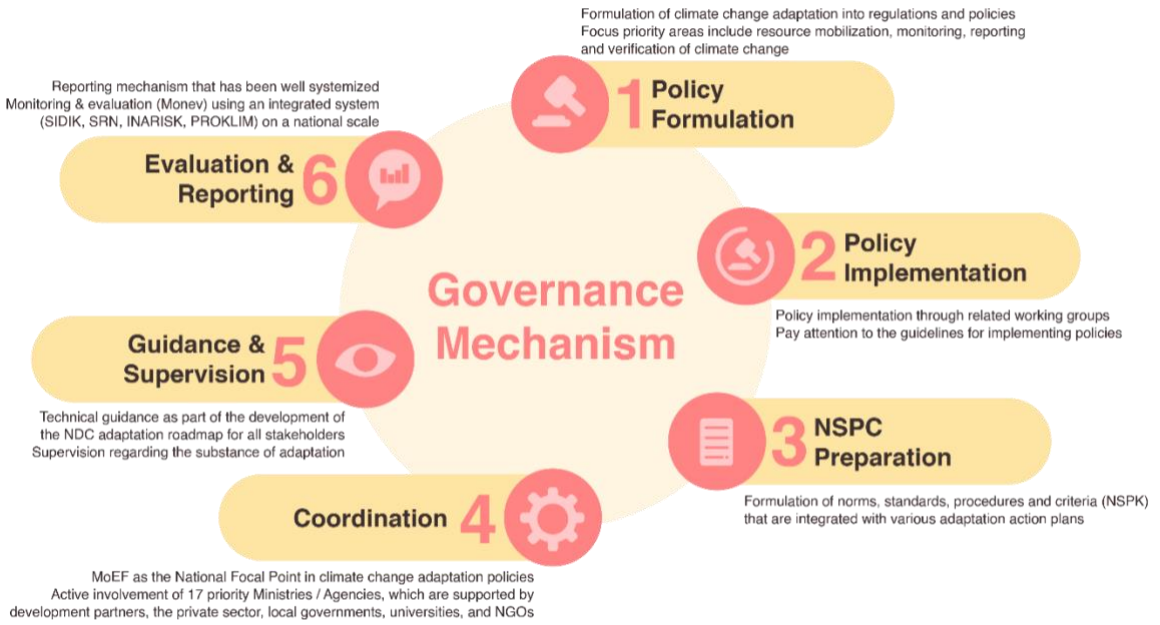


Figure 22 Proposed governance mechanism for the implementation of adaptation actions.

3.5 Goals

The goals of climate change adaptation in Indonesia (set out in the NDC Roadmap and Enhanced NDC) are to build climate resilience and increase adaptive capacity to reduce the risk of losses due to climate change through economic, social, and livelihood resilience as well as ecosystems and landscapes to meet basic needs of the community, such as food, water, and energy with a landscape approach (environmental health, ecosystem, and disaster). Targets were set taking into account the main objectives of adaptation in accordance with the mandate of Law No. 32 of 2009 and the principles of the three dimensions of sustainability, i.e., economic (increasing resource efficiency), social (accelerating access), and environmental (maintaining ecosystem services). As of now, there is no quantification of adaptation targets. However, an initiative has been made to measure the impacts of climate change in terms of production impacts translated into percentages of GDP loss. The study included in the NDC Roadmap on Adaptation estimated the potential losses as shown in Figure 23.

Figure 23 Study results on the adaptation targets contained in the NDC Roadmap on Adaptation. Source: Illustrated from RPJMN 2020-2024 [31], APBN 2010, Roadmap NDC Adaptation [46])

3.6 Actions

The adaptation action planning procedures that have been implemented in Indonesia are described in sub-chapter 4, starting from the determination of key programmes to the preparation of an action program, producing actions for each goal (economic, social, and livelihood security as well as ecosystems and landscapes). Detailed actions to achieve

climate resilience targets are attached in the Enhanced NDC Annex 1. In general, the main adaptation programmes, strategies, and actions in Annex 1 aim at:

a) Reducing triggers for vulnerability regarding the impacts of climate change,
b) Responding to the impacts of climate change and managing risks,
c) Improving community capacity and sustainability of ecosystem services,
d) Increasing stakeholder engagement at all levels in building climate resilience.

3.6.1 Implementation

The implementation of actions to achieve the targets as stated in the NDC Roadmap and Enhanced NDC involves cross-sectoral support and collaboration between stakeholders because adaptation targets are no longer sector-specific but rather lead to the fulfilment of basic needs for the sustainability of the lives of Indonesian citizens. Referring to Presidential Regulation No. 98/2021, the GoI has mandated Ministries/Agencies (*Kementerian/Lembaga*/K/L) to increase resilience and reduce vulnerability to the risk of climate change impacts. In addition, the GoI also needs to establish partnerships with Non-Party Stakeholders (NPS) such as Regional Governments (Province/Regency/City), the business world or the private sector, Non-Governmental Organizations, universities/academics, and the community by upholding the principle of leaving no one behind.

Several policy documents and action plans provide direction for all stakeholders in the implementation of climate change, regarding:

a) Providing input on supporting data and documents both in mapping modalities and community institutions as well as in analysing vulnerabilities and risks (contributing factors)
b) Performing validation and verification of input data and supporting documents to achieve the expected output
c) Accessing and decision-making from the process of preparing adaptation actions
d) Reporting, reviewing, and facilitating adaptation actions in several stages

3.6.2 Monitoring, Reporting, and Evaluating

The GoI has provided a reference in the implementation of monitoring, reporting, and evaluation (MRV) through MoEF Regulation No. 72 of 2017, MoEF Regulation No. 33 of 2016, and MoEF Regulation No. 71 of 2017 that has been updated in Presidential Decree No. 98 of 2021. Indonesia's MRV system is developing a transparency framework so that the actions and commitments of the stakeholders can be measured, reported, and verified. The MRV process for climate change adaptation begins with comparing the indicators or target indicators in the planning with the implementation results. Then a report is carried

out containing several data, including climate change adaptation action policies; assessment of vulnerability, risk, and impact of climate change; planning and implementation of Adaptation Actions, including Baselines and targets, monitoring and evaluation, capacity building, technology, and funding. Quality control and assurance of measurement results and action monitoring is performed through validation and verification (MRV technical details are described in sub-chapter 5.5).

3.6.3 Recognition

The GoI has established a system for recording and reporting climate change adaptation actions called the National Registry System for Climate Change (SRN-PPI) to support the transparency framework in the MRV system. SRN-PPI can be accessed via https://srn.menlhk.go.id/. The SRN serves as the basis for the government's recognition of the contribution of NEK implementation in achieving NDC targets, of efforts to avoid double-calculation of mitigation actions and adaptation of mitigation co-benefits, transfer tracking materials, and further operational policy considerations as needed. Validation and verification of the results of measurement and monitoring of the implementation of Climate Change Mitigation Actions, Climate Change Adaptation Actions, and Carbon Pricing are reported and recorded in the SRN-PPI (explained further in sub-chapters 5.2 and 5.5.2). Climate change actions that have received approval by the results of validation and verification will receive a certificate of appreciation.

ProKlim Awards are given annually by the government to recognise best practices of climate change adaptation and mitigation conducted by the community at the local level. The GoI also appreciates the local government to guide and other non-party stakeholders (e.g. private sector, CSO) to support the implementation of adaptation and mitigation activities at the ProKlim locations.

Implementation and Support Need of, and Provision of Support to, Developing Country Parties

Strategic • Support • Stakeholder • Funding

4. Implementation and Support Needs

4.1 Strategies for Action

Strategy and coordination with related sectors are carried out to strengthen synergies in achieving climate resilience in accordance with the 2020-2030 NDC targets and RPJMN 2020-2024. Coordination and synergies processes are conducted to avoid overlapping and increase the effectiveness and efficiency of implementing various action programmes.

WHAT

Indonesia adopts a transparency framework for climate change action to implement its NDC commitments and ensure the achievement of the Paris Agreement commitments. This commitment is now mandated by the Presidential Regulation No. 98/2021. An action strategy is established in accordance to the NDC adaptation target within the framework of the Paris Agreement aimed at achieving economic, social, and environmental resilience. The focus of climate change adaptation actions has also been aligned with the adaptation strategies in the national development plan. The strategies to implement adaptation actions are: 1) developing a policy framework, 2) disseminating the policy framework, 3) coordinating and collaborating efforts to address climate risks, 4) developing a monitoring and evaluation framework, 5) strengthening knowledge and understanding climate change impacts in various sectors, 6) strengthening adaptation support systems to increase climate resilience, 7) providing a multi-stakeholder collaboration platform to encourage NPS participation, and 8) strengthening data collection and early warning systems by developing required tools. The implementation of adaptation actions are synchronized with the related UN conventions, i.e., the United Nations Convention on Biological Diversity (UNCBD) and The United Nations Convention to Combat Desertification (UNCCD).

What

The implementation of adaptation actions

Why

The country commitment of NDC translated into Presidential Regulation 98/2021

When

The actions are implemented to achieve the NDC target by 2030

Where

The vulnerable areas or sectors Impacted by climate change

How

The actions require a good coordination and multi-stakeholders' engagement

WHY

Presidential Regulation No. 98/2021 mandated the national and sub-national governments, the private sector, NGOs, and other relevant stakeholders to conduct mitigation and adaptation efforts. The Provincial Government is responsible for reporting the efforts to the MoEF as a National Focal Point to UNFCCC. The contribution of each party to achieve the NDC targets (i.e. economic, social and livelihood resilience as well as ecosystems and landscapes) has been regulated in the Presidential Regulation No. 98/2021.

WHEN

The timeline for adaptation actions is in accordance with the NDC Adaptation Roadmap for the period of 2021-2030 [46]. The implementation of adaptation actions also considers the targets of Indonesia's LTS-LCCR 2050 and the SDG agenda 2030. In shorter period, the adaptation actions are integrated with the efforts to achieve the targets of RPJMN 2020 to 2024.

WHERE

The adaptation actions are conducted in priority areas determined based on regional and sectoral pathways [42]. The regional pathway defined priority areas based on climate change hotspots, i.e., the areas affected by climate change. The sectoral pathway is determined in accordance to the six priority sectors defined in the NDC Roadmap, i.e., food, water, energy, health, ecosystem, and disaster. The targeted areas also selected by considering data of SIDIK [52], InaRISK, and PBI analysis.

HOW

Adaptation actions are implemented by strengthening coordination among relevant stakeholders, providing adequate means of implementation (e.g., funding, technology, and capacity building), and establishing monitoring, reporting, and evaluation mechanisms.

Figure 24 Implementation and Support Need of Adaptation. The upper part illustrates the framework of needs in the implementation of adaptation in Indonesia, starting from the need for adaptation progress in the form of policies, tools, practices, programmes, literacy, and funding to achieve economic, social, and ecosystem resilience. Goals can be achieved by overcoming the gaps through the support of various stakeholders. Support needs are divided into six (6) major parts: funding, capacity building, technology transfer, networking opportunity, collaboration, research, innovation and development (described in sub-chapter 4.2). The yellow table explains the participation information from various stakeholders in the six (6) priority sectors so that no one is left behind and cross-cutting issues can be achieved for the target beneficiaries.

4.2 Adaptation Support Needs

Efforts to mainstream climate change adaptation into development agendas and policies are ongoing but Indonesia is still facing challenges. The challenges are associated with adaptation finance, capacity building, adaptative technology, research innovation and development (Figure 24). The fundings for implementing adaptation actions are beyond the capacity of the national government, thus require international cooperation and supports to fill the financing gaps. In addition, there are needs to enhance community participation, stakeholders' collaboration, and institutional governance. The required support is illustrated in Figure 24 and described in the following sub-chapters.

4.2.1 Funding

Adaptation fundings are needed to conduct climate change adaptation actions [46] both from national budgets as well as international funds. The budget tagging has been developed by the government to define activities on adaptation in the annual budget. However, estimation of the financial requirements for implementing the adaptation actions [41] is still challenging. The challenges are related to the methodology, data availability and reliability, and stakeholders' understandings on adaptation actions, for assessing adaptation financing [41].

4.2.2 Capacity Building

Capacity building is required to raise awareness on climate change issues [41]. The challenge in capacity building are related to collect and record data systematically on lesson learnt and best practices, and geographical coverage areas. The other challenges include the diversity of regional conditions, development progress, culture, literacy, and scattered information on capacity building programmes and implementation [41]. The required activities are capacity building on technology, institutional governance, and mainstreaming adaptation actions into development planning [91]. Awareness-raising activities are directed to strengthen advocacy, increase knowledge, and mobilize stakeholders' involvement in responding to climate change risks.

4.2.3 Technology Transfer

The technology transfers [41] consist activities related to information technology, proper database system, accessible learning tools, and adaptive technology on the 6 priority areas of the NDC Roadmap on Adaptation (food, water, energy, health, ecosystem, and disaster) [46].

4.2.4 Networking Opportunities

The networking among non-party stakeholders (i.e., local government, private sector, academia, financial institution, CSO, and community) as described in Chapter 1.4 is continually strengthened. The opportunities require much more contribution from the private sector and the development partners. The private sector or companies may contribute more in climate change adaptation by considering the climate risks into their business planning and operations as well as assisting the community to enhance their capacity in implementing adaptation actions. The development partners are expected to provide technical and financial assistance.

4.2.5 Internal and External Collaboration

Technical collaboration with the relevant stakeholders is needed to effectively address challenges across the six adaptation priority areas (i.e., food, water, energy, health, ecosystem, and disaster). The public-private partnerships in the area of climate change adaptation require continuous exploration and elaboration to support adaptation actions.

4.2.6 Research, Innovation, and Development

Research, innovation, and development are needed to support climate change adaptation. Research on adaptation actions will strengthen readiness to minimize the losses and optimize the benefits of climate change. The technology, local wisdom, and best practices are essential part of the research, innovation, and development. International support is needed to assist in accelerating the national development on implementing adaptive technology to manage the climate change risks [41].

4.3 Stakeholder Involvement and Arrangement

As described in sub-chapter 1.4, the Presidential Regulation No. 98/2021, Institutional Governance for Climate Resilience [90], and the NDC Adaptation Roadmap [46], establish coordination mechanism to strengthen institutional arrangement in national and sub-national level. The Enhanced Transparency Framework (ETF) provides the mechanism for reporting and monitoring in accordance to principles of MRV (measurable, reportable, and verifiable). The National Registry System/SRN has been developed and operationalized to facilitate the implementation of reporting and monitoring mechanisms of climate change actions, including adaptation as articulated in Presidential Regulation No. 98/2021. The description of stakeholders' involvement and arrangement are described below.

International Support Needs

The development partners (DPs) contribute to the development of many developing countries, including Indonesia. The contribution are provided in terms of funding, programmes or pilot activities, and technical assistance. The DPs support government-led initiatives to tackle complex challenges with evidence by conducting pilot activities for demonstrating adaptation actions. The supports also use to facilitate climate adaptation activities conducted by civil society organizations directed to encourage and promote the adoption of adaptation knowledge and technologies.

The stakeholder involvement and arrangement are defined to align the contribution of each stakeholder in conducting the main activities grouped into the six (6) adaptation priorities, i.e., food, water, energy, health, ecosystem, and disaster. Each adaptation priority has specified main activities that require participation and partnership as described in Figure 24. The contribution of each stakeholder is mainly defined based on their role in conducting the adaptation actions with regards to their tasks and functions as described in Section 1.4. The involvement and arrangement of the main stakeholder related with the adaptation actions for the six priorities are briefly described below.

National Government

- The Ministry of Environment and Forestry (MoEF) is responsible for the coordination of climate change adaptation actions as the national focal point (NFP). The MoEF also specifically contributes to ecosystem protection and restoration for conservation areas, and increases capacity of the public on environmentally friendly ecosystem management.
- The Ministry of National Development Planning (MNDP) coordinates the integration of climate change adaptation actions into the development planning in accordance with the implementation of SDGs including SDG goal No. 13 (Climate Action).
- The Ministry of Finance (MoF) coordinates the required budget plan and allocation to implement adaptation actions.
- The Ministry of Home Affairs (MoHA) regulates essential service standards and coordinates the sub-national government to implement adaptation strategies and actions.
- The Meteorological, Climatological, and Geophysical Agency (BMKG*),* the Geospatial Information Agency (BIG*)*, and the National Statistics Agency (BPS) provide data and information required for conducting climate change impact assessments as a reference for designing adaptation strategies and local-specific actions.

- The National Research and Innovation Agency (*Badan Riset dan Inovasi Nasional/BRIN*) contributes to research and development activities to support adaptation actions.

The other institutions have the functions and responsibilities to mainstream climate change adaptation into their programs and activities focusing on a specified adaptation sector, i.e., food, water, energy, health, ecosystem, and disaster. The institutions are:

- The Ministry of Agriculture (MoA) coordinates climate change adaptation activities in ensuring the achievement of food security.
- The Ministry of Energy and Mineral Resources (MEMR) contributes to address the impacts of climate change on energy supply and ensuring the achievement of energy security.
- The Ministry of Village, Development of Disadvantaged Regions, and Transmigration (MoVDDRT) contributes to ensure villages having adequate capacity on adaptation in addressing the impacts of climate change.
- The Ministry of Trade (MoT) contributes to monitoring and stabilizing prices of commodities or inputs required for implementing adaptation actions.
- The Ministry for Public Works and Human Settlements (MPWH) develops climate-proofing infrastructures and its management in accordance to national strategy on climate change adaptation.
- The Ministry of Health (MoH) coordinates adaptation actions on health and its related issues such as clean water and healthy sanitation, management of climate-related diseases, and adaptive health care facilities.
- Mangrove and Peatland Restoration Agency (BRGM) is responsible for accelerating the implementation of peat restoration and efforts to improve community welfare in peat restoration work areas in supporting the achievement of ecosystem resilience.
- The National Agency of Disaster Management (BNPB) coordinates climate-related disaster management efforts which include prevention, emergency management, rehabilitation, and reconstruction.

Sub-National Government and Other Stakeholders

- The sub-national governments have a role in developing climate adaptation policy and guidance to facilitate the community to strengthen the adaptive capacity at the local level.
- The private sector contributes to support communities in conducting adaptations on the six adaptation priorities.

- Civil society organizations are involved in public awareness-raising activities and support the implementation of climate change adaptation to enhance community capacity in responding climate change impacts.
- Academics and universities play a key role in education, training, capacity building, and research on climate change impacts and adaptation.
- Development partners contribute to mobilize resources for the implementation of adaptation actions.

4.4 Existing Funding and Actionable Opportunities

4.4.1 Assessment of Domestic Budget Potential

Climate Change Adaptation Funding Needs

The Adaptation NDC roadmap estimates that climate change in Indonesia for the period of 2021-2050 poses a negative impact on the basic needs (food, energy, health, and water sectors). The loss based on GDP 2020 is predicted for 0.66%-3.45% of the National GDP, which is equal to IDR 110.38 trillion-IDR 577.01 trillion (USD 7.26 billion-USD 37.97 billion) [46], or in the range of IDR 11 trillion to IDR 57 trillion (USD 724 million-USD 3.8 billion) per year. When the impact of disasters and ecosystem damage is included, the total potential loss may reach up to IDR 4,328.38 trillion [46]. The Third National Communication (TNC) Report of Indonesia (2018) [92] estimated the adaptation funding needs for the 2015-2020 period reached up to IDR 840 trillion (USD 64 billion).

Funding needs for adaptation consist of funding for adaptation governance (5%-10%) and adaptation implementation (90%-95%) [46]. However, there is no standard and comprehensive method for calculating the total funding needed to achieve the NDC adaptation target. Concerning the limitations of methodology on estimating required funding on adaptation, the projection of adaptation funding has not been estimated adequately. Taking into the consideration this projection is important for budget planning and efforts to mobilize climate funds [93], there is a need to conduct a more comprehensive estimation of required budget for climate change adaptation.

Adaptation Budget Tagging

Climate change budget tagging is a process to identify the amount of budget used to finance specific outputs for climate change activities. This budget tagging process can identify adaptation funding needs and allocate funds effectively and efficiently. In addition, the climate change budgets aim to increase public transparency and accountability in the management of the State Budget to fund climate change activities. Climate change budget tagging is carried out at the output level to facilitate the achievement of development targets and the allocated budget [94]. The assumption of achievement of adaptation targets is

based on indicators contained in SIDIK [93], which utilized socio-economic indicators to measure vulnerable level of an administrative area, i.e., the village-level vulnerability.

Budget tagging for climate change in Indonesia has been initiated in 2016-2017 but only covered mitigation programmes activities. Climate change adaptation budget tagging was initiated in 2018, with the following details:

- In 3 years (2018-2021), the GoI has allocated a climate change budget of IDR 307.94 trillion (equal to USD 20.27 billion) [94].
- Based on the realization of the budget and the type of activity, the 2018-2019 climate change budget was mostly spent on the mitigation budget which reached IDR 129.93 trillion (equal to USD 8.55 billion) or 62.0% of the total climate change budget [94]. The Government also had expenditures for climate change adaptation activities with a total of Rp66.64 trillion (equal to USD 4.38 billion) or 31.8% of the total climate change budget [94]. However, the adaptation spending has not been based the needs to addressing the impacts of climate change. The funds are more towards development activities which are considered related to climate change adaptation across different sectors.
- The cumulative co-benefit activities from 2018 to 2019 reached IDR 13.01 trillion (equal to USD 856 million) or 6.2% of the total climate change budget.
- In 2020, the Government allocated a climate change budget of IDR 77.81 trillion (equal to USD 5.11 billion), with a mitigation budget of IDR 41.65 trillion (equal to USD 2.74 billion) or 53.5% of the total climate change budget, an adaptation budget of IDR 33.30 trillion (equal to USD 2.19 billion) or 42.8% of the total climate change budget, and a co-benefit budget of IDR 2.86 trillion (equal to USD 188 million) or 3.7% of the total climate change budget.
- For the period of 3 years (2018-2020), a total of 18 Ministries/Agencies (M/As) tagged climate change budgets. From the 18 M/As, 16 M/As tagged climate change adaptation budgets [94]. The ministry with the largest climate change adaptation budget tagging is the Ministry for Public Works and Human Settlements with most of its budget being used to support the water and food security. The largest proportion of the budget was allocated to the water security sector, reaching IDR 21.89 trillion for the output of water infrastructure development such as dams, reservoirs, raw water supply, irrigation as well as operation and maintenance of water infrastructure to maintain the sustainability of water availability [94].

Current Funding Adequacy

Ministries/Agencies have allocated budgets for climate change adaptation, however more funds are allocated to mitigation activities than to adaptation. The mitigation budgets are

used for financing mitigation-related activities in different sectors. The achievement of GHG emission reduction targets from mitigation outputs is easier to measure (e.g., the reduction in GHG emissions after using new renewable energy power plants). Meanwhile, the performance achievement of adaptation activities is relatively difficult to measure. The current assessment of climate change adaptation in Indonesia is still conducted using a qualitative assessment. Indonesia continues to develop toward a quantitative assessment. Therefore, there is a need for developing a standard method to assess the effectiveness of the adaptation activities that are planned and carried out [93].

4.4.2 Funding and Actionable Opportunities

Climate change funding is from multiple sources, including public funds (from grants and loans from foreign countries and government budgets), private, and blended finance. These funds can be sourced from domestic funding (government, private sector, philanthropy) and external funding (Adaptation Fund/AF, Global Environment Facility/GEF, Green Climate Fund/GCF, and Development Partners or Development Finance Institution/DFI). The total external funding sources are listed in Table 2 [93].

Table 2 Total funding from several external funding sources

Funding Sources	Total Amount (USD in millions)
Adaptation Fund (AF)	5,3
Global Environment Facility (GEF)	356,9
Green Climate Fund (GCF)	296,4
Development Finance Institution (DFI)	
•WorldBank	9.230
•Asian Development Bank (ADB)	44.470

Note: Funds spent are **not only** for Climate Change Adaptation

Indonesia has established the Environmental Fund Agency (*Badan Pengelola Dana Lingkungan Hidup*/BPDLH) responsible for collecting and distributing funding for environmental protection and a climate change fund. BPDLH funding is sourced from public and private funds at the domestic and international levels, including funds from the private sector and philanthropy. The funds are allocated for small grant activities, green investment, and capacity building [95]. Blended finance provides additional funding for the government to implement adaptation actions. However, the GoI still faces the challenge of preparing a legal framework and policy tools that can support the effective implementation of blended finance.

Additionally, the potential funding sources is also identified from the private sectors. The possible instruments to attract private sector engagement in climate change adaptation are debt finance instruments (microloans, corporate loans, Public-Private Partnerships (PPP),

Green Bonds), business conduct instruments (Corporate Social Responsibility/CSR), and de-risking instruments (insurances and guarantees). However, the involvement of the private sector in climate change adaptation is still low due to lack of awareness and understanding on climate change. The adaptation measures are still implemented as Business as Usual (BAU), slowing the development of the adaptation investment [96].

International funds for climate change in Indonesia include the GEF, the GCF, and the AF. For GEF funding, Indonesia gets a different budget allocation every year. Meanwhile, to access GCF funding, Indonesia must compete openly with other countries. GCF funds for the readiness programme is managed by the MoF as the GCF NDA [46]. The AF has been financing adaptation projects in Indonesia with pilot locations in: Pekalongan City, Saddang Watershed, Bulukumba Regency, Samarinda City, and Central Maluku Regency.

Implementation of Adaptation Actions and Plans

Efforts • Mitigation Co-Benefits
• Cross-cutting Issues • Monitoring Evaluation

5. Implementation of Adaptation Actions and Plans

5.1 Progress and Results Achieved

5.1.1 Progress and Results Achieved regarding Policies

GoI has high commitments for climate change adaptation by developing policies, regulations, and programmes to implement adaptation priorities. The commitment, which is translated in the first NDC submitted to UNFCCC in 2016, the Updated NDC in 2021, and the Enhanced NDC in 2022, is recently regulated through the Presidential Regulation No. 98/2021. The adaptation priorities are food, water, energy, health, ecosystem, and disaster.

Food-based Policy

Early warning systems and management of climate change impacts in the agricultural sector are regulated by the Minister of Agriculture Regulation No. 39/2018. The sustainability of agricultural land is regulated by Law No. 41/2009 on Sustainable Agricultural Land Protection and Government Regulation No. 1/2011 on the Determination and Transfer of Agricultural Land Functions for Sustainable Food. The GoI has also committed to achieve sustainable food consumption by the Presidential Regulation No. 22/2009 concerning policies for Accelerating the Diversification of Food Consumption based on Local Resources. In addition, the MoVDDRT has issued the Decree No. 82/2022 concerning Guidelines for Food Security in Villages.

Water-based Policy

Water resources management is regulated through the Law No. 17/2019 and the Presidential Regulation No. 33/2011 concerning drinking water supply, water resources, resource management, water, and irrigation. The government also established the National Water Resources Council through the Presidential Regulation No. 10/2017 acting as a coordinating body for water resources management at the national level. The Minister of Health regulations related on water and sanitation are the Minister of Health Regulation No. 492/2010 on Drinking Water Quality Requirements and the Minister of Health Regulation No. 3/2014 on Community-based Total sanitation.

Energy-based Policy

The GoI regulates the implementation of energy in Indonesia through the Law No. 30/2007, concerning the establishment of the National Energy Council responsible for Indonesia's energy policy. The Government Regulation No. 79/2014 regulates the National Energy Policy, followed by Presidential Regulation No. 22/2017 on General Plan on National Energy. One of the national targets is to achieve an energy mix with New and Renewable Energy at 23% by 2025 [97].

Health-based policy

The Minister of Health established the Technical Team for Climate Change Adaptation in the Health sector through the MoH Decree No. 532/2019. The GoI through MoH is preparing the Health National Adaptation Plan 2020-2030 as a guidance and reference for coordinating adaptation action on the health sector at the national and sub-national level. The MoH also issued MoH Regulation No. 1018/2011 on Climate Change Adaptation Strategy in Health and MoH Regulation No. 035/2012 on the Identification of Disease Risk Factors related to Climate Change.

Various activities of environmental health related to climate change adaptation have been conducted by the MoH. The activities include:

- Strengthening the Healthy Living Community Movement (*Gerakan Masyarakat Hidup Sehat*-GERMAS)
- Increasing the percentage of villages that prohibit open defecation *(Stop Buang Air Besar Sembarangan*-SBS)
- Increasing the percentage of drinking water facilities fulfil the drinking water quality standards [31].

Ecosystem-based policy

The main regulations for protecting the ecosystem are Law No. 41/1999 on Forestry and Law No. 32/2009 on Environment Protection and Management. The related regulations concerning ecosystem-based policies include:

- The Government Regulation No. 28/2011 on the Management of Nature Reserve Areas (*Kawasan Suaka* Alam/KSA) and Nature Conservation Areas (*Kawasan Pelestarian* Alam/KPA)
- Minister of Forestry Regulation No. 85/2014 on the Procedures for Cooperation in the Implementation of Nature Reserve Areas and Nature Conservation Areas
- MoEF Regulation No. 44/2017 on the Implementation of Cooperation in Nature Reserve Areas (*Kawasan Suaka* Alam/KSA) and Nature Conservation Areas (*Kawasan Pelestarian* Alam/KPA)
- The Minister of Forestry Regulation No. P.48/2014 stipulated Procedures for Implementing Ecosystem Recovery in KSA and KPA
- The MoVDDRT regulation No. 21 of 2020 on General Guidelines for Village Development and Village Community Empowerment [98]

Disaster-based policy

The main regulation is Law No. 24/2007 on disaster management. The related regulations concerning disaster-based policies include:

- The BNPB Regulation No. 1/2012 on the general guidelines for disaster-resilient villages.
- the Presidential Regulation No. 87 of 2020 on the Master Plan for Disaster Management (*Rencana Induk Penanggulangan Bencana*/RIPB) 2020-2044.
- Regulation of MoVDDRT No. 21/2020 on the General Guidelines for Village Development and Village Community Empowerment informs on climate change-responsive villages (13th Village SDGs).
- Regulation of MoVDDRT No. 7/ 2021 concerning the Priority for the Use of Village Funds in 2022 explains the handling of natural and non-natural disasters in accordance with the authority of the village.

To what extent are policies related to climate change adaptation at the national level known and implemented by the Indonesian people?

Policies at the national level related to climate change adaptation have been followed by sub-national regulations. The sub-national regulations bring policies at the national level into a more technical form so that they can be implemented, adapted to the local context, and integrated into the local development plans. In addition, related policies at the national level have also been followed by derivative regulations to implement the actions. With the issuance of Presidential Regulation No. 98/2021 and the submission of the Enhanced NDC in 2022 further efforts should be carried out to strengthen policies and regulations at different levels.

5.1.2 Current status of planned and implemented adaptation actions

Based on the Enhanced NDC document, the targets and actions are divided into economic, social and livelihood, and ecosystem and landscape resilience (**Annex 1)**, and briefly described below.

Economic Resilience

Climate change presents significant risks for Indonesia's natural resources. Some of the actions include food crop activities on ex-flood land, processing of agricultural products, and diversification of livelihoods. In general, the actions are in line with the strategies and adaptation actions in the Enhanced NDC submitted to UNFCCC in 2022, with an emphasis on actions such as farmer's economic empowerment, water management systems, the integration of watershed management into local spatial planning, as well as sustainable biomass energy, plantations, and the bio-energy industries. The actions are largely at the implementation stage, where some of them are at the reporting stage. The status of adaptation actions, which are directed to build economic resilience, are listed in **Annex 1** with sub-heading of Economic Resilience.

Social and Livelihood Resilience

Climate change affects the day-to-day lives of all Indonesians. Various actions related to efforts to achieve social and livelihood resilience targets have been implemented at the site level. In general, the actions are directed towards: 1) developing early warning systems, awareness campaigns, education, and training, 2) enhancing stakeholder participation at all levels in building climate resilience, including in health protection and waste management, and 3) improving water resource management including soil water and measures to deal with disaster emergency. The implementation also endorses improvements on the development of appropriate mechanisms for community participation, gender participation, gender equity, and gender balance as well as involvement of vulnerable groups (persons with disabilities, children, and elderly). The status of adaptation actions for social and livelihood resilience, are listed in **Annex 1** with sub-heading of Social and Livelihood Resilience.

Ecosystem and Landscape Resilience

In order to build ecosystem and landscape resilience, Indonesia protects and sustains a number of targeted ecosystems by taking an integrated and landscape-based approach to managing terrestrial, coastal, and marine ecosystems. Adaptation activities have also been adjusted with the direction of the Enhanced NDC, including the forest and climate change programme, maintaining peat wetting infrastructure, capacity building for communities, and improving the skills of women. The directions for action are associated with the objectives as follows: 1) awareness campaign on the important role of forest and forest areas in ecosystem resilience, 2) implementation of ecosystem-based adaptation in coastal zone development, 3) implementation of integrated management of mangrove ecosystem, and 4) improvement of the livelihood of communities living in or depending on coastal areas.

Annex 1 summarises the compilation of related programmes with adaptation actions and their implementation compiled based on the group of actions described in the Enhanced NDC submitted to the UNFCCC in 2022.

5.2 Adaptation Efforts for Recognition

Article 13 of the Paris Agreement established an enhanced transparency framework (ETF) for action. This framework is a central component for the credibility and operation of the Paris Agreement directed to enhance the current measurement, reporting and verification (MRV) requirements under the convention. Referring to the ETF, Indonesia should report on progress in adaptation measures and support provided or received. The information gathered through the ETF will feed into the Global Stocktake which will assess the collective progress towards the long-term climate goals (Figure 25). Information on finances, technology transfer, and capacity-building support needed and received is provided to the ETF. Through this process, Indonesia gains the opportunity to share related achievements, best practices, and experiences. The country has various modalities for adaptation commitments and actions, but also gaps that need to be addressed.

Various policies in Indonesia issued by Ministries or Agencies with their respective duties and functions have contributed to implement climate change adaptation. These policies have also been largely translated into sub-national policies in the form of sub-national regulations and district/city regulations. Climate-related policies have also been integrated into the national and regional mid-term development plans.

The implementation of climate change actions is carried out by conducting specific actions as well as the integration of various adaptation programmes through systematic procedures. Actions are conducted by the local government on instructions of the Ministry or Agency at the national level. For example, ProKlim, a programme launched in 2012, has been transformed into a national programme since 2016 to encourage and facilitate the active participation of multi-stakeholders, collaboration and partnerships among governments, local communities, local businesses, NGOs, private companies, academia, and financial institutions.

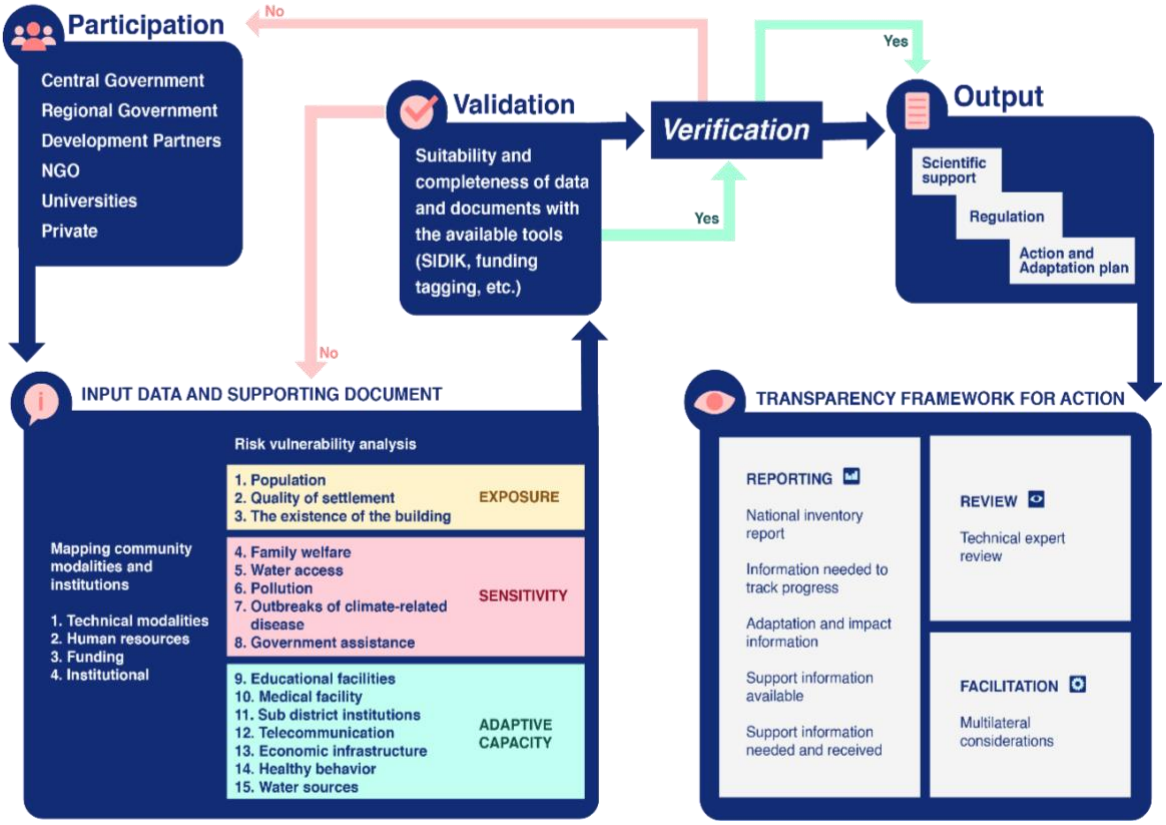


Figure 25 Transparency framework for the implementation of climate change adaptation actions. Source: adapted from Article 13 of the Paris Agreement.

The GoI has developed an SRN-PPI and initiated a Climate Change Adaptation Platform to systematically record adaptation actions. Through the SRN, data and information from the actions and resources used can be reported to the system. This SRN system can be seen as a form of government recognition for the various contributions on responding to climate change in Indonesia. In addition, the platform will be used as a medium for public literacy related to climate change and to report on activities and good practices of climate change adaptation in various fields or sectors.

The GoI also acknowledges the efforts of communities and stakeholders involved in the implementation of climate change adaptation actions at the site level through a reward mechanism. The ProKlim (Climate Village Programme) is categorised into ProKlim Pratama, Madya, Utama, and Lestari according to level of the implementation of climate change adaptation and mitigation at the local site.

5.3 Mitigation Co-Benefits

The government takes a note the concept of mitigation co-benefits. It basically states that the implementation of adaptation actions can minimize the impacts of climate change by

not increasing GHG levels in the atmosphere. To support this, the GoI is working to explore synergy between adaptation and mitigation activities. In addition, it is necessary to develop tools that calculate the contribution of co-benefit adaptation actions to the achievement of emission reductions that facilitate the practice of co-benefit mitigation.

The mandate of mitigation co-benefits is also stated in the adaptation scheme of the LTS-LCCR 2050 document where adaptation actions as part of the strategy towards climate resilience should also contribute to reducing GHGs [42]. The concept of adaptation co-benefits is also in line with the principles of Climate Smart Agriculture (CSA). Existing adaptation activities should not increase GHG emissions, and whenever is possible to help reducing GHG emissions. One of CSA's real practices contributing to emission reduction is the application of cultivation technologies [99]. In addition, the GoI is involved in the REDD+ (Reduced Emissions From Deforestation and Degradation) scheme to reward countries that succeed in reducing carbon emissions by reducing the level of deforestation and forest degradation and further in the process to develop non-carbon benefit mechanism under the implementation of REDD+ [100].

5.4 Gender-Responsiveness, Traditional, and Local Knowledge

The GoI recognise climate change has different impacts on each group, i.e., men, women, children, persons with disabilities, local communities, and the elderly. Therefore, as explained in sub-chapter 2.3, Indonesia has adopted the principle of "no one left behind" in the concept of sustainable development and adaptation to climate change. The Paris Agreement mandated that climate change adaptation actions must consider gender equality and the existence of all communities, including local communities, children, the elderly, and persons with disabilities. To ensure this, Indonesia has ratified and issued various regulations focusing on fulfilling the rights of each vulnerable group discussed in Sub-chapter 2.3. The compilation of data and information related to the local communities in Indonesia is presented in Figure 26.

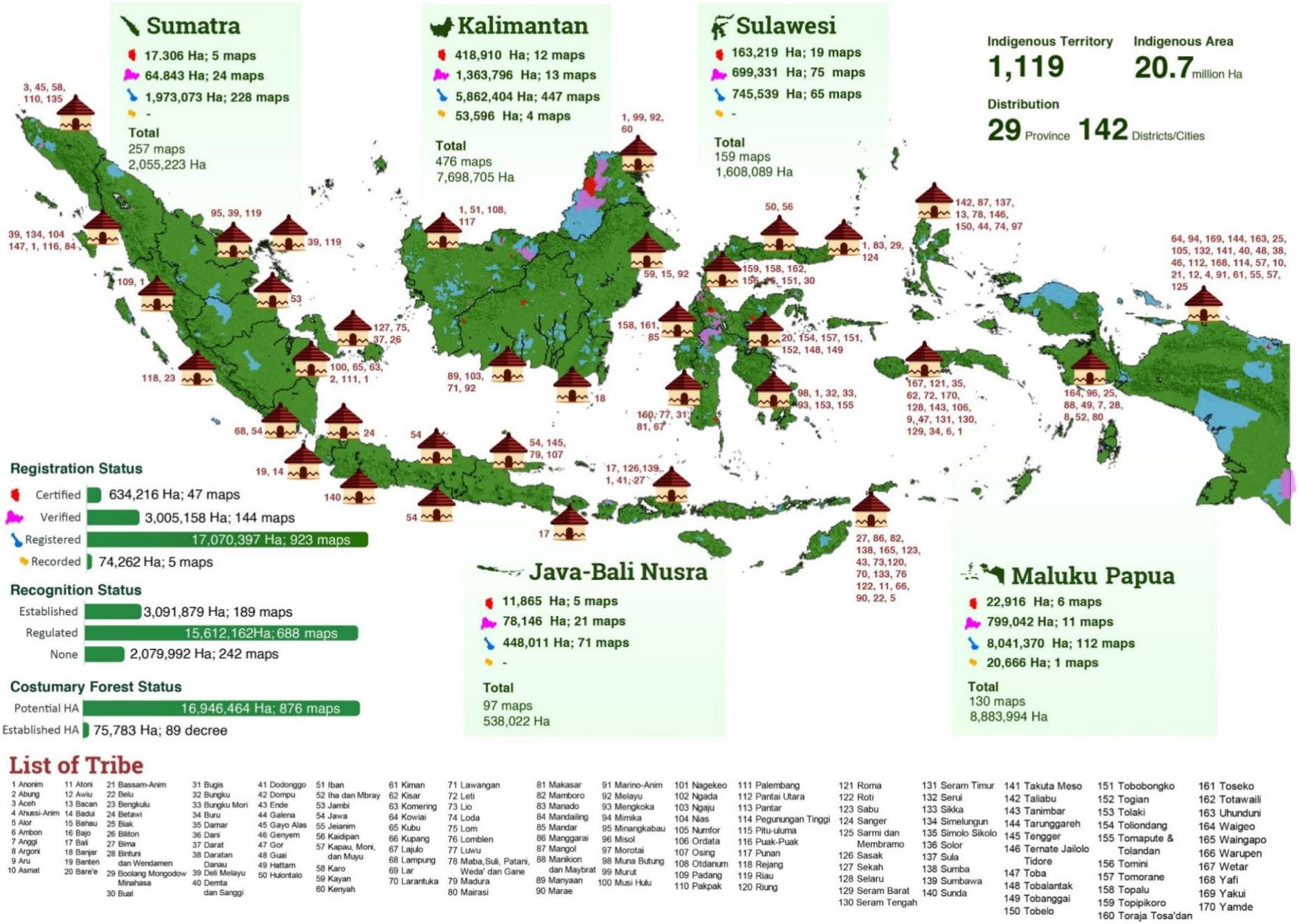


Figure 26 Indonesian local communities' distribution. This figure intends to show the distribution of 170 tribes (the numbers on the map are the tribe codes explained at the bottom of the "List of Tribe") and customary territories mapped in 29 provinces based on 1,119 maps with a total area of 20.7 million Ha from the Registration Agency for Customary Territory (*Badan Registrasi Wilayah Adat*/BRWA). The status of customary territory registration in BRWA has 4 stages (information on the left of the map), starting from and recorded (yellow), registration (blue), verification (pink), to certification (red). There are still few customary certified areas (47 maps). The information related to the recognition status is divided into three: established, regulated, and none. 'Established' is a customary area that the local government has determined. 'Regulated' covers customary areas that have been regulated in regional policies. Meanwhile, 'none' means that the customary area has no policy. Most of the customary areas recorded in the BRWA are regulated (688 maps). Customary Forest Status provides information on potential or existing customary forests by the MoEF. There are still a few customary areas whose customary forests have been determined by the MoEF (89 decrees). Source: illustrated from data and information compiled by AMAN [112], MoEF [113]

Policy Support

Referring to the Enhanced NDC document, the Government of Indonesia has realized that mainstreaming gender-based climate change adaptation inclusively is very important to increase social resilience and livelihoods at the community level. Women play an important role in supporting the family's recovery and survival because of their knowledge and experience in managing natural resources to meet the family's needs [81]. In the NDC Adaptation Roadmap, the MoEF as the national focal point for climate change has included gender-based human resource capacity development as one of the directions in the 5th NDC adaptation strategy on strengthening local capacity [46]. The roadmap states that gender participation must also be considered in the development planning process at all levels. To support its implementation, the Ministry of Women's Empowerment and Child Protection has published General and Technical Guidelines for Gender-Responsive Climate Change Adaptation (2015). The book also describes strategies and recommendations for integrating gender in climate change adaptation (particularly in the fields of food, energy, and water resources) and regional planning documents, as well as gender-sensitive risk assessment tools. There are tools for assessing the inclusion of gender issues in climate change projects, i.e., Gender Equality and Social Inclusion (GESI) [80]. This shows that Indonesia's policy is quite responsive in dealing with gender issues.

Regarding other vulnerable groups, climate change policies in Indonesia have not specifically addressed all of them: children, persons with disabilities, local communities, and the elderly. These groups are still generally addressed as a single group of vulnerable people. The MoEF as the national focal point for climate change has included a strategy for mainstreaming climate change adaptation based on vulnerable groups inclusively to improve social resilience and livelihoods at the community level [46]. However, collaboration and coordination with other relevant ministries, i.e., the Ministry of Women Empowerment and Child Protection and the Ministry of Social, are needed to map the impacts, needs, and involvement of each vulnerable group. In the 2020-2024 Mid-Term Development Plan, the Government focuses more on efforts to increase social protection, social welfare, and the fulfilment of basic services for the vulnerable groups.

Implementation

Indonesia has tried to mainstream gender issues in the climate change adaptation perspective. This can be seen from the various gender-responsive climate change adaptation programmes that focus on increasing the adaptive capacity of women, such as the Women Farmers Group (*Kelompok Wanita Tani*/KWT), the involvement of the Family Welfare and Empowerment Mobilization Team (TP.PKK), and other community-based climate programmes. In addition to government programmes, gender-responsive climate change adaptation activities have been carried out by various NGOs, for example, Building Resilience through the Integration of Gender and Empowerment (BRIGE) by Mercy Corps in Central Java and West Nusa Tenggara. However, there are several aspects that still need to be considered by the government in implementing the integration of gender issues in climate change adaptation. Among them are gender-based disaggregated data to conduct gender analysis, the implementation of gender-responsive budgets, and governance of mainstreaming gender issues in climate change [109, 110].

Other vulnerable entities (children, persons with disabilities, the elderly, and local communities) in climate change adaptation policies are seen only as one vulnerable group that must be protected. The government's overall attention can also indirectly impact on increasing the social resilience of the community. The groups are described as follows:

a) Children's group. Indonesia already has programmes that encourage the role and fulfilment of children's rights in society, for example, Child-Friendly Cities (*Kota Layak Anak*/KLA) and Women Friendly and Child Care Villages (*Desa Ramah Perempuan dan Peduli Anak*/DRPPA). KLA is a City/Regency that can carry out all development programmes with a focus on children's rights and obligations. Meanwhile, DRPPA is a village that integrates a gender perspective and children's rights into governance, development, and village community empowerment. Indonesia also has a National and Regional Children's Forum under the Ministry of Women's Empowerment and Child Protection, which is spread across all regions from the provincial level to the village level. This is also in line with Indonesia's commitment to encouraging the role of children to become agents of change as "Pioneers and Reporters" to assist the government in solving various child issues [104]. The issue of climate change can be integrated into various existing modalities so that children's capacity for climate resilience can be increased.
b) Person with Disabilities Group. Climate change is one of the focuses of the 2022 Global Disability Summit commitment. The participants confirmed their commitment to change practices to make all humanitarian action fully inclusive and accessible to persons with disabilities, mainstream inclusion in disaster risk reduction, and response to the

impacts of climate change. The participants are also committed to strengthening the participation of persons with disabilities and engagement with Office of Disability Programmes (ODPs) in humanitarian and climate action [105]. To support all the commitments, the Ministry of Human Rights and the Law Republic of Indonesia has launched the formation of a Working Group on Respect, Protection, Fulfilment, Enforcement, and Promotion of Human Rights for Persons with Psychosocial Disabilities in Indonesia. The government through the MNDP and the Office of the Presidential Staff (*Kantor Staf Presiden*/KSP have collaborated with Indonesian Disability Activists and Organizations Network (*Jaringan Pegiat dan Organisasi Disabilitas Indonesia*/JPODI) facilitated by the Australian Embassy to create Disability Rights Indicators (DRI) [106]. These indicators can help to assess disability groups and climate resilience. The government is also trying to include persons with disabilities in the Social Welfare Integrated Data (*Data terpadu Kesejahteraan Sosial*/DTKS) [107]. In addition, the Ministry of Social Affairs (MoSA) has launched the "Indonesia Hearing", "Indonesia Seeing", and "Indonesia Stepping" programmes to realize the rights of persons with disabilities [108].

c) Local Communities**.** Local communities have been recognized as owners of customary forests in a Constitutional Court Decision No. 35/2012 about customary forests. There are also several legal products that have been issued as the implementation of the Constitutional Court's decision (Law No. 6/2014, Minister of Forestry Regulation No. P.62/2013, MOHA Regulation No. 52/2014, Minister of Agrarian and Spatial Planning Regulation No. 10/2016). In relation to the environment and climate change, local communities are seen as the communities closest to the forest and are considered to have the most strategic role in forest conservation and climate change. With the various climate problems, the Government sees the local wisdom of local communities as a solution to climate change adaptation through the maintenance and sustainable use of natural resources [111]. The GoI has been implementing programmes to engage local communities in the forest management, such as social forestry programme and ProKlim.

There is already the *Aliansi Masyarakat Adat Nusantara* (AMAN) as an independent community organization in promoting the fulfilment of the rights of local communities. Currently, AMAN has a total membership of 2,449 local communities, with individual members reaching 20 million people out of an estimated total population of local communities in Indonesia of 40-70 million people [112]. AMAN has also coordinated and collaborated with the government, for example in the integration of customary maps [113]. This map can be a modality in optimizing climate change adaptation actions based on local communities in Indonesia (Figure 26).

d) Elderly Group. Overall, programmes for the elderly in Indonesia focus on social protection with the aim of strengthening the implementation of social security for the elderly [114]. Currently, Indonesia also has a National Sustainability Strategy which is a reference in formulating programme policies related to the elderly. An example of a social protection programme for the elderly is the Elderly Social Rehabilitation Assistance (*Asistensi Rehabilitasi Sosial Lanjut Usia*/ATENSI-LU), with the implementation of comprehensive multifunctional services and the provision of assistance to the elderly. The Government has also activated Integrated Health Post (*Pos Pelayanan Terpadu/Posyandu*) for the elderly throughout Indonesia to support health services and as a forum for productive activities for the elderly. In addition, there is a specialized school with the concept of informal education for the elderly, which offers the study of physical health, social, psychological, economic, environmental, and spiritual aspects. These programmes are in line with efforts to increase the resilience of the elderly, considering that the most direct impact of climate change on the elderly is in the health sector [115]. There is also an improvement in the quality of health services for the elderly through the regulation of health services in primary and referral facilities as stated in the National Action Plan for Elderly Health 2020-2024 [73].

e) Poor and Rural Communities. Based on the trend of the poverty rate, Indonesia has made efforts to reduce poverty progressively. There have been many inclusive village-based government programmes involving the village community. For example, in ProKlim and the Climate Field School, the adaptation activities carried out have an impact on increasing community capacity in various sectors such agriculture and livestock directed to improve the community's economy. In addition, there are assistance programmes from the government that aim to improve the welfare of the poor and are expected to reduce poverty levels, such as the Prosperous Family Savings program, Smart Indonesia, and Healthy Indonesia.

5.5 Monitoring and Evaluation

Indonesia already has regulations for monitoring, evaluation, and reporting climate change actions in MoEF No. P.72 of 2017 which has been updated in Presidential Decree No. 98 of 2021. However, Indonesia does not yet have concrete guidelines for monitoring and evaluation. The current modality for monitoring and evaluation is described below.

5.5.1 Mechanism of Monitoring and Evaluation

In practice, adaptation actions that have been or are being carried out will be reported on their implementation by beneficiaries (relevant ministers, governors and regents/mayors, and business actors) through the existing reporting mechanism. The reporting mechanism

shall employ a dedicated system at the national and global (international) level to obtain a reporting status. Monitoring is generally carried out by the relevant institutions as an output of existing reports. The evaluation process is carried out by a third party, i.e., a group that is not involved in the adaptation actions, to assess the implemented actions against a set of criteria and indicators. The results of the evaluation are then returned to the beneficiaries as an effort to improve the implementation in the future. The monitoring, evaluation, and reporting process is depicted in Figure 27.

There are two monitoring and evaluation (M&E) processes illustrated in Figure 27. The first focuses on measuring the impacts of individual projects and interventions and the second on measuring overall performance and achievements in a region [46].

1. M&E for project implementation: Each intervention must be monitored and evaluated to ensure that the intervention is successfully implemented and impacts the targeted beneficiaries.
2. M&E to measure resilience: The overall contribution of all projects must be evaluated jointly to monitor and evaluate adaptation activities in building overall resilience.

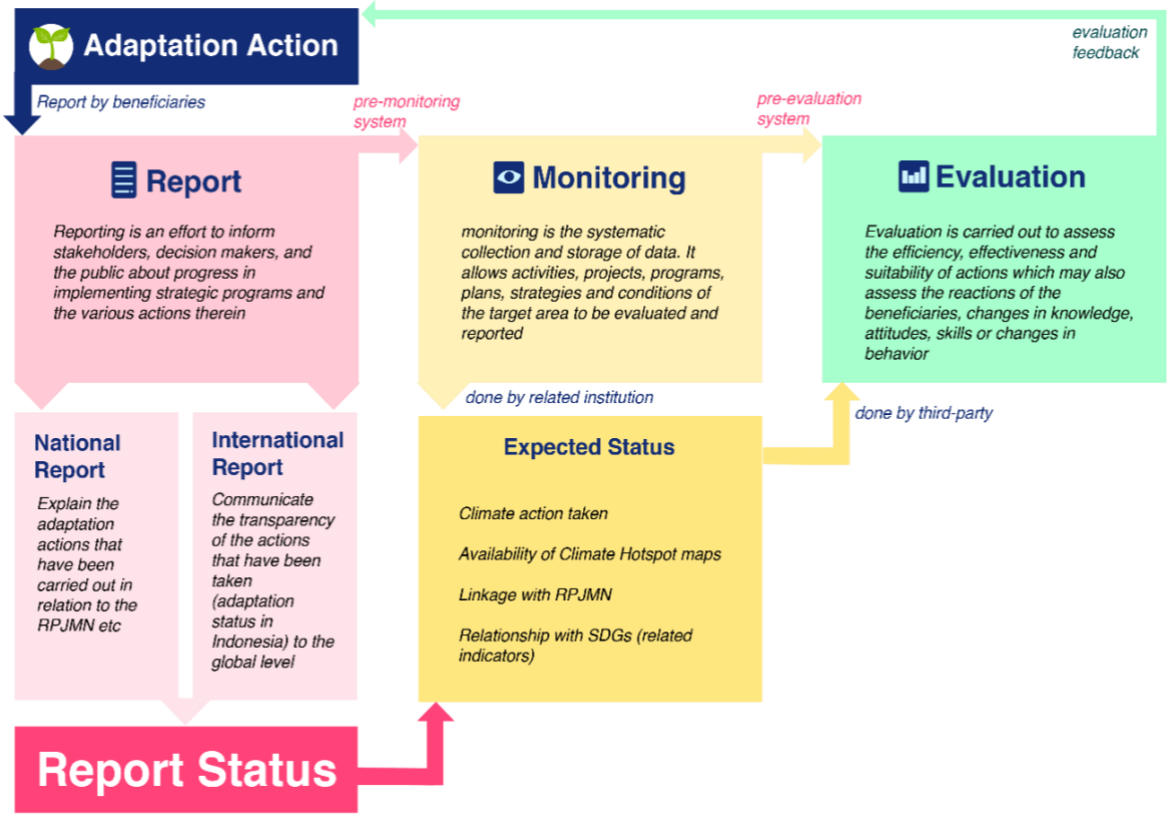


Figure 27 The framework of monitoring, evaluation, and reporting of climate change adaptation actions. Source: Illustrated from Roadmap NDC for Adaptation [46]

5.5.2 National Modalities of Monitoring and Evaluation

Indonesia already has the modalities to support the implementation of the monitoring and evaluation mechanism as well as the reporting system for adaptation actions. The details are described below.

Indicators

Most national-level monitoring systems have organized their indicators according to categories such as exposure, vulnerability, impacts, response, and others. The indicators for monitoring and evaluating climate change adaptation actions can be constructed based on existing knowledge and data that are available and accessible. The modalities are:

a) Climate Change Hotspots
b) SDG Indicators
c) Vulnerability Index Data Information System (SIDIK)
d) InaRisk
e) Health Climate Change Adaptation
f) National Socio-Economic Survey (*Survei Sosial Ekonomi Nasional*/SUSENAS) publication
g) Area Resilience Index (IKD)
h) Social Welfare Integrated Data (DTKS)
i) Monitoring and evaluation indicators in village-based programmes

Resources

The M&E mechanism from reporting to evaluation requires human resources at all levels. In practice, reporting on adaptation actions at the site level is usually carried out by a working group (*Kelompok Kerja*/POKJA) that consists of the Village Disaster Preparedness Team (*Tim Siaga Bencana Desa*/TSBD), the District Disaster Preparedness Team (*Tim Siaga Bencana Kabupaten*/TSBK), the Climate Change Adaptation Working Group (*Kelompok Kerja Adaptasi Perubahan Iklim/Pokja*-API), and the ProKlim Working Group. Furthermore, monitoring and evaluation at the district/city and provincial levels are performed by the head of government. At the national level, the M&E is carried out by the relevant Ministries or Agencies as regulated in Presidential Regulation No. 98 of 2021.

Funding for M&E can be sourced from domestic funding (government, private sector, philanthropy) and external funding (Adaptation Fund/AF, Global Environment Facility/GEF, Green Climate Fund/GCF, and Development Partners or Development Finance Institutions/DFI). More detailed information regarding funding can be found in Sub-chapter 4.4. However, estimating the cost for conducting M&E is quite complex because it requires synergy and the contribution of various stakeholders, equipped with proper M&E tools.

Tools

Currently, reporting on adaptation and mitigation actions in Indonesia is proposed to be consolidated by the National Registry System for Climate Change (*Sistem Registri Nasional*/SRN) managed by the Directorate General of Climate Change of the MoEF. The system serves as a medium for collecting and reporting mitigation and adaptation actions to achieve climate resilience in avoiding the adverse impacts of climate change.

The SRN is also recognized as an effort to realize the need for standardization and integration of data and information to handle data issues such as low data accuracy, redundancy, inefficiency, and data inconsistency. The use of SRN as a reporting system has been mandated by MoEF Regulation No. 71 of 2017 and MoEF No. 72 of 2017. Recently, the use of SRN as the backbone of transparency in Indonesia is endorsed by Presidential Regulation No. 98/2021. As of now, there are approximately 263 mitigation actions, 16 adaptation actions and 238 ProKlim villages that have been recorded in the SRN [116]. Cross-sectoral climate change adaptation actions have not been widely reported in the SRN. Currently, the MoEF already formed a team to map climate change adaptation and mitigation actions and raising awareness about the SRN [124,125].

5.6 Barriers, Challenges, and Gaps

The process of preparing, implementing, monitoring, and evaluating adaptation actions in Indonesia has barriers, challenges, and gaps. Barriers are usually related to social and cultural aspects. Challenges are usually related to technical aspects that hinder achieving the goal of the action. Gaps are usually related to unmet knowledge that needs to be addressed to achieve the objectives. Identified barriers, challenges, and gaps compiled from the national documents related to the implementation of climate change adaptation actions are described in the following tables.

Table 3 Identified barriers to climate change adaptation in Indonesia

Aspect	Barriers	Details	Needs
Social and Cultural	There are social inequalities that result in unequal adaptation of society	• Limited best practices from the local level • Lack of cooperation in carrying out multisectoral actions • Less commitment to the local implementation • Inequality of climate literacy patterns in various community groups [46] • Lack of understanding regarding adaptation to be integrated into policy making • Results of innovations have not been further applied	• Development of best practice criteria • Increasing capacity to respond to climate risks across sectors

		• Lack of involvement in many public-private engagements • Lack of law that regulates customary law communities and their rights comprehensively (the law is still in the process of being drafted)	
	Direction of development is not yet climate-adaptive	• Implementation of development that often does not pay attention to risk codes and climate change hotspots [46] • Disproportionate placement of climate change impacts and adaptation burdens [46] • Implementation actions have not considered the potential threat of climate change	Determination of standard criteria for climate change adaptation actions and environmental risks in various development activities
Collaboration	Lack of coordination between directorates	• No clear task division between central and local government • Less commitment to the local implementation • Low participation in governance and institutional arrangements	• Building a multi-stakeholder platform mechanism • Building a multi-stakeholder communication framework and network

Table 4 Identified challenges for climate change adaptation in Indonesia

Aspect	Challenges	Details	Needs
Technology Transfer	Digital transformation	• Lack of understanding of climate adaptive technology • Fewer technology indicators that work in agricultural systems, production systems, and plant cultivation	• Improving and updating learning tools so that knowledge transfer using portals can be accessed without

		● Inadequate funding for the development of adaptive technology ● Local governments lacking human and technological capacity	limits by all levels of society ● Portal enhancement ● Good database system mechanism.
Networking Opportunity	Resilience of the network opportunity system	● Internet and electricity networks are not evenly distributed, especially in rural areas ● Efforts to increase advocacy capacity among communities are still ongoing	Improving infrastructure, increasing human and financial capacity, and incorporating climate adaptation and mitigation considerations into programming and planning
Research and Innovation	Lack of database for analysis	● Lack of database of vulnerable people ● Lack of data and evidence related to: - Disability and youth participation - Climate education - Food security - Social policy analysis - Epidemiological data - Energy-sensitive data for households - Green/climate financing data - Minimum Service Standards on education facilities, social health, community protection (Public Protection/LINMAS), and housing - climate-related data to guide the planning, operation, and	Increasing research on sector-based climate change adaptation actions

		monitoring of systems across environmental and disaster sectors - Rainfall threshold to measure climate change hotspot ● Lack of updates, including data on WASH conditions in schools and households. ● Availability of data only at the provincial level or in certain areas ● Data adaptation disaggregated by age, gender, and disability	
	Recording data problems	● Overlapping data between agencies on the One Data Indonesia (SDI) portal ● Diverse data formats making it difficult to link and compare data between directorates in the SDI portal ● Lack of specific Standard Operating Procedure (SOP) for data recording ● Surveillance information system not yet real-time and integrated, so not all areas are well mapped	Standard Operating Procedure (SOP) for data recording
	Limited data access	● Information systems are difficult to access, especially for vulnerable groups ● Internet and electricity networks are not evenly distributed, especially in rural areas	Increasing coverage of internet and electricity networks in rural areas
Capacity Building	Limited capacity building of the related actors	● Diversity of regional conditions ● Development progress, culture, and literacy require a fairly long process both in adjusting programmes and approaches in their implementation ● Lack of coordination between programmes and capacity activities	● Creating capacity-building technology for training ● Training local governments for institutional

			development and strengthening for mainstreaming climate change
	Infrastructure and facility	• Low climate resilience of public facilities infrastructure • Limited capacity in health facilities and communities to anticipate and cope with the burden of climate change impacts • Difficult and dangerous access via roads to public service facilities in some areas • Clean water crisis (seawater contamination) and lack of sanitation in some rural and coastal areas	• Improving infrastructure and incorporating climate adaptation and mitigation considerations into programming and planning • Developing policies on the integration of land spatial planning development and coastal and marine spatial planning

Table 5 Identified gaps regarding climate change adaptation in Indonesia

Aspect	Gaps	Details	Needs
Finance	Low ability to manage climate change adaptation finance, especially at the local level [46]	• Lack of standardization of funding to increase communal understanding [46] • Insufficient funding for technology development [46] • Lack of institutional capacity, coordination, policy, and systems to channel and disburse climate finance effectively • Lack of data management capabilities to increase the transparency of climate finance flows • Lack of guidelines for estimating the	Development of guidance and training on climate change adaptation funding analysis

		financing needs for climate change adaptation activities ● Lack of coordination and oversight of funding	
	Lack of national agenda and incentives that are quite burdensome for local governments [46]	● Lack of access to national and international climate finance [46] ● Reduced national, institutional, and individual perceptions of the costs and benefits of various adaptation options [46] ● Lack of legal framework for the mixed funding scheme ● Lack of institutional capacity, coordination, policy, and systems to channel and disburse climate finance effectively	Mixed funding legal framework
Capacity Building	Lack of availability of knowledge	● Low institutional interest in identifying, developing, and meeting climate-adaptive development criteria for sustainable development ● Deficit of knowledge, education, and human capital [46] ● Lack of understanding of how to integrate adaptation into policy making ● Lack of analysis of losses and benefits between adaptation sectors ● Insufficient distinction of vulnerable groups in climate change adaptation ● Guideline for POKJA monitoring and evaluation still in progress to be built ● Lack of concrete calculation of adaptation needs ● Lack of standard for calculating the quantification of adaptation targets	● Capacity building for climate adaptive development to achieve sustainable development ● Separate adaptation guidelines for each vulnerable group ● Guidelines for concrete monitoring and evaluation mechanisms equipped with standards for calculating achievement targets

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Annex

Annex 1. Climate change adaptation actions in Indonesia

Economic Resilience

Key Program	Strategy	Action	Sector	Related Action	Program	Status	References	Potential Synergy
Sustainable agriculture and plantations	Mainstreaming/integrating climate change adaptation into agricultural sector, especially for strategic commodities	Identification, development, and implementation of best practices for farmers' economic empowerment	Food	Food crop activities in ex-flooded land	Destana	Conducted	BNPB (2021)	Potential synergy with implementation of UNCCD Potential co- benefit to mitigation in AFOLU
				Processing of drinks of turmeric, ginger, coconut, and medicinal plants	ProKlim	Conducted	BNPB (2021)	
				Training and introduction to income diversification for farmers' families	-	Ongoing/ implemented	PBI (2021)	
				Capacity building for rainfed lowland farmers	-	Conducted	PBI (2021)	
		Enhancing management and provision of ecosystem services in agricultural sector	Food, Ecosystem	Compost house, organic plant cultivation, manufacture of Local Micro Organisms, APH, vegetable pesticides and fertilizers with APH	Organic farming village	Ongoing/ implemented	RPJMN 2020-2024	
				Integrated farming/mix farming	-	Conducted	SRN	
				Sustainable Agriculture-Bioindustrial Systems	-	Planned	Litbang Pertanian	
				Improvement and rehabilitation of irrigation networks based on farmers participation	P3TGAI	Planned	PUPR (2021)	
		Development of financing scheme for agriculture	Food	Increasing access to agricultural business credits for poor farmers	-	Ongoing/ Implemented	PBI (2021)	
				Reinforcement of Village-Owned Enterprises and Small and Medium Enterprises	-	Ongoing/ Implemented	PBI (2021)	
	Development and implementation of climate adaptive technologies for sustainable production of agricultural crops and plantations	Improveing agricultural crops protection from pests and diseases	Food	Use of micro-nutrient fertilizers; floating rice; organic agriculture	ProKlim	Conducted	BNPB (2021)	
		R&D to produce high quality (genetically improved) seeds and cultural techniques to increase productivity	Food	Development of superior crop varieties and efficient agricultural equipment and machinery	-	Ongoing/ Implemented	PBI (2021)	
		Improving water management systems for increasing resilience to climate change	Food, ecosystem	Institutional strengthening for integrated water resource management	-	Conducted	SRN	
				Community empowerment and regional and village institutional development; provision of	Pamsimas	Ongoing/ Implemented	CLAC	

				drinking water and public sanitation facilities				
				Tertiary irrigation networks, pumped irrigation, agricultural reservoirs, water conservation buildings and anticipation of climate anomalies, piped irrigation	-	Conducted	Kemenkeu (2020)	
				Rainwater harvesting for irrigation	-	Ongoing/ Implemented	PBI (2021)	
				Construction of river embankments around the agricultural lands	-	Ongoing/ Implemented	PBI (2021)	
		Application of integrated cropp calendar	Food	Integrated Planting Calendar (Kalender Tanam Terpadu/KATAM)	-	Ongoing/ Implemented	Litbang Pertanian	
Integrated watershed management	Enhancing synergy across sectors and regions in watershed management	Implementation of integrated **upstream and downstream** approach in forest rehabilitation and restoration, watershed management planning, and protection of terrestrial water resources	Water, ecosystem	Vegetative forest and land rehabilitation, provision of structures for irrigation network, and collecting irrigation water	-	Ongoing/ Implemented	PBI (2021)	Potential synergy with implementation of UNCCD
		Creating an enabling environment for integrating Natural Disaster Risk Management into business models and practices	Water, ecosystem, disaster	Formation of DRR documents, disaster risk maps, evacuation maps, and DRR forums; Processed fish products, Handicrafts, Fish trawlers, Tourism Villages	Destana	Conducted	BNPB (2021)	
				Aapplication of weather modification technology to prevent drought and flooding	-	Ongoing/ Implemented	PBI (2021)	
	Mainstreaming/integrating climate change adaptation in watershed management to reduce risks/loss as a result of climate-related natural disasters	Development of ecosystem services in watershed management	Water, ecosystem	Institutional Strengthening of Integrated Water Resource Management in the 6 Cis River Basin Territory	-	Conducted	SRN	
		Identification, development, and implementation of best practices in watershed management	Water					
		Integrating watershed management into Local Spatial Planning	Water, ecosystem	Hot Springs Tourism Village	Desa Pesisir Tangguh	Conducted	BNPB (2021)	
Reduction of deforestation	Mainstreaming/Integrating climate	Strengthening implementation of deforestation reduction efforts	Ecosystem	Vegetative forest and land rehabilitation	-	Ongoing/ Implemented	PBI (2021)	Potential co-benefit to mitigation in

and forest degradation	change adaptation in forest management to support mitigation actions and enhancement of economic resilience of communities living in/surrounding forests	Sustainable utilisation of non-wood products by local and adat communities	Ecosystem	Provision of quality and productive forest vegetation seeds	-	Ongoing/ Implemented	PBI (2021)	AFOLU
		Identification, development, and implementation of best practices and local wisdom in utilisation of natural forest resources	Ecosystem					
	Development and implementation of environmentally friendly technologies (EFT) in production forest management	Creating enabling environment for EFT	Ecosystem	Development of payments for ecosystem mervices Mechanism	-	Ongoing/ Implemented	PBI (2021)	
		Facilitation, oversight, enforcement, and compliance on the implementation of EFT	Ecosystem	Natural resource efficiency and implementation of circular economy	Green Industry	Ongoing/ Implemented	Kemenperin (2021)	
				Construction of the largest green industrial area in the world utilizing the Hydroelectric Power Plant (Pembangkit Listrik tenaga Air/PLTA)	Green Industry	Ongoing/ Implemented	Kemenperin (2021)	
				Accelerating motorized vehicles or Battery-Based Electric Motor Vehicles/KBLBB, carbon absorption technology, and development of clean energy-based industries	-	Ongoing/ Implemented	Kemenperin (2022)	
Land conservation	Avoiding conversion of productive lands for other uses	Integrated rehabilitation of degraded land and soil and water conservation	Water, ecosystem	Water injection technology from flood inundation	-	Ongoing/ Implemented	PBI (2021)	Potential synergy with implementation of UNCCD
		Facilitate, oversight, enforcement and compliance to spatial plan	Ecosystem	Review of regional spatial plans	-	Ongoing/ Implemented	PBI (2021)	
		Strengthening implementation of regulations relating to spatial planning	Ecosystem	Preparation of policies on Protected Groundwater Areas	-	Ongoing/ Implemented	PBI (2021)	
	Development and implementation of climate adaptive technologies to support sustainable land management	Application of soil and water conservation technology using mechanic and vegetation methods	Water, ecosystem	Vegetative and civil technical forest and land rehabilitation	-	Ongoing/ Implemented	RPJMN 2020-2024	
		Identification, development and implementation of best practices	Ecosystem					

	practices	in land utilisation and management						
Utilisation of degraded land for renewable energy	Integrated programme on rehabilitation of degraded land and development of biomass energy	Rehabilitation of degraded land with species suitable for energy	Energy, ecosystem		-			Potential synergy with implementation of UNCCD
		R&D to support sustainable biomass energy plantations and the bio-energy industries	Energy, ecosystem	EBTKE infrastructure development services and bioenergy services	-	Planned	Kemenkeu (2020)	Potential co- benefit to mitigation in AFOLU
Improved energy efficiency and consumption patterns	Enhancingawareness of all stakeholders on the adaptation benefits of mitigation through improved energy efficiency and consumption patterns	Energy efficiency campaign	Energy	Solar Initiative Movement/GERILYA	-	Conducted	ESDM 2021	
				Use of renewable resources, efficient use of clean water, green transportation	Green Campus	Ongoing/ Implemented	IPB (2016) UGM (2021)	

Social and Livelihood Resilience

Key Program	Strategy	Action	Sector	Related Action	Program	Status	References	Potential Synergy
Enhancement of adaptive capacity.	Reducing vulnerability through improved capacity on social-economy and livelihood	Development of Early Warning System (EWS)	Disaster	Community adaptation forum -> Early warning signs	Destana	Conducted	BNPB (2021)	Potential synergy with implementation of SFDRR
				Early warning system	ProKlim	Conducted	BNPB (2021)	
				Maritime Integrated Data System (MIDAS)	-	Ongoing/ Implemented	PBI (2021)	
		Capacity enhancement for all stakeholders in responding to EWS	Disaster					
		Awareness campaign, education, and training	Disaster	Formation of DRR documents, disaster risk maps, evacuation maps, and DRR forums; Processed fish products, Handicrafts, Fish trawlers, Tourism Villages	Destana	Conducted	BNPB (2021)	
				Utilization of weather and climate forecast information	-	Conducted	PBI (2021)	
	Responding to climate change impacts and managing risks including health	Addressing drivers of vulnerability to climate change impacts	Health	Recovery for areas contaminated by hazardous waste	-	Planned	KLHK 2021	
				Development of disease vulnerability models and health biomonitoring tools for diseases caused by climate change	-	Ongoing/ Implemented	PBI (2021)	
		Enhancing stakeholder participation at all levels in building climate resilience, including in health protection and waste management	Health	Compost fertilizer, water hyacinth crafts, bamboo crafts, biopesticides, ornamental plant seeds, vegetable plant seeds	ProKlim	Conducted	BNPB (2021)	
				Garbage bank, Recycled crafts, Garbage shop, Laundry house, Motorcycle wash, Plastic chopper, Shell bag	ProKlim	Conducted	BNPB (2021)	
				Synchronization of work programmes and division of roles of central and regional governments in the recovery of and emergency response systems for hazardous waste management	-	Conducted	KLHK 2021	
				Zero waste policy	Green Campus	Planned	UGM (2021)	
				Malaria elimination intensification services, arbovirosis disease control services, intensification of malaria elimination acceleration in Papua and West Papua		Planned	Kemenkeu (2020)	

		Enhancing community capacity in reducing climate change impact on health	Health	PHBS training for officials	PHBS	Conducted	CLAC	
				Livable settlement -> training on handling urban slums	Kota Tanpa Kumuh (KOTAKU)	Conducted	BPSDM (2022)	
				Settlement areas, Public facilities and infrastructure, Areas for orderly traffic facilities and transportation services, healthy mining areas, healthy forest areas, healthy industrial and office areas, Healthy tourism area, Food and nutrition security, Independent community life, Healthy social life, Smart City	Kabupaten/ Kota Sehat	Planned	Kemenkeu (2020)	
				Climate healthy village socialization	Desa Sehat Iklim	Ongoing/ Implemented	CLAC	
				Community-based disease prevention and control by utilizing natural resources and local wisdom	STBM, Destana	Ongoing/ Implemented	PBI (2021)	
				Washing hands with clean water and soap, using healthy latrines, eradicating larvae at home	PHBS	Ongoing/ Implemented	CLAC	
				The provision of community assistance for access to health service financing	-	Ongoing/ Implemented	PBI (2021)	
Development of community capacity and participation in local planning processes, to secure access to key natural resources;	Enhancing community capacity in natural resource management as a source of income, including capacity in risk management and sustainable utilisation of natural resources	Awareness campaign, education, and training	Ecosystem	Tree planting, Environmental sanitation, Biopori holes, Community disaster preparedness team, Village DRR Forum	Destana	Conducted	BNPB (2021)	Potential Sinergy with implementation of CBD, UNCCD, and SFDRR
				Environment-based curriculum	Adiwiyata School	Ongoing/ Implemented	CLAC	
				Community empowerment and regional and village institutional development; Improvement of hygienic behaviour and sanitation services	Pamsimas	Ongoing/ Implemented	CLAC	
		Identification, development and implementation of best practices	Ecosystem, disaster	Building maintenance, Non-structural mitigation, Fire safety, Disaster preparedness plans at family level, Family reunification plans, School training (simulation), Education on structural safety; next Construction as an educational opportunity, Education sector analysis, Multi-hazard risk assessment and Child-centred assessment and planning	Satuan Pendidikan Aman Bencana (SPAB)	Conducted	Kemendikbud (2021)	
	Strengthening community engagement in development	Development and implementation of appropriate mechanisms for community participation, taking into account	Ecosystem	Psychosocial Disaster Assistance	-	Conducted	PBI (2021)	

	planning process at all levels, taking into account gender participation, gender equity, and gender balance as well as vulnerable groups and intergenerational needs	gender participation, gender equity, and gender balance and vulnerable groups (PwDs, children, and the elderly), and intergenerational needs						
		Facilitation and oversight to ensure community interests, including gender, are accommodated in development plan	Ecosystem	Playground for each village	Child-friendly village	Conducted	BNPB (2021)	
				Environment-based policy	Adiwiyata School	Ongoing/ Implemented	CLAC	
				Smart park, child-friendly health centre, fairy tale village	Child-friendly village	Done	BNPB (2021)	
				Policies, implementation, facilities, and infrastructure, child and other participation, monitoring and evaluation, and follow-up action of Child-friendly school	Child Friendly School	Ongoing/ Implemented	CLAC	
				- Involvement of women's groups in the development of MSMEs and Tourism Villages (Jeruju Besar Village and Kalepu Village) - Management of the Indonesian Women's High Leaders Association	Child Care and Women Friendly Village (DRPPA)	Conducted	Kemenppa (2021)	
				Daycare Park (TPA)	-	Conducted	DP3AKB	
				Working Group Committee for Women and Children	-	Conducted	Kemenppa (2021)	
				Community complaint services, victim outreach, case management, temporary shelter, mediation, victim assistance	-	Conducted	DP2KBP3A (2022)	
Ramping up disaster preparedness programmes for natural disaster risk reduction	Increasing effectiveness of natural disaster preparedness and post disaster recovery programme	Development and maintenance of natural disaster control infrastructures	Disaster	Early warning signs	Destana	Conducted	BNPB (2021)	Potential synergy with SFDRR
		Revitalisation of climate related natural disaster control infrastructures based on climate change analysis	Disaster	Early warning system and infrastructure	ProKlim	Conducted	BNPB (2021)	
		Protection of cultural and historical sites	Disaster					
	Empowering communities in natural disaster preparedness	Awareness campaign, education, and training	Disaster	Formation of DRR documents, disaster risk maps, evacuation maps, and DRR forums; Processed fish products, Handicrafts, Fish trawlers, Tourism Villages	Destana	Conducted	BNPB (2021)	

	and post disaster recovery			Improving institutional capacity to integrate climate resilience into sustainable development at the district and provincial levels	-	Conducted	SRN	
				Participation-based environmental action	Adiwiyata School	Ongoing/ Implemented	CLAC	
				Vulnerability assessment of school buildings, rehabilitation and strengthening of building structures	Disaster Safe Schools	Ongoing/ Implemented	BNPB (2021)	
				Disaster response family movement campaign -> mothers and women, high school students	Disaster Resilient Family (Keluarga Tangguh Bencana/Katana)	Conducted	BNPB (2022)	
				Campaign for Disaster Awareness Culture through radio play, “Asmara in the midst of Disaster”	Disaster Awareness Cultural Movement	Ongoing/ Implemented	BNPB (2020)	
Identification of highly vulnerable areas in local spatial and land use planning efforts	Development and utilisation of information system and data provision on vulnerability, risks, and impacts of climate change	Strengthening Information System on vulnerability index (Id. Sistem Informasi Data Indeks Kerentanan/ SIDIK)	Ecosystem, disaster	SIDIK technical guidance	-	Conducted	SRN	Potential synergy with Sendai Framework DRR and UNCCD
				Study of Climate Change Risk and Adaptation in coastal and marine sectors, water resources, coral reef and seagrass ecosystems, forest honey bee ecosystems, agropolitan, coastal	-	Conducted	SRN	
				Study on Climate-related Hazards of the Bantimurung Bulusaraung Karst Ecosystem, South Sulawesi	-	Conducted	SRN	
		Integration of SIDIK with other related systems regarding vulnerability, risks, and impacts of climate change	Ecosystem, disaster			Conducted		
Improvement of human settlements, provision of basic services, and climate resilient infrastructure	Mainstreaming adaptation into spatial planning and strengthening compliance in the implementation	Climate awareness campaign, standard enforcement and oversight in human settlement development, including building and environmental health	Health, ecosystem, disaster	Socialization to school residents: Health requirements for school buildings	Child Friendly School	Conducted	SRN	Potential synergy with SFDRR
				Capacity building in health facilities	-	Ongoing/ Implemented	PBI (2021)	
				Construction of sanitation facilities	-	Ongoing/ Implemented	PBI (2021)	

development	of spatial planing			Media campaign on DRR issues on social media	-	Ongoing/ Implemented	PBI (2021)	
	Integrating adaptation in infrastructure development and maintenance	Increasing compliance to carrying capacity related regulations in infrastructure development	Energy, disaster					
		Improving water resource management including soil water, measures to deal with disaster emergency	Water, ecosystem	Hydrodynamic modelling for flood reduction and climate resilient infrastructure development pathways in DKI Jakarta	-	Conducted	SRN	
				Provision of shallow groundwater drills for emergency response	-	Planned	Kemenkeu (2020)	
Conflict prevention and resolution.	Strengthening coordination and communication in policy formulation and implementation	Implementation of complain and redress mechanisms	Disaster	Community complaint services, victim outreach, case management, temporary shelter, mediation, victim assistance	-	Conducted	DP2KBP3A (2022)	
				Post-disaster assistance in disaster/social conflict areas	-	Conducted	PBI (2021)	

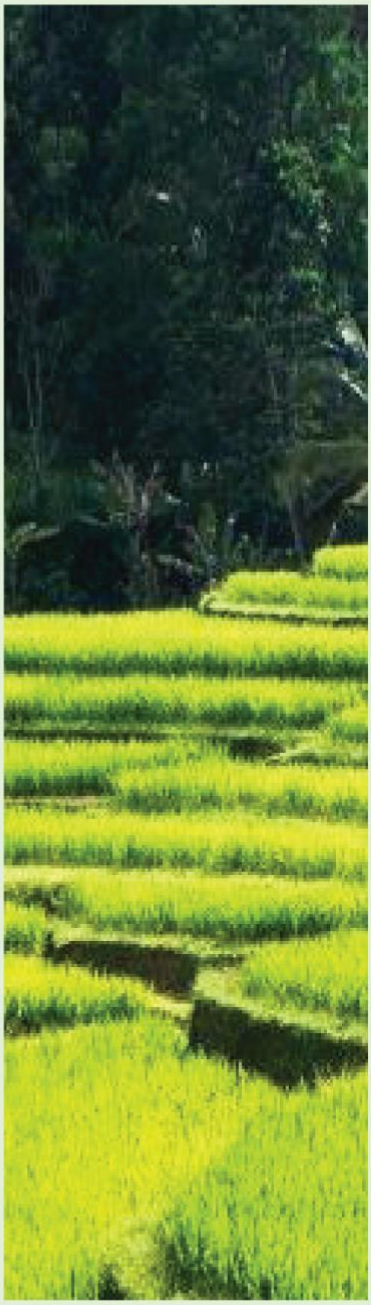
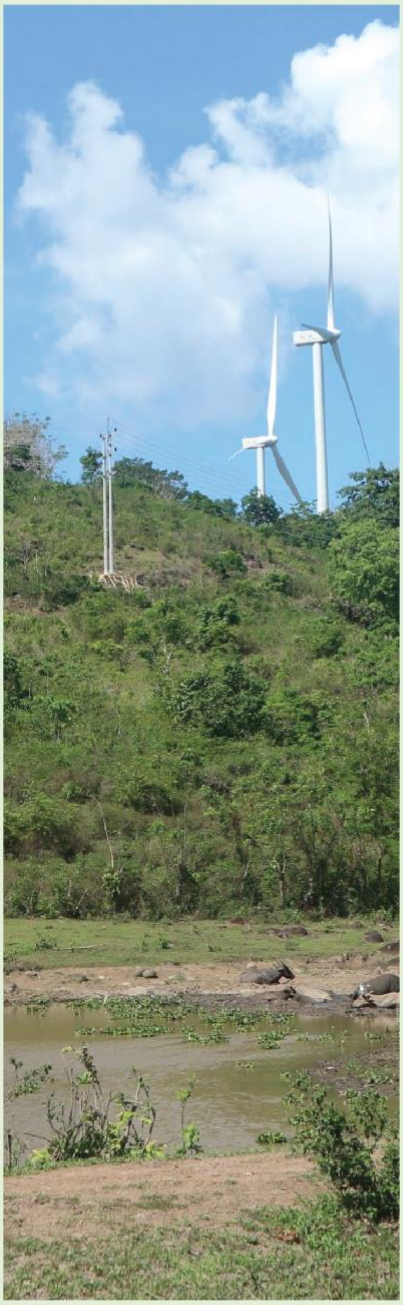
Ecosystem and Landscape Resilience

Key Program	Strategy	Action	Sector	Related Action	Program	Status	References	Potential Synergy
Social forestry	Enhancing engagement of local and adat communities in social forestry development process.	Awareness campaign on the important role of forest and forest areas in ecosystem resilience	Ecosystem	Tree planting, Environmental sanitation, Biopori holes, Community disaster preparedness team, Village DRR Forum	Destana	Conducted	BNPB (2021)	Potential synergy with CBD and UNCCD
	Strengthening implementation of landscape approach in social forestry	Facilitation, oversight, and compliance to sustainable principles applied to each scheme of social forestry	Ecosystem					
	Implementation of EFT in social forestry	Creating enabling environment for EFT	Ecosystem					
		Identification, development and implementation of best practices applicable for social forestry	Ecosystem					
Coastal zone protection	Mainstreaming adaptation into policies and programmes on coastal zones and oceans	Implementation of ecosystem-based adaptation in coastal zone development	Ecosystem	Ecotourism facilities (public toilets, monitoring posts, evacuation routes, landfill, piping)	Desa Pesisir Tangguh	Conducted	BNPB (2021)	Potential synergy with implementation of Ramsar Convention, CBD, SFDRR, and UNCCD
		Implementation of integrated management of mangrove ecosystems	Ecosystem	Strengthening mangrove working groups and mangrove care forums	-	Ongoing/ Implemented	RPJMN 2020-2024	
		Enhancing coastal zone and ocean pollution control, including marine litter and plastic debris	Ecosystem	Construction of marine guard facilities and coastal protection structures	-	Ongoing/ Implemented	PBI (2021)	
	Development of climate resilient coastal zones	Increasing communication, Education, and Public Awareness (CEPA) on the important role of coastal ecosystem protection in natural disaster impact	Ecosystem, disaster	Increasing public understanding of maritime meteorological information	Sekolah Lapang Nelayan	Ongoing/ Implemented	RPJMN 2020-2024	
				Dissemination of knowledge related to coastal ecosystems and shallow marine waters	Sekolah Pantai Indonesia	Ongoing/ Implemented	PBI (2021)	

		reduction						
		Restoration of degraded coastal zones as essential ecosystem	Ecosystem					
		Improving **livelihood** of communities living in or depending on coastal areas	Ecosystem	Livelihood Diversification -> Brackish water fishery products, Mangrove coffee, Mangrove track	Desa Pesisir Tangguh	Conducted	BNPB (2021)	
				Diversification of Livelihoods -> Woven bamboo mats, coconut sugar, processed fish products	Desa Pesisir Tangguh	Conducted	BNPB (2021)	
				Improved skills of coastal women -> Flower products, Lantern products, Fish meatballs, Fish nuggets, Fish shreds	Desa Pesisir Tangguh	Conducted	BNPB (2021)	
				Increasing access to fisherman insurance based on weather index and climate risk (Weather Index Insurance)	BPAN	Ongoing/ Implemented	PBI (2021)	
				- Arranging the fishing centre/village area - Implementing the reconstruction of adaptive population settlements, public facilities, and social facilities for coastal areas	Kampung Nelayan Maju (KALAJU)	Ongoing/ Implemented	PBI (2021)	
				Relocation of coastal communities affected by tidal flooding	-	Ongoing/ Implemented	PBI (2021)	
				Capacity building for salt and fish farmers	-	Conducted	PBI (2021)	
Ecosystem conservation and restoration	Enhancing ecosystem, species and genetic conservation	Development and implementation of in situ and ex situ conservation	Ecosystem	Community-based forest management	-	Conducted	PBI (2021)	Potential synergy with implementation of Ramsar Convention, CBD, SFDRR, and UNCCD
		Prevention and eradication of invasive alien species	Ecosystem					
		Protection of existing and development of new marine protected areas	Ecosystem	Construction and improvement of sea walls, breakwaters, and other coastal protection structures	-	Ongoing/ Implemented	RPJMN 2020-2024	
				Construction of hybrid, hard, and soft structures for coastal protection with an ecosystem-based approach (planting and rehabilitation of mangroves)	-	Ongoing/ Implemented	PBI (2021)	

	Improving functionality of integrated ecosystem to ensure improvement of essential services	Restoration of degraded mangroves and peatlands	Ecosystem, water	Rehabilitation of mangroves in coastal areas and small islands	-	Ongoing/ Implemented	RPJMN 2020-2024	
				Canal blocking planting and construction	-	Ongoing/ Implemented	PBI (2021)	
				Capacity building for community groups maintaining peat wetting infrastructure	Peat Care Village	Conducted	BNPB (2021)	
		Enhancing conservation education, including engaging adat communities for indigenous knowledge and local wisdom	Ecosystem	Community-based forest management	-	Conducted	PBI (2021)	
Integrated watershed management	Developing climate resilient watershed ecosystem management	Improving watershed management planning by taking into account climate vulnerability, risks, and impacts	Water, ecosystem, disaster	Institutional Strengthening for Integrated Water Resource Management in the 6 Cis River Basin Territory	-	Conducted	SRN	Potential synergy with implementation of Ramsar Convention, CBD, SFDRR, and UNCCD
		Developing policy instruments and tools to assess climate vulnerability, risks, and impacts to national priority watersheds	Water, ecosystem, disaster					
Climate resilient cities	Promoting development of climate proof cities	Awareness campaign on the importance of integrating climate vulnerability, risks, and impacts in city planning and development	Ecosystem, disaster					
		Capacity building and institutional strengthening	Disaster energy	Improving institutional capacity to integrate climate resilience into sustainable development at the district and provincial levels	-	Ongoing/ Implemented	SRN	
				Institutional Strengthening for Integrated Water Resource Management in the 6 Cis River Basin Territory	-	Conducted	SRN	
		Revitalisation of city infrastructure to increase	Ecosystem, disaster	Construction of main urban drainage system infrastructure (flood canals, polders, pumps,	-	Ongoing/ Implemented	RPJMN 2020-2024	

		adaptive capacity and resilience to climate change impacts		etc.)				
				Construction of integrated residential areas	-	Ongoing/ Implemented	PBI (2021)	
		Increasing urban forest area and other green open spaces	Disaster energy	Reforestation to achieve the ideal proportion of Green Open Space (Ruang Terbuka Hijau/RTH)	Green Campus	Conducted	SRN	
				Development of Climate Resilience and Inclusive City	Climate Resilience and Inclusive City	Ongoing/ Implemented	PBI (2021)	


INDONESIA'S ADAPTATION COMMUNICATION

Report to the United Nations Framework Convention on Climate Change on October 2022