Kementerian PPN/
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NATIONAL ADAPTATION PLAN

EXECUTIVE SUMMARY

National Adaptation Plan Executive Summary 2019
Ministry of National Development Planning/
National Development Planning Agency (Bappenas)

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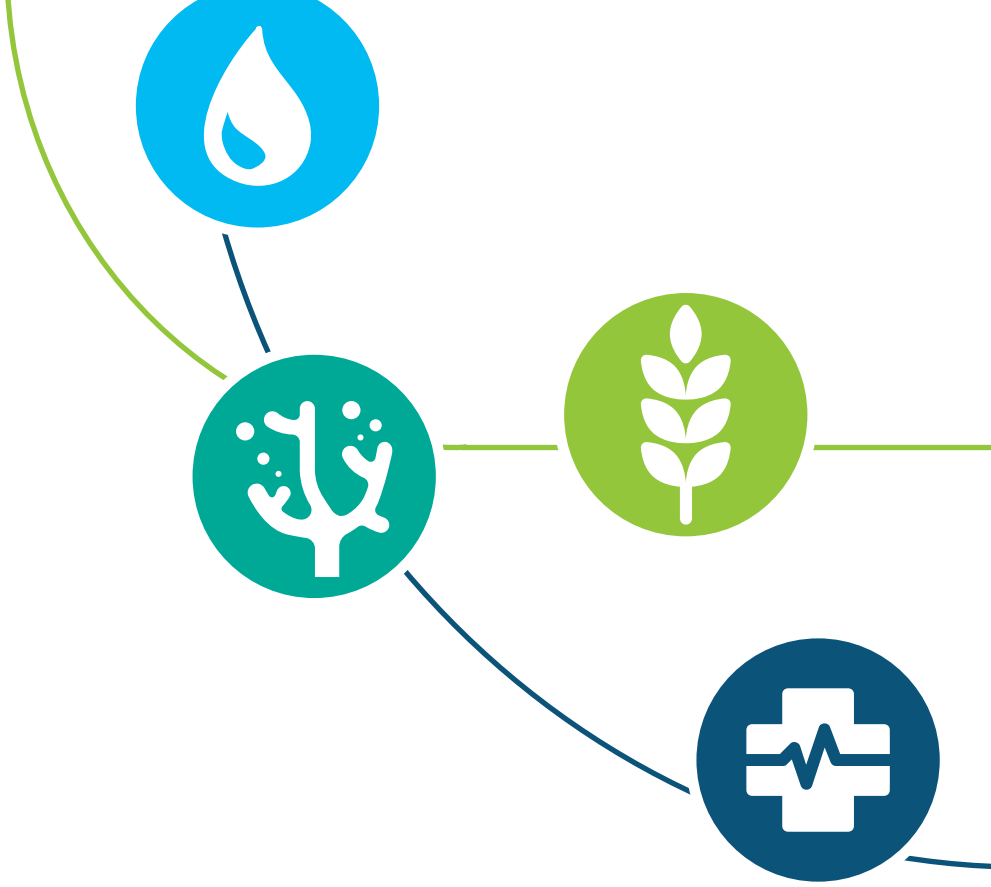

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Foreword

Indonesia is one of the countries located right on the equator, and is the largest archipelagic country in the world, making it very vulnerable to the effects of climate change. Based on climate change projection, Indonesia is experiencing an increase of temperature, including sea surface temperature, and changes in the pattern and intensity of rainfall. Changes in climate conditions will potentially cause various hazards including prolonged drought, flooding, and increasing extreme weather events that will have social, economic and environmental impacts, such as crops failures, reduced capture fisheries production, reduced livelihoods opportunity, loss of biodiversity, increase in number of outbreak events for various types of infectious diseases. The impact of climate change can ultimately hamper the implementation of the national development plan.

Adaptation action strategies in the development of climate resilience on short, medium and long term are needed to protect the community and development sustainability, especially for preventing massive socio-economic losses in the future. To anticipate the potential negative impacts, the Indonesian Government is committed through the preparation of the National Action Plan for Climate Change Adaptation (RAN API) or National Adaptation Plans (NAPs) as the main reference in the planning of climate change adaptation actions through the adoption of adaptive criteria.

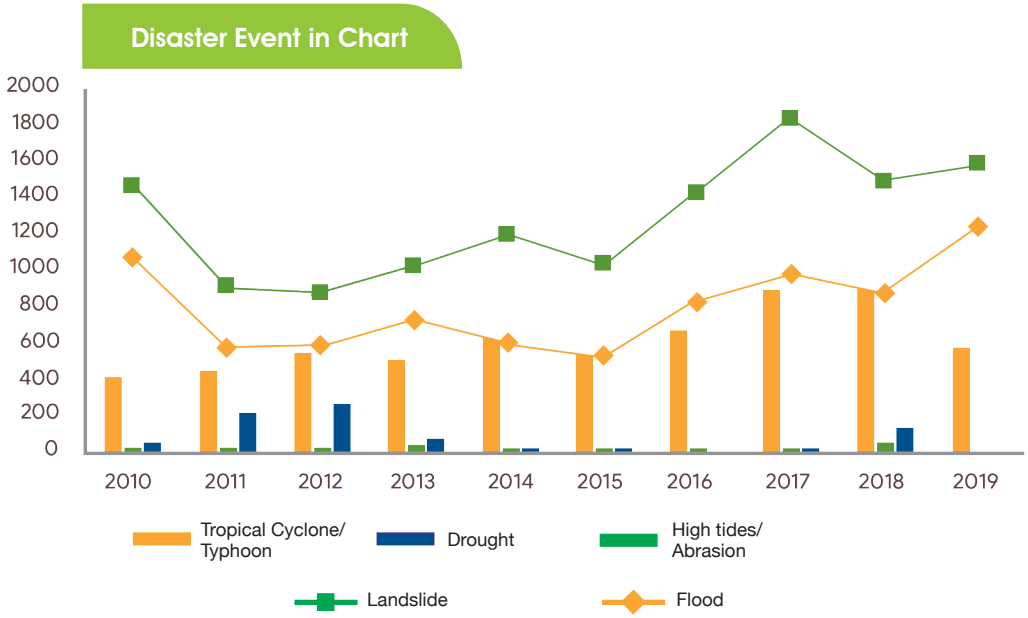
This document is prepared through a scientific, inclusive and iterative process by taking into account the characteristics of sectors and regions through scientific studies that were strengthened with experience and best practice at the local level from various stakeholders. As it is known, adaptation is a collaborative effort from various stakeholders and cooperation between the national governments, sub-national governments, private sectors, development partners and communities. Through climate resilience development, it is expected to support the achievement of national development targets that are sustainable and adaptive to climate change.

Finally, I would like to thank to all those who have helped in the preparation of this document and can be helpful to the beneficiaries.

Jakarta, December 2019

Dr. Ir. H. Suharso Monoarfa
Minister of National Development Planning/
Head of National Development Planning Agency
(Bappenas)

Why Indonesia needs to Adapt?



Source: Disaster Information Data of Indonesia, BNPB (2019)

Climate Change is a natural phenomenon that must be faced and anticipated wisely. Indonesian territory is located on the equator and also between two oceans, those geographic characteristics will affect the climate patterns. As an archipelagic country, most rivers in Indonesia are short river and potentially prone to flood or drought.

Extreme weather impacts on a series of disasters in Indonesia, such as drought followed by land and forest fires, flood also followed by landslides, sea level rise and extreme sea waves, no doubt they have direct impacts to the community. Loss of critical biodiversity is also a threat from climate change, one of them is coral bleaching due to rising of sea surface temperatures. In addition to the potential disaster event and environmental loss, most of Indonesian will lose their livelihoods as a negative impact of climate change.

Besides, Indonesia's economy is predicted to be threatened by climate change, as shown by the potential loss in GDP per capita. Therefore, appropriate and measurable policymaking is critically needed by considering various climate change scenarios and climate risks which might establish a resilience community and development to climate change. Compare to other countries in the world, Indonesia is a vulnerable country that has an extensive coastline, high population density in coastal areas, high dependence on the agricultural production and natural resource, relatively low in adaptive capacity, and tropical climate.

"Climate is what we expect, weather is what we get."

- Mark Twain

Potential Economic Losses from Climate Change Impacts in Four Priority Sectors
(IDR Trillion)

SECTOR	YEAR 2020	2021	2022	2023	2024
 Marine & Coastal	81.30	81.43	81.57	81.69	81.82
 Water	3.83	4.74	5.61	6.45	7.29
 Agriculture	11.20	13.40	15.59	17.77	19.94
 Health	6.03	6.15	6.26	6.37	6.48
TOTAL	**102.36**	**105.72**	**109.03**	**112.29**	**115.53**

Climate Projections, Hazards, and Impacts: Climate Change on Development

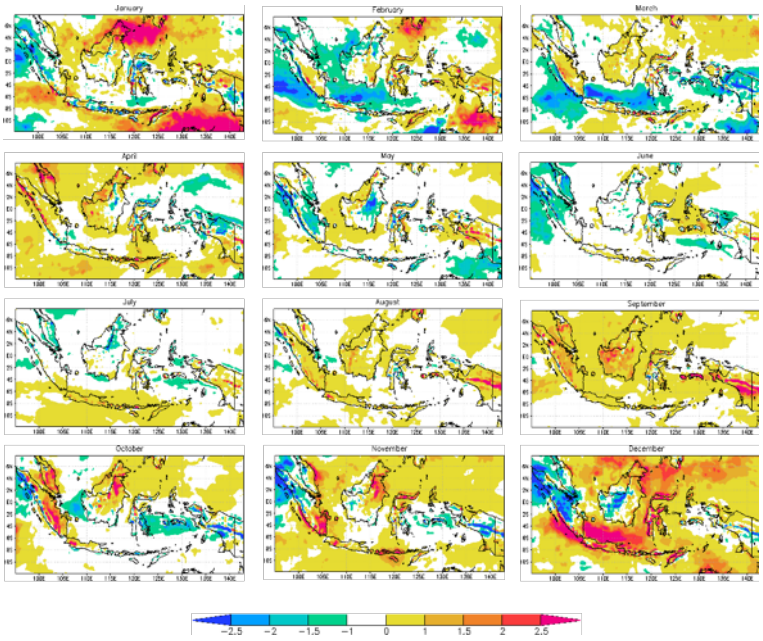
The global temperature record shows the increase of surface temperature. The rise of global average temperature is increasing the frequency of daily and seasonal extreme high temperatures, as well as decreasing in frequency of extreme low temperatures. The frequency and duration of heat wave events are also increasing certainly. The increase of global surface temperature is affected the global water cycle shown by changing rainfall during wet and dry season. The climate projection shows an increase of rainfall in equatorial regions, particularly on the Pacific Ocean. The long-term changes of climate parameters affect climate anomalies in shorter periods, such as El Niño-Southern Oscillation (ENSO), Indian Ocean Dipole (IOD), and monsoons.

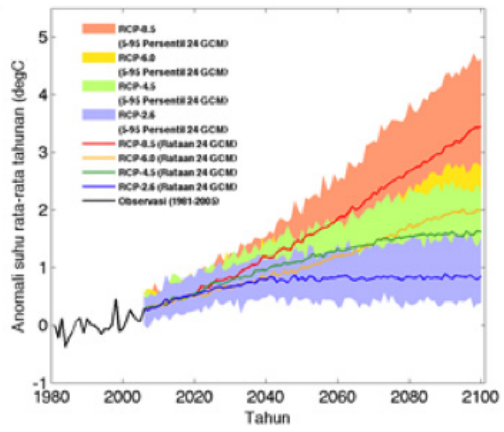
Increasing temperature, changing rainfall patterns and intensity in Indonesia imply the environment condition. It is then affected the human activities. Moreover, plant metabolism, especially crops, is strongly influenced by temperature. The increase temperature in the central of agricultural commodities may reduce the productivity of crops, or it may even change the suitability as well as the cropping patterns. Changes in rainfall patterns and intensity also affect crops production, as the water requirement is different between crops and growth phases. Higher temperature and lower rainfall will dry out the soil and reduce the water availability, which then affected the water demand for settlements, households, and other economic activities.

Ocean warming dominates the increase of heat storage in the climate system. The increase in atmospheric temperature and sea surface temperature will affect the global ice coverage areas. The changes of ocean conditions will affect marine ecosystems and human activities. The increase of sea surface temperatures will amplify the risk of coral bleaching and it may decrease the fisheries production. Settlements located in coastal area are vulnerable to abrasion, coastal inundation, coastal flood, and high tides. Sea level rise also impact the increase of frequency and intensity of coastal inundation, tidal wave height, and coastal abrasion. Furthermore, the coastal community's livelihood and activities are affected. It may potentially damage the infrastructure of public facility, agricultural land and aquaculture, markets, and other economic sectors.

> *"Climate change does not respect border; it does not respect who you are – rich and poor, small and big. Therefore, this is what we call 'global challenges', which require global solidarity."*
>
> **- Ban Ki-moon**

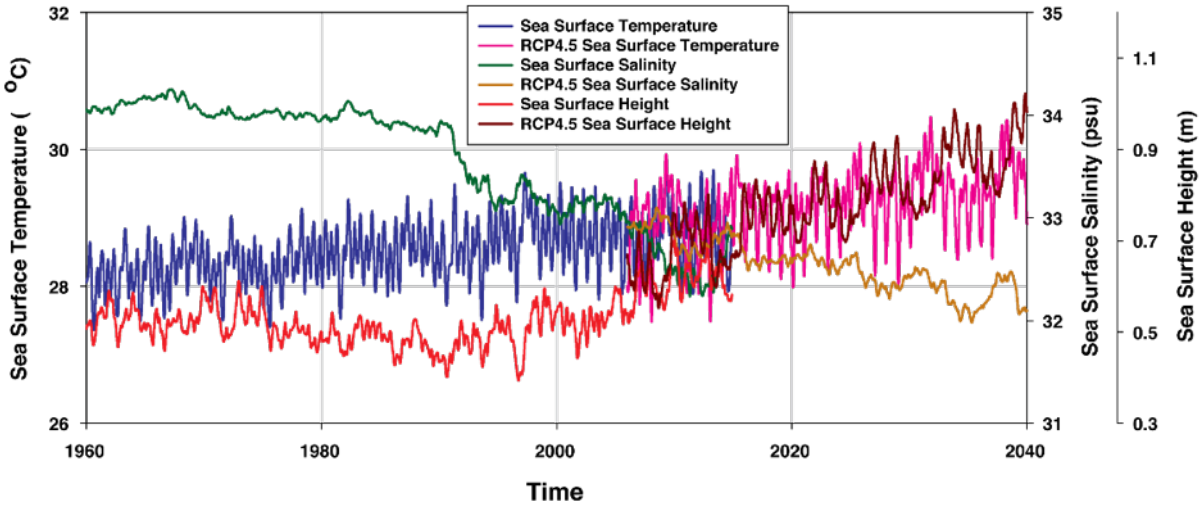
Projection of Daily Rainfall and Temperature Changes in Indonesia





Source: BMKG (Indonesian Meteorological, Climatological, and Geophysical Agency) in Atmospheric Climate Projection Assessment (Bappenas, 2018)

Changes of Monthly Average Sea Surface Temperature, Sea Surface Height, and Surface Salinity from 1961 to 2040



Source: BIG (Indonesian Geospatial Information Agency) in Ocean Climate Projection Assessment (Bappenas, 2018)

A significant increase in wave height might affected the potential of ship accidents and disturbance of sea transportation. Changes in atmospheric and oceanic conditions affect their interactions in climate system, including ENSO and IOD events, which also have impact on the Indonesian environment and waters. Extreme weather events such as tropical cyclone might also increase due to changes in atmospheric and ocean conditions, both its frequency and magnitude. Tropical cyclone which previously had insignificant impacts, begin to occur frequently approaching the equator area and trigger extreme weather events in Indonesia, namely extreme rainfall and storm.

The climate prediction indicates a significant decrease of rainfall during El Nino and intensify the possibility of drought for the next 5 years.

The related impacts to this issue in potential disaster area are forest fire, crop failures, and clean water shortage, as well as the other derivative impacts that may occur, such as air pollution, health and transportation safety, due to the haze pollution.

Increased Extreme Wave Height of **1.5 meter**

Increased Temperature **0.45°C-0.75°C**

Rainfall **2.5 mm/day**

Sea Level Rise from **0.8 to 1.2 cm/year**

Climate hazards in each sector

Flood

Water availability

Drought

Decrease of fisheries and agriculture commodity production

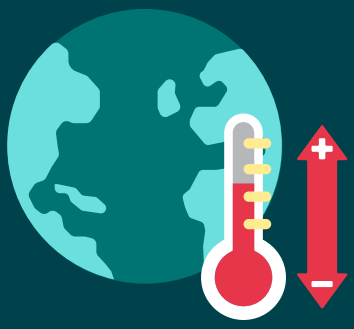
Coastal flood affects the slope of the coastal environment

Endanger marine safety

Changes in sediment supply

Reduce the cruising range of small fishing boats <20GT

Development of vector diseases and heat stress in urban areas



EXTREME CLIMATE CONDITION

BOX 1

Marine & Coastal Sector

MARINE

Wave height projection until 2045 shows that 5.8 million km^2 or approximately 90% of total area of Indonesia waters is dangerous for <10 GT vessel.

Some of the freeway shipping lane connected through sea toll determined by Ministry of Transportation will cross dangerous to extremely dangerous waters, especially on western part of Sumatera and northern part of Maluku.

Furthermore, the vessels of the National Shipping of Indonesia (PELNI) will be exposed to more than 3 m of wave height on western part of Sumatera.

COASTAL

Approximately 102,000 km of Indonesian coastline has various vulnerability level and 1,800 km of it is categorized as highly vulnerable coast. South Sulawesi Province is the longest coastline (573 km) with very high coastal vulnerability index (CVI 5).

Water Sector

Decreasing water availability has been projected to occur evenly in Java and Nusa Tenggara Island until 2045. In 2024, the average of decreasing water availability in Java Island will reach 439.21 m^3/capita/year and 1,654.82 m^3/capita/year in East Nusa Tenggara Province.

Agriculture Sector

Rice production is projected to decrease more than 25% in Gorontalo Province, Maluku Province, and North Maluku Province until 2045.

Health Sector

Projection of dengue fever event will be very high until 2045 in these following cities: Pekanbaru, Palembang, Banjarbaru, Banjarmasin, Samarinda, Tarakan, Kolaka, Ambon, Semarang, Bali, and Kupang.


akubakau
jaga aku
akuakan
membuatmu
Tersenyum

SUMATRA

NAD (Banda Aceh)	4	4	5	3	3
North Sumatra	3	3	4	3	4 (Medan City)
Riau	3	3	4	3	5 (Pekanbaru City)
Riau Islands	3	5	2	3	5 (Pekanbaru City)
West Sumatra	2	5	4	2	4 (Padang City)
Jambi	3	2	4	3	5 (Jambi City)
Bengkulu	2	5	3	2	4 (Bengkulu City)
					4 (Kepahiang City)
South Sumatra	3	3	4	4	5 (Palembang City)
Lampung	3	5	3	3	2 (Bandar Lampung City)
Bangka Belitung	3	5	4	3	-

KALIMANTAN

West Kalimantan	1	4	4	2	3 (Pontianak City)
North Kalimantan	1	5	3	5	5 (Tarakan City)
Central Kalimantan	1	4	4	4	5 (Palangkaraya City)
South Kalimantan	1	5	3	3	5 (Banjarbaru City)
					5 (Banjarmasin City)
East Kalimantan	1	5	3	3	2 (Balikpapan City)
					4 (Samarinda City)

JAVA

Banten	4	5	3	3	1 (Pandeglang City)
DKI Jakarta	4	3	5	1	-
West Java	4	5	3	3	-
Central Java	4	5	5	3	5 (Semarang City)
DI Yogyakarta	4	5	4	3	3 (Yogyakarta City)
East Java	4	5	3	3	2 (Malang City)

Infographic Description

Water Coastal Marine Agriculture Health

Hazard Scale

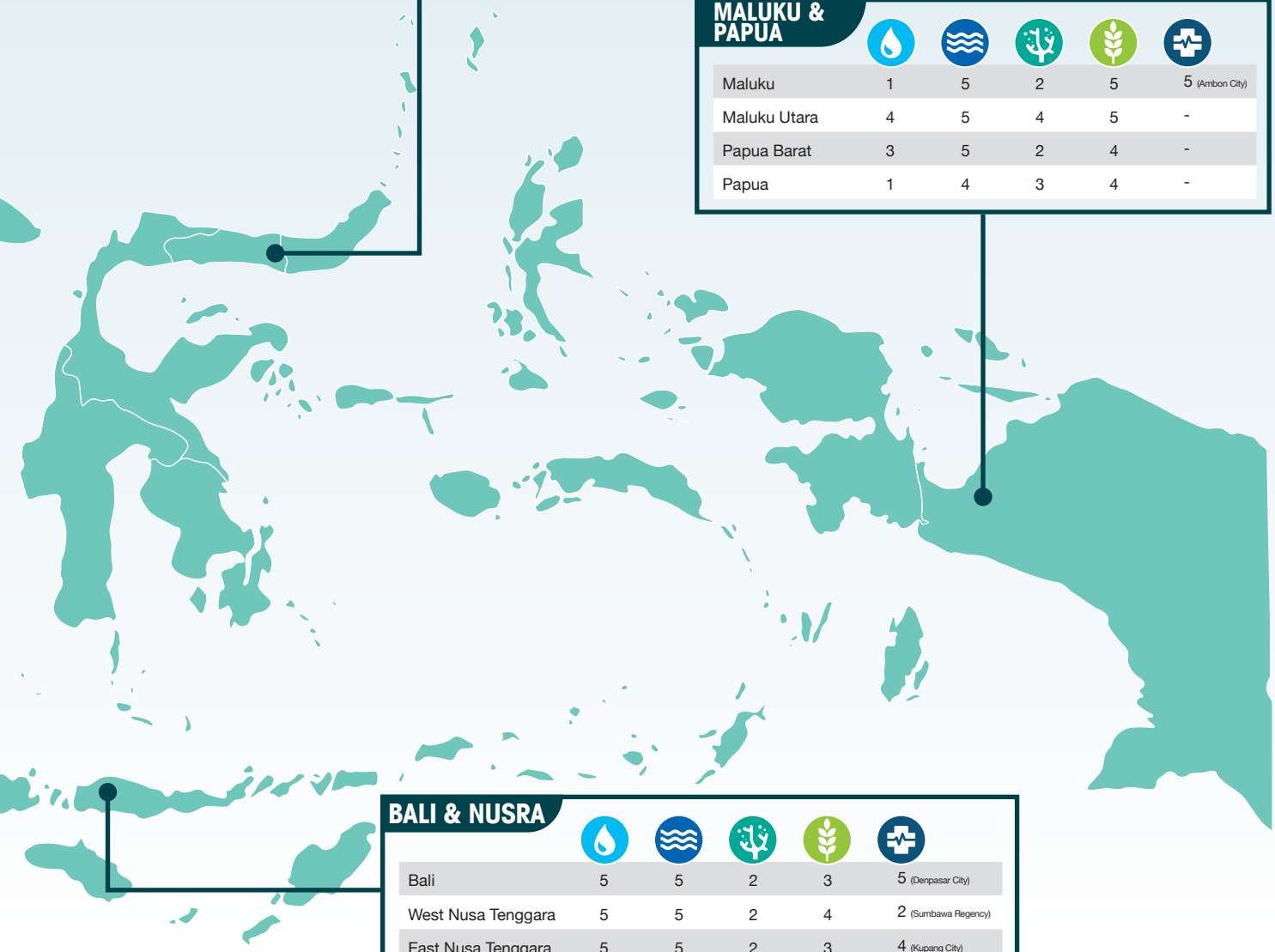
1 = very low
2 = low
3 = moderate
4 = high
5 = very high

SULAWESI

Gorontalo	1	5	2	5	2 (Gorontalo City)
North Sulawesi	1	5	4	4	4 (Manado City)
Central Sulawesi	1	3	4	4	-
West Sulawesi	1	4	4	3	-
Southeast Sulawesi	1	5	4	3	4 (Kolaka City)
South Sulawesi	1	5	5	3	2 (Makassar City)

MALUKU & PAPUA

Maluku	1	5	2	5	5 (Ambon City)
Maluku Utara	4	5	4	5	-
Papua Barat	3	5	2	4	-
Papua	1	4	3	4	-



BALI & NUSRA

Bali	5	5	2	3	5 (Denpasar City)
West Nusa Tenggara	5	5	2	4	2 (Sumbawa Regency)
East Nusa Tenggara	5	5	2	3	4 (Kupang City)

Remarks

- Water sector (projection of water scarcity period 2020-2034)
- Marine sector (projection of wave height for vessels <10GT period 2006-2045
- Coastal Sector (coastal vulnerability in 2018)
- Health Sector (projection of dengue fever cases period 2020-2034)

What We Have?
RAN API: Approach in Development Planning

"Change is coming, whether you like it or not."

- Greta Thunberg

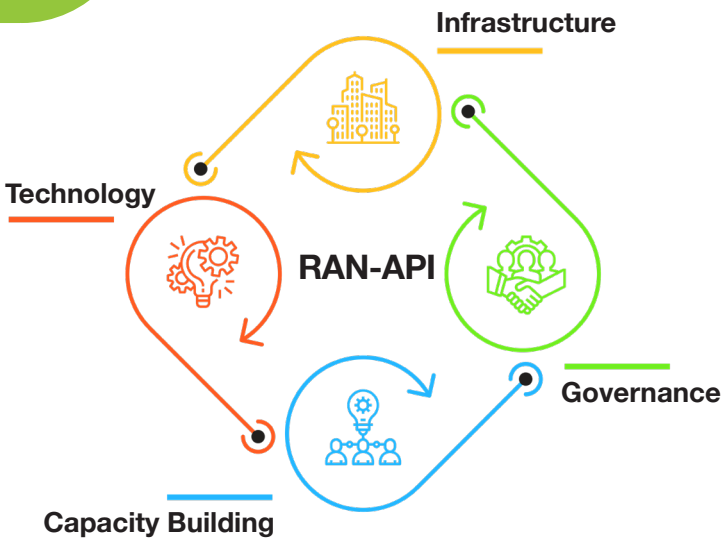
For developing countries, especially Indonesia, climate change adaptation is no longer an option, but a priority for sustainable development. Therefore, the involvement of all stakeholders must be inclusive and efficient.

As a national strategic plan, RAN API has four priority sectors for climate change adaptation, i.e. the marine and coastal, water, agriculture, and health. In the implementation of climate resilience development of those priority sectors, there are 4 (four) clusters of adaptation strategies (infrastructure, technology, capacity building, and governance). The clusters need to consider (embedded) gender sensitivity and vulnerable groups, ecosystem-based, landscape-based or spatial, as well as financial innovation.

RAN API identifies priority adaptation programs and provides a policy mechanism that can be modified to become more climate-resilient. RAN API also provides location priority directions for climate change adaptation actions. Based on the analysis of the Vulnerability Index Data System Information (SIDIK) there are 98% of regions (villages) with moderate-high vulnerability (KLHK, 2019).

Sharing information between stakeholders is the most important part of this process. Thus, adaptation policies and programs that have been planned for a certain period and how they are implemented will be compiled and communicated sustainably among stakeholders. Then, all adaptation action plans will often be reviewed and updated.

FRAMEWORK OF RAN API



GOAL
Climate-resilient development within the sustainable development framework

OBJECTIVE
Climate risk management in four priority sectors and affected areas

CONSIDERATION
Gender sensitivity and vulnerable groups, ecosystems, landscapes, financial innovation

Policy Direction and Strategy of National Action Plans for Climate Change Adaptation

In addition, RAN API documents should cover monitoring and evaluation mechanisms, in which the results could become feedback to ongoing processes and used in updating the RAN API or other related plans periodically. RAN API is part of Indonesia's national development planning framework.

In terms of national development planning, RAN API roles as a specific cross-sectoral plan for climate-resilient development. Thus, the purpose of priority activities in RAN API is to strengthen the strategic plan of each institution in climate change adaptation.

At national level, RAN API roles as a guideline or reference that provide direction on future Government Work Plans in order to be responsive to climate change impacts. At regional level, RAN API roles as a reference for local governments in preparing the Regional Action Plan / Strategy and to deal with climate change.

Monitoring & Evaluation Mechanism

Evaluation is a key measurement instrument that shows the process of implementing climate change adaptation. Evaluation in climate change adaptation is carried out annually by monitoring (on going), in the middle term, and at the end of period of development planning document (ex post). The final evaluation result of the adaptation process is very important for the country in order to know how far the potential economic losses reduction of climate change can be achieved. Climate change adaptation programs and activities will be monitored and evaluated through climate budget tagging system, both from state budget resources (Fiscal Policy Agency/Ministry of Finance) and National Climate Change Registry System of Ministry of Environmental and Forestry (MoEF).

Climate Budget Tagging

The climate budget tagging from the state budget resources aims to monitor and evaluate the state budget allocation and the effectiveness of activities. It should be done as a form of transparency and accountability of climate activities to the community. All parties who involved in the climate budget tagging, are the government institutions with state budget resources. Each government institution should tag all climate programs, activities, and outputs into the Ministry of Finance website. Currently, the ministry of finance is developing the climate budget tagging system for local government budget of climate change activities. Thus, all local governments can tag climate change programs and activities on the Ministry of Finance website, directly.

National Climate Change Registry System (SRN)

National Climate Change Registry System involves all stakeholders, such as government institution, local government, research institution, NGO, development partner, university, philanthropy, private sector, indigenous group, and other community groups. SRN was ratified through Minister of Environment and Forestry (MoEF) Regulation Number 72 of 2017. SRN can be accessed through the website of the Ministry of Environment and Forestry.

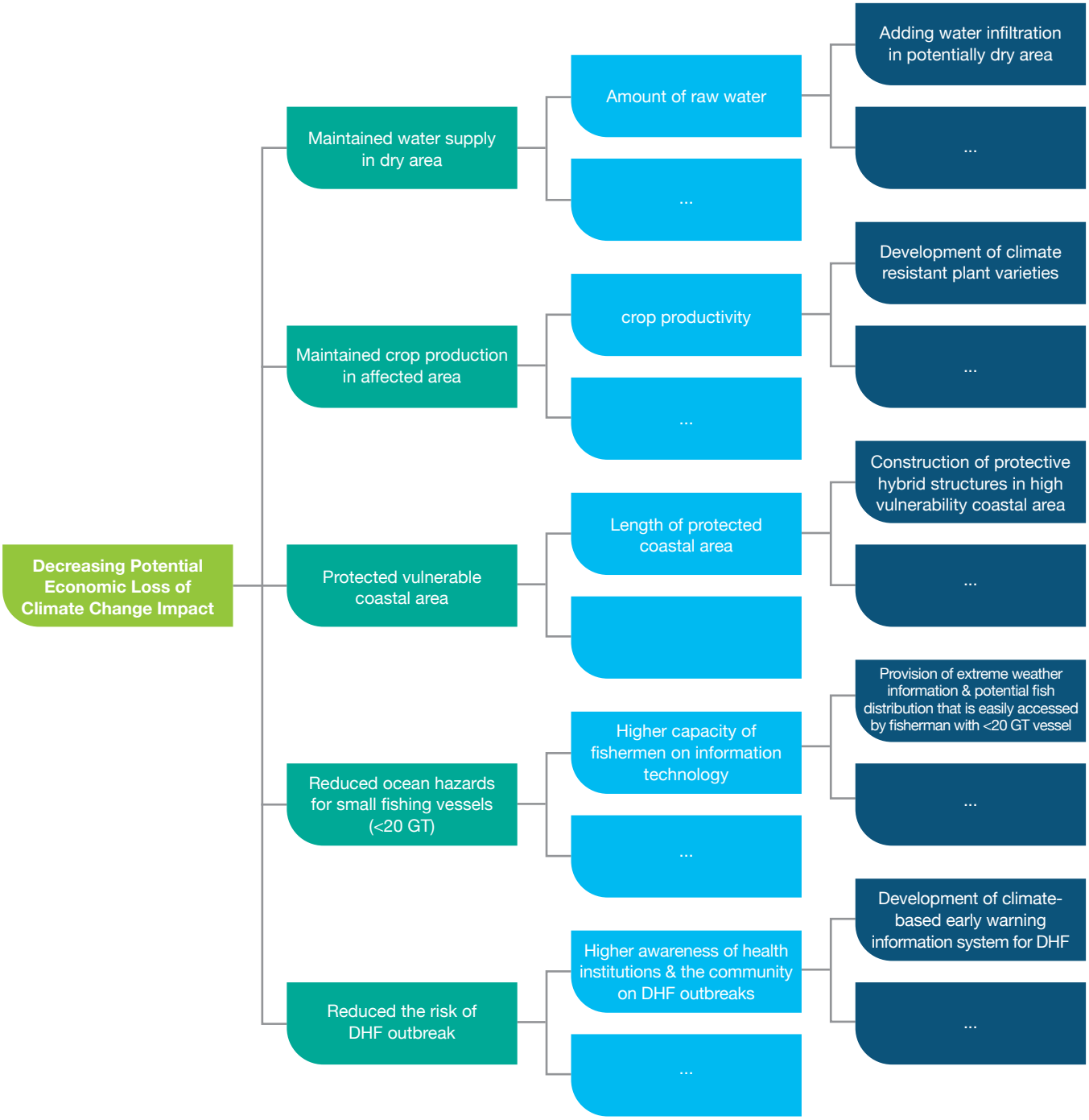
Components registered in the SRN, include: (1) climate change adaptation policies; (2) scientific studies; (3) climate change adaptation planning; (4) activity implementations; (5) monitoring and evaluation; and (6) capacity building. Meanwhile, the scope of monitoring and evaluation of RAN API (NAPs) from the SRN list, includes: (1) the suitability of the choice of activities with the level of vulnerability; (2) time period for achieving the target of adaptation activities; (3) the achievement of objectives by comparison of planning indicators/ targets.

"Unless strategy evaluation is performed seriously and systematically, and unless strategists are willing to act on the results, energy will be used up defending yesterday."

-Peter Drucker

The implementation of RAN API (NAPs) refers to logical framework, as follows:

Climate Change Adaptation Strategies & Action Framework



BOX 2

CLUSTERS IN CLIMATE CHANGE ADAPTATION

Climate-resilient Infrastructure

In adaptation, infrastructure must have a climate-resilient, ecosystem-based, and retrofit in order to face the challenges and impacts of climate change (Davis, 2010; BPIW, 2016; European Commission, 2018).

Grey infrastructure is a man-made facilities and infrastructures using pavement design, such as concrete or non-natural structures.

Green infrastructure is a facilities and infrastructure built in harmony with the landscape or using environmentally-friendly and inexpensive technology for maintenance. The infrastructure is built with the purpose to develop strong basic local knowledge on climate variability and the possibility of climate change impacts.

The infrastructure needs to support multi-hazard and risk reduction. The infrastructure must consider low-income people and vulnerable groups, because they are the most vulnerable or at risk to climate change.

Infrastructure development must be fully integrated with national development plans, SDGs, and poverty reduction strategy plans.

Capacity Building

Capacity Building on Climate change encourages stakeholders to design and implement various actions to reduce climate change impacts, adapt, overcome the loss and damage, arrange credible steps to monitor climate-related parameters, adopt new technologies and methods, and raise climate change awareness.

Climate-proof Technology

Technology as a scientific method for practical needs in solving the potential impact of climate change on humans and environment. Technology can also be utilized for gaining the benefits of the positive effects of climate change.

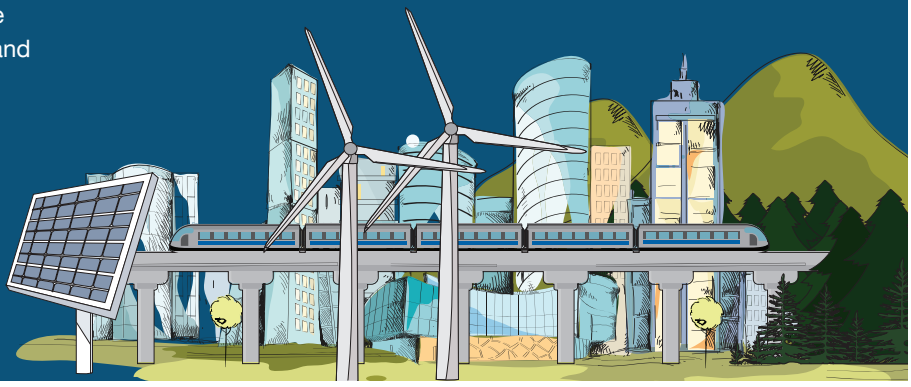
Adaptive technology capable to response the potential impacts of climate change and in line with development goals, cost-effective, environmentally friendly, culturally compatible, and socially acceptable (UNFCCC, 2006).

Climate Change Adaptation Governance

Governance is related to regulation, institution and coordination strategies for adaptation efforts in development pillars, including governments, private sectors, and communities.

Governance requires mechanisms and instruments to support the effectiveness of adaptation efforts, i.e. policy and operational instruments, such as regulations and information systems.

A well-governance is implemented through coordination of the development pillars by applying the principles of inclusiveness, transparency, easy access to information, and accountability.



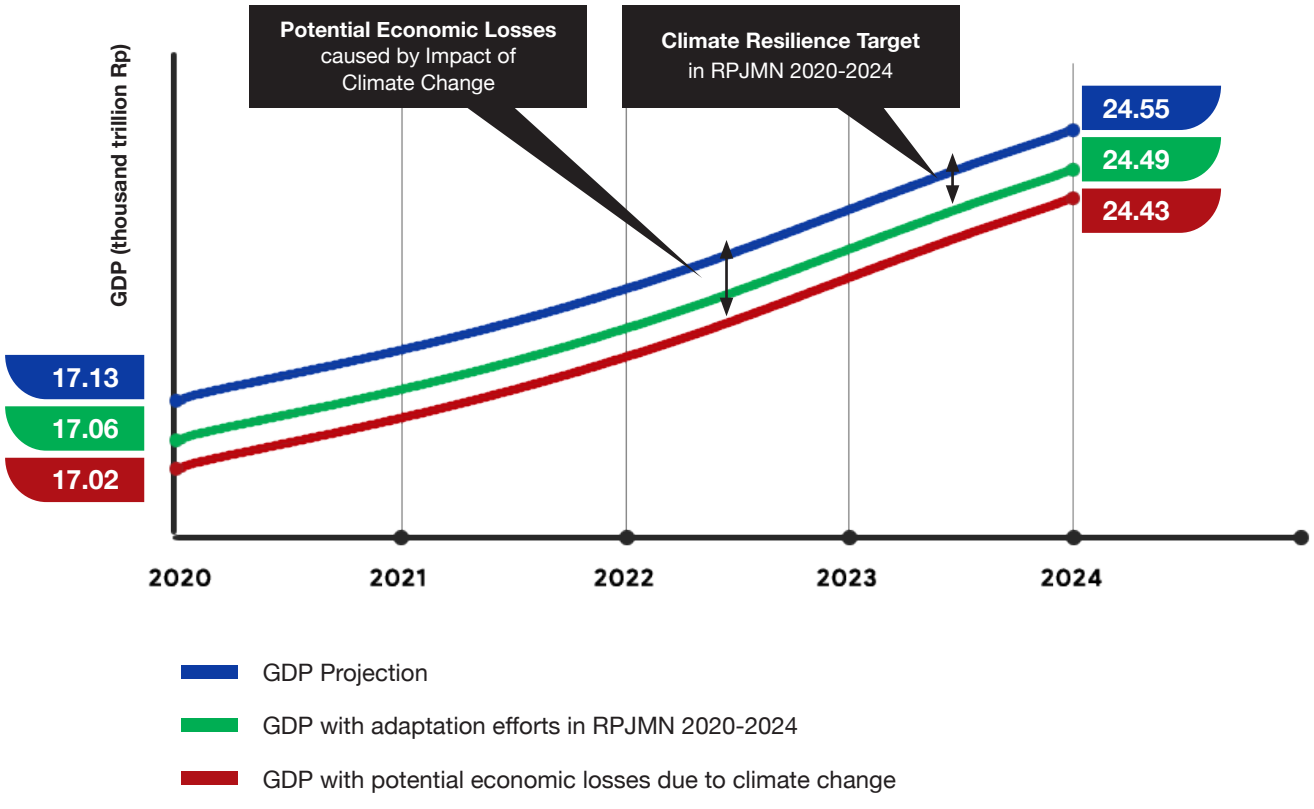
Adaptation Targets

Potential economic losses caused by climate change impact can be reduced through the well-planned and measured climate change adaptation actions. On a macro-scale, the risk of climate change can be managed by adjusting policies, strategies, and technologies for all adaptation options. In climate change adaptation efforts, Government of Indonesia is committed to protect the people and environment against the impact of climate change, which will simultaneously bring benefits and improve people's livelihoods and as well as the ecosystems.

"Climate change is the environmental challenge of this generation, and it is imperative that we act before it's too late."

-John Delaney

Chart of Potential Economic Losses caused by the Impact of Climate Change



To avoid national GDP loss and economic losses, the policy makers should make a numerous efforts not only mitigation, but also adaptation. According to economic valuation, adaptation efforts can avoid national GDP loss from

IDR 24.43 thousand trillion

(without adaptation actions) to

IDR 24.49 thousand trillion

(with adaptation actions)[5] in 2024.

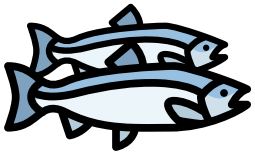
The planned scenario and effort of climate change adaptation will bring benefits:

Indonesia is able to reduce the potential for economic losses by **50.51%** in 2024

Protect at least **269.2 trillion m^3** of water resource

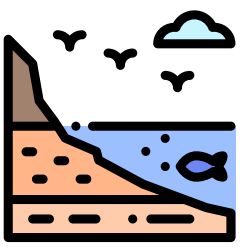
Avoid as many as **350,828 cases** of Dengue Fever due to climate change in 2024

Avoid as many as **43,477** ship accident in all categories of ships



Save **1,697.8 tons** of capture fisheries production of in 2024

Maintain production as much as **8,406.4 million tons** of rice



Protect **413,209 ha** of residential areas in the coastal area

Action Plans

Climate resilience development is an obligation to protect the community and other various aspects of development from threats and risks of climate change. This effort brings benefits for the continuity of economic, social and environmental life, consider that Indonesia is an agricultural country and has second longest coastline in the world. Indonesia intended to achieve the ideal climate resilience condition with robust anthropological and ecological systems that is resilient to the hazard of climate change.

To take the actions regarding the impacts of climate change, is not only stated in the RAN API document, but will need an integrative support from other policy and strategy or planning documents to achieve the targets of RAN API.

Participation of various stakeholder namely national and sub-national governments, private sectors, development partners and the community is critically needed. To ensure the involvement of stakeholder, it will need certain policies that can provide incentives for all stakeholders, especially for private sectors and individuals to have the willingness to act together towards climate resilient economy.

> *"Climate change is sometimes misunderstood as being about changes in the weather, in reality it is about changes in our very way of life."*
>
> **-Paul Polman**

Water Sector

Agriculture Sector

Marine & Coastal Sector

Health Sector

Strategy and Delivery Strategy
of climate change adaptation in

4 PRIORITY SECTORS

to be conducted in
the period of 2020-2045

Adaptation action in each priority sector involved various stakeholders, including national and sub-national governments who have the direct authority related to priority sectors. To develop the adaptation actions, each priority sector has specific strategy and delivery strategy.

Water Sector

Strategy
Management of water resources to meet the clean water demand and to prevent the climate disaster caused by water damage.

Cluster	Delivery Strategy	Indicative Intervention
Infrastructure	• Consider the area (ha) that are threatened by drought and flood. • Calculate the capacity based on the number of households affected, the size of the agricultural area, and industry. • Consider the numbers and locations of increasing rainfall intensity.	• Dam construction. • Retention basin construction. • Vegetation management at upstream area. • Construction and structure adjustment for rain harvesting/provision for alternative sources of clean water.
	Adjustment for technical capacity based on rainfall projection.	Urban drainage width adjustment.
	Freshwater management in coastal areas by adjusting location, dimensions, and quantities based on the threat of sea level rise.	Construction and adjustment for infiltration well.
Technology	Efforts to redistribute water during heavy rain in potentially flooded areas.	Weather modification technology (rain reduction).
	Filling reservoir to meet fresh water demand.	Weather modification technology (rain enhancement).
	Increases water discharge into the aquifer.	Water injection technology.
	Distribute water to drought areas in real time.	Technology to detect leakage and identify water consumption needs
Capacity Building	Increased of public awareness (sense of belonging) to utilize and manage water sources for supplies during drought.	• Increase public awareness. • Increase community capacity through training, campaigns, etc.
Governance	Development or revision of adaptive Engineering Design/ technical standards/ infrastructure operational.	Technical input on the revision of national building and operational standards.
	Determination of Ground Water Protected Areas (KLA) in watershed, to reforest and restrict forest utilization inside the KLA /catchment area.	Technical input on the policy set for KLA restrictions.
	Management of water resources to increase the water availability to meet water demand for households, agriculture and industry.	Issuance of Norm, Standard, Procedure, and Criteria (NSPK) of master plan development for a climate change adaptive drinking water supply system.
	Management of water resources to improve environmental quality.	Development of environmental water security.

Agriculture Sector

Strategy
Climate Smart Agriculture to maintain the food production.

Cluster	Delivery Strategy	Indicative Intervention
Infrastructure	Fulfill the agricultural water requirement in agricultural centers area that are prone to drought and crop failures.	• Construction of dams, retention basins, and detention ponds, which are needed for irrigation. • Construction and maintenance of irrigation networks. • Normalization of rivers, dams and other water reservoirs. • System of piping and shallow well, drip irrigation, and sprinkler irrigation.
	Improve soil characteristics on dry and critical land to better retain water, through water and soil conservation.	• Rainwater harvesting to extend planting time in drought conditions (integrated small reservoirs). • Increasing the use of organic fertilizers and reducing chemical fertilizers. • Using cocopeat for seedbed in ex-mining areas and critical land.
Technology	Utilize biotechnology in developing superior varieties that are climate resistant.WW	• Development of superior varieties of plants that are resistant to climate stress and pests. • Rice varieties that resistant to flood, drought, salinity, and pests. • The use of certain microbes to develop high salinity resistant rice varieties. • High nutritional tubers that resists extreme weather.
	Strengthen agricultural innovations and technologies which consider climate impact and supports food security.	• Utilization of technology for precision farming and smart farming. • The use of sensors that are able to identify water content and soil chemistry on agricultural land (vidiometry/drone/cctv, etc.). • Modeling the water balance and plant nutrients on the land, as well as the development of geographic information systems on distribution points of nutrition and water shortages. • Automation of watering and fertilizing tools according to land requirements.
	Adopt and modify technology to identify plant growth, to record water and nutrition use.	Monitoring rice fields (standing crop) using Modis and Sentinel-2 images.
	Adjust planting time based on seasonal predictions to avoid drought.	• Integrated planting calendar information system. • Identify the suitability of seasons and regions with the appropriate crop commodities. • Climate prediction for agriculture.

	Strengthen innovation in agriculture to increase food production in addition to the main commodity (rice) which consider climate effects.	• Development of brackish tilapia that withstands high salinity. • Development of nutritious grass that is resistant to climate stress. • Improved quality of livestock supplements to overcome heat stress. • Development of livestock vaccines to cope with heat stress. • Development of superior livestock genes that are resistant to climate stress.
	Fulfil irrigation water for agricultural land during dry season to increase rice production using modern technology.	• Weather modification technology to replenish agricultural reservoirs and anticipation of drought in the food production central area. • Solar water pump.
Capacity Building	Improve farmers' understanding on climate information that is useful to determine planting time and agricultural practices.	Climate Field School.
	Educating the public to utilize innovations and agricultural technologies (superior climate resistant varieties, precision farming methods, planting calendars, and agricultural information systems).	Assistance and facilitation to farmer groups and association of farmer groups.
	Enhance the understanding of agricultural businesses related to climate smart agriculture strategies.	Assistance and facilitation to agricultural companies.
	Improve institutional capabilities and agricultural human resources.	Training of officers and members of agricultural institutions (vocational) related to agricultural climate information systems, database management, and implementation of precision farming methods.
Governance	Improve the effectiveness and efficiency of water and nutrition use to increase crop productivity, cost efficiency and reduce greenhouse gas emissions.	• Application of precision farming methods on strategic agricultural lands. • Application of intermittent irrigation in rice fields. • Utilization of agricultural wastes (livestock manure for plants). • Integration of several types of plants in one agricultural land.
	Develop integrated agriculture database as part of the Climate Smart Agriculture strategy.	• Mapping the location and characteristics of agricultural land development (both negatively and positively affected by climate change) • Mapping of data and information resources. • Strengthening coordination between institutions in the agricultural sector.
	Provide alternative financing for agricultural land when climate failure occurs.	• Climate-based agricultural insurance. • Encourage leveraging finance and manufacture of agricultural investment products.
	Strengthening the distribution and agriculture market in accordance with the climate smart agriculture strategy.	• Review and strengthen the regulations related to agricultural business chains. • Create new agricultural markets (trading agricultural innovations between researchers and companies, as well as other agricultural entrepreneurs). • Cooperation with telecommunications providers. • Strengthening of village-owned company (BUMDes), and small and medium enterprises in the agricultural sector. • Application of operating standards (ISO) that consider climate and environment.

Marine & Coastal Sector

Strategy
Coastal Area Protection and Maritime Safety.

Cluster	Delivery Strategy	Indicative Intervention
Infrastructure	• Infrastructure that takes into account the characteristics of coastal morphology in areas that have high vulnerability to the effects of climate change. • Combine Ecosystem-based adaptation (EbA) and community-based adaptation (CbA) approaches. • Risk reduction for abrasion in coastal areas.	• Construction of the beach belt (geotextile bags/KGM). • Construction of hard structures: beach belts, hybrid structures, concrete structures. • Construction of soft structures (mangrove planting and/or coastal vegetation)/greenbelt. • composite flood gates; automatic floodgates to drain water in urban flood channels (coastal areas) by utilizing the water level difference in flood channels.
Technology	The application of marine survey technology that is able to detect fish stocks, avoids the potential decline in fishing catches of fishermen due to climate change.	ROV (Remotely Operated Vehicle) marine survey technology.
	Technology with capability to detect extreme waves to reduce the number of ship accidents.	Application of AIS (Automatic Identification System) technology; automatic tracking on ships and ship traffic shipping (VTS).
	Adaptation to shoreline changes due to the effects of climate change; innovative design of coastal dynamics monitoring systems in areas that require spatial planning that consider the danger of sea level rise and extreme weather.	Application of phyto-sandbar artificial technology.
	Increase the certainty of fishing time and reduce fisherman sailing hazards due to extreme waves.	Innovations of small fishing boat design that are adaptive and made with fiberglass.
Capacity Building	Assistance to fishermen in the application of <10GT fishing boat standardization.	ToT fishing boat manufacturing with fiberglass raw material (design, selection of material until it is ready to sail).
	Provide alternative livelihoods for small fishermen who cannot go to sea due to extreme waves.	• Strengthening the capacity of cooperative and fishing group. • Fisherman insurance (Weather index insurance).
	Increase human resource capacity for disaster response in coastal areas.	Assistance to fishermen groups, communities and local governments.
	The participation of coastal community groups to apply the concept of ecosystem-based adaptation.	Community based coastal ecosystem management.
Governance	Increase capacity and information access for small fishermen in reading marine climate information.	• Provide fisheries information that is easily accessible. • Early warning system. • Education, counseling & public awareness.
	Provision of regulatory instrument and information related to high wave hazards, type and capacity of fishing boats.	• Technical input on climate hazards for disaster-related regulations in coastal regions and small islands. • Technical input related to climate hazards for the regulation of sea space & coastal areas. • Disaster risk map in coastal areas. • Fishing management regulations in restricted area or marine protected areas.

Health Sector

Strategy
Protect the Community and Environmental Health.

Cluster	Delivery Strategy	Indicative Intervention
Infrastructure	Build appropriate infrastructure in high vulnerability location of DHF.	Houses and buildings that comply with building health standards.
	Consider the potential DHF outbreak location while calculating capacity of health facilities.	Increase capacity of health facilities.
	Increase Environmental health based on the characteristics of endemic area.	• Implementation of Community Based Sanitation (STBM). • Clean water and minimum livelihood provision. • Fogging (dengue vector extermination). • Addition of green open space (RTH).
Technology	Availability of DHF Outbreak information and early warning system.	• Development of DBD-Klim early warning & information system to prevent outbreak (daily reporting system). • Data and information completion.
	Model the potential vector-borne disease occurrence (infection number and period).	Health Biomonitoring of climate change diseases.
Capacity Building	Increase community understanding, especially vulnerable groups toward climate change diseases.	• Early education about the effects of climate change. • Addition of public health and climate curriculum in lower education level (natural science} • Increasing climate risk knowledge for health facilitator and jumantik (wiggler surveillance) • Dissemination and rising awareness of prevention and diseases control in potentially endemic area.
Governance	Law and program revitalization of prevention and transmission control based on projected DHF outbreak indication.	• Revised diseases prevention guidance. • Field checking of diseases prevention program. • Healthy building standardization adjustment.
	Maximize the community based adaptation in preventing/ response to DHF outbreak.	Simple technology use (DBD cap) to prevent dengue vector propagation and provide clean water.
	Household Based Adaptation (active involvement of communities to reduce vulnerability in household scale).	Health sector climate change adaptation in household level: • Woman in family welfare (household & neighborhood). • local youth community. • other Village level communities.

Coordination & Resource Mobilization Mechanism

RAN API document is a long-term planning document to support the achievement of Sustainable Development Goals (SDGs) in 2030 and Indonesia Vision 2045. RAN API implementation considers and synergy on the process with other strategic policy documents, i.e. SDGs, disaster risk reduction, spatial plan, and low carbon development, which have direct and indirect benefits to strengthen the climate change adaptation action.

An inclusive and iterative approach is applied in the preparation of RAN API by understanding the characteristics of the affected sectors through experience and best practices at local level.

The financing mechanism for climate change adaptation is not only from state budget (APBN and APBD), but also from international mechanisms, both bilateral and multilateral, private investment and Corporate Social Responsibility (CSR). International fund resources are available for governments, private sectors, and communities. The adaptation efforts need to be mainstreamed in all affected development sectors. Proactive government (national and local) and other stakeholders (private sectors, development partners, and communities) is important to support the efforts.. As stated in the Article 12 of Paris Agreement, “Parties shall cooperate in taking measures, as appropriate, to enhance climate change education, training, public awareness, public participation and public access to information, recognizing the importance of these steps with respect to enhancing actions under this Agreement”.

STAKEHOLDER	INTEREST AND ROLE
Ministry/Institution	• Contribute in international agreements and participate in international negotiation for regional/local program. • Implement policy, program, and sectoral plans. • Improve human resource development in national level. • Develop capacity and effective mechanism to solves sectoral isues in national level. • Reduce national climate risks.
Local Governments	• Solves local issues. • Improve local capacity. • Finance local plans and program. • Strengthen local institutions. • Prevent local climate hazard and damage.
Research Institute/ Higher Education	• Contribute to solves climate change issues in human system and vulnerable ecosystem in national and sub-national level. • Improve national and local capacity to cope with climate change. • Develop national and local approach in coping climate change by developing proper perspectives.
Non-Government Organization/NGO	• Facilitate local community organization and identify actions for local needs. • Finance local program and development projects. • Improve capacity (example: facility, finance, human, institution). • Strengthen local institutions.
Local Community	• Improve or maintain health, education, and settlement. • Increase or sustain the water and soil productivity. • Decrease the local vulnerability to climate risk. • Increase or maintain adaptive capacity to cope with climate risk.

Final Notes

[1]Potential reduction in GDP per capita in 2020 is 2.29% and in 2024 is 4.33% (Burke & Hsiang, 2015).

[2]The analysis results of the evaluation index information system data evaluation (SIDIK) - Ministry of Environment and Forestry 2019

[3]Climate budget tagging mechanism (fiscal policy Agency – Ministry of finance, 2018)

[4]National Climate Change Registry System (Ministry of Environment and Forestry, 2016)

[5]Result of Economic Loss Assessment Impact on Climate Change for RPJMN 2020-2024.

Benefits of adaptation actions are calculated based on adaptation efforts planned by the Government in 4 priority sectors in the draft RPJMN 2020-2024.

The assessment of economic losses combines projections of potential hazards with trend changes in economic parameters, which consist of:

GDP projections use the simulation results of GDP/ capita growth on September 2019, from the RPJMN 2020-2024 Macro Economy Framework date December 3th, 2019.

The projected population based on the 2015 SUPAS results, with a population growth scenario from the Ministry of National Development Planning/ National Development Planning Agency.

IDR 14,000/USD exchange rate.

Economic loss assessment combines the projected potential hazard with a trend of changing economic parameters, which consists of

Sectors and Hazards:

Water: Decrease water availability for agricultural, household and industrial.

Marine and Coastal: Disturbance of sea transportation and fisheries production; inundation of coastal settlements.

Agriculture: Decrease in rice production.

Health: Increase in Dengue Fever outbreaks.

Parameters of Economic Loss calculation:

Water: Reduced water discharge, in which the amount is valued by rice production (m^3/ton water demand) and price/m^3 of water for settlements and industry.

Marine and Coastal: Disturbance of sea transportation safety and fisheries production is valued from (1) the potential loss of fish captured, (2) the economic loss from damaged ship, and (3) the lost vessel crew's income; Losses from inundation on coastal settlements are calculated based on the settlements that are potentially inundated and their property values.

Agriculture: The price per tons of rice predicted to lost due to climate change.

Health: Medical expenses for Dengue Fever sufferers; DALY costs (health care costs for mortally dengue cases).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NATIONAL ADAPTATION PLAN

EXECUTIVE SUMMARY

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