

Climate Change Loss and Damage in Indonesia

Assessment on Its
Status of Knowledge,
Governance, and
Management
Framework

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Foreword

Bridging the Gaps, Preparing the Governance and Framework to address Loss and Damage from Climate Change

Climate change impacts have affected various sectors, including coastal and marine areas, agriculture, health, and water resources. Some of these impacts can be lessened with appropriate adaptation efforts, but in certain contexts, these impacts will exceed the limits of adaptive capacity. Loss and Damage are climate change impacts that cannot be avoided through mitigation, adaptation, and other actions such as disaster risk management.

This issue is not only affecting the future condition, but is already being felt in the present, as seen in the decade-long flooding and coastal inundation in the Pekalongan City and Regency (Greater Pekalongan). A study conducted by Mercy Corps Indonesia indicates that the losses and damages caused by flooding in the coastal areas of Greater Pekalongan were highly significant. In 2020, these regions experienced losses amounting to IDR 1.55 trillion, equivalent to 40% of the total regional budget (APBD) for both the city and regency in the same year. Future projection shows that these losses could increase to around IDR 31.28 trillion by 2035 if comprehensive and significant measures are not taken.

The calculated losses encompass both economic and non-economic aspects borne by the community, such as loss of productive land, disruptions to livelihoods, and also expenses to protect their settlements as well as to sustain their livelihoods and daily lives. However, it is important to note that these figures have not include government expenses to address the impacts of flooding in the region. Thus, the actual costs are likely higher, particularly considering that the Greater Pekalongan has permanently lost 468 hectares of its area and is expected to triple to 1,526 hectares by 2035.

At the 27th Conference of the Parties (COP) to the United Nations Framework Convention on Climate Change (UNFCCC) in Sharm-el-Sheikh, historic steps were taken by including loss and damage as a formal agenda in the formulation of a new climate change regime. A new funding mechanism, including a Special Loss and Damage Fund, was developed to assist developing countries that are vulnerable to adverse climate change impacts, with a focus on addressing loss and damage. Parties also agreed on the operationalization of the Santiago Network on Loss and Damage (SNLD), which has a primary function to catalyse technical assistance in averting,

minimizing, and addressing losses and damages. This mechanism is expected to be accessible for developing countries and local communities.

Domestically, to ensure optimal response to global developments and meet the existing needs, it is of important to have policies, strategies, human resources, knowledge, and funding that could address the ongoing loss and damage. A distinct governance structures, yet synergistic with climate change adaptation efforts and disaster risk reduction, are necessary to address loss and damage from climate change. Some climate change impacts in Indonesia have not been fully studied and understood, especially those on natural resources (biodiversity, marine fisheries, etc.). Gaps are still found in the institutions responsible for monitoring the impacts of climate change and addressing them.

Considering the above points, Mercy Corps Indonesia conducted an assessment to examine the knowledge status of climate change impacts in Indonesia, potential institutional gaps, the scope of current adaptation and disaster risk reduction efforts, and also to explore different options of frameworks to address loss and damage from climate change.

It is hoped that this study can serve as an initial input in efforts to foster the development and strengthening of climate change impact management schemes in Indonesia, and also to reinforce our commitment to protect our country, future generations, and the planet from further damage. Together, we can achieve positive changes and create a better future for all.

Jakarta, October 2023

Executive Director
Mercy Corps Indonesia

Executive Summary

Loss and Damage Concept at Global Level

The establishment of Warsaw International Mechanism (WIM) to address loss and damage associated with climate change back in 2013 marked the emergence of a fervent global attention on the concept of loss and damage. Paris Agreement that came out in 2015 has further strengthened the attention on this context. The Paris Agreement use the phrase of “averting, minimizing, and addressing” to discuss the concept of loss and damage. Averting is done by reducing the green house gas emission, while minimizing is done through adaptation measures.

Although the mitigation effort is intensively implemented to limit the increase of global temperature below 2 degrees celcius, as committed by countries in the Paris Agreement, and the adaptation has been carried out optimally as a response to the avoidable impact of climate change, but the unavoidable impact remains. The next step that needs to be implemented is to address the residual loss or the unavoidable impact. This notion then become the foundation for “loss and damage” concept in the Paris Agreement.

The use of weather and climate forecast information as well as development of technology and variety of climate-resilient plants and fisheries resources are the examples of adaptation to minimize the impact from climate change. However, residual impact will always remain despite the adaptation initiatives. The loss of agriculture and fisheries products, and health issue are still experienced by some farmers and fishermen. Another examples of the loss and damage are casualties, loss of property caused by hydrometeorological disasters such as flood, landslide and tropical cyclone; as well as the loss of biodiversity and the sinking small islands.

After the WIM and Paris Agreement, international agreement on the loss and damage, including the launch of Santiago Network on Loss and Damage (SNLD), continues to identify, understand, and effectively response to the loss and damage associated with climate change; while also keep assisting the vulnerable communities and countries to face global climate change impacts that become more apparent over time. SNLD in particular, is mainly focused on the most impacted countries from climate change that have limitations in addressing the impacts.

Climate Change Impact: How Much Do We Know?

Talking about climate change, to date, most of data and studies about loss, damage and efforts in addressing the climate change are primarily focused on flood, landslide and tropical cyclone. Those disasters are short-term climate change.

The data and studies on the long-term climate change are still limited, let alone the initiative to address it. As an example, changes in temperature will affect biodiversity, fisheries and coral reefs; where those impacts are occurred slowly and over a long period so that the changes are not clearly visible unless it monitored regularly. However, the National Action Plan on Climate Change Adaptation– which has been

refined into the 2020-2045 Climate Resilient Development Plan – only covers half of the impact of climate change on non-living resources, such as coastal erosion, high waves and coastal inundation. The loss and damage that occurs to these non-living resources can be clearly seen by the layperson. Efforts to address this particular loss and damage have started to be undertaken.

The limitation of data and studies hinders the efforts to understand the climate change impacts on various living resources, both in ecosystem (e.g. mangrove ecosystem) and species level (e.g. *Rhizopora* sp). The limitation caused the lack of understanding on developing the effective strategy to manage the resources. The adaptation efforts, including the efforts to address the loss and damage on living resources has not yet planned or implemented comprehensively.

The Ambiguity in Managing Coastal Inundation

Flood associated with sea water inundation and rainfall is expected to increase and expand in several coastal areas of Indonesia. This condition is defined as coastal inundation. These coastal areas, mainly in the lowlands of northern coasts of Java island, have experienced loss and damage, such as the permanent inundation of productive land experienced by the community in Pekalongan City and Regency. The high tides (the local community often called it as “rob”), sea waves and rainfall are the various factors that cause the coastal inundation. The land subsidence in the lowland increases the possibility of inundation in the coastal areas.

The tide in the northern coastal region of Central Java cause inundation that recurring monthly, even during the dry season, and reaches its peak in the rainy season. As a result, the loss and damage are likely to increase and expand soon. Despite the increase, it can be said that the impact of sea tides is on ambiguous status under the disaster management framework. The status of disaster (disaster emergency) is generally determined when the loss and damage is higher than usual and occurs instantly, such as flash flood that struck Lembata, East Nusa Tenggara in April 2021, which prompted the Lembata Regent to declare emergency status. The high rainfall provides legitimacy to assign the disaster status as it serves as the basic argument for the potential increase of hazard level in the area. This assignment of disaster status then trigger the start of disaster management cycle mechanism on the abovementioned event, which thus makes the related resources and funding under the disaster management framework becomes available.

However, the situation is different for the slowly occurring disaster such as high tides and permanent coastal inundation associated with the tides. There is an uncertainty on aspect that could trigger the assignment of disaster status for this slowly occurring loss and damage, so that disaster management mechanism and cycle are likely ineffective for this kind of situation.

Framework to Address Loss and Damage Associated with Climate Change

There are several policies and approaches to address the loss and damage from climate change, both for the existing impact and the potential impact in the future. By considering the characteristic from the loss and damage, several options of policies and approaches that can be taken, including: (1) Implementation of Adaptive Social Protection (ASP) scheme, (2) Management of the impacted areas through ecosystem rehabilitation, building of coastal protection structure, settlement areas adaptation, including relocation and spatial planning efforts, (3) Environmental management policy that covers conservation, gene bank provision, and natural resources moratorium, (4) Risk transfer, among them are climate insurance, (5) International dialogue and cooperation on cross-border and border-related loss and damage, (6) Public private partnership through Business Continuity Plan (BCP), and (7) Strengthen the climate change adaptation efforts.

Adaptive Social Protection (ASP) and climate insurance are appropriate for the swift loss and damage, particularly those caused by a hydrometeorological disaster. However, this strategy is difficult to apply for loss and damage that occur slowly over a long period of time (several years period). For instance, a number of insurance products in Indonesia exclude the flood risk associated with sea tides from their protection coverage. In United States of America, the insurance program often increases their premium for properties located in vulnerable coastal areas. Meanwhile, the United Kingdom's Government does not provide government insurance to protect the properties that built after 2009, with the assumption that the property developer has the knowledge on the risk of building a property in coastal areas, knowing that the information about climate change is publicly available and has been disseminated for more than two decades.

Among available options to manage areas affected by coastal inundation – which considered as loss and damage from slow onset event - are ecosystem rehabilitation, relocation of settlement area, spatial planning and the construction of coastal protection structures. In certain cases, the policy of “withdrawing from the coastal areas” needs to be planned and taken. This policy could reduce the economic and non-economic loss in the long term, while also provides an opportunity for the coastal ecosystem to adapt with and grow towards the mainland.

Challenges in Addressing Loss and Damage from Climate Change

Indonesia has **institutional** gap in the monitoring of climate change and its impacts, especially when it comes to the coastal and sea areas. There is no clarity particularly on the responsible organization or institution that provides projections on sea level rise, inundated areas in coastal, and the inundation rate in the small islands. To date, the regency/city-level climate projections (including the risk model and analysis) available only in small part of Indonesia, and most of the projections are the output of the program funded by international donors (among them are ACCCRN, USAID APIK and UNDP-SPARC program). There is only small number of regencies and cities in Indonesia that have climate projections and integrated the climate change context into their long-term spatial plan and development plan; less than 5% from the total number

of regencies/cities in Indonesia. Further, some of those regencies and cities only have projections for temperature and rainfall parameter, while sea level rise projections that are needed by the coastal areas are still unavailable.

Climate projection process is not an easy task to be done, especially for the local government. They do not have the capacity to develop climate projection and **integrate it into their long-term spatial plan and development plan**. Currently, there is no ministry/central government institution that has the main responsibility to provide such an information and translate it into a more 'down-to-earth' context for local government, and also provide an assistance to build the capacity of the local government. For those areas, the context of climate change and its impacts are rather difficult to be locally contextualized, including to identify the potential loss and damage in their area. The institutional gap and overlap also have the potential to be potentially discovered during the implementation of activities to address loss and damage from climate change.

Greater efforts are needed to develop a **comprehensive study that can serve as a basis for monitoring process**; where this monitoring then should be able to provide an indication on the effectiveness of the actions that are taken to address loss and damage from climate change, both the slow-onset and rapid-onset one. This such a study will be able to provide information regarding the impact of long-term changes in temperature, rainfall, and humidity on biodiversity (especially the important species related to the food security), the growth of vectors transmit malaria and dengue, also on coral reefs and fisheries (particularly on the fish with high economic value). At the moment, the currently available studies only cover the period when weather anomaly occurs (extreme weather) in one season.

Aside from institutional aspect, another challenge related to loss and damage that can be identified, particularly in coastal areas, is **the loss of residential land and productive land**. The sea water inundation and repeated rainfall has caused economic, social and psychological loss on the coastal communities across several regencies and cities. Large number of houses and land area where the communities rely their livelihood on are permanently inundated. **Relocation** for this affected community is not an easy and simple option, considering the limited land that is available and suitable for the relocation purposes. For areas with limited administrative area, cross-administrative relocation (cross regency or city) has become an unavoidable option. Thus there is a need to have a national program focusing on preparing reserved land to address this land availability issue for relocation process. A number of coastal cities and regencies that affected by coastal inundation do not have land that are suitable for the relocation of coastal communities, particularly for the fishermen. Moreover, the livelihood ecosystem also needs to be developed so that the relocated communities can continue their livelihood activities.

The discussion about the loss of land cannot be separated from the issue of changes of the outer boundaries of the country. This change in outer boundary occurs as an implication of the loss of small islands due to sea level rise and also coastal abrasion or the strengthening of small islands using coastal protection structures to anticipate sea level rise. The relevant discussions are thus need to be initiated to avoid the consequences from the changes of the outer boundaries, particularly the boundary of

archipelagic countries. Dialogue at the UNFCCC can be conducted as a prelude to further dialogue at UNCLOS.

Another challenge arises when it comes to **financial aspect** in the context of addressing the climate change impacts. The budget tagging since 2016-2017 period shown that state budget (Anggaran Pendapatan dan Belanja Negara/APBN) meets around 10% of the **estimated budget needs for climate adaptation**. The budget tended to decrease in 2019, and continued in 2020. Infrastructure development conducted by the Ministry of Public Works and Public Housing, particularly those related to water resources, dominating the funding of climate change adaptation activities in Indonesia. The figure is close to 90% of the total budget for climate change adaptation. Although some fraction of the budget was distributed for activities to address the loss and damage, but those allocation was still using the business-as-usual budgeting mechanism. Specific financing mechanism for loss and damage is not yet available.

International cooperation is needed to address the loss and damage from climate change on the cross-border natural resources, among them are in fisheries and biodiversity. Indonesia will experience **difficulties in terms of knowledge and financing** to address the loss and damage from climate change on biodiversity. This biodiversity aspect is potentially a lesser priority for the government at the moment. Accordingly, this gap and challenge must be responded through financing resources as well as knowledge and assessment transfer in the global level.

1. Introduction

1.1 Background

The Warsaw International Mechanism for Loss and Damage associated with climate change impacts is established in 2013. WIM has put this theme as one of main discussion on the Conference of Party (COP) in United Nations Framework Conventions for Climate Change (UNFCCC). The studies and dialogues in regards to this topic within the country must be conducted to prepare the government position and knowledge to negotiate at the next COP meeting.

The launched of Paris Agreement in 2015 is strengthen the global attention on the loss and damage issue. The Paris Agreement used the word “Averting, Minimizing, and Addressing” to discuss the concept of loss and damage. The averting efforts is implemented through strategy that related to greenhouse gas emission reduction, while the minimizing effort is through adaptation strategy. Although the mitigation effort has been improved to limit the increase of global temperature rise to below 2 degree celcius, aligned with the joint commitment of countries in Paris Agreement, and the adaptation efforts have been made as much as possible to face the avoidable impacts, but the fact remains that there are still unavoidable impacts.

This unavoidable climate change impact serves as the basis for “loss and damage” concept in the Paris Agreement. In this context, loss and damage refers to the loss and damage associated with the impact of climate change that cannot be avoided or averted. This concept recognizes that even though great efforts has been taken to reduce the emission and adapt with climate change, there are impacts that remain and need to be managed specifically. Having said that, there are needs to address the loss and damage that occurred as the direct impact of climate change, and this is an important feature in global efforts to address climate change impact.

Averting, minimizing and addressing the loss and damage must be immediately implemented for the affected countries. However, over one decade, there has been little progress in formulating the governance and policy framework for its financing at the global level that adopted by COP. The WIM Executive Committee’s five years plan that started in 2018 has not yet provided the guideline that is expected by the country members. The establishment of Santiago Network on Loss and Damage (SNLD) as the implementing body of WIM – complements the Executive Committee – is expected to catalyze technical support to foster implementation of actions at country level, although the implementing scheme has yet to be determined.

In early 2022, the Coordinator of Loss and Damage Group of the G77 country members held a preparation meeting for COP 27 and The Loss and Damage Dialogue in Glasgow, Scotland. The meeting highlighted the importance of Loss and Damage financing facility that should complement adaptation efforts and also be the overarching goal of climate financing. Progress was achieved at COP27 in Sharm el-Sheikh, Egypt in 2022. The country members agreed on the need of financing to address the loss and damage from climate change, also on the necessary funding facility and implementation arrangements.

As the leading organization in advocacy for Zurich Flood Resilience Alliance (ZFRA) Program, Mercy Corps place special attention on the second objective of ZFRA, which is “Strengthening Policy at Global, National, and Sub-National Level to Support Flood Resilience”. Mercy Corps Indonesia (MCI), part of Mercy Corps, is among Indonesian delegation for negotiation process in several COP meetings. Mercy Corps attends closely the discussion on climate adaptation and the loss and damage, and actively provides input for the Indonesian delegates regarding those two issues. Considering this role, it is thus of important for Mercy Corps to conduct a study that can strengthen the knowledge of MCI team. Such a strong knowledge is critical to be able to carry out national dialogue and to provide inputs regarding loss and damage from climate change in global dialogue.

For MCI, this particular assessment offers two advantages as follow:

- i. National level: MCI team member supported the development of an official statement from the Government of Indonesia (Gol) at COP 26 for the Presidential Consultation of COP on Loss and Damage, that addressed the need for appropriate institutional arrangements for rapid and effective implementation of the Santiago Network plan. This also includes the importance of fostering financial support for loss and damage that equal to mitigation and adaptation efforts. The particular statement was also prepared by utilizing the results of a ZFRA study regarding economic and non-economic losses due to flooding in the Greater Pekalongan area.

The Gol understands that the limited study on Indonesian context, the scattered and incomprehensive knowledge about issues between government and other relevant actors, and also no agreed guideline and framework on loss and damage mechanism at national level are all the challenges in developing the appropriate policy that could support in formulating government statement for UNFCCC negotiation process. To enrich the government statement, it needs a study that able to provide a strong and comprehensive basis through information and policy analysis, as well as governance related to the loss and damage.

- ii. Global level: this study can be utilized to support the ZFRA policy dialogue on the loss and damage, which is one of main issues that affects ZFRA in the global level.

1.2 Objectives

This study has the following objectives:

- i. Asses the existing situation of loss and damage discussion and governance in global level;
- ii. Provide the information on loss and damage governance landscape in national level, including the institutional gap;
- iii. Identify and develop recommendations of options to address loss and damage associated with climate change impact as well as the challenges for each recommendation that can be implemented and followed-up by the relevant stakeholders; and

- iv. Strengthen the basis of understanding in the development of position, submission and official statement from the Government at UNFCCC negotiation process.

1.3 Scope

Intergovernmental Panel on Climate Change (IPCC) has specific writing procedures for the term “Loss and Damage”, where each form of the writing has its own definition or meaning. The term of “loss and damage” that start with lowercase letter is defined as impact (monitored) and risk (projected) from climate change. While “Loss and Damage” that start with capital letter refer to the discussion and political activities under UNFCCC following the establishment of Warsaw International Mechanism (WIM) for Loss and Damage associated with Climate Change Impacts in 2013 (IPCC, 2022)^{i,i}

However, to make it easier for the readers to understand the “Loss and Damage” context, this study does not adopt the said procedure. The loss and damage that discussed in this study refers to the related phenomena. While when the study discussed about loss and damage mechanism, what is meant is the context of overcoming or addressing the phenomenon.

To respond to the abovementioned objectives, this study covers:

- The Concept of Loss and Damage with discussion that focuses on the interpretation of the terminology of loss and damage in the context of climate change and disaster risk reduction.
- Analysis of the Development of the Context of Loss and Damage at the Global Level, with main discussion points on the progress of loss and damage discussion and governance at the global level as well as the potential funding mechanisms currently available.
- Evaluation of Loss and Damage Governance at the National Level, with discussion that focuses on the existing conditions of loss and damage governance at the national level; identification of gaps in existing governance and institutional structures, including examining the existing roles of stakeholders and the adaptive capacity of affected communities and environments; and also gaps in adaptation efforts.
- Analysis of Climate Change Impact Assessment Framework that covers the existing approach and instruments to assess climate change impact and the data availability for monitoring and evaluation purposes. This data also relates to the evaluation of potential and gaps in governance and institutional context in addressing loss and damage.
- Potential Framework of Loss and Damage from Climate Change that covers the feasible management framework, the gaps and opportunities in implementation, as well as the potential of stakeholders’ involvement.
- This study is conducted in national level, with several examples of issues and program from different areas. A separate discussion is done for coastal inundation event in the north coast of Java as an evidence of potential large-scale coastal impact in the future.

2. Conceptual Framework of Loss and Damage

2.1 Definitions of Loss and Damage

The Paris Agreement uses the phrase “averting, minimizing, and addressing” to discuss the concept of loss and damage associated with climate change impacts. Averting refers to the climate change mitigation strategy and efforts through greenhouse gas emission reduction, while minimizing refers to the climate change adaptation strategy and efforts.

Table 1 General Scope of Work “Averting, Minimizing, as well as Addressing the Loss and Damage”

Mitigation	Adaptation	Addressing
Reduce the greenhouse gas emission for the future benefit.	Avoid the climate change impact by making adjustment to their life and economic activities.	Addressing loss and damage of unavoidable impact, residual impacts and also those occurred because of the inability to implement adaptation measures.
Example: renewable energy utilizations, forest protection and rehabilitation, and public transportation improvement.	Example: Utilization of seasonal and weather forecasts, climate-responsive farming method, and technology development.	Example: community relocation, risk transfer through climate insurance, social protection, and also coastal and island physical protection structure.

Climate change mitigation aims to prevent climate change from getting worse in the future. The IPCC shows that if the world takes rapid and optimum actions to reduce greenhouse gas emission, it will decrease the existing greenhouse gas (in the atmosphere) in the next few decades. However, if efforts to reduce the greenhouse gas emission are slower than expected, then it will prolong the climate change impacts.

Minimizing through climate change adaptation is the current efforts to avoid the ongoing impacts of climate change on the life and livelihoods of the population. Climate change adaptation can reduce and eliminate some of those losses and damages. Through effective adaptation, some climate change impacts can be avoided. The use of weather and climate forecasts, the development of technology and climate-resistant plant varieties, improvement of irrigation, and also controlling the malaria and dengue vectors are all part of adaptation measures.

However, in reality, despite the global strategies and actions to avert and minimize the loss and damage -both through climate change mitigation and adaptation-, those are not yet sufficient in facing the ongoing climate crisis. Lack of global mitigation measures has caused issues related to global warming to become a part of the climate system. It is getting harder to fully avoid the ongoing impacts and risks. As a consequence, the global community must focus on minimizing the climate change impact through adaptation and disaster risk management. Nevertheless, the currently insufficient

funding and ineffective policy often result in adaptation measures in the climate-vulnerable developing countries being fragmented, small-scale and designed only to respond to the current impacts and the short-term risk. Those countries have no instruments nor sufficient resources to reduce and comprehensively address the climate change impacts, whether it is for the ongoing impacts or future impacts. This condition ultimately create **gaps in climate change adaptation**, with increasing significance (ZFRA, 2023)ⁱⁱ. These minimal adaptation also causes larger residual impact from climate change. Although there are options to reduce the impacts of climate change, most of developing and least-developed countries are unable to undertake such options.

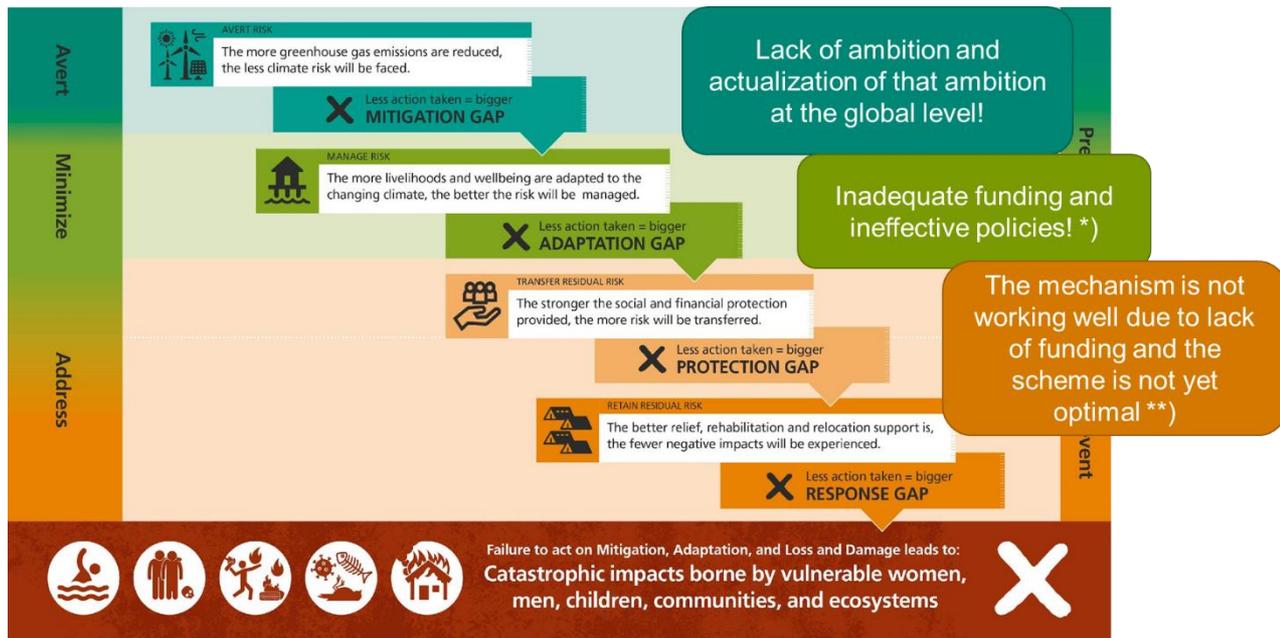
Furthermore, the lack of effectiveness in adaptation and the facts that some of physical changes caused by climate change impacts (e.g. sea level rise) can no longer be avoided, has caused significant loss and damage for many countries and people around the world. The vulnerable household and communities must suffer from those loss and damage, while they have limited capacity to address it. Hence, it can be concluded that the ongoing averting and minimizing measures are only able to partially address the avoidable impact, and have not been able to address the unavoidable impacts.

The “loss and damage” concept in Paris Agreement refers to the loss and damage as the adverse effect of this residual and unavoidable climate change impacts. Despite the great initiatives that has been taken to reduce emission and adapt with the climate change, this particular concept recognizes that there are impacts that will remain. These impacts then manifested into significant loss and damage on casualties, livelihood, and the future of the communities. As an example, some farmers and fishermen will continue to experience losses in their agriculture and fisheries production. Another examples are loss of life and property damages due to natural disasters caused by hydrometeorological factors such as flood, landslide and cyclone. Certain steps and management are needed to ‘address’ the loss and damage from climate change.

Addressing the loss and damage associated with climate change is absolutely an effort that must be carried out by the government and other stakeholders, so there will be no further impact on mankind. The loss and damage that must be addressed consist of those resulting from unavoidable impact, residual impact, as well as loss and damage due to the inability to implement adaptation measures. The ongoing strategy and initiatives that have been applied to reduce and address those loss and damage – such as social and financial protection, and support for rehabilitation – are not entirely successful. One of the causes of this failure is the lack of investment which then creates **gap in terms of protection and response** (ZFRA, 2023)ⁱⁱⁱ.

Most of developing and least-developed countries already have limited capacity to implement climate change mitigation and adaptation measures, not to mention if they have to address the loss and damage from climate change. Financing and technical support, including from the global sources, to implement those three climate actions (mitigation, adaptation and addressing loss and damage) simultaneously (without reducing resources for one of the actions) are needed by those countries.

Figure 1. Summary of Framework of Policy, Impact, and Gap on the Concept of Loss and Damage (Zurich Flood Resilience Alliance, 2023)



Notes:

*) IPCC AR5 states that most adaptation in developing countries that are vulnerable to climate change is 'partial, small-scale, designed to respond to existing impacts and short-term risks'

***) Relocation efforts due to permanent coastal inundation have not been fully regulated in disaster management schemes, nor in climate change adaptation. Schemes that are possible through area management must be carried out by semi-self-help, which means placing additional burdens on the affected communities

2.2 Loss and Damage in The Context of Disaster and Climate Change

The concept of "loss and damage" in the context of disaster risk management and climate change are two interrelated things. The link between these two concepts can be seen from the conditions in which climate change and its impacts can increase the risk of disasters, especially those related to hydrometeorological disasters. This overlapping condition shows the need for synergy and collaboration to be able to effectively manage disaster risks related to climate change. However, there are fundamental differences in loss and damage in those two contexts, particularly in terms of focus and impact and the period of the disaster event.

Firstly, in terms of Focus and Impact. In disaster risk management scope, damage is seen as total or partial damage of a physical asset located in a disaster area or area that are affected by the disaster, while loss is defined as the changes of economic flows (product and services) due to the disaster. The number of damages is counted only when the disaster strikes and after the strike, while loss is counted up until the economy recovery and reconstruction are completely accomplished (Jovel & Mudahar, 2010)^{iv}.

In climate change scope, as stated in previous section, the loss and damage are defined as loss and damage that arises and is suffered by an area (and its community) as the result of residual and unavoidable impacts following the mitigation and adaptation. The loss covers the irreversible impact on life, including casualties, loss of

biodiversity, and indirect social-economy impacts on livelihood, community, culture and country. While damage generally refers to the direct impact and/or reversible on livelihood, infrastructure, and ecosystem (Mechler et al., 2019)^v. Due the character that is residual and unavoidable, so even if physical, social and economic impacts arise from a climate-induced disaster, if the adaptation measure is still feasible to be implemented and there is no residual impact, then it is not considered as a loss and damage in this scope.

Second, in terms of the period of the event. This is related with the time of an event or phenomena, which divided into two types of period, slow onset and rapid onset.

The increase of greenhouse gases in the atmosphere has raised the earth's surface temperature which subsequently causes sea temperature to rise, melting of the polar ice caps, sea level rise, and also changes in the acidity and salinity of sea water. These changes tend to occur slowly over a long period of time (several decades) and known as a slow onset phenomenon.

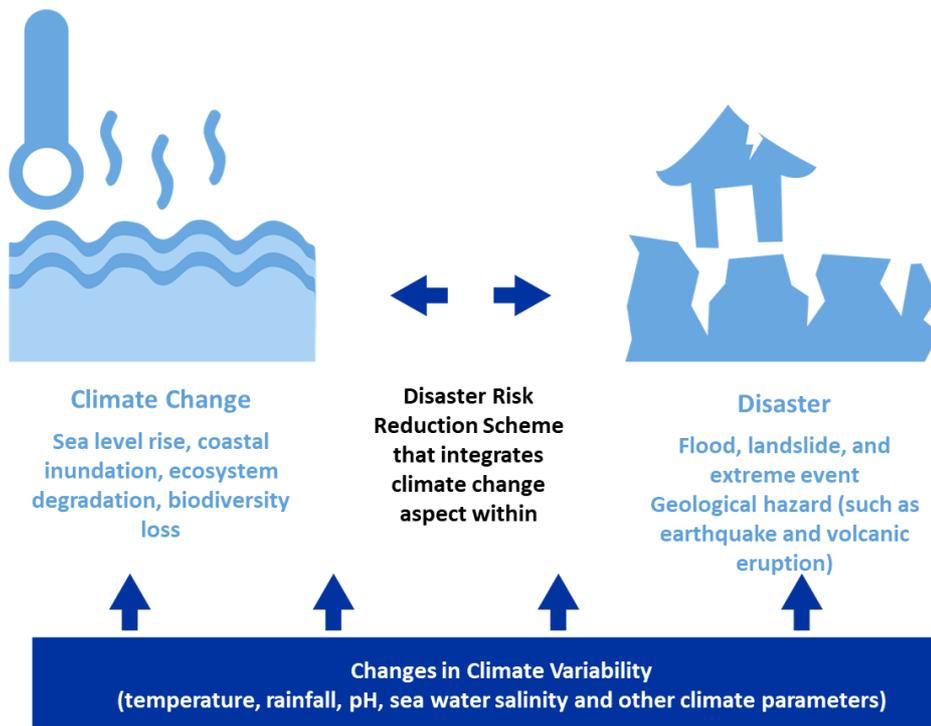
Climate change affects the frequency and intensity of hydrometeorological disaster. The rise of earth's surface temperature and sea level affects the wind speed, and subsequently the rainfall pattern.

The probability of extreme weather event such as strong wind, storms, high waves at sea also tend to rise. These hydro-meteorological disasters generally occur instantly and within a short period, and thus called as rapid onset. Drought can also be classified into this category because even though it occurs slowly, it occurs in a short period or one season. The risk of loss of life (death, injury or missing), property damage, loss of livelihood, disruption to economic activities and environmental damage increases with weather anomalies and extreme weather.

By looking at the period of events, it can be said that climate change loss and damage is generally triggered by changes in climate variability that occur over a long period of time. Meanwhile, in the context of disaster, not all disaster events are triggered by changes in climate variability, where these events are purely rapid onset. For disaster events caused by climate change or climate-induced disasters, these events are an intersection between the context of disaster risk reduction and climate change.

Similarly, with the loss and damage that occurs in disaster event that is intersection between disaster and climate change, the concept of loss and damage from disaster side can still be applied. However, if these events occur repeatedly and/or continuously over a long period of time to the point of causing residual impacts and impacts that cannot be avoided, then in this condition, loss and damage from the side of climate change should be applied. This condition then demands changes to the Disaster Risk Reduction scheme, from the previously conventional one to one that already integrates aspects related to climate change.

Figure 2. The Event of Rapid Onset and Slow Onset from Disaster and Climate Change Context



2.3 Summary of Hydrometeorological Disaster in Indonesia and Its Loss and Damage

Global and national data demonstrate that climate change intensify the risk of hydrometeorological disasters. The Indonesian Disaster Data and Information (*Data Informasi dan Bencana Indonesia/DIBI*)^{vi}, managed by the National Disaster Management Authority (BNPB), recorded a significant increase in the frequency of disaster events over the last 10 years (2011-2021). A total of 3,868 disasters occurred in 2019 and 4,977 disasters in 2020, and around 90-94% of them were climate-induced (hydrometeorological) disasters.

West Java, Central Java, and East Java are the three Indonesian provinces with the highest number of disaster incidents in the period of 2016-2021. In 2020, disaster incidents in West Java reached 1,121 incidents or around 22% of the total national incidents that year. Floods, landslides and strong winds (tornado) contribute to almost 30% of all disaster incidents.

According to data from the 2021 Indonesian Disaster Risk Index (IRBI) and the DIBI platform, around 80% of cities/regencies in Indonesia has high risk of disaster, with most of the disasters are hydrometeorological disasters. At least 2,841 natural disaster events such as flood, strong wind, landslide, and forest fire were recorded in 2021.

Losses due to disasters each year can reach 30.83% of the National GDP (KLHK, 2020)^{vii}. The average loss per disaster reaches IDR 633 billion for floods, IDR 108

billion for landslides, and IDR 1.5 billion for droughts (BNPB 2019 in KLHK 2020). BNPB recorded that in the period between 1 January to 13 December 2020, there were 6.1 million people affected and displaced by the disaster, 360 casualties, 42 people were missing, 532 people were injured and 41,903 houses were damaged.

At the global level, losses from natural disasters induced by extreme weather in 2020 alone reached \$210 billion. That number is expected to continue to increase. One study estimates that the total damage sustained in the developing and least developed countries (countries in the non-Annex-1 category) ranged between \$290–580 billion in 2030, \$551 billion–1.016 trillion in 2040, and \$1.132–1.741 trillion in 2050 (WRI, 2022)^{viii}.

3. The Development of the Context of Loss and Damage from Climate Change at the Global Level

3.1 Progress of the Global Discussion and Governance of Loss and Damage from Climate Change

Poor and developing countries have limited resources (finance, experts, technology, and policy and institutional framework) to adequately implementing the three spectrums of climate actions (mitigation, adaptation and addressing the loss and damage) at the same time. In fact, to appropriately implement one of those climate actions will create additional burdens for the budget in those countries.

For years, the Small Island Developing States (SIDS) and the Least Developed Countries (LDCs) have been vocal about the loss and damage that cannot be addressed only through adaptation and risk reduction strategies. The LDCs encourage the responsibility of developed countries that emit greenhouse gas (GHG) to support addressing the ongoing loss and damage.

The loss and damage then were officially acknowledged at COP19 for UNFCCC. The impact posed by Typhoon Haiyan/Typhoon Yolanda on the Filipino people was the trigger for this agreement. The high number of fatalities and the scale of the damage caused by Typhoon Haiyan opened the eyes of the world that the developing countries need financial support and technical assistance to enable them to address the impact of the ongoing climate disaster^{ix}. The Warsaw International Mechanism (WIM) that was established at COP19 aims to address the loss and damage associated with climate change impacts.

This establishment of WIM has become an institutional embryo for the governance of loss and damage at the global level. WIM has an Executive Committee that possesses mandate to seek for the appropriate approach in addressing loss and damage associated with climate change. The main functions of WIM are to increase the knowledge and understanding on risk management, strengthen dialogue and coordination, as well as increase the actions and support to address loss and damage^x. Moreover, Paris Agreement that was produced at COP21 in 2015 outlined a separate article for “Loss and Damage”. The article was prepared separately from climate adaptation as an effort to address loss and damage^{xi}.

Throughout its journey, the WIM’s performance was considered not up to the expectation. Even though WIM aware and acknowledge that the emergence of gap in climate change adaptation is contributed by limited funding and supporting policy framework, yet there is lack of attention on the funding aspect for addressing the loss and damage. The knowledge collection, technical assistance and coordination across institutions instead are dominating the scope of work of the WIM^{xii}.

To strengthen the loss and damage governance, Santiago Network on Loss and Damage (SNLD) was established at COP 25, as part of WIM. SNLD is a platform that

focuses on the initiatives to catalyze the mobilization of technical assistance to address loss and damage. This mobilization is implemented by connecting the vulnerable developing countries with relevant organizations, agencies, networks and experts so the countries able to apply the suitable and adequate approach to implement the three spectrums of averting, minimizing and addressing the loss and damage at the local, national, and regional level. However, the financing aspect becomes a gap due to the absence of agreement to fund SNLD as well as the implementation mechanism of technical assistance mobilization. The pressure comes from SIDS and LDCs in regards to the needs for specific funding for loss and damage.

The loss and damage governance had progressed significantly at COP 27 in Sharm el-Sheikh, Egypt. **Agreement was reached not only in terms of funding to address loss and damage, but also the establishment of specific funding agreement and its fund for loss and damage and also its implementation arrangements.** A Transition Committee will be formed with the main scope is to formulate recommendations regarding the operationalization of funding arrangement and funds to be considered and adopted at COP28. The decision on more detailed technical arrangements are likely to be decided at this global conference. The operational scheme for these funds must in line with the funding mechanism arrangements, especially those in the UNFCCC.

Another progress was made for adaptation financing, where at COP27 there was a new pledge to allocate more than USD230 million to the Adaptation Fund. The “Sharm el-Sheikh Adaptation Agenda” increases resilience for the most climate vulnerable communities by 2030. The UN Standing Committee on Finance (SCF) was required to prepare a report on process to increase adaptation financing to be considered at COP28 which will take place on November 2023^{xiii}. This increase in adaptation funds is an opportunity to close the funding gap for climate change adaptation, so that loss and damage can be reduced. The Implementation Plan of the Sharm el-Sheikh Agreement emphasizes the need of transformation on financial system and also the establishment of a swift and holistic process and structure to distribute the funding. This mechanism will involve government, central bank, commercial bank, institutional investors, and other financial actors^{xiv}.

It is undeniable, that over a decade since the establishment of WIM, there have been progress on loss and damage governance at the global level. Not only the attention is increasing, but there are also the strengthening of knowledge and resources aspects, as well as steps towards formulating the management mechanisms. However, this progress has not yet touched upon the actual mechanism for mobilizing the funds and also receiving the funds in recipient countries. Apart from that, there is also gap in the funding mechanism to overcome slow onset events, which of course have different event characteristics and event periods from rapid onset events.

Institutions and mechanisms related to fund management for addressing loss and damage need to be available for developing and least-developed countries that potentially receive such funding, so that fund distribution schemes can be implemented effectively, fairly and in timely manner. Funds must be distributed immediately to address loss and damage due to hydrometeorological disasters that occur quickly in a short time (rapid onset) as well as slow onset events. Obstructing financial and

regulatory mechanisms need to be improved. However, in terms of funding for slow and long-term types of impact, the speed at which the fund should be disbursed is not the main objective. The options of actions must provide just and sustainable benefits in the long term. Integration with development plans and spatial planning is part of the approach to achieve this goal.

3.2 Global Funding Potential for Loss and Damage Associated with Climate Change

Funding aspect has become a key to adequately response both to the gap in climate change adaptation, and to the gap in protection and response to address loss and damage from climate change. Following the COP27, the discussion about New Collective Quantified Goals on Climate Finance (NCQG) must be implemented by 2024. These discussions should take into account the needs and priorities of developing countries, and the world will see whether the agreement that is achieved in COP 27 will turn into reality.

The funding commitment delivered during COP comes from the developed countries and other actors, such as philanthropist. The developed countries had previously committed to jointly mobilize USD100 billion per year in 2020, but the commitment is not yet achieved^{xv}. Denmark at COP26 pledged 100 million DKK (equal to USD13 million). At COP27, Scottish Government and the Belgian state of Wallonia increased their previous pledges by around USD 2.5 million and around USD 1 million respectively. At the same meeting, more specific commitments to the previously mentioned pledge were stated by Germany, Austria, New Zealand, Canada, Ireland, Spain, France, the United States, the United Kingdom and the European Union. Meanwhile, from philanthropic groups, the Children's Investment Fund Foundation, European Climate Foundation, Global Green Grants Fund, Hewlett Foundation, and Open Society Foundation at COP26 pledged USD 3 million to address loss and damage. The question that arises then is not only the achievement of the pledges of developed countries and philanthropists, but also how much funding is mobilized or allocated specifically for Loss and Damage. These questions will hopefully be answered soon at the next COP.

The funding framework for climate change can be divided into two categories: those under the UNFCCC and those outside the UNFCCC. Funding under the UNFCCC currently consists of the Least Developed Countries Fund (LDCF), Special Climate Change Fund (SCCF), Adaptation Fund (AF) and Green Climate Fund (GCF). The LDCF, SCCF, and AF are specific funding frameworks for the context of climate change adaptation. Meanwhile for the GCF, projects funded by this mechanism are not only focus on climate adaptation activities, since can be identified that there are projects directed to overcoming loss and damage. The IPCC report on March 2022 shows that approximately 24% of all GCF-approved projects aim to address loss and damage from climate change (WRI, 2022). However, officially, there is no institution within the UNFCCC framework that is specifically focused on managing funds for addressing loss and damage from climate change.

Outside the UNFCCC climate change finance framework, relevant funding to address climate change loss and damage is available through disaster management funding facilities managed by the Global Facility for Disaster Reduction and Recovery

(GFDRR), Global Risk Financing Facility (Global Risk Financing Facility/GRiF), and multilateral development banks. The three categories of funding in the GFDRR also address loss and damage caused by the hydrometeorological disasters, which are: funding for 'Strengthening Financial Protection' (USD55.8 million in total funding as of June 2021), 'Resilience Building at the Community Level' (USD 94.3 million), and 'Enabling Resilient Recovery' (USD10.2 million) (WRI, 2022)^{xvi}.

Together with the World Bank, GFDRR also developed GRiF, a Multi-Donor Trust Fund (MDTF) that enables early action after hydrometeorological and geological disasters, and crises by leveraging previously designed risk financing instruments. With this mechanism, the actions to be taken have been planned and agreed upon in advance. GRiF^{xvii} provides technical assistance and invests in global risk financing instruments, including premium financing, initial/capital costs, capitalization on government's public assets. This scheme aims to develop a disaster risk financing and insurance mechanism that can help the government by providing funds to respond quickly to shocks. GRiF also aims to create incentives for disaster prevention, preparedness, response and resilient reconstruction^{xviii}.

Another climate financing mechanism is the Global Shield against Climate Risk which was officially launched on 14 November 2022 at the COP27 climate conference. This mechanism emerged through an agreement among the G7 Countries, under the German G7 Presidency in 2022, with the V20 countries or the association of countries most threatened by climate change. In close collaboration with the V20, Global Shield is a funding mechanism that combines funding activities in the insurance sector as well as climate risk prevention and preparedness under one roof. Protection solutions under the Global Shield will be designed as can be implemented swiftly if damage from climate change occurs. This process is certainly closely related to the emergency plans of developing countries. This way, communities and authorities can more easily and rapidly access the assistance they really need when a disaster strikes.

Furthermore, the Global Shield will mobilize additional funds to meet the increasing demand for financing. At COP27, Chancellor Olaf Scholz announced German contribution of 170 million euros to this mechanism. Together with Denmark, Germany was one of the first supporters of Global Shield^{xix}.

However, it should be noted that the relevant funding framework for the context of loss and damage that is outside the UNFCCC context has several gaps. Among the gaps are the characteristics of funding and distribution mechanisms that are focused on overcoming the characteristics of disasters that occur quickly (rapid onset events), and are not compatible enough for slow onset event phenomenon. Aside from that, most of the available funding focus on two elements of averting and minimizing; while for the context of addressing loss and damage, such funding is rather minimum. The funding scheme outside the UNFCCC framework are also not developed through a multilateral process and spirit, hence it needs specific focus on the issue of equitable accessibility and geopolitical influence in determining priority scale.

A number of countries currently do not specifically state the budget that has been spent or is needed to address the loss and damage. However, the related funding and actions have been implemented under the funding frameworks of climate change adaptation, disaster management or social protection. The central government and a number of

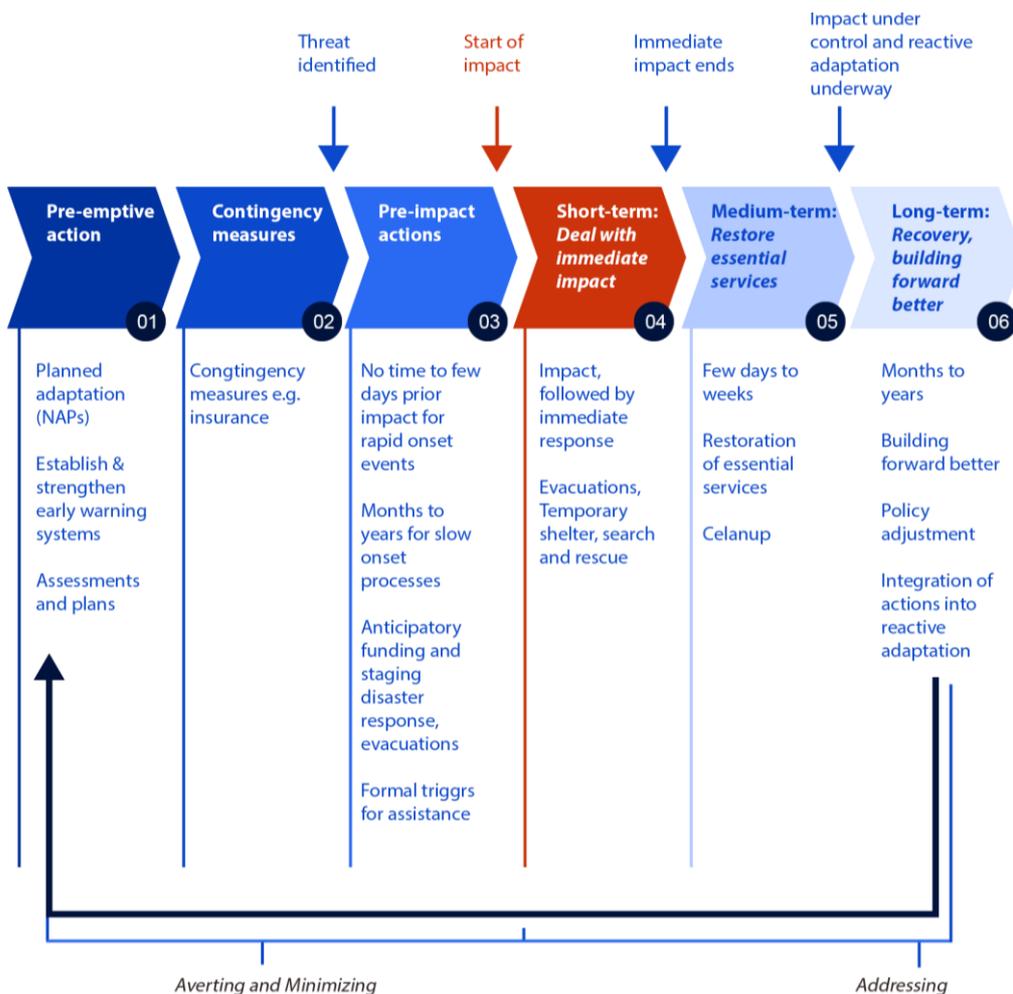
regional governments in Indonesia, for example, have budgets to pay insurance premiums for farmers and fishermen affected by extreme weather. Relocation and establishment of new settlements are also carried out for communities affected by climate disasters, including coastal inundation, flooding and coastal erosion. The question is whether the budget that has been spent on these activities has been able to cover the entire loss and damage? If not, how great is the need and what funding sources that can be accessed?

4. The Landscape of Loss and Damage from Climate Change in Indonesia

4.1 Framework for the Assessment of Climate Change Impact and Loss and Damage in Indonesia

As we may aware that Indonesia is a country that is vulnerable to climate change impacts. This vulnerable condition, coupled with limited resources that are available and can be mobilized, have placed Indonesia and its community in the face of potential loss and damage from climate change. To be able to address the loss and damage effectively and efficiently, it is necessary to understand the stages of the spectrum of actions to deal with the impacts of climate change; when are we at the range of averting and minimizing, and when do we start to address the loss and damage.

Figure 3. Spectrum of Actions in Addressing the Climate Change Impact (UNFCCC, 2023)



To translate this understanding into strategies and implementable initiatives, it needs to be strengthened by the ability to know the limitations at each point of the spectrum. In

the context of loss and damage, in order to identify the potential magnitude of the loss and damage that occur, the limitation point that becomes the main focus is the adaptation limits, both for rapid onset and slow onset events.

Determining adaptation limits can be done by monitoring the impacts that occur and projecting the risks from the climate change impacts. This process certainly requires data collection and provision. Periodical annual monitoring data on climate parameters such as temperature, rainfall and waves, sea level height, etc. as well as studies on climate change impact must be available. Until now, climate change impacts and their risks have not been fully understood and translated into the appropriate management steps due to limited data and studies.

This data availability also needs to be complemented by the availability and implementation of an appropriate impact and risk assessment framework. The current practices in Indonesia, monitoring, as well as addressing climate change hazard and impact are implemented using two separate frameworks, which are the climate change framework and the disaster management framework. The two regulatory frameworks have separate institutions for monitoring the climate change impacts.

The disaster management framework monitors the hazards and the impact of geological^{xx} and hydrometeorological^{xxi} disasters. These two types of disasters generally strike quickly over a short period, or are known as 'rapid onset'. Although drought disasters can be categorized as slow onset due to its long period. Meanwhile, the climate change framework includes changes in climate parameters that strike slowly over a long period, or what is known as 'slow onset'. Climate change affects the intensity and frequency of hydrometeorological disasters, or often referred to as climate-induced disasters. This climate-induced disaster then intersects between the disaster management framework and addressing climate change impacts.

Not only this difference in framework, the risk and impact assessment activities are also implemented by different Ministry/Institution and Local Government Agencies. Disaster management is conducted by the National Disaster Management Agency (BNPB) and Local Disaster Management Agency (LDMA/BPBD) in each region, meanwhile the climate change impact management is implemented by the Ministry of Environment and Forestry (KLHK), National Development Planning Agency (BAPPENAS), and a number of technical ministries. On the other side, the monitoring activity for almost all hazards, both under the framework of disaster management and climate change, are managed by the Meteorology, Climatology and Geophysics Agency (BMKG).

This particular sub-section of this assessment provides an overview on existing approaches and instruments for hazard monitoring and climate change impact assessment; data availability for the assessment and monitoring; as well as the stakeholders that currently involved in these monitoring and assessment activities.

4.1.1 Hazard Monitoring

In order to determine the climate change impacts, it is necessary to monitor climate parameters in the long term (at least 30 years), both for atmospheric and maritime climate parameters. BMKG is the only institution that by law has a mandate to monitor climate parameters and regularly disclose it to the public.

Monitoring and disclosure of atmospheric climate parameters, such as temperature, rainfall, humidity, has been conducted in Indonesia since the end of the 19th century, during Dutch colonialism, which was then continued by the BMKG after independence. However, monitoring of maritime climate parameters such as wave height, ocean currents and sea water salinity has only been conducted in the last 2-3 decades. The number of weather monitoring stations and data on maritime climate parameters are relatively limited compared to atmospheric climate parameters.

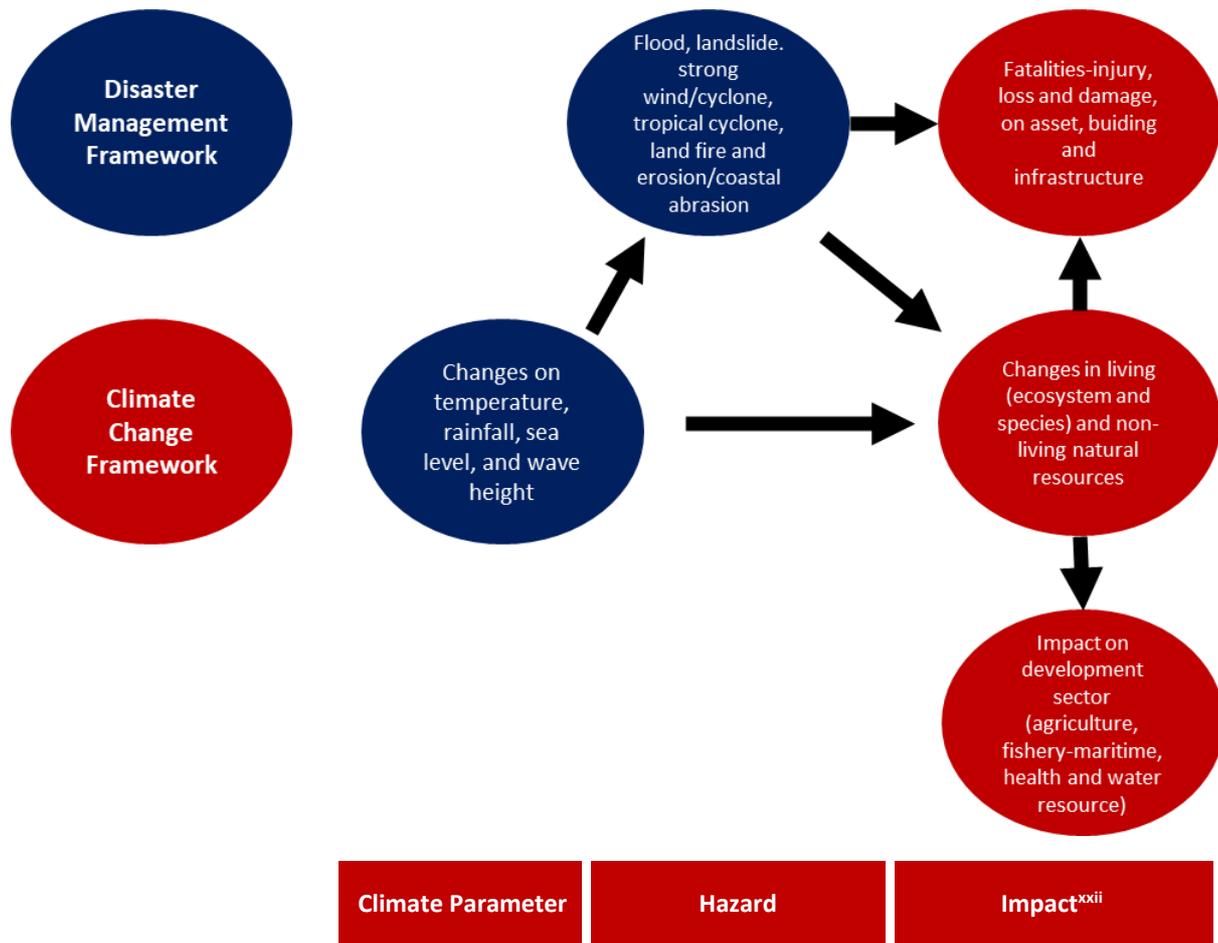
Monitoring of these climate parameters not only provides information on changes in climate variability, but also provides an indication of potential changes in the intensity and frequency of hazards from climate-induced disasters. Hence, it can be said that hazard monitoring in the climate change framework and hazard management framework, both should pay attention to changes in climate parameters.

However, currently there are slight differences in the framework of disaster management and climate change, especially in the scope of the observed hazards. The differences between the two are presented in the illustration below which shows that monitoring related to climate change has a broader scope.

The climate-induced disaster management framework in Indonesia examines seven disaster risks (or in the illustration are categorized as climate change impacts), which are floods, landslides, strong winds/cyclones, drought, tropical cyclones, land fires, and erosion/abrasion. Those disasters are caused by four extreme climate parameters that occur in a short period, which are temperature, rainfall, wind speed and sea waves.

Meanwhile, for climate change monitoring, apart from covering disaster risks as observed in disaster management frameworks, the monitoring also cover the changes of all climate parameters, both those that occur slowly and those that occur rapidly over a short period. Another difference can be seen in how the scope of climate change monitoring also includes impacts on living and non-living resources, while the disaster management framework only focuses on impacts on non-living resources.

Figure 4. Impact and Hazard on Disaster Management and Climate Change



From governance and institutional side, the LDMA/BPBD holds the main role for **hazard monitoring**, where the institution is responsible for documenting and managing the hydrometeorological disasters in the region. This data will be received and managed by BNPB through DIBI platform. Since the documentation process is conducted only after the disaster occurred, then hazard monitoring within the disaster management framework is limited to events that had happened (historical events); without considering the potential hazard in the future.

For climate change scope, BMKG and several universities are the actors that often involved in hazard monitoring. The hazard monitoring that related to the climate change covers projection process (10, 20, 30, up to the next 50 years), as well as predictions in a shorter time scale for several climate parameters based on the existing historical climate parameters; so historical changes is not the sole aspect that is monitored. Historical data of annual climate parameters are required to conduct climate projection over the next few years, in which the historical data is owned by BMKG. Nevertheless, it is not the main task of BMKG to do climate projection; furthermore, there is no available state budget to carry out climate projection. BMKG only conduct climate projection based on request, and the fund must be provided by the party who request the climate projection.

Currently, projections for temperature, rainfall, sea level rise, and wave height are available at macro level (large islands in Indonesia), where the macro-scale projection is done for the purpose of developing the national adaptation plan and also the national mid-term and long-term development plan (RPJMN/RPJPN). Meanwhile a more detailed climate projection, down to the provincial and regency/city level, was done only on limited number of areas in Indonesia. Most of these medium and micro scale projections are conducted as part of studies and planning in specific areas that funded by bilateral donors (i.e. USAID, JICA, GIZ and others), philanthropist (i.e. Rockefeller Foundation or other foundations) or other donors.

So far, the atmospheric climate projections are mostly conducted by BMKG and small number of universities that have meteorology program. The measurement model needs to be developed prior to conducting the climate projection and each climate parameters need a different type of measurement model. Referring to climate projection conducted for the development of national adaptation plan and RPJMN/RPJPN, the atmospheric climate projection process (temperature, rainfall, water resources) involved BMKG and universities (ITB and IPB). These involvements can be found as well in climate change projection activity that carried out as part of donor-funded project.

As of now, most of the projection for maritime climate are conducted by a small number of oceanography experts at ITB and Geospatial Information Agency (BIG). There are no involvements of other experts from several public universities with maritime science program in Indonesia (e.g. IPB, Hasanuddin University, Diponegoro University, and others). It is also unknown whether BMKG is involved in conducting analysis of maritime climate projection. However, BMKG does provide the monitoring data over maritime climate, as well as prediction in a shorter period (monthly). Sea level and wave height are two maritime climate parameter that frequently being monitored and projected. Meanwhile up until now, the monitoring of sea water salinity and acidity (pH level) are not getting the same attention as the other parameters. BMKG is also known to not monitoring the pH levels^{xxiii} despite the fact that changes in the acidity and salinity of sea water will have a direct impact on marine biological resources, especially the process of forming coral reef structures and marine fisheries. Consequently, studies of the impact of climate change on marine biological resources cannot be done comprehensively.

Currently, pH monitoring is implemented by various institutions, particularly universities, for environmental assessment purposes in certain limited locations and only for short periods. To be able to project seawater acidity, annual monitoring data of pH is needed, which currently is unavailable. If the annual monitoring data of pH is available and relevant, Indonesia can rely on global data and then implement down-scaling to get a rough picture of changes in seawater pH in Indonesia. Meanwhile, sea water salinity has been monitored and published by BMKG along with the other maritime weather information, via the official BMKG website. However, projections of sea water salinity have not been done, and thus it is unknown whether the calculation model for the projection of sea water salinity is readily available at the global level and can be carried out in Indonesia.

Considering the presence of marine fleets, the Directorate General of Sea Transportation -within the Ministry of Transportation- could support the monitoring of pH

and salinity of the seawater. The expertise of the National Research and Innovation Agency (BRIN) and universities (ITB, IPB and others) is needed to assist in analyzing the projections of these two parameters in the future.

Table 2 shows the identification result on actors that involved in the monitoring of climate parameter, and also actors with potential to provide climate projection.

Table 2 Monitoring of Climate Parameters and Climate Projections

Parameter	Data Availability and Monitoring Implementation	Potential Providers of Climate Projections
Atmospheric Temperature (historical)	BMKG	
Atmospheric Temperature projection	Upon request ^{xxiv}	BMKG (has been done)
Sea Temperature (historical)	BMKG	
Sea Temperature Projection	Upon request ^{xxv}	BMKG (has been done)
Rainfall (historical)	BMKG	
Rainfall projection	Upon request	BMKG (has been done)
Wave Height (historical)	BMKG, LAPAN (now BRIN)	
Wave Height Projection	Upon request ^{xxvi}	ITB (has been done), BRIN
Sea Tide (historical)	Dishidros TNI-AL	
Sea Tide (projection)	Not yet available ^{xxvii}	ITB, BRIN (never been done)
Sea Level Height (historical)	BMKG, LAPAN (on request)	
Sea Level Projection	ITB, BIG, BMKG (On request) ^{xxviii}	ITB, BIG (has been done), BRIN
Salinity ^{xxix} (historical)	BMKG ^{xxx}	
Salinity Projection	Not yet available ^{xxxi}	BRIN, BMKG (never been done)
Seawater pH (historical)	Not done ^{xxxii}	BMKG/Ministry of

		Transportation (never been done)
Seawater pH Projection	Need a long time to conduct the projection	BRIN (never been done)

4.1.2 Climate Change Impact Monitoring

Climate change has potential impact on living and non-living resources. Changes on physical environment of non-living resources are impacts of climate change. Examples of these changes are erosion/coastal erosion and also sea water inundation in coastal areas and small islands that we can see vividly. Therefore, analysis is needed to assess the rate and extent of the changes, including coastal inundation. On the other hand, monitoring of climate change impact on living resources is still minimal. The climate change adaptation plan (RAN-API), that has been refined into the 2020-2045 Climate Resilient Development Plan (PBI) has covered the assessment of coastal inundation coverage and the initiative to address the inundation within the document. However, PBI has not include climate change impacts on fisheries, biodiversity and biological ecosystem in coastal areas.

Meanwhile, disaster management framework does not take into account the impact on living resources. It monitors hazardous events -- floods, landslides, tropical cyclones, and other types of hazards -- that directly threaten human kind and cause damage to property. These hazardous events also cause changes in the physical environment, including abrasion/coastal erosion and landslides. Thus, the impacts monitored in the disaster area are impacts on non-living (physical) resources and their derivative impacts on socio-economic conditions. Table 3 shows the differences in the scope of impact monitoring between the climate change framework and the disaster management framework.

Table 3 Scope of Monitoring in the Framework of Climate Change and Disaster Management

Framework	Scope	Notes
Climate change	Changes to living resources (coral reef ecosystems (including non-living resources), mangroves, marine fisheries, biodiversity)	<ul style="list-style-type: none"> - Minimum monitoring Covers predictions of future impact (including based on historical data)
	Changes to non-living natural resources (physical environment, including shoreline erosion/abrasion, coastal inundation and small islands).	<ul style="list-style-type: none"> - Monitoring is available Covers predictions of future impact (including based on historical data)
Disaster management	Hydrometeorological disaster events (floods, landslides and others) that strike quickly in a short period of time ^{xxxiii} . Focus on human safety, public facilities and property damage.	<ul style="list-style-type: none"> - For past events - Does not include/minimum predictions of future impacts. According to the disaster management framework, these events are categorized as hazard events.

Even though it is part of impact monitoring under the climate change framework, but in reality, monitoring the impact of climate change on living resources is difficult to do. In contrast to the impact of climate change on non-living resources which can be seen with the naked eye, the impact of climate change on living resources is not clearly visible. This situation is thus a challenge in monitoring; and studies conducted by experts are definitely required. The main challenge is on how to carry out an analysis that can ensure the existence of a causal relationship between climate parameters (and its changes) and changes that have occurred or will occur in living resources. These changes include changes in biodiversity, marine fisheries, coral reefs, and also distribution and mosquito populations. The analysis must be able to separate the influence of other factors on these changes, including the influence of direct anthropogenic factors, such as pollution and development.

Moreover, the limited data and studies present a challenge to understand the impacts of climate change on various living resources, both in ecosystem and species level. Consequently, efforts to address loss and damage are challenging. Coastal erosion or inundated small islands are several forms of loss and damage on non-living resources that can be seen with naked eye, so that the relevant data is more likely to be obtained, and therefore, tends to be addressed first or become a priority. As a consequence, the initiative to address 'the non-visible' impacts on living resources will be far behind them.

Table 4 below shows the knowledge status, gaps, and challenges of climate change impact (the past and the future prediction).

Table 4 The Status of Knowledge, Gaps and Challenges of Climate Change Impacts

Impact Potential	Monitoring/Assessment	Challenges and Gaps
1. Temperature Rise		
a. Disease vector	Partially implemented ^{xxxiv}	Studies of temperature rise, changes in long-term rainfall patterns on the development and distribution of mosquitoes in Indonesia are almost unavailable.
b. Vector- and water-borne diseases		What is available is a study on the number of malaria and dengue cases in short periods (during wet and transition seasons).
c. Loss/decrease in biodiversity	Barely implemented ^{xxxv}	Lack of basic data and also monitoring plan
d. Decreasing populations of species that play a role in food crops (among them are the pollinating bees)	Minimally implemented ^{xxxvi}	Lack of basic data and also monitoring plan
e. Increase in plant pests	Implemented ^{xxxvii}	Lack of basic data and also monitoring plan
2. Changes in rainfall and seasonal patterns		
a. Decrease in raw water availability	Implemented ^{xxxviii}	
b. Crop failure, decreased crop production	Implemented ^{xxxix}	Basic data is available
c. Increasing the vulnerability to land and forest fires	Implemented	Basic data is available
3. Anomalies/Extreme Weather (on land)		
Increase in climate-induced disasters (floods, landslides, others)	Implemented	Basic data is available

4. Anomalies/extreme weather at sea (temperature and seasonal rainfall, high waves, wind and strong ocean currents)

a. Accident at sea	Report is available	Lack of regulation on safety at seas for fishing boats
b. Decrease in fish catch	Partially implemented ^{xi}	Lack of basic data per region
c. Beach erosion/abrasion	Minimally done ^{xii}	Need to clarify the responsible institution for monitoring
d. Damages to coastal and marine aquaculture (seaweed, fish cages)	Report is available	Lack of basic data and systematic review
e. Coral mortality/bleaching	Minimally done	There is only monitoring for the impact of climate anomalies, not climate change.

5. Sea level rise

a. Coastal inundation	Limited implementation ^{xiii}	Need to clarify the responsible institution for monitoring
b. Coastal erosion/abrasion	Limited implementation ^{xiii}	Need to clarify the responsible institution for monitoring
c. Erosion/abrasion of coastal ecosystems (mangroves and others)	Mostly implemented ^{xiv}	Need to clarify the responsible institution for monitoring

6. Sea temperature rise, changes in ocean acidification (pH)

a. Death, decrease in the coral reef's diversity	Barely implemented	Methodological challenges of assessing the impact of changes in temperature and other parameters on coral reefs.
b. Changes in fish migration patterns and spawning ground	Not implemented ^{xlv}	Lack of basic data
c. Disruption of the diversity and growth of marine species	Barely implemented ^{xlvi}	Lack of basic data

4.1.3 Instruments to Assess Loss and Damage from Climate Change

After conducting monitoring on loss and damage, the next step is to assess the loss and damage from climate change impact. Climate change impact, including climate-induced disaster, has caused loss and damage on natural resources, human being,

infrastructure asset, and socio-economic condition. However, the instrument to assess this loss and damage under the climate change framework is not yet available in Indonesia. The Ministry of Environment and Forestry has issued Ministerial Regulation No. 7/2018 regarding Guidance on the Assessment of Vulnerability, Risk, and Impact of Climate Change. This guidance can be a reference to assess the loss and damage from climate change.

Meanwhile, the disaster management framework already has a number of instruments to assess damage and losses caused by climate-induced disaster and geological disasters. There are three damage and loss assessment instruments in disaster management in Indonesia which are used at different stages of a disaster. These instruments are: Disaster Risk Assessment, Rapid Disaster Assessment and Indonesian Post-Disaster Needs Assessment (JITU PASNA). All three are used to assess economic damage and losses caused by rapid onset disasters, i.e. geological disasters and hydrometeorological disasters.

Those disaster management instruments assess both the potential loss in the future (risk assessment) and the loss caused by a disaster that had occurred (disaster impact assessment). Table 5 shows the difference between each instruments within the disaster management framework in terms of time of use and its purposes. Further discussion on damage and loss assessment instrument in disaster management framework is available on Appendix 1.

Although disaster risk assessment is able to provide an estimation on the future damage and losses, but the hazard component for this assessment relies on historical data/values (disasters that have taken place). The trend of disasters, among them are flood and landslide, is stated to remain the same for the next few years. If we consider the context of climate change, the level of climate-induced hazards is potentially to increase in the future due to the changes in climate variability. The use of climate predictions (for temperature, rainfall, sea level rise, and other climate parameters) must also be included in the study of loss and damage from climate change. Other than that, the adaptive capacity level and disaster vulnerability level of the community, government, and environment tend to change. This is the striking difference between the damage and loss assessment under the disaster management framework and the loss and damage assessment under the climate change framework.

Table 5 Assessment Instrument for Loss and Damage from Disaster and Climate Change

Assessment Framework	Instrument	Application
Disaster management framework	(i) Disaster Risk Assessment	Before the disaster strikes, on rapid onset hazard, district/city scale, development (5 years or more), input for disaster management strategies, spatial planning and development plans.
	(ii) Rapid Disaster Impact	After the disaster strikes, on rapid onset hazard, per disaster event, the scale of the

	Assessment	affected area, the basis for emergency response activities
	(iii) JITU PASNA	After the disaster strikes and the disaster status is determined, on rapid onset hazard, per disaster event, the scale of the affected area, the basis for disaster rehabilitation-reconstruction activities
Climate change framework	Guideline of Climate Change Risk, Vulnerability and Impact Assessment	Estimation of future impacts, on rapid onset and slow onset hazards, at district/city/province/ or per sector at national level, periodically (5 years or more), input for climate change adaptation strategies, spatial planning and development plans.
	Instrument for the implementation of the assessment is not available	

Instrument and guideline for risk and impact assessment under the disaster management framework contain complete information on data to be collected and procedures for conducting the study. Implementation of these guidelines follows a top-down approach as they are determined by the BNPB which is then used and stipulated in local/sub-national regulations.

Different conditions are found in the climate change framework, where risk and impact assessment instruments tend to be bottom-up. Although the Guideline of Climate Change Risk, Vulnerability and Impact Assessment from the Ministry of Environment and Forestry (MoEF/KLHK) outlines the minimum scope, data and indicators, as well as a framework for assessing risk, vulnerability and impact of climate change; however, the directions presented in the instrument are rather general, and can be adjusted by the study proponent as long as they meet the general framework and minimum scope required. Thus, it is expected that this guideline will provide a space or encourage practitioners to develop instruments for assessing the risks, vulnerabilities and impacts of climate change. Further discussion regarding the scope of these guidelines can be seen in Appendix 2 (a). Currently, there are several climate change risk and impact assessment instruments for various levels of government or landscapes developed by climate change adaptation practitioners (Appendix 2 (b)).

Furthermore, long before these guidelines were issued in 2018, climate change practitioners (experts from universities and civil society organizations) had developed their own assessment instruments. And to date, practitioners are still developing risk and impact assessment instruments while still using the Guidelines from the

MoEF/KLHK as a reference. One of them is an assessment on risks and impacts of coastal inundation in Pekalongan City and Regency (2022) which uses an assessment instrument that is relatively more thorough than the 2018 MoEF/KLHK Guideline. By considering local conditions, the indicators used in this assessment are more comprehensive than the minimum examples mentioned in the MoEF/KLHK Guideline, with predictions (and projections) that were applied on three risk components, which are hazard, capacity and vulnerability. This study was conducted by Mercy Corps Indonesia and partners as part of the Zurich Flood Resilience Alliance (ZFRA) program funded by the Zurich Foundation (further discussion is in Appendix 2 (c)). This Mercy Corps Indonesia's assessment has the potential to be used as a reference for risk and impact assessment, across various hazards and locations.

4.1.4 Publications on Loss and Damage from Climate Change

Due to limited monitoring of slow onset phenomena, currently, most of the information regarding loss and damage due to climate change in Indonesia comes from the impact of hydrometeorological disasters (rapid onset). Impact of climate change on biological resources which has a slow onset character is the part that is least understood. Studies on the impact of climate change on ecosystems (terrestrial forests, coastal ecosystems and marine fisheries) and biodiversity in Indonesia can be said to be almost non-existent. Data related to living resources inventory should have been the basic data to conduct the relevant impact assessment. However, this particular inventory data is still very limited and is a major challenge in conducting the impact assessment.

For more than a decade, information about various hazard events throughout Indonesia that caused by loss of damage due to disasters, including climate-induced disasters, are recorded in DIBI. DIBI provides information for eight types of disaster events listed in the Disaster Management Law. All information presented in DIBI comes from incident and disaster impact reports submitted by the LDMA/BPBD and the community. DIBI provides data on the number of fatalities, damage to private property, infrastructure and public facilities (health facilities, education facilities, places of worship) affected by the disaster events. Considering the existence of an information dissemination scheme and the types of information distributed (disaster events and impacts), then from an institutional perspective in the disaster management framework, it is possible to encourage local governments/LDMA/BPBD to continue reporting disaster events and impacts to the Central Government (in this case to BNPB). This way, data on disaster events and impacts can be properly documented and published.

However, the similar information dissemination and documentation mechanisms are rather difficult to be applied for the climate change framework. The long-term impact of changes in climate parameters on natural resources and the development sector requires studies led by experts. Publications regarding the estimation of loss and damage from future climate change can only be found in two documents: (1) Projections of Climate Change Impacts in the Nationally Determined Contributions (NDC) Roadmap for Climate Change Adaptation in 2022 or NDC Roadmap, and (2) Climate Resilient Development Plan 2020-2045.

The 2020 NDC Roadmap provides estimation of economic losses due to the climate change impacts. The Roadmap presents projected impacts in Indonesia on the food,

water resources, health, energy and disaster sectors. The analysis was using average temperature data, Indonesia's National Gross Domestic Product (GDP), sensitivity analysis using predictions of future temperature changes, and projection of rainfall changes. In the food sector, food crops modeling is conducted only on rice and the impact is assessed on crop failure during extreme weather.

The impact of climate change on water availability is analyzed for specific island-based regions, including Java and Bali, Sumatra, Borneo, Sulawesi, Nusa Tenggara, the Moluccas, and Papua. The climate variable that has the most significant impact on water availability is rainfall. However, the NDC document does not elaborate on projections for changes in water demand in various sectors or plans to increase/decrease vulnerability in these sectors.

In the Health sector, projected economic losses resulting from an increase in the number of prevalence (all diseases that occur at a certain time in an area) in the future are observed in dengue, diarrhea, malaria and pneumonia. Modeling was carried out by considering four possible conditions, namely, changes in rainfall and temperature (using the RCP 4.5 projections of the CSIRO and MIROC models) as well as an increase in the incidence of floods, landslides and drought. The modeling states that environmental damage increases the risk of floods, landslides and other catastrophic events. Furthermore, floods, landslides and drought events can increase disease transmission.

The NDC Roadmap was also using the DIBI data to assess the loss from climate-related disasters such as flood, landslide, tornado, and drought. losses from climate-related disasters such as floods, landslides, tornadoes and drought. Economic losses are assessed from the destruction of infrastructure, and the impact of disaster events is calculated based on historical events. However, modelling of future events and losses was not carried out. This is because an adequate model that specifically designed to predict disaster events resulting from climate change is not yet available.

Overall, the NDC roadmap document has not completely covered climate change hazard, such as the sea level rise, changes of wave height, and pH level. The lack of analysis on these hazards is due to the data limitations. Most of the presented economic losses and damage within the NDC document are impact of extreme climate events and seasonal pattern (rapid onset). Meanwhile, slow onset impact is only available for water resource prediction and its impact on the water availability for agriculture, household and power plant (energy). With the lack of hazards data, then this document has not yet provided the analysis of loss and damage in coastal and maritime sector, in terrestrial and ocean ecosystem, and also the impact from risk of sinking small islands and coastal area. The climate change impact on various type of ecosystems in land and sea is also unavailable since there is no natural resources balance that can be used for modeling. Modeling, particularly on coastal and ocean ecosystem, requires the projection of sea level rise and the increase of wave. Further discussion on this matter is presented in Appendix 3.

Meanwhile, **the Climate Resilient Development Plan 2020-2045 (PBI)** published by BAPPENAS presents economic losses for four climate resilience priority sectors in 2020-2024 which are agriculture, coastal and maritime, health and water resources. Without any policy interventions, these economic losses can be realized.

The coastal and marine sector is estimated to have the highest economic loss. BAPPENAS (2023)^{xlvii} stated that 18,000 km coastal lines categorized as vulnerable^{xlviii}. The loss in coastal and marine sector is calculated from the impact of ship accidents and coastal inundation, the loss in agriculture sector is calculated from the decrease of rice production, while the loss in health sector is calculated from the increase of dengue cases. The loss estimation of each sectors is presented in more detail in Appendix 4.

The discussion of marine and coastal sectors in PBI document mentioned that 199 regencies/cities located in coastal areas are threatened by climate change impact. The sea level rise due to climate change made the community who lived in the coastal area losses their houses. BAPPENAS (2023) presents a map indicating potential threat of population migration due to the rising sea levels, where 40 regencies/cities have a very high coastal vulnerability index, among them are Aceh Singkil Regency, Cilacap Regency, Denpasar City and Wakatobi Regency^{xlix}. The assessment of economic loss on the development sector faces challenges in data availability. For example, the loss on coastal sub-sector is calculated from the impact of inundation in coastal area caused by sea level rise to the economic activities. To obtain a more detailed estimate of economic losses, data on the affected coastal area in Indonesia and the rate of inundation per year in spatial basis which can be overlaid with the spatial profile is required. Unfortunately, this such data is not yet available for all regions of Indonesia. Another example is on assessing the loss in the marine sub-sector due to high waves. It requires at least data on the number of Indonesian fishermen in various ship size categories, the number of non-fishing days, and the respective units of loss per non-fishing days, and losses due to accidents at sea per year. These data are not available at this time.

4.2 Gaps in Addressing the Impact and Loss and Damage from Climate Change

4.2.1 State of Loss and Damage Assessment of Natural Resources

The assessment of climate change impacts on living resources, both at ecosystem and species level, is still minimal and even almost not available. Universities have started to conduct assessment on the impacts of climate change on biodiversity, with a particular emphasis on terrestrial species^{l, li}. On the other hand, assessment funded by the state budget (APBN) have yet to be incorporated into the current five-year strategic plans of ministries and government agencies.

This lack of climate change impact assessment on living resources is attributed to: (1) Limited historical monitoring on biodiversity, ecosystem, and species which are essential for establishing baseline data for comparison; (2) The availability of methodology and analysis that are able to differentiate and highlight the significance of climate change contributions to the changes in living resources in comparison to other factors (e.g. pollution and land use change); and (3) Limited funding and human resources, so that the impact on living resources is not a priority.

Moreover, assessment of climate change impact on marine and coastal ecosystem is also still lacking. Studies on the impact of climate change on marine living resources are carried out over short periods; often during climate anomalies. While impact assessment of long-term climate parameter changes on natural resources is not available, such as assessment on coral reef and fisheries.

As an example of this short-term study is the monitoring on the coral reefs that are experiencing stress, bleaching, and mortality during El Nino. Indonesia has experienced five coral bleaching events from 1983 to 2016^{lii}, ^{liii}. This situation is caused by the stress induced by sudden sea temperature rise over a short period (one season). Not only that, economic loss is also incurred as there is a need to restore and maintain the damaged coral reefs, not to mention the loss of livelihood for the fishermen and the tourism sector. The damage of coral reefs caused by sudden temperature rise within a short time (climate anomaly in one season) is different with the changes in climate parameter – particularly on temperature – which occurs over a long period of time to the coral reefs. Coral reefs exhibit varying abilities to adapt with changes that occurs rapidly and those changes that occur slowly. The Coral Reef Rehabilitation Management Program (COREMAP) funded by World Bank and ADB loans since more than two decades ago has collected extensive data on coral reef growth in Indonesia. However, currently, there are no studies that examine the relationship between coral reef growth and changes in climate parameters in the sea (such as temperature, acidity and salinity)^{liv}.

Furthermore, the impact of climate change on Indonesian fisheries is also not very well understood. There is a study regarding the effect of climate anomaly during El Nino and La Nina towards pelagic fish with significant economic value, which are tuna and mackerel. These studies, initiated by researchers from IPB and BPPT in the early 2000s, have provided some insights^{lv}. Furthermore, the Marine and Fishery Ministry monitored the fish catch in several fish auction sites. The study was conducted during several occurrences of El Nino and La Nina phenomena in Indonesia. But this study is far from the ideal one, due to the limited information about the location and the depth of the catch fish.

The economic loss due to climate change impacts on the fishery sector has been included in the PBI document. But with the limited data and study of climate change impacts on living resources, the economic loss is only estimated from climate change impacts due to high waves and coastal inundation; and it does not consider the impact on living resources, such as on marine fishery and coral reef^{lvi}. Because of the high wave, it is difficult for fishermen to catch fish. Other than that, coastal inundation also cause losses in economic activities in the coastal area, including aquaculture and industry.

The impact on plantation and non-rice food crops commodities has also yet to be prioritized. The agricultural sector in PBI also does not include this sub-sector. Several testimonies in Indonesia mention the impact of climate change, particularly rising temperatures and changes in rainfall patterns, on the pollination process of plantation crops, which then has a negative impact on fruit growth. There is also international literature that assess the impact of climate change on bees as key actors in the plant pollination process. The study states that pollination disturbances are caused by

changes in rainfall patterns that are not in line with normal pollination periods. In Indonesia, a study conducted by Buchori et al. (2020) monitored the risk of loss of a number of bee species which play a role in pollinating various types of plants^{lvii}. Apart from climate change, the use of pesticides and a lack of food sources for bees are the causes of the decline in the species' population. The decline in bee populations is a serious threat to global food availability in the future.

A number of protection program for living resources in Indonesia has been conducted by several related ministries, particularly MoEF/KLHK and Ministry of Marine and Fishery (MoMF/KKP). Those programs protect the living resources from the impact of human activities, including land use change, pollution and destructive practices. Although it has positive impacts to living resources on land, coastal and ocean, However, being an invisible and silent threat, climate change requires a distinct approach to address it compared to the damage caused by human actions.

Aside from the protection programs that has not yet focused on living resources protection from climate change impact, monitoring is also still limited on climate change impacts on non-living resources or physical ecosystem. It was stated on the previous section that the loss and damage to physical ecosystem is very visible. Coastal erosion as well as the inundation in coastal and small islands are evident. Despite that, comprehensive calculation of the inundation and erosion rate in coastal area and small islands across Indonesia is not yet available. The monitoring of inundation and erosion area is only limited to specific coastal area. Instead of monitoring the rate of loss of the small islands (one of them by using satellite imagery), report often made only after the island is completely inundated. Further, there is no government institution that explicitly states monitoring as its primary responsibility.

4.2.2 Poor Management on Slow Onset Phenomena: Coastal Inundation Case Study

Inundation in coastal area (or coastal inundation) is an event that causes damage on a number of coastal lowlands in Indonesia. The loss and damage from this hazard are estimated as will increase and cover large area in Indonesia. However, there is a policy gap in addressing this coastal inundation issue.

Coastal inundation is caused by multiple factors, including multiple hazards and susceptibility to land subsidence. The inundation during high tide period occurs over several days every month all year round in coastal lowlands such as Pekalongan Regency and City, Semarang City, Demak Regency, Tegal City and Jakarta. This condition has been an ongoing situation in the area for at least the past two decades. Aside from the contribution of climate variability and maritime factors, those areas are also experiencing land subsidence. Ground water exploitation and geological character of the area are among the causes for the subsidence. Further discussion on land subsidence is presented in Appendix 5.

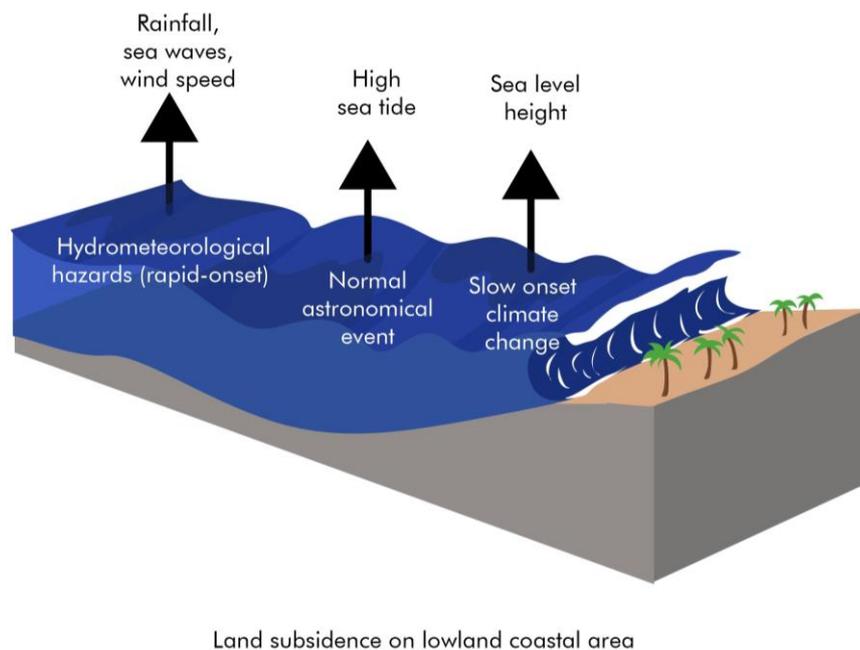
The high sea tide is a regular and normal astronomical event affected by moon position towards the earth and take place every 15 days of lunar calendar. Some part of coastal community, especially shrimp farmers, are aware of the high sea tide timing by looking at the calendar which made based on moon position towards the earth (hijr calendar). Inundation caused by this event occurs in coastal lowlands. Sea water enters land up to

several tens to hundreds of meters from the coastline. Therefore, coastal inundation repeatedly hits communities and can last several days a month. The inundation continued slowly for several hours, and also receded slowly. In some conditions, land subsidence worsens this incident because it creates the emergence of 'basins' in the land which results in incoming water being trapped in the depressions and can no longer flow out; and ultimately form a permanently inundated area. The frequency and height of inundation on the north coast of Central Java has been observed as continue to increase in the last decade.

High wave and wind directions towards the land also increase the height of the inundation and its destructive power. This such incident does not occur regularly and usually the BMKG will provide an early warning several days before a high wave strikes. This coastal inundation caused by high tide and sea wave (jointly or separately) occurred during both dry season and rainy season. The local community use the term 'rob' to name the event. Additional information on the number of rob caused by high tide and high wave in 2020 is available in Appendix 6.

In rainy season, high rainfall could increase the height of the already slowly increasing inundation. If river water levels rise significantly, river overflows and embankment breaches can lead to rapid increases in inundation levels and fast-flowing water. Overflowing of river or broken embankment when river water levels rise significantly will cause inundation level to increase rapidly and create a fast-flowing water. The risk of damage to buildings, plants and human accidents increases in these conditions.

Figure 5. Cause of Coastal Inundation in Indonesia



With various sources of hazard and the occurrence of land subsidence (vulnerability factor), a number of local governments seems hesitant to declare disaster status to this incident. For example, in May 2022, the Pekalongan City Government has not declared disaster status, even though a number of families have been evacuated due to

inundation that occurred for three days caused by high tides in the city^{lviii}. At that time, BMKG predicted that the sea waves will decrease in the next few days, so that the city government use this statement as their reasoning for not declaring the disaster status. The Pekalongan City Government encourages others, including the National Zakat Agency (BAZNAS), to support in the management of evacuation; particularly considering their budget constraint.

The City Government had actually declared an emergency status on tidal floods back in June 2020. Several embankments were broken due to the increased level of river water. Because of this emergency status declaration, the Unexpected Expenditure Budget of the Pekalongan City Local Budget (APBD) was able to be disbursed^{lix}.

Meanwhile, the coastal inundation has not assigned to a definite category in disaster management framework in Indonesia. Some actors who are responsible for disaster management in the local, including Demak Regency and West Tanjung Jabung Regency, sees that coastal inundation is not part of disaster management^{lx}. Instead, they view the coastal inundation as more appropriately managed as an impact of climate change. The viewpoint was supported by the Law Number 24 of 2007 on Disaster Management that does not explicitly mention sea water inundation as one of disaster threats^{lxi}.

Various forms of hazards that causes coastal inundation make the efforts of managing the sea water inundation under the disaster management framework becomes unclear. The disaster status for the inundation caused by the tidal flood has never been determined. Inundation due to high tides rarely causes damage to buildings (buildings collapse), but these incidents not only damaging the crops, but also disrupting community's livelihoods and lives. Over time, the quality of buildings and infrastructure is also slowly deteriorating. This event, which occurs slowly and repeatedly, until it eventually becomes a permanent coastal inundation, is not considered a disaster event. The character of coastal inundation is recurrent and predictable, so the insurance industry tends not to provide coverage against the impact of coastal inundation.

Local government only declares the disaster status if the flood is caused by high rainfalls, overflowing of river or high wave. Floods due to rainfall and high wave are categorized as disaster hazard according to the Law Number 24 of 2007 on Disaster Management, hence the local government perceives declaring a disaster status for such flood inundation has a legal basis. The broken embankment (as occurred in Pekalongan) and collapse building also driven the decision to declare disaster status. The disaster status of coastal inundation in Pekalongan City or Pekalongan Regency, for example, has only been determined once in the last decade.

The "Unexpected Expenditure" Budget within APBD can be disbursed for disaster management following the disaster status declaration from the related local government. Without a disaster status, the management for high tides then will be funded through routine expenditure budget of the local government which usually is limited.

A separate monitoring for tidal floods is not yet conducted. Based on disaster impact reports from LDMA/BPBD and the local community, DIBI records the impact of coastal inundation under the 'flood' and 'tidal wave/abrasion' category. The 'flood' category

does not differentiate the source of the flood, whether caused by the sea tide or rainfall. The 'tidal wave/abrasion' category does not differentiate between tidal wave and coastal abrasion. Besides that, the characteristic of coastal inundation that occurs over a long period of time, even has become a permanent condition in several areas, unable to be managed using the same approach as flood management, because there is no clear reference point in activating the disaster management cycle.

The use of mix categories for coastal inundation data collection and recording will make it difficult to analyze trends in recent years and predict coastal inundation in the next few years. The future data collection categories and processes need to differentiate between the categories 'tidal floods', and 'rainfall floods and river runoff', as well as a combination of the two and also the 'permanent coastal inundation' category.

In the last five years, BMKG and BNPB have worked together to develop tidal flood forecasts in Indonesia, and the information have been disseminated to the public. The estimated time for tidal flood to occur usually coincides with the full moon period, apart from the existence of a low-pressure center in the ocean which is also the basis for tidal flood forecast^{lxii}.

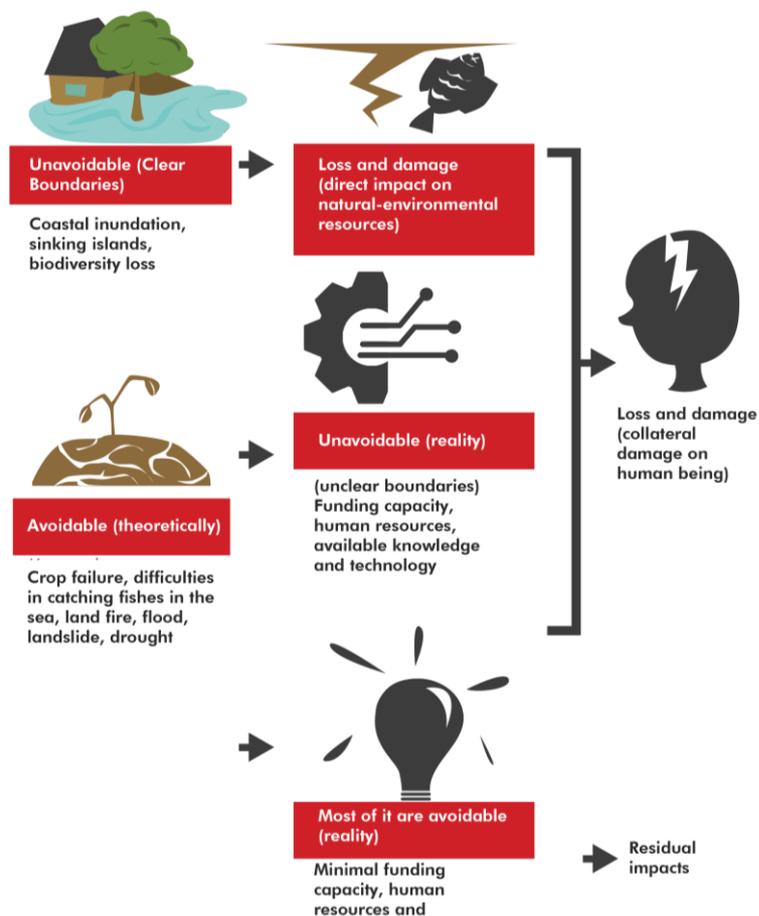
4.2.3 Distinct Limits of Avoidable and Unavoidable Impact of Climate Change

With an effective and adequate adaptation, most of climate change impacts can be avoided. For example, the impact of rainfall pattern change and temperature rise on agriculture can be avoided using a number of adaptative measures, such as weather/seasonal projection, irrigation system enhancement, as well as drought-resilient or inundation-resilient crops.

Most of the direct impacts to natural resources are considered unavoidable. Lack of options to prevent inundation in coastal areas and small islands, loss/reduced biodiversity, coral reef loss and mortality, changes on fish migration pattern and areas where fish seeds develop, is among the cause for the loss of biodiversity; where some of the biodiversity will simply disappear without being able to be prevented or even studied.

Most of the impacts on human beings are avoidable. Despite that, the developing and least developed countries are not able to avoid climate change impacts, even if there are options for adaptation. Financial, human resources and technological constraints are the barriers for effective and adequate adaptation measures. On the other side, even if adaptation measures are carried out, there will still be remaining climate change impact. This remaining impact (residual impact) becomes greater if adaptation efforts are minimal, especially in the developing and least developed countries. Loss and damage from climate change are a combination of unavoidable, unavoids and residual impact.

Figure 6. Category of Loss and Damage from Climate Change Impact



The above illustration provides an example of how coastal inundation in small islands and coastal lowlands is almost unavoidable. The impact from the inundation will subsequently affect the community lives in the area. The further impact on human can be avoided or minimized, if there are effective and adequate adaptation efforts. For example, by increasing the height of the land or build coastal protection or relocate to an area that suitable with the current socio-economy condition.

As mentioned before, even if adaptation measures are implemented, there will still be residual impacts. Loss of productive land, increasing expenses and also loss of social cohesion and cultural symbols on the origin area are various residual impacts experienced by the community who relocate to another area or those who choose to survive by strengthening the coastal areas with coastal embankment.

Figure 7. How Climate Change Causes Loss and Damage



The community and government have various ability to avoid every forms of climate change impact. Analysis becomes essential to be done in various level of government, community and household/individual. Community may not be able to address some impacts of climate change, but it can be managed with the support from the local or central government.

Most of regency/city government currently have limited capacity to relocate their community who are affected by coastal inundation. Support from the provincial and central government is thus needed. The existing policies and regulations can be an obstacle for the central government to help local governments, which then becomes an impediment in efforts to assist the affected communities. Distinct limits/boundaries for assessing the ability of the government and society to address loss and damage cannot be set unequivocally for every type of hazard and impact due to climate change that are faced. Table 6 provides an overview of the loss and damage categories for each potential impact. However, further study is indeed needed to determine the limits between avoidable and unavoidable categories.

Table 6 General Assessment of Loss and Damage Categories on Natural Resources

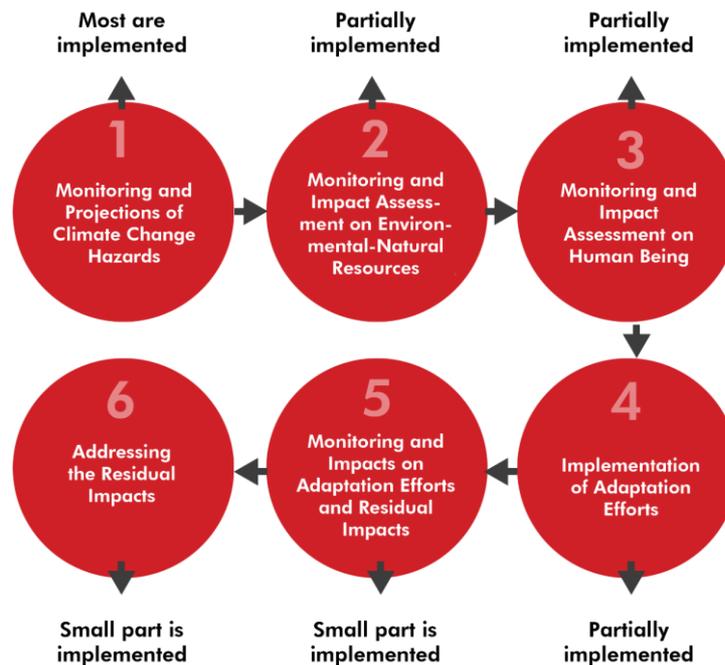
Potential Impact	Loss and Damage Category
1. Temperature Rise	
Increase of the reproduction and spread of mosquitoes in Indonesia	Potentially Avoidable
Loss/decrease in biodiversity	Tend to be Unavoidable
Population decreases of species that play a role in food crops (e.g. pollinating bees)	Unknown
2. Anomaly/extreme weather at sea (temperature and seasonal rainfall, high waves, wind and strong ocean current)	
Coastal erosion/abrasion	Potentially Avoidable
Coral reef mortality/bleaching	Tend to be Unavoidable
3. Sea level rise	

Inundation in coastal areas and small islands	Tend to be Unavoidable
Coastal erosion/abrasion	Potentially Avoidable
4. Rising sea temperatures, changes in ocean acidity (pH)	
Mortality, diversity loss of coral reefs	Tend to be Unavoidable
Changes in fish migration patterns and spawning areas	Tend to be Unavoidable
Reduced diversity and growth disruption of marine species	Tend to be Unavoidable

A number of national and international literature have identified the impact of climate change on various ecosystems and development sector. Indonesia has planned for adaptation measures through Climate Change National Action Plan (RAN-API) in 2013, which then transformed into 2020-2045 PBI. The PBI is a main reference for climate change adaptation initiatives in Indonesia^{lxiii}. This document covers the measures to address some impacts of climate change in four main development sectors and special area (including the disaster-prone areas and high-valued conservation area). Meanwhile, climate adaptation plan developed at local level, mostly have more limited scope.

Illustration below provides the description of the latest status on addressing climate change impact in Indonesia, starting from hazard monitoring, impacts, implementation of adaptation measures, until monitoring and managing of residual impacts. From the illustration, it can be seen that the current efforts is emphasizing on climate change hazard monitoring and projection, where these efforts is still considered as a starting point within the spectrum of addressing climate change impact.

Figure 8. The Flow of Addressing Climate Change Impacts



4.2.4 Scope and Gaps in Adaptation Measures

When the hazards and impacts of climate change have not been adequately monitored and studied, then the appropriate and adequate adaptation efforts certainly have not been carried out. Furthermore, comprehension over the impact on natural and human resources is also not fully understood. Talking about climate adaptation efforts, the 2013 RAN API document, which was later updated to become PBI 2020-2045, is the main reference document to see the scope of adaptation plans at the national level.

The Strategic Plans and Annual Performance Reports of related Ministries and Institutions and several regional adaptation plan documents are relevant references for viewing the implementation of climate change adaptation in various related development sectors at the national and local levels. There are a number of local climate change adaptation plans covering priority sectors contained in national plans, but generally there is minimal data and analysis of the hazards and risks of climate change at this local level.

Disaster management measures that stated in the BNPB's National Disaster Management Plan and Disaster Management Strategic Plan also include hydrometeorological disaster management. The National Plan involves a number of relevant Ministries and Institutions in developing the plan and dividing roles in its implementation, while the BNPB Strategic Plan contains disaster management activities implemented internally by BNPB^{lxiv}.

These documents provide information regarding the types of hazards and the types of data available for the development of strategic plans. From there, we can find out what types of hazards that are not monitored and which data that are unavailable. Information on climate hazards projections is available in the 2020-2045 PBI^{lxv}, while the National

Plan and Disaster Management Strategic Plan provide historical hazard data. Refers to these two documents, disaster management only covers rapid-onset disasters. Therefore, the PBI document is the most relevant document to see climate adaptation measures and efforts to address the loss and damage (if included) caused by changes in climate parameters that occur slowly (long term), as well as immediate disaster (short term). Table 7 shows the information related to climate change that can be found in government's key documents.

Table 7 Scope of Disaster Management- and Climate Change-related Key Documents

Reference Documents	Attainable Information
National Action Plan for Climate Change Adaptation (RAN API) 2013	<ul style="list-style-type: none"> • Types of hazards and priority impacts • Priority sectors • Options of adaptation strategy • Priority locations.
Climate Resilient Development Plan 2020-2045	
Strategic Plan of Ministries and Institutions	<ul style="list-style-type: none"> • Goals • Strategies and activities, including those related to climate change adaptation and implementing units.
Annual Performance Report of Ministries and Institutions	<ul style="list-style-type: none"> • Goals • Strategies and activities, including those related to climate change adaptation, implementing units, and achievements in the current year.
National Disaster Management Plan	<ul style="list-style-type: none"> • The main objectives of disaster management • Strategies at each stage of the disaster, especially capacity building activities, the role of related ministries and institutions, the level of disaster risk, the achievements of previous period.
BNPB Strategic Plan	<ul style="list-style-type: none"> • Goals • Strategies for each stage of the disaster, especially capacity building activities, the activities of each unit, the achievements of the previous period.
Nationally Determined Commitment (NDC) Report	<ul style="list-style-type: none"> • Indonesian government's commitment to reducing greenhouse gas emissions and reducing losses due to climate change • Achievements of climate change actions in the previous period (based on reports from ministries/institutions to the Ministry of Environment and Forestry).

General description of potential loss and damage in Indonesia can be seen from the abovementioned documents. As mentioned before that the potential loss and damage comes from unavoidable impacts, avoidable impacts and also remaining impacts (despite the adaptation measures). Rice production in several areas in Indonesia decreases, low number of fish catch during extreme weather, as well as dengue and malaria are examples of remaining impacts, despite climate adaptation measures have been carried out by the government and community.

If we look at the availability of climate information on local government's document, almost all regions (provincial and regency/city level) in Indonesia do not develop climate projection in developing its adaptation plan. A small number of regions which assisted by the Central Government (Bappenas and KLHK) as well as civil society organizations with international donors (including Mercy Corps Indonesia, ICLEI, and USAID APIK program) have projections on rainfall and sea level rise which included in the spatial and development plan, aside from being used in the climate adaptation or resilience plan. Semarang, Cirebon, Tarakan, Malang and Jakarta are among 15 regencies/cities in Indonesia that have climate projection data.

Table 8 below summarizes in general the progress of adaptation efforts in Indonesia. The lack of funding and limited human resources are the challenges in implementing a comprehensive adaptation measure. To overcome this, the central government do prioritization in addressing the impact and in selecting the adaptation strategies. This limited resources are not the issue for central government solely, but also for most of local governments in Indonesia. As a consequence, the loss and damage become unavoidable, although there are options to avoid some of those climate change impacts.

The monitoring of climate change impacts on living resources is also still minimal or even not yet implemented in Indonesia. Information on potential impact on living resources is available only for the events that caused by the climate anomalies, particularly during El Nino, for instance through monitoring of coral reef, number of dengue and malaria case, as well as the abundance of pelagic fish in the sea. With limited studies on the potential impacts, currently there is no strategy to address loss and damage on living resources. This results in minimal (or even non-existent) knowledge to conclude whether there is loss and damage today, or in the near future.

A small number of adaptation actions have been done to address climate change impacts on non-living resources (physical environment), including coastal erosion/abrasion, and also inundation on coastal area and small islands. Addressing coastal erosion/abrasion through coastal ecosystem restoration (especially through mangrove rehabilitation) and structural engineering has been implemented in small parts of the affected coastal areas. The community and local government have carried out self-relocations in small parts of the affected areas. Meanwhile, integrated management of coastal inundation has only been conducted in a small part of the coastal areas on the north coast of Java Island.

A large number of adaptation measures has been implemented in agriculture, water resources and fisheries/marine sectors in most regions across Indonesia. However, adaptation actions in the health sector are not as intensive as in other sectors, even though efforts to eradicate vector-based diseases (mosquitoes) have been widely implemented in Indonesia for several years before the 2013 RAN-API was developed^{lxvi}.

Table 8 Current Status on Climate Change Adaptation Actions in Indonesia

(Potential) Impact	Monitoring/ Impact Assessment	Adaptation Measures	Impact and Management Status
A. Increase in temperature			

1. Health Issues	Partially implemented ^{lxvii}	Partially implemented ^{lxviii}	Still limited to addressing malaria and dengue. No well-planned study nor management of pneumonia and others.
2. Loss/reduction of biodiversity	Not yet implemented	Not yet implemented	Not yet implemented
3. Declining populations of species that play a role in pollination (e.g. bees)	Minimal/not yet implemented	Not yet implemented	Decreased plantation production
4. An increase in plant pests	Implemented	Implemented ^{lxix}	Decreased yields, decreased income
B. Changes in seasonal patterns (rainfall)			
1. Reduced water availability	Implemented	Implemented	Worsening the water deficit, especially Java Island, Nusa Tenggara
2. Crop failure, decreased crop production	Implemented	Implemented	Decreased food security
3. Increases of the vulnerability of land and forest fires	Implemented	Implemented	Increased GHG emissions, complaints from neighboring countries, health issues, destruction of animal habitats, human-animal conflicts
C. Weather anomaly/extreme weather (on land)			
1. Increase in climate-induced disasters (floods, etc.)	Partially implemented	Partially implemented	Loss of life, personal accident and loss of assets, mental disorders, loss of social value.
D. Weather anomaly/extreme weather (at sea)			
1. Incidents at sea	Data collection was carried out	Partially implemented ^{lxx}	Boat damage and reduced fish catch
2. Fish catch decreased	Partially implemented ^{lxxi}	Partially implemented ^{lxxii}	Reduced income
3. Coastal erosion	Partially	Partially	Loss of houses,

	implemented ^{lxxiii}	implemented ^{lxxiv}	cultivation/productive land, social space and infrastructure.
4. Damage to aquaculture in the sea	Data collection was implemented	Partially implemented ^{lxxv}	Decreased yields
E. Sea level rise			
1. Coastal and small islands inundation	Partially implemented ^{lxxvi}	Partially implemented ^{lxxvii}	Settlements, cultivator/productive land, infrastructure, inundated industrial areas, health issues, loss of small islands (including on national borders)
2. Coastal erosion	Partially implemented ^{lxxviii}	Partially implemented ^{lxxix}	Mangrove ecosystem, and houses affected by abrasion
3. Erosion in mangrove ecosystems	Assessed ^{lxxx}	Partially implemented ^{lxxxii}	Damage on mangroves
F. Increases in ocean temperature, changes in ocean acidity (pH level)			
1. Coral reefs mortality	Partially implemented ^{lxxxii}	Partially implemented ^{lxxxiii}	Coral bleaching/mortality
2. Changes in fish migration patterns and spawning areas	Not implemented	Almost/Not implemented	Almost unknown
3. Reduced diversity and growth conditions of marine species	Almost/ Not implemented	Almost/Not implemented	Almost unknown

4.2.5 Budget Constraints for Climate Adaptation

Government of Indonesia has identified the funding needs as stated in NDC document, both through independent efforts and with international assistance. In the 'optimist' scenario of low carbon development priorities, the total required investment is US\$446.5 billion (equal to 34.6% GDP) for 2020-2024 or equivalent to US\$21.9 billion per year. Indonesia needs to pursue low-carbon economy to materialize the 2045 Indonesia vision^{lxxxiv}.

With NDC as Indonesia's commitment at the global level, as well as the 2020-2024 Middle Term Development Plan (RPJMN) as the directions of national development, the

state budget (APBN) is directed to support climate change mitigation and adaptation actions. State budget is a catalyst in the national development process that is low emission and climate resilient. Most of the funding for climate change comes from APBN, although the local government also prepares budget for adjustment to the local budget (APBD).

Aside from that, there are several climate change adaptation programs that funded by foreign and domestic grant. Foreign grant comes from government's partner (bilateral), international foundation, as well as from multilateral (e.g. Green Climate Fund, Adaptation Fund). Multilateral financial institutions (World Bank and ADB) also provides grant and loan for adaptation. Currently, climate change adaptation is seen more as a cost, therefore investment for these adaptation efforts is rather limited.

Climate change budget tagging (for mitigation and adaptation) has been implemented since the 2016-2017 budget year. Budget tagging is conducted by Ministries/Institutions based on guidelines from the Ministry of Finance, and the tagging does not include funding sourced from the APBD. In the 2016-2021 period, the APBN allocates an average climate change budget of IDR 97.76 trillion (USD 6.8 billion) per year or around 4.1% of the APBN. Meanwhile, the actual budget usage averages IDR 83.8 trillion per year or around 3.7% of the APBN realization. The mitigation budget has been the largest portion of the total climate change budget since 2018 (58% per year in average)^{lxxxv}.

In 2019, the climate change budget decreased by around 26.3% due to policy adjustments in determining the criteria for climate projects. One of the adjustments is that several outputs that in previous years were tagged as mitigation actions were reviewed and excluded from the calculation of the climate change budget. In 2020, the value of the climate change budget again decreased by 20.3% due to the policy of refocusing and reallocating the budget to handle the Covid-19 pandemic^{lxxxvi}.

This budget decreases occurred both in climate change adaptation and mitigation. The adaptation budget in 2019 down to IDR 39.20 trillion (around 2.67 billion USD) and in 2020 it was down to IDR 33.29 trillion. According to the Ministry of Finance (2021), this decrease was due to the government starting to diversify infrastructure development through other funding sources such as from state-owned/regional-owned corporations (BUMN/BUMD), the private sector and regional governments. The climate change budget in 2021 grew 42% post-pandemic.

However, the budget tagging shows that the APBN has only allocated around 10% of the estimated budget requirements for adaptation. The APBN has so far spent IDR 313.2 trillion (USD 21.6 billion) on mitigation actions, IDR 171.2 trillion (USD 11.8 billion) on adaptation, and IDR 18.5 trillion (USD 1.3 billion) on activities that have double benefits (co-benefit), namely initiatives that can reduce Green House Gas (GHG) emissions, while simultaneously increasing climate resilience^{lxxxvii}.

The largest climate change adaptation budget in the last three years was disbursed by the Ministry of Public Works and Public Housing (MoPWP/PUPR) (reaching 96.5% of the total adaptation budget), followed by the Ministry of Environment and Forestry, and the Ministry of Agriculture. From this information, it appears that infrastructure development dominates climate change adaptation measures in Indonesia. The

development of water resources infrastructure is the reason for the significantly larger budget of the MoPWP/PH/PUPR compared to other ministries that handle food security, coastal and marine, and health. The budget for community empowerment, institutional strengthening, technological innovation and policy strengthening is much smaller than infrastructure development. Appendix 15 provides further information regarding the budget used by each relevant Ministry/Government Institutions for climate change adaptation.

Meanwhile, the Central Government spent around US\$90 million to US\$500 million per year for disaster response and recovery during 2014-2018 period. In the same period, the Local Government is estimated to have spent US\$250 million^{lxxxviii}.

Another funding alternative is village funds. The village funds come from the APBN and are transferred directly to the village government account. Adaptation efforts, disaster management and protection of natural resources within the village administrative area can be financed using the Village Fund. The Ministry of Villages, Development of Disadvantaged Regions and Transmigration (Kemendes PDTT) issues priority guidelines for the use of Village funds annually. However, adaptation measures carried out by villages with funding that comes from the APBN have not been completely monitored and tagged at the national level.

Although there are many funding alternatives, but the local government budgets, private sector funding, and also bilateral and multilateral cooperation (grants and loans) have not been calculated. However, roughly speaking, it can be estimated that the budget for climate change adaptation from these diverse sources is still relatively small. The lack of regional planning that includes climate change assessment within and also the lack of adaptation-related studies and efforts in the local level are appropriate indicators to support the conclusion regarding the limited budget for climate adaptation at present time.

4.3 Framework for Addressing the Loss and Damage from Climate Change

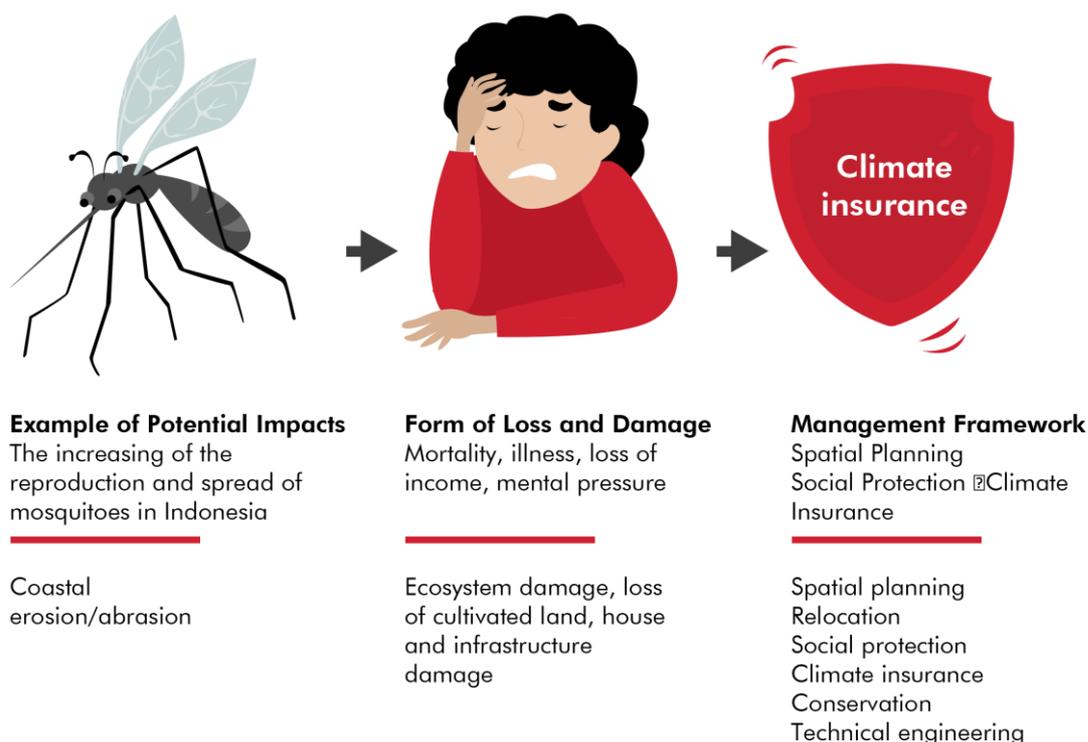
The limited knowledge, technology, budget, and human resources are the challenges to optimize adaptation. The policy and institutional gap increase the complexity of the ongoing challenges to implement effective strategy and adaptation initiatives. Currently, the policy and institutional context for climate adaptation only 'valid' to a number of the known impacts of climate change. Some climate change impacts are still unknown, particularly on natural resources.

Small number of local governments have planned and implemented adaptation initiatives by referring to the national plan on climate adaptation. However, despite diverse adaptation efforts have been implemented by various actors, the residual impacts can still be felt. Community remains to experience crop failure, incidents at sea, decreasing income, climate-induced disease, ecosystem and property damage, productive land that inundated with sea water and rainfall. The conditions will be more severe in areas with minimal adaptation activities.

A number of options that can be applied to address loss and damage caused by climate change have been identified and assessed. The identification of options in this

particular study considers the different form of climate change impacts and the opportunity for its implementation, including by taking into account the availability of knowledge, human resources and funding in Indonesia. Some of these can be implemented with international assistance. Illustration 7 presents brief illustration on the process for identifying options for loss and damage mitigation frameworks. Full information on the process for finding these options is presented in Appendix 7.

Figure 9. Process for Identification of Frameworks for Addressing Loss and Damage



By considering various forms of loss and damage from climate change, the options of relevant strategies to address the loss and damage are as follow:

1. Adaptive Social Protection (PSA)
2. Management of affected areas, through ecosystem rehabilitation, physical structure for coastal protection, settlement relocations and spatial planning.
3. Environmental management policy which covers conservation, genetic bank, moratorium of natural resources utilization.
4. Risk transfer, among them through climate insurance.
5. International diplomacy/dialogue.
6. Fostering public private partnership through business continuity plan.
7. Strengthening the current climate adaption measures.

One option has the potential to address several forms of loss and damage. Vice versa, one form of loss/damage requires one or more strategy options to address it. For example, loss and damage on coastal area caused by coastal abrasion/erosion can be addressed through a combination of policies for managing affected areas, social

protection, settlement relocation, insurance and environmental management/conservation policies.

4.3.1 Options for Addressing Loss and Damage from Climate Change

4.3.1.1 Adaptive Social Protection

Adaptive Social Protection (ASP) is suitable to be implemented for reducing the impact on communities that are most vulnerable to the impacts of hydrometeorological (floods, landslides, tropical cyclones, etc.) and geological disasters. Implementing ASP requires a mechanism to determine the time to distribute aid and the people who receives the aid. Thresholds also need to be set as triggers for distributing assistance. In addition, climate hazard or risk maps are needed to determine the most vulnerable communities who are entitled to receive assistance.

Together with a number of Ministries/Institutions, BAPPENAS is currently developing an ASP policy. The final draft of the ASP Roadmap has been awaiting approval through a Presidential Decree since last year. The process of preparing this Road Map is supported by a number of international development partners, including GIZ, UNICEF, UNDP and WFP. The approval of this ASP Road Map^{lxxxix} then needs to be followed up with the development of a number of technical guidelines for its implementation.

Disaster that declared with disaster status by local/central government can be a reference or trigger to activate the distribution of ASP package. The ASP Program is planned to be added into existing poverty alleviation/social protections, right after the disaster strikes^{xc}. ASP and insurance can be distributed at the same time or complementing each other to reduce the loss experienced by the vulnerable community following the hydrometeorological disaster. Not only in form of cash, ASP also can be developed as climate insurance premium and other instruments. This ASP strategy is relevant to address loss and damage in the community such as death, illness, loss of income, mental pressure, reduced income for farmers and fishermen due to climate anomalies.

The implementation of ASP is certainly requiring substantial funding. With limited APBN, mobilization of funding from various sources is necessary. Especially considering the fact that the APBN mechanism is not suitable for the implementation of ASP and insurance mechanism^{xcii}. Not only that, this mobilization of funding from diverse sources also needs to be equipped with an appropriate institutional scheme and mechanism to manage and channel the funding as grant or investment. Public Services Agency (BLU), a trust-fund type government organizations, is the most appropriate form of institution for raising and managing funding sourced from the APBN, APBD and third parties in a more accountable manner.

Ministry of Finance have been implementing insurance program to protect State-Owned Property (BMN) since 2019^{xcii}. Disaster Pooling Fund (FPB) was organized to support disaster management actions. This joint funds originating from various sources are managed to support funding needs for disaster management, both at the pre-disaster, disaster emergency and post-disaster. In early 2021, Indonesia received a loan of US\$500 million or around IDR 7.05 trillion from the World Bank to strengthen Indonesia's financial and fiscal resilience against the risks of natural disasters, climate

change and risks originating from the health sector^{xciii}. This Disaster Pooling Fund will be equipped with the ability to transfer disaster risks to financial markets through, among others, an insurance scheme^{xciv}.

Currently, only BMN that managed by central government, such as office buildings, that is protected with disaster insurance. The government has filed claims for damage on the government assets caused by flood and earthquake in various regions in 2020-2022^{xcv}.

Ministry of Finance has also encouraged local government to protect the assets, particularly buildings, with disaster insurance. However, almost all local governments have not followed up on this encouragement. A number of local governments are known to have large budgets and are able to protect their assets with disaster insurance. What is known to be an obstacle in this case is data availability. Determining premiums for insurance protection must be based on the results of an inventory of the number and value of the owned assets^{xcvi}.

4.3.1.2 Affected Areas Management

Affected Areas Management can be applied to address the unavoidable impacts. People living in several coastal areas in Indonesia have experienced ecosystem damage, loss of cultivated land, house and infrastructure damage, psychological issues due to inundation in coastal areas and small islands. The options of affected area management could encompass efforts to protect settlement area that is exposed to the climate change impact (particularly sea level rise and high wave) through coastal ecosystem rehabilitation and construction of physical structure for coastal protection. Although this is the very last option, sometimes relocation becomes an unavoidable option when the inundation in coastal area occurred permanently and causes recurring economic and non-economic loss to the community, industry and other land users in coastal areas.

As sea levels continue to rise slowly, coastal ecosystems that directly adjacent to the sea will be damaged and lost. Regeneration of coastal ecosystems towards land can only take place if there are available space for these ecosystems to 'retreat' towards land. A coastal spatial planning policy is needed to achieve this regeneration^{xcvii}.

Population relocation is an option if coastal land users continue to experience loss and damage due to inundation, and it is a long-term solution. For example, the relocation option was finally taken by coastal communities in Demak and Pekalongan Regencies after years of experiencing loss and damage due to inundation. Population relocation provides an opportunity for coastal ecosystems to adapt and develop 'backward' towards land that is abandoned by the previous land users^{xcviii}.

The management of affected areas is also related to spatial planning. According to the Environmental Law, a spatial plan must consider disaster risks and climate change. However, it needs to be understood that the spectrum of spatial planning is quite broad, the consideration upon disaster risk and climate change are not the only analysis conducted in the process of spatial planning. However, this analysis needs to be the fundamental basis for determining spatial patterns and regional spatial structures. Avoiding or managing spatial use provisions in areas with high climate and disaster risk

is essentially part of the follow-up action for the implementation of regional spatial plan that considers disaster risk and climate change. Integrating hazards, vulnerabilities and climate risks into spatial planning and development plans has also become a mandate in Law Number 32 of 2009 on Environmental Management, Law Number 26 of 2007 on Spatial Planning and Law Number 1 of 2014 on Management of Coastal Areas and Small Islands.

4.3.1.3 Environmental Management Policy

The limited knowledge and technology in Indonesia and globally regarding the impact of climate change on living resources causes minimal information on the appropriate measures to address biodiversity loss. On the contrary, the physical damages on the ecosystem are clearly visible for the laymen. Rehabilitation on the ecosystem (one of them is on mangrove ecosystem) due to the physical damage caused by abrasion has been started.

Reducing pressure on the ecosystem affected by climate risk is one of the options. The ecosystem that deserves the attention include those with high biodiversity and have an important role in a broader ecosystem, for example ecosystem that are migration locations for marine and land species. Indonesia has a number of conservation and non-conservation area in land, coastal and sea. High biodiversity is among the criteria for determining the area. Therefore, the impact of climate change must be included in the management of conservation and non-conservation area.

There is a need of an area management plan that accompanied by efforts to avert as well as address the loss and damage on living resources. Reducing pressure on ecosystem and implementation of interventions down to species level, that affected by temperature rise as well as other climate parameters, are options of action that can be conducted. The protection can be implemented within the natural habitat (in-situ) or outside the natural habitat (ex-situ). This kind of protection approach is not a new idea in conservation. For example, conservation of one-horned rhinos and anoa. Protection within the original habitat is conducted if the habitat condition supports this, including the aspect of climate and human disturbance.

With the limited funding and human resources, the efforts to avert and address loss and damage can only be implemented in a small number of areas. The application of priority area becomes a strategy, and information about climate risk become the basis to determine areas that should be prioritized. However, the information on climate risks to natural resources is not yet available, due to limited knowledge on the impacts of climate change. Thus, it is estimated that climate risk upon living resources will not be available within the next one-two decades or more.

The limited knowledge and data mean that the prioritization can be done based on subjective considerations. Impacts on health and food security can be taken into account. Assessment on climate change impacts needs to prioritize species that play role in food availability or cause a severe health issue. Bees as an example, play major role in the pollination of food crops, secondary crops and plantation. A number of literatures mention the impact of climate change on the bees. However, in current conditions, neither the NDC Roadmap nor the PBI yet cover the plantation sub-sector, nor include plans for impact assessment on living resources.

Reducing pressure on ecosystem can also be applied to avert/address impact of climate anomalies/extreme weather, for instance through the application of natural resources moratorium. The impact of the El Nino weather anomaly on coral reefs is the best example of the need to apply this moratorium^{xcix}. It will provide the affected coral reef ecosystem with an opportunity to recover quickly. This initiative needs to be part of the Environmental Management Policy in the near future.

A number of species will be affected by climate change, either decreasing significantly or disappearing undetected. This is an unavoidable impact of climate change. Collecting, storing and preserving specimens through genetic banks are the last resort and are relatively feasible given the current state of knowledge, technology and funding. The aim of operating a genetic bank is to preserve and store the genetic code in specimens for future use. To do this, there needs to be a synergy between the genetic data collection institutions (in this case BRIN) and the natural resource management institutions (in this case the MoEF/KLHK).

With limited knowledge on the impact of climate change on living resources, there is an apprehension that discussion upon this discourse will not be a priority for the Government. The Indonesian government will of course prioritize addressing the impacts of climate change that have been understood.

4.3.1.4 International Dialogue and Cooperation

International dialogue and cooperation are required to address the impacts of climate change, which have cross-border impacts. There are at least two things that are the subject of discussion, which are: (1) the impact of climate change on state borders, and (2) the impact on cross-border natural resources, especially marine fisheries and water resources.

The loss of small islands on the state border has the potential to affect the state border line. The MoMF/KKP recorded that since 2005, at least 24 islands have been submerged, including the Island of Lawandra, Nirwana, Linon Coral, Niankin, Lereh, Inggit, Begonjai, and others^c. BRIN mentioned that there is a risk of sinking in 115 small islands^{ci}. Indonesia has a total of 17,508 islands, of which 111 small islands are Indonesia's outermost islands that border other countries^{cii}. For archipelagic countries, the loss of the outermost islands raises state border problems. There will be the potential for border conflicts with neighboring countries.

Nipah Island, for example, is part of a group of islands located in the outermost part of Indonesia and borders Singapore to the north. This uninhabited island is almost sinking. From an area of 60 ha at low tide, now only no more than 5,000 square meters remain during high tide. Nipah Island is located 4.8 miles northwest of Batam Island from Singapore. Apart from the threat of sea level rise, sand extraction on the island in the past has also accelerated the process of losing the island^{ciii,civ}.

Efforts by island countries to rehabilitate and strengthen the islands will likely face challenges. United Nations Conventions on the Law of the Sea (UNCLOS) does not provide clarity on the status on the outermost island of a country, that undergoing reclamation or other adaptation initiatives^{cv}. Discussion regarding the definition of "natural islands" and "artificial islands" according to UNCLOS in the context of climate

change adaptation must be a discussion at UNFCCC meetings. Not only at the UNFCCC, similar discussions also need to be held at UNCLOS meetings. Further review on this matter is presented in Appendix 8.

Addressing the impact of climate change on marine fisheries and biodiversity also require collaboration among countries. Fisheries and biodiversity are resources that do not reside/stay within an administrative area (country) and the impact on marine fisheries has international interest. This collaboration needs to include the exchange of monitoring, conservation and law enforcement data. Cooperation between countries for sustainable management of marine fisheries has been going on for decades; and this cooperation model can be adopted and strengthened by integrating studies and strategies for mitigating the impact of climate change on marine fisheries and marine biodiversity.

4.3.1.5 Public Private Partnership through Business Continuity Plan (BCP)

Private sector also affected by climate change. Usually, the mid-size and large private corporations have conducted disaster risk reduction as an inseparable part of their operations, or known as Business Continuity Plan (BCP). The same approach needs to be implemented to deal with climate change. Agriculture, plantation, fisheries companies and other companies are directly affected by flood, strong wind, irregular rainfall, and high wave. The direct impact from those events including the loss and damage of company's asset, disruption on transportation and production, and subsequently disrupt the relevant value chain that involves community and other stakeholders. The initiatives that can be implemented by private sectors including (i) implement adaptation and disaster risk reduction initiatives in the operational area, and (ii) support partners within the value chain so that they will be able to adapt and reduce disaster risk.

BCP is an internal process of the company. Government can play part in identifying and eliminating challenges in policies and regulations that may hinder the BCP implementation. Government also may offer incentive to encourage the formulation of BCP that involved the community.

BCP needs to be developed, particularly when the private sector and community have a similar interest, both of them are affected by the climate change. Since climate change impact/disaster is identical to an area, BCP is thus mostly applied in the upstream process (production) together with the community who are engaged within the production.

Private sector needs to share resources and strategy to allow the community reduces the impact of climate change. Even though the success of community in addressing climate change impacts, both directly or indirectly, could actually reduce the business risk; unfortunately, not many examples of public private collaboration to address the climate change impacts that can be found.

BCP seems as suitable to be developed to deal with the rapid onset impacts of climate change. The feasibility of implementing BCP for slow onset events is certainly different and there are not many examples. Relocating business premises or product change initiatives are examples of long-term options for the companies.

One of BCP's form is the Partnership for Sustainable Agriculture in Indonesia (PISAgro) program which involves many companies in the agricultural sector and civil society organizations. Implemented in collaboration with the Indonesian Government, PISAgro is an important initiative to strengthen farmers in improving production quality, improving supply chains, and also access to financing and markets.

There is ongoing partnership in marine fisheries sector between companies and communities involved in fishing (production). Currently, this collaboration is based on the company's interest in implementing responsible fishing that is accepted by the market.

Appendix 7 provides a detailed description of the forms of loss and damage that can potentially be addressed with the diverse options of strategy listed above, which ministries/government institutions need to be involved as well as the challenges and opportunities for its implementation.

The MoEF/KLHK and BAPPENAS are the key institutions that relevant in leading the implementation of the above strategies. BAPPENAS is relevant to lead the ASP scheme and spatial planning, together with MoEF/KLHK and the Ministry of Agrarian Affairs and Spatial Planning/National Land Agency (MoAASP/NLA). In accordance with regulations, MoEF/KLHK plays a role in environmental management policies. A number of sectoral technical ministries - such as the Ministry of Agriculture, Ministry of Health, MoMF/KKP - will play a role in supporting the implementation of strategies to address loss and damage from climate change.

BNPB and the Ministry of Social Affairs can be involved in implementing the ASP scheme. After the disaster status was determined, the roles of the two ministries are almost the same as the distribution of cash and non-cash assistance during emergency response. Further, if the ASP scheme is added to beneficiaries of the Family Hope Program (PKH), in that case, the data on PKH recipients affected by disasters in that location will be obtained from the Ministry of Social Affairs. The Ministry of Finance, through the existing Public Service Agency (BPD LH), or the Ministry of Social Affairs has the potential to become the manager of these ASP funds. BAPPENAS and the Ministry of Finance will have a key role in designing the fund distribution mechanism for the ASP scheme.

4.3.2 Opportunities and Challenges of Options in Addressing Loss and Damage Mitigation

4.3.2.1 The Challenges of Adaptive Social Protection for Climate Change

Adaptive Social Protection or ASP has the potential to address a number of forms of loss and damage from climate change impacts. This scheme is deemed as suitable to be applied to the rapid onset impacts of climate change. Discussions and examples of ASP implementation at the national and international levels are almost entirely about the impacts of rapid onset climate change.

Significant challenges will be found when applying the ASP scheme to slow onset events, such as impacts arising from sea level rise and recurring or permanent coastal inundation.

Determining the threshold to trigger the issuance of an adaptive social protection scheme to the affected communities in a location is a major challenge. Thresholds are usually set for rapid onset disaster events. Determination of disaster status or level of damage is an example of a trigger for launching the aid. Thresholds have never been applied to slow onset changes.

There are big challenges in implementing ASP scheme on slow onset events, such as the impact caused by the sea level rise and repeating or permanent coastal inundation.

The major challenge is to determine the threshold to trigger the issuance of an adaptive social protection scheme to affected communities in a location. The threshold usually developed based on rapid onset disaster. By determining the status of a disaster or damage level is example of a trigger for launching aid. The threshold has never been applied to the slow onset changes.

Integrated Data for Social Welfare (DTKS)^{cv}, InaRisk^{cvii}, DIBI^{cviii} and Vulnerability Index Data and Information System (SIDIK)^{cx} are the most relevant sources of data to support the implementation of ASP. DTKS is managed by the Ministry of Social Affairs and is a social record that contains information regarding the socio-economic conditions of individuals and households. Meanwhile, InaRisk and DIBI that managed by BNPB are disaster risk and disaster event information system which geographical scope covers all provinces and cities/regencies in Indonesia. Meanwhile, SIDIK, which is managed by the MoEF/KLHK, provides climate change vulnerability maps down to the village/kelurahan level.

Those four data and information platform can support the implementation of ASP for rapid onset climate change impact (hydrometeorological disasters) and also drought. To be able to support its application on the slow onset climate change impacts in the next few years, information on climate projections down to units smaller than regencies/cities is needed as a basis for determining thresholds. Meanwhile, these four platforms do not yet provide climate projections for various forms of climate change hazards.

Currently, even the projected climate change hazards and risks only exist in some cities/regencies in Indonesia. The disaster risk index produced by NDMA/BNPB is compiled from historical data. The disaster risk index includes hydrometeorological hazards such as floods and landslides, but does not include slow onset changes in climate parameters, such as sea level rise, temperature and rainfall. There is no Ministry/Government Institution that has clearly stated - or is stated by law - to be responsible for producing climate projections for all regions of Indonesia down to the city/regency level. Further discussion regarding the challenges of implementing Adaptive Social Protection to address loss and damage from climate change is presented in Appendix 9.

Other forms of Social Protection, such as Cash Transfer Program (CTP) has been implemented for disasters that caused by drought. Drought is a short period of climate anomaly within one year. There has been no discussion regarding the feasibility of implementing social protection for the slow onset (annual) climate change impacts, such as the risk of inundation in coastal and small islands due to sea level rise and high tides^{cx}.

4.3.2.2 Insurance Does Not Cover Slow Onset Events

Discussion regarding options for addressing the climate change impacts in international^{cx} and national level considers insurance as a risk transfer option for climate change and disaster. Insurance has the principle of protecting against the impact of loss and damage arising from events that cannot be predicted in advance, such as floods, landslides, tropical cyclones, land fires, earthquakes, tsunamis, ship accidents at sea. Protection is provided by insurance for a duration of one year, and can then be extended in subsequent years. Insurance companies also evaluate their products every year.

The government and civil society organizations (CSO) have introduced insurance as an instrument for transferring the risk of loss and damage due to hydrometeorological disasters and also the impact of climate anomalies and extreme weather on farmers and fishermen in Indonesia. Further information regarding insurance products can be seen in Appendix 10.

Climate change has both slow onset and rapid onset impacts. Insurance is a suitable option for protection from rapid onset events such as hydrometeorological disasters, and less suitable for protection from slow onset impacts, especially sea level rise. Protection from predictable changes, such as sea level rise, is considered to be contrary to the main principles of insurance products.

The level of loss and damage from climate change in the next few years/decades can be predicted. Currently, climate projections have been implemented on sea level rise, temperature, rainfall and wave height tendencies, where sea level rise and temperature tend to increase linearly or exponentially. The height of inundation and the coastal inundation area over the next few decades can also be estimated. Because the nature of the increase tends to be linear or exponential, insurance coverage will tend to exclude protection due to rising temperatures and sea level rise. Meanwhile, rainfall and wave height tend to fluctuate. Due to this fluctuating tendency, the elements of rainfall and wave height can then be considered as unpredictable. So, there is the possibility of implementing insurance coverage for impacts related to rainfall levels and wave height.

An illustration of the inability to implement an insurance scheme can use the example of coastal inundation due to sea level rise. In the first few years, it can be expected that the property will not be flooded. Starting from a particular year, after 15 years for example, the property will start to be inundated. This event will always last for an indefinite amount of time. Insurance products are not designed to cover property where the loss or damage does not occur during the initial period (a few years), and then the loss and damage persists for a continuous annual period.

Insurance coverage can be provided for an event which is likely to occur in the first, second and subsequent years, and is random. This means that there could be opportunities for events to occur in the first year and not in the second year, or vice versa. For example, car damage or ship accidents at sea..

Insurance Coverage Exclusions for High Tide

High tide is an event that can be predicted in advance. The high tide (that could subsequently leads to tidal flood) is a monthly recurring which is affected by the position of the moon to the earth (full moon). The sea level rise due to climate change that comes with high tides increases the height of the inundation and the reach of sea water to the land.

Insurance industry differentiates between floods that caused by rainfall and river runoff, and floods in coastal areas that caused by high tides. Some insurance companies in Indonesia have declared impacts caused by tidal floods as events that are not covered by insurance products, especially for impacts caused by permanent coastal inundation. However, not many people are aware of this information, including insurance customers and insurance marketing staff. The government encourages the public to submit claims for damage to agricultural land due to tidal inundation, but there has been no further news regarding these claims^{cxii}. An example of insurance product that excludes impacts of inundation from high tides is Fisheries Insurance for Small Fish Cultivators (APPIK) and insurance for Contractors' Plant and Equipment (CPE). Further discussion on the tidal flood that is excluded from insurance coverage can be found in Appendix 11 (a).

Climate change increases the risk of loss and damage. This condition will be followed by the increasing of insurance premium, which will potentially be reducing the interest on insurance products. In the long term, along with the decreasing demand, the particular insurance product will be diminished.

The high increase of insurance premium and the increase risk of sea level rise are reported in several studies in the United States of America^{cxiii,cxiv}, England and New Zealand. The Federal Emergency Management Agency (FEMA) insurance program increased premium for buildings that located close to water bodies. Meanwhile the UK Government's Flood Insurance scheme will not protect properties located in coastal area that built after 2009. Developers and communities should have known for a long time about the climate change risks faced by buildings in the coastal area, so 2009 was set as the threshold. New Zealand is considering the same approach as the UK. Apart from that, a policy for spatial planning away from the coast is being planned. Further review is presented in Appendix 11(b).

4.3.2.3 The Challenges on the Management of the Affected Areas

Management of the Affected Areas can be implemented through ecosystem rehabilitation, strengthening physical infrastructure and relocation. Strengthening physical infrastructure aims to maintain the function of areas as residential area, industrial area, and others. Relocation can be an option if the exposure to hazards cannot be reduced, and the community and others continue to experience loss and damage throughout the year.

Coastal ecosystems, such as mangroves, play a role in reducing exposure to extreme weather. However, mangrove ecosystem cannot prevent damage and loss caused by sea level rise and high tides. Exposure to the hazards of sea water, which is gradual, causes coastal ecosystems to gradually and slowly experience damage, erosion and sinking. A number of regencies and cities on the coast of Central Java are clear examples for this situation.

Strengthening physical infrastructure to overcome the impact of coastal inundation requires a large budget and is generally beyond the financial capacity of the Local Government. The sea wall stretching on the coast of Semarang City to Demak Regency which is being built by the Central Government is one example. The aim of the sea wall is to protect the land from sea water and also function as a toll road. This infrastructure development is part of the 'Large Coastal Protection Project for Five Cities on the North Coast of Java' listed in the Ministry of Public Works and Public Housing's (MoPWPH) Strategic Plan 2020-2024. This kind of large infrastructure development is not implemented by the Local Government due to its large budget.

Even though it aims to protect coastal areas from Semarang to Demak Regency area, large infrastructure development like this is estimated to have the potential to cause new issues. The coastal ecosystem behind the sea wall will die and disappear because it is cut off from the flow of sea water. Sea wall which dispel the energy of waves and ocean currents will channel this energy to the surrounding coast. The higher waves and sea currents experienced by the coast around this infrastructure will resulted in erosion. Community's testimony states that sea water levels on the coast of Pekalongan are increasing following the construction of sea wall along Demak Regency to Semarang. A similar phenomenon was reported by people in other coastal areas outside Semarang two decades ago, after the construction of jetty facilities at the port in Semarang City.

Beach embankments are a short- or medium-term solution. The coastal protection built in the Muara Angke-Muara Baru area, North Jakarta is starting to experience cracks in several parts. The sea water level at high tide almost reaches the height of the embankment. Water has passed the surface of the embankment several times. In the next few years, sea levels accompanied by high tides will exceed the surface of the embankment.

Challenges on Land Availability for Settlement Relocation

Relocation on a hamlet and village level due to hydrometeorological hazards have been carried out, one of which was for communities affected by tidal flood in Demak Regency and those affected by coastal erosion at Amurang Beach, South Minahasa Regency. Relocation on a limited and widespread scale is also conducted independently by communities affected by landslides, and also flood and coastal inundation.

At this moment, there have been no reports of relocation conducted by the Government for the communities on small islands that affected by sea level rise. The availability of suitable land is the main challenge for relocating the communities that affected by coastal inundation. The communities certainly expect the location close to the original settlement area, which also not vulnerable to high tide. Not only that, the communities also expect the livelihood activities can still be continued in the new relocation area.

The reality is that the Regency and City Governments in Java Island have limited land that suitable with those land criteria. Solutions from the Demak Regency Government for example, asking the community to find the relocation area

independently and provide fund for the communities to build their houses. Meanwhile Uninhabitable Housing Program (RTLH) managed by the city/regency governments to rehabilitate and reconstruct slum houses also can be used to support the relocation.

On the one hand, the Central Government (through MoPWPH) has the budget or program to build a new simple house, one of which is flats. However, the new housing program must be built in the land that belongs to the local government or privately owned. This program is not allowed to be provided for building in the Village Treasury Land. This regulation must be revised so it can expand the availability of land for relocation. Further discussion regarding land limitations for relocations is presented in Appendix 12.

The affected communities need to accept the possibility of relocation out from the affected administration area (relocation between regions), if they would like to have a new land that is safe and not far from the coast. However, it is not easy to find available land in urban areas on Java island that fulfill those kind of criteria (safe and still close to the coastal area). Most of the available land that matches with those criteria are located in the rural areas on Java island and outside Java island. Hence, the relocation for the communities affected by climate change needs to become a national program.

The land that suitable in terms of number and quality must be prepared to face the needs for relocation of communities affected by climate change, which will increase in the near future. The national program is required to provide land reserves, or what we called land banks. DKI Jakarta Government has planned to have land bank for development activities at provincial level starting in 2022. The available land will be used to build residential areas, open green spaces, reservoirs and other purposes that have not been determined by DKI Jakarta Government.

At national level, the establishment of Land Bank Agency in 2021^{cxv} was intended to guarantee the availability of the land for public interest, social interest, national development interest, economic equality, land consolidation and agrarian reform. The establishment of Land Bank Agency through Presidential Regulations No. 113 Year 2021 is referring to the Job Creation Law (Omnibus Law) that provokes controversy. With the cancellation of the Job Creation Law by the Constitutional Court on 25 November 2021, Government had issued Government Regulations In Lieu of Job Creation Law which revise and continue the regulation. Further information on Bank Land Agency can be found in Appendix 13.

On the side of legal formalities, Presidential Regulation No. 113 Year 2021 refers to the legal basis that is being debated. However, in principle, the need for a land bank that is organized fairly and transparently for the communities affected by disasters and climate change is indeed needs to be prepared from now on.

4.3.2.4 Challenges on the Environmental Management Framework

The environmental management policy in Indonesia has numbers of instruments and measures that are relevant to address the loss and damage from climate change, among them are: climate responsive spatial planning, moratorium and conservation. Considering the impact of climate change on biodiversity, the in-situ and/or ex-situ

protection and also preservation of the genetic code or gene banks are also need to be considered.

a. Challenges on Climate Change Responsive Spatial Planning

Mainstreaming of hazards, vulnerabilities, and climate risks into spatial plans and development plans is mandated in Law Number 32 of 2009 on Environmental Management. Based on the Strategic Environment Assessment (SEA/KLHS) Guidelines (Government Regulation Number 46/2016) and Minister of Environment and Forestry Regulation Number 69/2017, the contents of the KLHS Study include, among other things, estimation of environmental impacts and risks, as well as levels of vulnerability and adaptive capacity to climate change. Thus, spatial planning requires climate projection information.

Development activities are still planned and implemented in areas with high climate and disaster risk. The local government has not comprehensively integrated the result of climate and disaster risk assessment into development plan and spatial plan. In many cases, these conditions caused by the inability of the local government in assessing the climate risk and analyzing the climate resilience, which rooted from the limited capacity as well as data availability issue. On the other hand, the regulations order the utilization of climate projections for development planning and spatial planning. The projections of climate parameter down to regency/city level, including sea level rise and rainfall/water resources availability, are not available in most areas. This is a challenge in integrating climate change into spatial planning.

Guidelines for incorporating disaster risk and climate change into spatial planning were prepared by the MoAASP in the 2017-2018 period^{cxvi}. In 2019-2020, the guide is still in draft version. Meanwhile, the process of preparing a technical design for the mainstreaming of disaster risk and climate change into spatial planning was prepared separately by the MoAASP. It will be difficult to mainstream disaster risk and climate change in two separate spatial planning processes and documents, for regency and city governments, as well as provinces that have limited budgets and human resources.

Therefore, the MoAASP made a breakthrough through Government Regulation Number 21/2021, where KLHS was then integrated into technical material in the Regional Spatial Plan (RTRW). Articles 60-84 in PP no. 21/2021 states that KLHS is no longer prepared as a separate document from RTRW. Considering the regulation of coastal areas within the RTRW, thus the KLHS content related to risk and vulnerability analysis becomes increasingly important. In the process, the validation of KLHS documents is done by KLHK. Specifically, for the Provincial RTRW, the technical material for coastal areas that is integrated into the RTRW must have received technical approval from the Minister of Marine and Fishery. The mainstreaming process of climate change into the content of spatial plan is presented in the infographic in Appendix 14.

b. Challenges on Implementing the Natural Resources Moratorium

Moratorium aims to provide an opportunity for affected ecosystems to recover. The example of natural resources moratorium is most suitable for coral reefs affected by El Nino anomaly^{cxvii}. However, generally it can be said that the coral reef moratorium faces multiple challenges. First, to be able to implement moratorium, it requires at least (i)

Knowledge on the impact of weather anomaly/extreme weather on coral reefs, (ii) Budget and human resources to monitor the impact right after the weather anomaly/extreme weather occurs, as well as (iii) Budget to compensate the communities who rely on the fisheries and tourism around the coral reef ecosystems, during the moratorium period. The second challenge is that most of the parties who managing the coral reefs more often than not do not (or only minimally) possess those three resources^{cxviii}. The needs and challenge must be managed and addressed in order to ensure an effective and optimal moratorium.

Monitoring of the impact of weather anomalies on coral reefs is still minimal. The APBD and APBN, that planned one year early, do not anticipate this weather anomaly phenomenon. Unexpected Expenditure ('Belanja Tidak Terduga') budget items in the APBD and APBN have the potential to be used in these conditions. Disaster status must be declared before using this Unexpected Expenditure budget. However, the impact of extreme weather/weather anomalies on living resources has never been part of the criteria in declaring disaster status in Indonesia. Even when disaster emergency response is established to anticipate drought hazards, the impact on living resources is not part of the concern. Limited budget and knowledge of resource managers can be the reason for the limited response on impacts on living resources.

To be able to conduct moratorium, the challenge on budget mechanism must be addressed first. The limited knowledge and budget mechanism challenge also result in minimal monitoring of the impact of weather anomalies on coral reefs. Most monitoring after an El Nino event is implemented by CSOs through donor-funded programs.

Further, the moratorium should be complemented by the provision of compensation to the local community. Local fishermen and tourism actors depend on coral reef ecosystems and marine fisheries. During moratorium, they will lose access to these resources and will decrease their income. Compensation then needs to be provided as a form of Social Protection. The budget can be planned in the following year's local budget if time is available for planning. Other funding mechanisms that are faster and more flexible need to be developed. Among the option is to channel funds through a trust fund (Public Service Agency or Trustee according to regulations).

c. Challenges on Conserving the Vulnerable Species

Conservation instruments are relevant to maintaining as much as possible the threatened and the critical condition species. Considering the feasibility, protection can be implemented within the natural habitat (in-situ) or outside the natural habitat (ex-situ). This kind of protection approach is not a new idea in conservation. For example, conservation of one-horned rhinos and anoa. Protection within the original habitat is conducted if the habitat condition supports this, including the aspect of climate and human disturbance. If knowledge and technology have developed in the future, population recovery can be conducted. The same approach can also be done by storing the genetic code samples of dead species.

The Government needs to decide on prioritized species to be protected from the impacts of climate change. The selection can be based on the following criteria, among others: impact coverage, size and their role to a broader ecosystem as well as to food security. Challenges in the implementation of conservation, apart from funding and

human resources, are mainly due to limited knowledge regarding the impact of climate change on biodiversity.

There has yet to be a government program, especially that of MoEF/KLHK, that specifically designed to monitor and study the impact of climate change on biodiversity or the loss of certain species. Nor PBI documents or the 2020-2024 National Strategy of MoEF/KLHK mention this matter. However, programs of several MoEF/KLHK's directorates will directly and indirectly have an impact on maintaining and increasing biodiversity.

Prioritizing biodiversity can be done if there is knowledge about the impacts of climate change. An impact study also needs to be done beforehand. Again, it is important to determine which species and ecosystems are priorities for the assessment.

The minimum effort that can be made is to take inventory and preserve samples of species in Indonesia. Species inventory is an ongoing program at the Directorate General of KSDAE (Conservation of Natural Resources and Ecosystems) - MoEF/KLHK. This preservation inventory activity can record and store the genetic code of Indonesia's biodiversity in a genetic bank. With the development of knowledge and technology, the aim of preserving this biodiversity is for future use.

4.4 Stakeholders in Addressing Loss and Damage from Climate Change

4.4.1 Key Ministries and Institutions

A small number of ministries/government agencies play an important role in designing and leading the implementation of several options of strategy to address loss and damage due to climate change. The MoEF/KLHK, BAPPENAS and the Ministry of Finance will have important roles in implementing several strategies. Meanwhile, the Ministry of Social Affairs, MoAASP/ ATR/BPN, NDMA/BNPB, and a number of sectoral ministries (MoMF/KKP, Ministry of Agriculture, MoPWPH/PUPR) will play a role in supporting the implementation of the loss and damage management framework. Additionally, the MoEF/KLHK will be much involved in efforts to address the slow onset loss and damage.

Table 9 Government Institutions and Ministries are Relevant Keys for Addressing Loss and Damage from Climate Change

Agency	units	Addressing Framework
MoEF/KLHK	Directorate General of Climate Change/Directorate of Climate Change Adaptation	Spatial planning (specifically for KLHS-related aspects)
	Directorate General of Conservation of Natural Resources and	Conservation

	Ecosystems (KSDAE)	
	Directorate General of Climate Change/Directorate of Climate Change Adaptation	UNFCCC negotiations
MoMF/KKP	Directorate General of Marine Resources and Fisheries Supervision	Conservation: Moratorium International Cooperation
	Directorate General of Capture Fisheries, BLU-LPMUKP	Adaptive Social Protection International Cooperation
Ministry of Agriculture	Director General of Plant Protection	Climate Insurance
BAPPENAS	Directorate of Poverty Reduction and Community Empowerment	Adaptive Social Protection
Ministry of Social Affairs	Directorate General of Social Protection and Social Security/Directorate of Social Protection for Victims of Natural Disasters	Adaptive Social Protection
MoPWP/PUHR	Directorate of Housing Implementation System and Strategies	Relocation: Housing Implementation
NDMA/BNPB	Deputy for Emergency Management	Adaptive Social Protection
Ministry of Finance	Fiscal Policy Agency (BKF)/BPD LH	Adaptive Social Protection
	Fiscal Policy Agency (BKF)/BPD LH	Climate and Disaster Insurance
MoAASP/NLA (ATR/BPN)	Directorate General of Spatial Planning	Spatial planning

	Directorate General of Land Procurement and Land Development	Relocation: Management of Reserve Land
Ministry of Foreign Affairs		UNFCCC Negotiations, and International Cooperation
Financial Services Authority Body	Non-banking Finance Sector	Climate and Disaster Insurance
Local government	Local Planning Agency (Bappeda), Public Works Agency, and Human Settlement Agency	Relocation: Land Acquisition and Settlements

MoEF/KLHK is the key institutions in implementing climate change adaptation and mitigation. This ministry is the most relevant for Spatial Planning policy (specific for KLHS-related aspect) and conservation. The MoEF/KLHK is also the focal point of the Government of Indonesia at UNFCCC conference and responsible for reporting the progress of Indonesia’s commitment in addressing the climate change, so they will be relevant for strategy related to UNFCCC negotiations. In addition to that, the MoEF/KLHK must also ensure that climate change is taken into consideration in spatial planning, as well as being a key agency for biodiversity protection in Indonesia.

BAPPENAS along with several Ministries/Institutions is responsible for developing climate change mitigation and adaptation plan. Other than that, BAPPENAS is also responsible for developing Adaptive Social Protection plan together with several Ministries/Institutions and international development partners (GIZ, UNICEF, UNDP, and WFP). NDMA/BNPB and the Ministry of Social Affairs are considered as will be able to support the implementation of this scheme. Meanwhile, the Ministry of Finance plays a role in determining the financing policy for the implementation of Social Adaptive Protection plan. There is a possibility for the Public Service Agency (BLU) – particularly the Indonesian Environmental Fund Management Agency Fund (BPD LH) – that established by the Ministry of Finance to mobilize and distribute this financing scheme¹.

The MoAASP/NLA (ATR/BPN), specifically the Directorate General of Spatial Planning, is responsible for national spatial planning and developing a guidance for local government to develop their local spatial plan. Together with the MOEF/KLHK, they foster the integration of disaster and climate change aspects into local and national spatial planning.

¹ At the time this study was conducted, the Indonesian Government was in the process of developing a Disaster Risk Financing and Insurance scheme under the Ministry of Finance; and up until this study was finalized, the scheme had not been fully published and operationalized.

In the future, the provision of land for relocation of the affected communities will also involve MoAASP/NLA (ATR/BPN). Providing reserve land has the potential to be a solution for relocation issue related to land availability.

The MoPWPH/PUPR is the ministry with the largest budget expenditure compared to other Ministries/Government Agencies for activities under climate change adaptation category, especially for the construction of agricultural irrigation infrastructure, reservoirs and embankments. The MoPWPH/PUPR can play a role in developing housing for poor people, slum settlements and those affected by disasters. This role is implemented together with the Regency/City and Provincial Governments, as well as NDMA/BNPB and the Ministry of Social Affairs.

By law^{cxix}, BMKG is the sole agency that is responsible for monitoring in almost all climate components. However, it is not the main role of BMKG to develop projections of climate change hazards. This is largely due to the fact that the APBN does not provide a routine budget for climate projections. As a result, BMKG only make atmospheric projections (temperature and rainfall) based on requests from other parties. Meanwhile, climate projections for maritime aspects (such as sea level rise and wave height) for the national climate change adaptation plan are implemented by a handful of experts from higher education institutions (such as Bandung Institute of Technology/ITB). BMKG has not demonstrated its capacity to conduct climate projections for maritime aspects^{cxx}. Climate projections are currently only available at the macro level (national and large islands), while more detailed projections down to the city/regency level are still minimal. Ideally, the formulation of spatial plan for coastal areas requires projections of sea level rise up to the regency/city scale.

With minimal knowledge regarding climate change impacts, especially on living resources, BRIN must take a larger role. Together with BMKG, BRIN also needs to take a role in providing climate projection data for various parameters for all regions of Indonesia. BRIN needs to take a leading role in international dialogue and cooperation within the framework of Loss and Damage at the UNFCCC negotiations, together with the MoEF/KLHK.

Further review on the role of Ministries and government institutions (including a number of sectoral ministries) is presented in Appendix 16.

4.4.2 Civil Society Organizations

There are a large number of civil society organizations (CSO) and individuals conducting climate change adaptation programs at the village/community level. The same goes for disaster management activities. However, only a small number of organizations are involved in the development of climate change policies and programs at the national level. There are more organizations that focused on disaster management program and policies at the national level compared with those who are focused on climate change. It can be seen from the participation in developing Disaster Management National Plan, Disaster Management Master Plan, as well as 2013 RAN API and PBI.

Most climate change-related activities conducted by CSOs in the last decade, cover climate vulnerability and risk assessment in village and regency/city level; assistance in

developing adaptation plan at village level; the introduction and technical assistance for climate-smart agriculture; coastal ecosystem rehabilitation through reforestation; water catchment areas restoration; and preparation of urban resilience plan.

Technical assistance for climate-smart agriculture at the village/community level is provided by a large number of development organizations and humanitarian organizations. Restoration of coastal ecosystems and water catchment areas by planting trees is implemented by environmental organizations, humanitarian organizations and development organizations. Almost all programs are aimed at addressing the impact of extreme weather on human, agriculture, marine fisheries and health. Only a handful of organizations have the capacity and have assisted the local governments to conduct risk assessments on the long-term impacts of climate change. Climate projections are conducted by experts from universities (usually from ITB and IPB University) under the umbrella of climate resilience programs that funded by international donors.

It is difficult to name up to five CSOs who are actively conducting policy dialogue on climate change adaptation plans. Engagement in policy dialogue usually coincides with the existence of relevant climate change adaptation projects. Funding and human resources are generally no longer available when the project ends. A number of individuals continue to be involved in climate change adaptation policy dialogue by representing different organizations from time to time.

Mercy Corps Indonesia, ICLEI, APEKSI, URDI were involved in the process of preparing the National Action Plan for Climate Change Adaptation (RAN-API) in 2012-2013 period. The ACCCRN program of Mercy Corps also supports the Government (BAPPENAS) in the dialogue process and preparation of a city resilience plan pilot project. During the PBI preparation process in 2017-2020, the involvement of some organizations was lessened. There are a small number of organizations involved in the rest of the process. The USAID-APIK program supports the government (BAPPENAS and MoEF/KLHK) in preparing PBI documents and other adaptation policies at the national level.

Discussions on the preparation of adaptation plans tend to be technocratic, theoretical and future projections. It is not easy to play an active role in such a theme. Discussions on the four affected sectors (agriculture, health, water resources, coastal and marine) largely involve universities and ministries/institutions. Policy dialogue during the formulation of the climate change adaptation plans is also minimally/never attended by the private sector. However, the private sector is involved in dialogues on certain themes related to climate change. Insurance is a theme that always involves the private sector.

In contrast, more CSOs are involved in national policy dialogue for disaster management. Lessons from implementing disaster management activities makes many parties are able to participate in the dialogue. The disaster management community has a forum for dialogue and coordination, including through the National Platform (PLANAS) and the Indonesian Disaster Concern Society (MPBI). Disaster events that often occur in Indonesia also make communication more incentive.

Opportunities for coordination and dialogue among climate change adaptation actors are very limited. The dissolution of the National Council for Climate Change (DNPI) and the Civil Society Forum for Climate Justice reduced the platform for coordination for climate change adaptation actors. Meanwhile, many civil society organizations are conducting dialogue and studies to reduce greenhouse gas emissions (climate mitigation).

The loss and damage from climate change are not a theme that the organization pays attention to. Currently, only Mercy Corps Indonesia is conducting studies and also is involved in dialogue with the MoEF/KLHK and participating in international negotiations (UNFCCC-Subsidiary Body Meeting). Apart from Mercy Corps Indonesia, there are at least three organizations currently carrying out activities that can support policy dialogue regarding loss and damage, namely IRID, CARI! and Samdhana. Brief information regarding the activities of the three organizations is presented in Appendix 17.

A number of strategies to address loss and damage due to the various impacts of climate change are provided in the previous section. A number of CSOs in Indonesia are considered relevant to support the implementation of these strategies. This identification is based on relevant experience and competencies for implementing the strategy to address loss and damage. Table 10 presents a number of relevant organizations.

Adaptive Social Protection is a new theme among the civil society organizations in Indonesia, although there are already a number of humanitarian organizations that have experience in implementing the ASP scheme. The implementation of this scheme will be conducted in conjunction with the existing programs/schemes, including the Family Hope Program (PKH), direct cash assistance and non-cash programs..

Table 10 Initial Identification of Relevant Civil Society Organizations to Support Efforts to Address Loss and Damage Due to Climate Change

Mitigation Framework	Relevant CSOs
Spatial planning	ICLEI, Mercy Corps, Kota Kita, RDI, URDI, PPI-ITB, RCCC-UI
Adaptive Social Protection	Individual consultants/college experts, humanitarian organizations
Conservation	A number of conservation organizations (CI, WWF, YKAN, etc.) and professional organizations (entomology, etc.)
Conservation: Moratorium	A number of conservation/marine organizations (YKAN, Terangi, WWF, WCS, etc.) and a number of humanitarian organizations
Climate and Disaster	Mercy Corps Indonesia, CCROM-SEAP IPB

Insurance	
UNFCCC negotiations	Mercy Corps, Samdhana, IRID
International Cooperation for Cross-border Impact	A number of organizations in the field of sustainable fisheries (DfW, TNC, KEHATI, WWF, etc.)

4.4.3 The Affected Private Sectors

The role of the private sector in climate change adaptation in Indonesia can be divided into 3 categories, which are (1) Product marketing and investment to reduce the impact of climate change faced by society and the government, including marketing of insurance for climate-induced disaster and climate-smart agriculture technology; (2) Channeling of funding to the community to address the impacts of climate change (known as corporate social responsibility (CSR) programs); and (3) The company's internal initiatives to address climate change impacts faced by their industry. The discussion regarding the role of the private sector in climate change adaptation efforts in Indonesia mostly presents information on CSR programs.

The role of the private sector in the first category is for commercial purposes. Investments for development and climate-responsive technology in Indonesia are almost entirely implemented by multinational companies and state-owned enterprises (BUMN). PT. Sang Hyang Sri, for example, develops and markets seeds that are tolerant to high temperature stress and inundation/waterlogging.

The Indonesian government encourages insurance companies to market climate insurance products for farmers and fishermen in Indonesia. The government provides subsidies for premiums, so that the involved insurance companies perceive this program as an investment to understand market demand. Currently, the climate insurance is still in early stages and has not yet provided benefits for companies^{cxxi}. Only a handful of companies are willing to start developing new insurance products, for example, at the moment Swiss Re is the only company that develop and market global insurance products to protect coral reefs from extreme weather events. This insurance product has not yet been marketed in Indonesia, but the United Nation Development Program (UNDP) and The Nature Conservancy (TNC) in Indonesia (Yayasan Wisata Alam Nusantara/YKAN) are currently reviewing the feasibility of this product. Further information regarding CSR programs and insurance development in Indonesia is provided in Appendix 18.

The private sector is also affected by the impact of climate change, which in turn has a collateral damage on the actors involved in the private sector's supply chain. Direct adaptation initiatives for companies that implemented by the private sector are included in their Business Continuity Plan/BCP. The climate change adaptation initiatives that covered in BCP are focusing on internal context, where most of it is unknown for public

and does not involve local communities. Although, the companies will actually receive greater benefits if there is collaboration with communities that face the same impacts.

In general, the private sector has knowledge about the hazards and impacts of disasters, and they have prepared disaster management initiatives. However, there is a lack of knowledge regarding long-term hazards and impacts of climate change. In order to maximize the private sector's involvement in addressing the impacts of climate change, it should begin by providing an understanding on the hazards and impacts of climate change in their operational areas. Private sectors have the opportunity to take part or financing the climate change hazards projection up into regency/city level or even into more detailed level.

Indirectly, the initiatives in addressing the climate change that supported by CSR programs have the same goals as BCP. The CSR programs of a number of insurance companies, oil and gas companies, as well as mineral extractive companies in Indonesia can be an example. The CSR program aims, among other things, to increase the capacity of community and the environment; and it has direct benefits in reducing company risks. Reducing climate risk that is similarly faced by the community and private sectors can be done by not only funding provision, but also by collaborative planning and taking joint actions.

One of BCP examples is the the Indonesian Partnership for Sustainable Agriculture (PISAgro) program^{cxix}. Collaboration between companies and communities can also be seen in the marine fisheries sector, by involving communities involved in fishing (production). Although currently this collaboration is based more on the company's interest in ensuring responsible fishing by their supplier and ensuring them to be accepted by the market, and is not yet fully motivated by joint efforts to address the impacts of climate change.

5. Conclusion

5.1 General Conclusion

Climate change has resulted in loss and damage in natural resources, infrastructure, human being and assets. This loss and damage are caused by changes in climate parameters that occur slowly over the long term as well as an increase in climate-induced disasters such as hydrometeorological disasters that strike instantly over a short period (rapid onset). Despite the understanding that loss and damage arise from the two causal characteristics above, but the available data, studies and efforts to address loss and damage from climate change currently still focus on rapid onset hydrometeorological disasters; both in Indonesia and at the global level. Attention to addressing the impacts of long-term climate change (slow onset) is still relatively minimal, including attention to adaptation initiatives as well as addressing loss and damage on living resources, such as the biodiversity.

Limited data and studies are challenges to understanding the slow onset climate change impact, especially on a number of living resources, both at the ecosystem and species levels. As a result, it is difficult to implement effective initiatives in addressing the loss and damage. The loss and damage to non-living resources (physical environment) that are clearly visible—such as coastal erosion, inundated coastal areas and small islands—tend to be addressed first.

Thus, strategies and measures to address loss and damage caused by hydrometeorological disasters (rapid onset events) are relatively more prepared than those caused by slow onset phenomena. The disaster management framework for this rapid onset event is ready in terms of the data and information availability and monitoring, institutional context in addressing the impacts, as well as funding sources and mechanisms to address the related loss and damage.

As a country that is vulnerable to climate change impacts that faces resources limitation issue, especially at the local level, Indonesia needs to understand the potential for loss and damage that will occur in various regions as a result of climate change impacts, especially the slow onset phenomenon. The identified institutional gaps also need to be dealt so that coordination in addressing loss and damage in the context of climate change and disaster risk reduction can be implemented in synergy. Strengthening the related assessments to better understand the limits of adaptation as well as to have a better clarity on the governance to address Loss and Damage, is something that needs to be fostered.

5.2 Specific Conclusion

Below are the main conclusions on each topic discussed within this particular study:

- Monitoring of Climate Change and its Impacts
 1. Monitoring on slow onset impacts of climate change, such as impacts of sea level rise, air and sea temperature rise, is very limited. On the other side, knowledge on rapid onset events' impacts, including impacts to the living resources is available.

For example, there is impact assessment of weather anomaly on coral reef and marine fisheries sector that conducted on several El Nino events; meanwhile, there is minimal assessment on impact of long-term temperature changes on coral reefs, marine fisheries and biodiversity.

2. The assessment of climate change impacts on living resources (ecosystem, species and biodiversity) in land, coastal, and ocean are very minimal/or even not available. Meanwhile impacts on physical ecosystem is more visible and the relevant monitoring is carried out.
 3. There is institutional gap in terms of actors who monitor some climate parameters and climate change impacts. The most prominent institutional gap is on climate change impact monitoring in coastal areas and oceans. There is no institution that states/is stated by law as responsible for providing data related to climate projections (sea level rise), coastal inundation area, and inundation rate in small islands. There is no analysis of changes in sea water acidity and salinity that is necessary to understand the impacts of climate change on coral reefs and other marine biota. It is not part of BMKG's main task to monitor ocean acidity.
 4. The National Innovation and Research Agency (BRIN) is one of institutions that has the potential to strengthen the coordination of research planning and implementation in Indonesia, which then will improve the effectiveness of data collection and assessment to monitor climate change and its impacts. Despite the potential, this institution still needs time to consolidate its institutional structure and working mechanism. This can delay the needed assessment.
- **Gaps on Climate Adaptation Efforts**
 1. Currently, adaptation efforts only implemented for some climate change impacts. The efforts on agriculture sector, for example, only cover food crops (rice). No plan for adaptation efforts upon climate change impacts that are not yet understood.
 2. Less than 5% of total regencies and cities in Indonesia that have climate projection analysis. The analysis generally covers up to integrating the results into the spatial plan and development plan in city and regency. However, several climate projections analysis that have been conducted only encompass atmospheric aspects (temperature and rainfall), while analysis of sea level rise projections is not available.
 - **Economic Loss Assessment**
 1. Most of the data on loss and damage from climate change comes from data that collected under the disaster management framework. This data comes from hydrometeorological disasters (floods, landslides and others), and is a historical data. Data on loss and damage from climate change that occur slowly over a long period (slow onset) are still limited.
 - **Unclear Governance on Coastal Inundation**
 1. Loss and damage have been experienced by several coastal areas in Indonesia, mainly in the northern coast of Java Island which is a lowland area. The loss and

damage have the potential to become a more widespread and arduous climate issues in Indonesia.

2. Historically, coastal inundation has repeatedly occurred in the lowland area of the North Coast of Java, and it can be caused by high sea tide (tidal flood), sea wave, rainfall or one of them. This inundation has caused significant impacts. However, the current way of addressing the coastal inundation has exhibited a gap in tackling slow onset climate change events. This inundation event is not included in the disaster category, despite loss and damage are occurred from the events. Moreover, often there are doubts when addressing the coastal inundation using a disaster management framework in Indonesia. If disaster status is not determined, then the “Read-to-Use-Fund” budget cannot be disbursed to manage emergency situation, such as managing inundation in coastal areas.

- Loss and Damage from Climate Change

1. Despite implementing adaptation initiatives, there are still residual impacts caused by climate change. The lesser and ineffective adaptation initiatives implemented, then the bigger and broader the potential loss and damage will be.
2. The potential impacts on living resources are almost unavoidable, so it has the potential to cause loss and damage on these resources, which can include, among other things: biodiversity loss/depletion, mortality and declining diversity on coral reefs, pattern changes on fish migration and spawning area, as well as declining diversity and growth of marine species. The effective and appropriate options to address these loss and damage are still unidentified due to the minimal studies in these sectors.
3. The knowledge on adaptation limit is required in order to identify the potential loss and damage associated with climate change impacts in Indonesia, particularly on slow onset events.
4. The interconnectedness of the concepts of loss and damage between the scope of disaster risk reduction and climate change strengthens the need for synchronized governance of Climate Change Adaptation and Disaster Risk Reduction (API-PRB). Synergic governance will be the basis for formulating Governance for Addressing Loss and Damage in Indonesia. The API-PRB convergence initiative has been initiated in the past, but it was vacuum for quite sometime up until now.

- Options in Addressing Loss and Damage

1. By considering the characteristics of loss and damage from climate change, there are several options of policies and approach that can be taken to address them, as follow: **(1) Management of Affected Areas**, through ecosystem rehabilitation, construction of physical structure for coastal protection, settlement relocation and spatial planning, **(2) Adaptive Social Protection Scheme (ASP)**, **(3) Environmental Management Policy** which covers conservation, genetic bank, and natural resources moratorium, **(4) Risk Transfer**, such as through climate insurance, **(5) International Diplomacy/Dialogue** for loss and damage that is cross-border as well as that related to state border, **(6) Community and private sector partnership through Business Continuity Plan (BCP)**, and **(7) Strengthen Climate Change Adaptation** initiatives.

2. ASP and climate insurance are suitable to be applied on the loss and damage that occur instantly over a short period of time (hydrometeorological disaster). However, those options/approaches need to be further assessed and developed on the loss and damage that occur slowly over a long period of time.
 3. Insurance has a principle to not provide coverage on impact that is predictable and occurs slowly over a long period of time. A number of insurance products in Indonesia even do not provide coverage against recurring coastal inundation (tidal flood) hazards. Sea level rise, high tide inundation and temperature rise are potentially exempt from insurance coverage. Having said that, loss and damage are a burden for the Government and community.
 4. The available options for managing areas affected by coastal inundation include ecosystem rehabilitation, settlement relocation, spatial planning, and construction of physical structure for coastal protection; where the first three options need to be implemented as one unit. The construction of physical coastal protection structures is a debatable option in Indonesia from a sustainability perspective.
 5. Financial strategies and instruments, including institutions and fund management mechanisms, that are being developed in Indonesia and at the global level, are mostly/almost entirely only suitable for rapid onset risks. For example, insurance schemes and other financial mechanisms are still only prepared to anticipate hydrometeorological disasters. A real gap exists in the availability of funding schemes for slow onset events.
 6. To address loss and damage, Indonesia may utilize/optimize the existing funding mechanism. However, adjustment to this current mechanism is still needed, especially related to the impact of climate change in Indonesia.
- Funding and Institutional Context
 1. Budget tagging since 2016-2017 shows that the state budget (APBN) fulfills only around 10% of the estimated budget needs for climate adaptation. This budget tends to decrease in 2019 and continued in 2020. Infrastructure development implemented by the MoPWPH/PUPR, especially related to water resources, dominates the financing of climate change adaptation activities in Indonesia, with budget use approaching 90% of the total budget categorized for adaptation to climate change.
 2. A number of activities under the climate change adaptation plan at this moment can be categorized as initiative to address loss and damage from climate change. The construction of coastal embankment and a number of other physical infrastructures, as well as subsidy for climate insurance premium are some examples of those adaptation initiatives. However, during the budget tagging process, the particular activities are tagged as expense for climate adaptation.
 3. BAPPENAS and MoEF/KLHK are the key ministries to carry out a number of options for loss and damage management framework that presented in this study. Several related-ministries and government institutions will play a supporting and implementing role.
 4. Funding under the disaster management framework is available for hydrometeorological and rapid onset geological disaster, through “Ready to Use

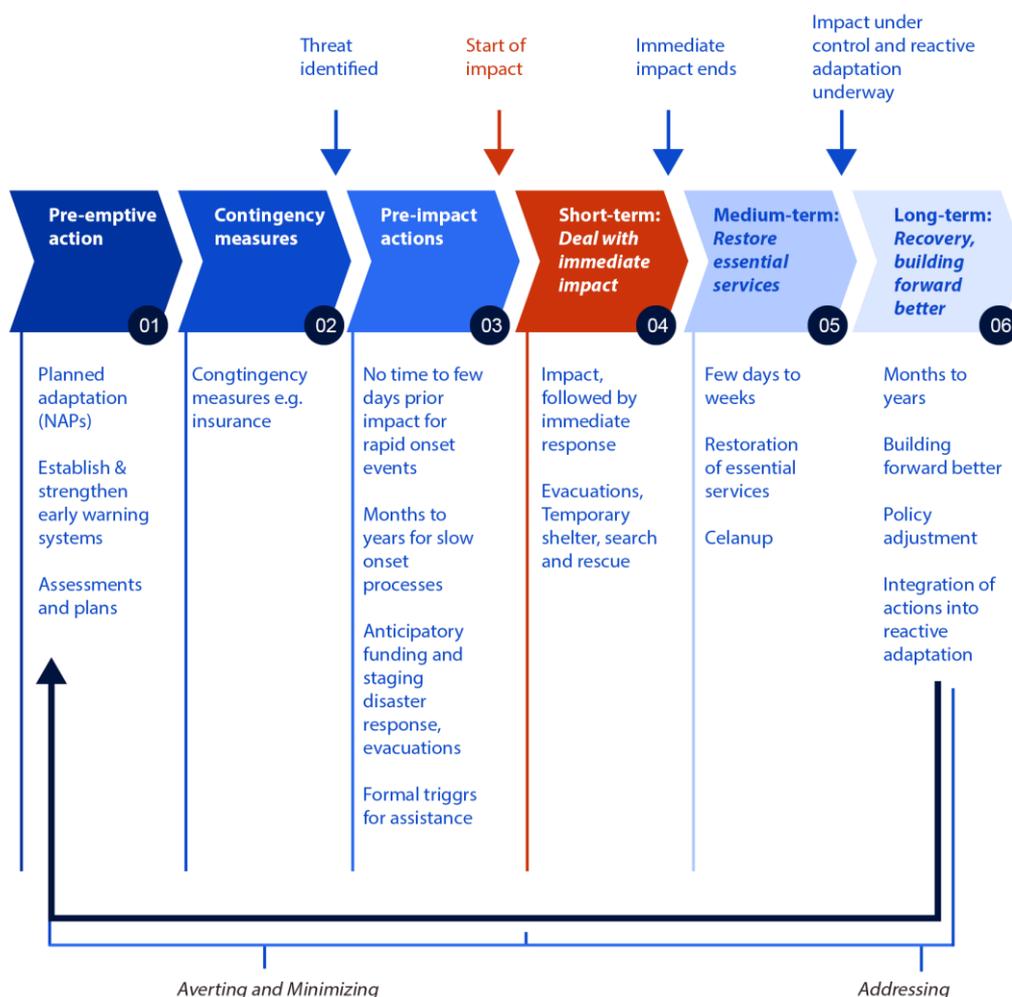
Fund” budget. Meanwhile, slow onset climate change is more appropriately managed through budget for planned activities.

5. Public Service Agency (BLU) is the appropriate institutional option for managing funding aimed at addressing loss and damage due to climate change. BLU can manage funding from various sources, including funding sources within the UNFCCC framework.

6. RECOMMENDATIONS

1. Understanding the spectrum phasing of strategies and initiatives in managing climate change impacts (as presented in the picture below) is of necessary. This spectrum will ensure that the strategies and steps taken in addressing climate change impacts are appropriate and in line with the needs.

Figure 1 Spectrum of Actions in Addressing Climate Change Impacts (UNFCCC, 2023)



2. Greater initiative is required for data collection, formulation of assessment, and implementation of initiatives to address loss and damage from climate change impacts that occurs slowly over a long period of time.
3. Specific studies also need to be implemented to determine the impact of long-term changes in temperature, rainfall and humidity on living resources (especially important species related to food security and health), the growth of the malaria and dengue vectors (mosquitoes), and on coral reefs and marine fisheries (especially on fish with high economic value).

4. Capacity building and funding increase is needed for developing climate projection, especially on sea level rise. These climate projections should be available for all regencies/cities so that the integration of climate change into development plan and spatial plan at the regency and city levels can be implemented in all regions of Indonesia, especially the coastal areas.
5. National Innovation and Research Agency (BRIN) needs to have a key role in carrying out climate change assessment. Coordination between Ministries and Government Institutions with BRIN is also required to plan for the development of climate change impact assessment needed by these Ministries and Institutions in order to address the impacts of climate change. BRIN involvement in technical discussions regarding loss and damage within the UNFCCC framework also needs to be fostered.
6. International cooperation is needed to study the impact of climate change on living resources (ecosystems, species and biodiversity). Such a cooperation is still lacking in Indonesia. Priorities need to be set for key ecosystems and species, including those that play a role in food security, in health and in the stability of the overall ecosystem.
7. Strengthening of legal regulations and coordination between ministries/government institutions is needed to provide a better clarity on the responsible actors for monitoring and analyzing loss and damage from climate change, especially in coastal and marine areas.
8. So far, the occurrence and impact of inundation from high tide is included in the "flood" category and the "tidal wave/abrasion" category. Floods, abrasion, waves and tides are four different forms of hazard. Therefore, it is necessary to create a separate category for coastal inundation caused by high tides in disaster data (DIBI).
9. Disaster management framework has gaps in terms of managing slow-onset impacts, where disaster status for these conditions is generally not determined. Hence a regulatory framework that can provide certainty for steps or actions to address loss and damage caused by slow onset events is needed. For example, for permanent coastal inundation caused by high tides. This incident has created significant loss and damage.
10. By considering the lack of knowledge regarding climate change impacts on living resources, the strategies to reduce pressure on ecosystems (or also known as increasing ecosystem resilience) are thus the right options that can be taken at present time.
11. The policy of "retreating from the coastal" is an option that needs to be planned from now on. This option reduces long-term economic and non-economic losses and gives coastal ecosystems the opportunity to adapt and grow towards to land. This policy indicates that climate change and disaster risks have been integrated into spatial planning, as mandated by the environmental management law.
12. Currently, it is difficult to implement Adaptive Social Protection (ASP) as a means to address the loss and damage caused by slow onset climate change. Other schemes need to be developed to protect vulnerable community that affected by climate change impacts in the form of slow onset events.

13. Permanent coastal inundation has occurred in several areas across Indonesia and relocation has been implemented to address it. The needs for relocation tend to increase in the future. The availability of suitable land for the potentially affected coastal communities also needs to be prepared early on. In certain cases, relocation between administrative regions is an inevitable option. The government also needs to prepare reserve land as part of a national program. To be able to plan for this, a study is required regarding the potential risk of permanent coastal inundation as well as the potential socio-economic impacts, including people displacement potential.
14. For the relocation context, the elements that need to be prepared are not only the availability of land, but also the preparation of a suitable business ecosystem for the relocated community (socio-economic rehabilitation). The challenges become greater if the affected people are fishermen who are used to living in coastal areas and depend their livelihoods in these areas. Yet, currently the institutional context and studies that needed to create the business ecosystem are not yet available.
15. Discussions need to be initiated to avoid the consequences of changing the outer boundaries of archipelagic countries due to the strengthening of small islands with coastal protection structures to anticipate sea level rise. Dialogue at the UNFCCC can be the beginning for further dialogue at UNCLOS.
16. International cooperation is essential to address loss and damage from climate change on cross-border natural resources, especially marine fisheries. This can be achieved by strengthening and integrating climate change into the existing international conventions, research collaboration and law enforcement for marine fisheries and global biodiversity.
17. Indonesia will have difficulties in the aspect of knowledge and funding to address loss and damage from climate change on biodiversity. This aspect has the potential not to be a priority for the Government. These gaps and challenges must be responded by global funding sources.
18. Indonesia and climate change-affected countries need to foster of how the financial mechanism to address climate change impacts should provide an equal portion for the slow onset impacts. The current framework discussion is focused on addressing the impact of rapid onset event such as hydrometeorological disasters.

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APPENDIXES

Appendix 1

Damage and Loss Assessment Instrument in the Disaster Management Framework

The disaster management framework conducts monitoring of the hazards and impacts of geological disasters^{cxixiii} and hydrometeorology disasters^{cxixiv}. Both types of disasters occur rapidly in a short period of time, or are known as 'rapid onset'.

Hydrometeorological disaster events are mainly carried out and reported by BPBD in each region and then managed by BNPB on the DIBI (Indonesian Disaster Information Data) platform.

There are three loss and damage assessment instruments for disaster management in Indonesia. Each of these instruments was used at different times. These instruments are the Disaster Risk Assessment, the Rapid Disaster Assessment and the JITU PASNA (Indonesian Post-Disaster Needs Assessment). In general, risk and impact assessment within the framework of disaster management is top-down from the global/national to the regional level. The guidelines and tools that have been determined by the National Disaster Management Agency (NDMA/BNPB) are then stipulated in regional regulations and used by the Regional Disaster Management Agency (LDMA/BPBD). The assessment guidelines and instruments contain in full the data that needs to be collected and the procedure for carrying out the assessment

a. Disaster Risk Assessment

Disaster risk assessment is an approach to seek the potential negative impacts that may arise as a result of future disaster events. Potential negative impacts that arise are calculated based on the level of vulnerability and capacity of the region. This potential negative impact is seen from the potential number of people exposed, loss of property, and environmental damage.

Disaster risk assessment provides information on the hazard level; vulnerability level; capacity level; disaster risk level value. Disaster management policies are prepared based on the results of studies and disaster risk maps. Disaster risk studies and disaster management plans are taken into consideration in the preparation of development plans and spatial plans.

The NDMA/BNPB Head Regulation states 13 disaster-prone areas in Indonesia consisting of geological, hydrometeorological, health, social and technological disaster categories^{cxixv}. Meanwhile, the National Plan for Disaster Management (Renas PB) contains 14 types of hazards. The Disaster Risk Assessment conducted by NDMA/BNPB as presented in the Indonesian Disaster Risk Index (IRBI) covers 9 hazards, namely: (1) Floods (2) Earthquakes, (3) Tsunamis, (4) Volcanic Eruptions, (5) Forest Fires and soil, (6) Landslides, (7) Extreme Waves and Abrasion, (8) Drought, and (9) Extreme Weather.

The nine hazards discussed in the IRBI are hazards in the context of anticipating the occurrence of quick extreme hazards (rapid onset). Other climate change hazards,

especially those that appear slowly/gradually in the long term (slow onset), are not presented in the IRBI^{cxvii}.

The hazard data used in disaster risk assessments is produced by a number of Ministries and Government Agencies, including BMKG, Ministry of Energy and Mineral Resources, Ministry of Environment and Forestry, and MoPWP/PH/PUPR.

The hazard, vulnerability and capacity components in the current disaster risk assessment are historical data. The Disaster Risk Assessment Guidelines do not regulate the use of climate projection data for disaster risk assessment. Suggestions from climate change and disaster management practitioners to incorporate climate projections into the hazard component have been submitted.

In the Disaster Risk Assessment, a loss assessment is carried out. Loss assessment is carried out on measurable aspects, namely in the process of assessing the Vulnerability Index (preparing a vulnerability map). Vulnerability assessment is divided into social, economic, physical and ecological/environmental vulnerabilities. The Vulnerability Assessment assesses the “assets” that are exposed to hazards, namely human life (social vulnerability), economic area, physical structure, and ecological/environmental area.

Most of the indicators used in the vulnerability analysis are exposure information. Exposure information includes population density, sex ratio, poverty ratio, disability ratio and age group ratio. The indicators used for social vulnerability are population density, sex ratio, poverty ratio, disability ratio and age group ratio.

The Loss Index is obtained from the economic, physical and environmental components. These components are calculated based on different indicators for each hazard. The calculated loss indicators include economic (productive land area, GRDP contribution per sector), physical (houses, public facilities, critical facilities) which are converted into Rupiah values.

The indicators used for physical vulnerability are the density of houses (permanent, semi-permanent and non-permanent), availability of public buildings/facilities and availability of critical facilities. The indicators used for economic vulnerability are the area of productive land (rice fields, plantations, agricultural land and ponds) and GRDP. The indicator used for environmental vulnerability is land cover (such as protected forest, natural forest, mangrove forest and swamps).

For social and psychological damage that cannot be measured quantitatively or cannot be converted into money, the Disaster Risk Assessment does not provide guidance on how to do so. The Disaster Risk Assessment Report can contain a narrative about those unmeasurable damage. However, this aspect does not affect the value of the Disaster Risk Index. Meanwhile, the disaster risk index is used as the basis for determining program priority locations. Locations with a high-risk index receive priority for disaster management activities.

Table 11 Period for assessing loss and damage in disaster management

Before		Ongoing (Emergency situation)	■ ■	After
Disaster risk assessment		Rapid Assessment Disaster Impact	JITU PASNA	

b. Rapid Disaster Impact Assessment

NDMA/BNPB developed the Rapid Disaster Impact Assessment, a simple instrument for assessing damage and losses during emergency response^{cxxvii}. A rapid assessment is carried out immediately after the disaster occurs. This study provides a brief description of what is needed to carry out Emergency Response activities, such as finding and evacuating victims, organizing public kitchens and emergency posts.

c. JITU PASNA: Indonesia’s Post-Disaster Needs Assessment

For a more complete disaster impact assessment, JITUPASNA was developed^{cxxviii}. This instrument is used to assess loss and damage and to develop post-disaster rehabilitation plans. Although Disaster Risk Assessments are available and contain information on loss estimates, the results of disaster risk assessments are often not used. Some of this information can be used by NDMA/BNPB or LDMA/BPBD as a complement to JITU PASNA.

The disaster loss and damage assessment is initially based on the Damage and Loss Assessment (DALA) developed by the World Bank. However, the DALA only contains information regarding physical damage and loss. Since 2009, after the earthquake in West Sumatra, the government has combined the application of DALA with the Human Recovery Needs Assessment (HRNA) developed by UNDP. HRNA also examines the socio-economic impact of the disaster on the community. The combination of DALA and HRNA later became the Indonesian Post-Disaster Needs Assessment, known as JITU PASNA.

The JITU PASNA assessment covers five sectors, namely (i) the housing sector including public housing infrastructure; (ii) the infrastructure sector includes transportation, water, energy, and telecommunications; (iii) the economic sector includes agriculture, agriculture, fisheries, trade, industry, small and medium enterprises, and tourism; (iv) the social sector includes educational, health and social protection institutions; and (v) cross-sectoral such as governance, security and social order, and the environment.

Assessment with the JITU PASNA instrument can only be carried out if the Government/Local Government has declared an emergency status. Therefore, JITU

PASNA is only used for rapid onset disaster threats. Disaster status has never been issued by the Government/Regional Government for climate change hazards that are progressing slowly/gradually^{cxxix}.

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Appendix 2

Damage and Loss Assessment Instrument Within the Climate Change Framework

The Indonesian government has not issued any guidelines for carrying out damage and loss assessments within the climate change framework. The Ministry of Environment issued a guide n Assessment of Risk, Vulnerability and Impact of Climate Change in 2018. Climate change practitioners can refer to this guide to develop instruments and carry out assessments. A number of practitioners/organizations have developed assessment methods and instruments, some of which were developed prior to the guidance from the ministry.

a. Guidelines for Assessment of Risk, Vulnerability and Impact of Climate Change

Guidelines for Assessment of Vulnerability, Risk and Impact of Climate Change issued by the Minister of Environment and Forestry (KLHK) in 2018^{xxxx}. This Ministerial Regulation is the only government regulation regarding guidelines for conducting climate change Vulnerability, Risk and Impact Assessments. This Ministerial Regulation aims to provide guidelines for the Government, Regional Governments and the community in: a. determine the scope of analysis, selection of methods, indicators, data indicators, and data sources in preparing the study of Vulnerability, Risk and Impact of Climate Change. Provisions regarding methods and data sources are adjusted to the scope of analysis, namely the macro level, mesa level, micro level, and site level.

Climate risk and vulnerability assessment requires climate projections for the next few years. Climate projections should be available for climate change risk and vulnerability assessment at each level of analysis (macro, mesa, micro). This is in stark contrast to the Disaster Risk Assessment issued by NDMA/BNPB, which does not require climate projections.

This guide provides very little discussion of climate change impact assessments. It only states that the impact analysis must be able to assess the Impact of Climate Change for selected sectors and areas by including at least information about the location; frequency; duration; and magnitude. This climate change risk and vulnerability guide contains minimum indicators that must be used for each risk component (hazard, vulnerability, and capacity). The guidelines open up space for a variety of indicators for each assessment component.

This Ministerial Regulation states that the preparation of indicators to measure the impact of climate change must be able to measure potential losses and/or benefits, at least physical indicators, social indicators, and economic indicators. Physical indicators consist of changes in production, changes in location or area of impact; and changes in frequency or duration. Social indicators consist of: behavior change; livelihood changes; economic indicators consist of changes in commodity prices and changes in the amount of income. The guidelines do not mention indicators of impact on the environment/natural resources. The assessor can develop an instrument that contains indicators of damage and loss to the environment/natural resources.

There are notable differences between assessments in the climate change and disaster management frameworks. The climate change risk assessment framework at the global

and national levels only contains general guidelines. Assessment instruments and indicators are developed by the executor by adjusting the context of the sector and location. Meanwhile, the disaster risk assessment guide contains almost complete indicators for each risk component, procedures for calculating and assessing risk indexes. Disaster risk guidelines, as well as Indonesia's PDNA/JITU PASNA, are regulated in a number of regional regulations. Little space is available for the diversity of regional disaster risk assessment instruments and implementation.

At the global level, the International Panel on Climate Change (IPCC) only provides general guidance on the components of climate change risk and the relationships between components. At the national level, climate risk components are discussed further, but this still leaves room for the development of indicators and instruments that are adapted to the sector and location context.

This guideline issued by the Ministry of Environment and Forestry does not provide a procedure for calculating and establishing an index for each component of climate risk and vulnerability. As a consequence, the results of climate risk assessments in a number of regions can be carried out using different assessment instruments.

There is scope for developing current climate change assessments. Knowledge about the impact of climate change in various sectors and certain locations still needs to be learned. Similarly, indicators are relevant for different sectors, respective hazards of slow climate change and specific locations. Freedom in making judgments is indeed the right choice at this time. Each manual contains detailed provisions which, while knowledge is still limited, will be impediments and irrelevant for the assessment of climate change risks and impacts.

b. Development of Climate Risk Assessment and Loss Assessment Instruments by Practitioners

Universities and international non-government organizations (or those that have turned into legal entities in Indonesia) are developers of climate vulnerability and resilience assessment instruments in Indonesia. ITB and IPB have been at the forefront in developing assessment guidelines and instruments since the 2008-2010 period. Mercy Corps Indonesia in collaboration with IPB developed and used assessment instruments in a number of cities and districts in Indonesia as part of ACCCRN Program implementation in 2008-2016 period.

Prior to 2016, the impact of climate change on humans and systems was assessed using the Vulnerability Assessment (VA) framework which refers to IPCC (2007). In the vulnerability analysis (VA) framework, the climate change hazard component is treated the same (score 1) in each location. Starting in 2015/2016, the climate risk assessment framework has been used in Indonesia, referring to the update of the IPCC assessment framework. This concept is an effort to harmonize climate change studies with the disaster management framework. Efforts to harmonize/converge climate-based disaster risk assessment were carried out through the SCDRR-UNDP program and the ACCCRN program prior to the 2015/2016 period. However, some organizations still conduct assessments using climate vulnerability assessment (VA) frameworks.

The climate risk approach looks at the various types and magnitudes of the climate change hazard components. The value is not uniform for each location. Threats in the Climate Risk assessment are projections of climate change components (sea level rise, rainfall and others). Initial use of the climate risk framework was carried out in the SCDRR-UNDP program in Sikka District and the ACCCRN program in Lampung in collaboration with the IPB team. Currently, there is no study that presents projections on the components of vulnerability and capacity.

Unlike the Disaster Risk Assessment which tends to be uniform in accordance with the Regulations of the Head of NDMA/BNPB, the development of instruments for assessing the risks and impacts of climate change is progressing at the study implementer (project/program level). The study of the risks and impacts of climate change in Pekalongan Municipality and Regency can be said to be the most recently developed instrument for assessing the risks and impacts of climate change. The method and series of indicators developed are more comprehensive than the minimum provisions stated in the Ministry of Environment and Forestry Regulations concerning Guidelines for the Assessment of Risk, Vulnerability and Impact of Climate Change.

c. Assessment on Coastal Inundation in Pekalongan Regency and City by Mercy Corps

The study of the risks and impacts of coastal inundation in the City and Regency of Pekalongan (2022) can be said to use the most complete instrument for assessing current damage and losses. This assessment was carried out by Mercy Corps Indonesia and partners as part of the Flood Resilience Alliance program funded by the Zurich Foundation. Projections are made on the components of hazard, vulnerability and capacity. Climate change hazard projections are carried out for two types of hazards that cause coastal inundation on the Pekalongan coast, namely rising sea levels and extreme rainfall. The study uses two climate change projections (the decadal projection and the RCP 4.5 projection). This could be the first and only assessment that provides projections on the three risk components.

This study identified a number of indicators for the three components that are relevant to local conditions and hazards. A number of indicators developed are more comprehensive than the minimal examples mentioned in the 2018 KLHK Guidelines. These have the potential to be used as a reference for risk and impact studies in various hazards and locations.

Coastal flooding in Pekalongan Regency and City has been going on for more than a decade. Sea water inundates the villages during high tide, lasting several hours a day, and several days a month throughout the year. High rainfall in the rainy season adds to the stagnation of water on the coast of Pekalongan. Land subsidence at a rate of several centimeters per year, due to exploitation of groundwater and soil suppression processes, increases the level of inundation. This study shows that in 2020 (base year) 36 out of 58 villages have a high to very high risk level. Apart from Pekalongan Regency and City, there are several other cities and regencies around the same coast (North Coast of Java Island) which were affected by coastal flooding, including Demak Regency, Semarang City and Tegal City.

The results of the spatial inundation modeling indicate that there will be significant permanent inundation changes in Pekalongan. Under baseline conditions, it will cover an area of 1,478 Ha and will reach 5,721 Ha at the end of the projection period (2035). By 2035, the farthest affected distances will increase to 8.5 km (for the decadal prediction) and 9.4 km (for the RCP 4.5 projection) from the coastline.

This study also assesses economic and non-economic losses using a monetary valuation approach in hotspot areas. Data for analysis were obtained from questionnaire data from 289 respondents in 42 villages/kelurahan. This study assesses 4 (four) components of loss, namely: i) Material loss; ii) Non-material loss; iii) agricultural land productivity; and iv) Ecosystem services. Losses are calculated for both the baseline year (2020) and the projection year (2035).

The calculated material losses include: adaptation costs to maintain living in the area, repair costs for damaged assets, medical expenses, additional costs for water, food, electricity, waste handling costs, as well as decreased income and increased business costs. Non-material losses that are taken into account include: mental/mental disorders and domestic violence (KDRT). Regulation of the Minister of Health Number 69 of 2013 concerning Standard Tariff for First and Advanced Health Services and IASC 2007 concerning Service Tariff is used as a reference for calculating the value of non-material losses for mental disorders. The quantification of the value of losses for disturbances to households refers to fines at each level of disturbance as stipulated in the Law on the Elimination of Domestic Violence No. 23 of 2004.

Calculation of the value of the decline in the productivity of agricultural land is carried out using the approach to the profit of agricultural land lost per year due to loss of agricultural land (due to flooding). The profit of agricultural land itself is calculated by taking into account: the annual productivity of rice fields and ponds, the average selling price and production costs; where the determination of the value used is based on the results of interviews with respondents and literature studies.

The calculation of the value of the economic loss of ecosystem services is only approached from the calculation of the recreational function of the affected ecosystem. Recreation costs are obtained using the Travel Expense Method (TCM). Limited data seems to be the reason for assessing damage and loss of ecological function of coastal ecosystems, both as a source of fisheries, as a buffer for the ecosystem as a whole and loss of biodiversity^{cxxxii}. Although other ecosystem functions have not been assessed due to data limitations, the use of indicators in this assessment showed a better attempt.

This study shows that the loss and damage due to flood inundation on the coast of Pekalongan is currently very large and is expected to continue to increase in the coming years. The overall quantified economic losses reach IDR 1.55 trillion per year (2020) for the community to maintain their settlements, livelihood activities and daily life. An in-depth study is needed to explore the community's considerations for surviving in such conditions, while a small number of community members have left the area. Obstacles faced by the government in implementing a permanent solution, namely adequate relocation according to the aspirations of the community, need to be examined in depth.

Of the four loss components assessed in the study, the Land Productivity Component (for paddy fields and shrimp ponds) is the smallest compared to the other components. This loss component is clearly assessed as the value of the loss per year. Meanwhile, the other three loss components (material, non-material and ecosystem services) can be in the form of multi-year costs. The calculation of the value of the loss also does not include the cost of adapting agricultural activities. This cost can be part of the loss of the Land Productivity Decline Component or the Adaptation Cost Component.

Appendix 3

Loss and Damage Assessment on the NDC Roadmap Document

The 2016 Nationally Determined Commitment document generally has targets for resilience in the economic, livelihood and ecosystem sectors. However, baselines and targets with clear quantification were not stated in the 2016 NDC. In the 2020 Updated NDC, more structured and measurable targets were then designed. The NDC Roadmap (2020) states that the instruments and tools for assessing climate impacts and risks are currently not yet integrated. The NDC document was prepared by the Ministry of Environment and Forestry.

Future impact projections in the Indonesia NDC Roadmap (2020) are carried out in the food, water resources, health, energy and disaster sectors. Analysis of the impact of climate change risks for NDC needs (2021 – 2050) was built using a model that uses historical climate data for 1990 – 2020 and other physical data with a 2010 baseline and uses sensitivity analysis to cover various existing studies. The analysis was carried out using average temperature data, Indonesia's National GDP, sensitivity analysis using projected changes in future air temperature, and changes in future rainfall.

The modeling of food crops in the 2020 NDC focuses only on rice plant types. The impact is assessed on puso conditions or crop failure during extreme weather. Calculation of food crop productivity is calculated based on the variable rainfall, High Degree Days (HDD), and Growing Degree Days (GDD). Modeling has not taken into account the components of vulnerability and capacity, including the presence of agricultural technology. Modeling is only carried out on the hazard component, namely climate factors and especially the chance of puso occurring due to climate-related disasters. The impact on corn, secondary crops and a number of plantation commodities is not presented. Loss data on a number of agricultural and plantation crops is not yet available.

An analysis of the impact of climate change on water availability is carried out by studying island-based regions, namely Java and Bali; Sumatra; Borneo; Sulawesi; Nusa Tenggara; Moluccas; and Papuans. The climate variable that has the most impact on water availability is rainfall. The assessment is carried out on household and industrial water needs, while the water demand for agriculture has been calculated when analyzing the food sector. The NDC document does not explain whether projections are made for changes in water demand for various sectors and projects to increase/decrease vulnerability in these sectors in the future.

The impact of climate change in the energy sector modeled in the NDC document is still limited to the use of household electricity which is assumed to be due to increased use of air conditioning and the potential loss of water availability for Hydroelectric Power Plants (PLTA). A more in-depth study and analysis needs to be carried out to assess the impact of climate change on the energy sector.

Losses resulting from increasing the number of disease prevalence in the future are seen in dengue, diarrhea, malaria, and pneumonia. The modeling was carried out with four possible conditions, namely due to changes in rainfall and temperature (using the RCP 4.5 projection of the CSIRO and MIROC models) as well as an increase in the

occurrence of floods, landslides and droughts. Modeling is done on the hazard component only, while projection or modeling is on the components

The incidence of this disease is not only caused by climate change, but also environmental conditions and other factors. Environmental damage increases the risk of floods, landslides and other disaster events. Furthermore, this occurrence increases the transmission of the disease. Infectious diseases that will emerge and spread during the rainy season and floods are acute respiratory infections (ARI), dengue, diarrhea, leptospirosis, malaria, skin diseases (Soeharsono 2002).

Assessment of the economic impact of climate change on ecosystems directly. The NDC Roadmap (2020) states that the results of an analysis of the impact of climate change on various types of ecosystems on land and in the sea are not yet available. Indonesia also does not yet have a balance sheet on natural resources. Economic impact modeling is mainly carried out on the impact of changes in rainfall and temperature on various types of ecosystems. Especially for coastal and marine ecosystems, modeling also needs to be done for rising sea levels and increasing sea waves.

The NDC Roadmap (2020) uses data sourced from DIBI (Indonesian Disaster Information Data) managed by NDMA/BNPB to see losses from climate-related disasters such as floods, landslides, tornadoes and droughts. Economic losses are assessed from the destruction of infrastructure. The impact of a disaster event is calculated based on historical events. Modeling of future events and losses is not carried out. The 2020 NDC Roadmap assesses that there is not yet an adequate model to specifically predict disaster events due to climate change.

DIBI data is sourced from incident, damage and loss reports collected by Regional LDMA/BPBDs. Because they originate from disaster events, the damage and losses do not include the slow onset and long-term impacts of climate change.

Overall, the NDC roadmap document (2020) has not yet cover the hazards of climate change in terms of sea level rise, changes in wave height and ocean acidity (pH). The absence of analysis on these hazards is due to limited data at this time. Most of the damage and losses are presented as a result of extreme climate events and seasonal patterns (rapid onset). Long-term impacts slowly (slo onset) are shown in the projection of water resources and their impact on the availability of water for agriculture, households and electricity (energy). Because hazard data is not yet fully available, the NDC Roadmap document (2020) does not yet provide an analysis of damage and losses in the coastal and marine sectors, in terrestrial and marine ecosystems, and the impact of the risk of small islands sinking.

Appendix 4

Loss and Damage Assessment in the Climate Resilient Development Document 2020-2045

Based on a 2019 Bappenas study, the total economic loss for the four climate resilience priority sectors in the 2020-2024 RPJMN is estimated at IDR 544 trillion, with an increase of 12.8 percent from 2020 to 2024, if policy intervention is not carried out. The government takes precautions to reduce potential losses. The Climate Resilience Development Plan, integrated with the 2020-2024 mid-term development plan, is prepared to reduce potential losses through a number of adaptation activities.

The coastal and marine sector is estimated to have the highest level of economic losses. Losses in the coastal and marine sector are calculated from the impact on ship accidents and coastal inundation which reach IDR 408 trillion. Losses in the agricultural sector are calculated from the decline in rice production which reached IDR 78 trillion. Losses in the health sector are calculated from the increase in dengue cases which reached IDR 31 trillion. Losses in the water resources sector are estimated at IDR 28 trillion^{cxxxii}.

As a mitigation measure, the Ministry of National Development Planning/Bappenas developed an online platform for the Indonesian Low Carbon Development Action Planning and Monitoring Application (Aksara), which plays a role in assisting the process of recording the actions of ministries/agencies and calculating the value of reducing economic losses. From the results of the 2020 report, BAPPENAS sees that Climate Resilience Development activities in Indonesia can reduce economic losses by IDR 44.39 trillion from the target of IDR 52.91 trillion or by 84 percent^{cxxxiii}.

The study of the value of the loss involved a focus group discussion guided by a consultant. The FGD explored the impact on each sector. At this time there is no information available on the method used by BAPPENAS to calculate losses in each sector throughout Indonesia. The value of losses in the marine sub-sector is obtained from disturbances to shipping safety which also affect fishing results, especially vessels with small capacities and not equipped with adequate technological facilities. The value of losses in the coastal sub-sector is the inundation of coastal areas by rising sea levels. Inundation in coastal areas affects economic activity or productivity of people in coastal areas.

To assess losses in the marine sub-sector due to high waves, at least data on the number of Indonesian fishermen in various boat size categories, the number of days not at sea, and the units of loss per day not at sea, losses due to accidents at sea per year. To assess losses in the coastal sub-sector due to inundation on the coast, at least data is needed on the area and rate of inundation of Indonesian coastal areas per year, categories of loss and damage in each sector/stakeholder on the coast (agriculture, settlements, industry, infrastructure, tourism others) as well as the unit value of loss and damage for each sector/stakeholder on the coast.

Overall, the calculation of losses in the 2020-2024 Climate Resilient Development Plan document emphasizes the impacts of long-term (slow-onset) climate change hazards, namely sea level rise, changes in rainfall and rising temperatures. Climate projections

for the three types of climate change hazard have indeed been carried out and presented in the 2020-2024 Climate Resilience Development Plan document.

A number of important impacts discussed in the National Action Plan for Climate Change Adaptation (RAN-API) are not part of this 2020-2045 Climate Resilience Plan. Priorities and resource limitations may be taken into consideration. Strategies and action plans have not been planned for the following impacts: coastal erosion and damage to coastal ecosystems, risk of inundated islands, impacts on coral reefs and marine fisheries and mariculture, impacts on plantations and food crops other than rice. The relocation of communities inundated by high tides ('rob') has been included in the 2020-2045 Climate Resilience Plan, in which the MoPWPH/PUPR plays the role of the key ministry for its implementation.

Appendix 5

Land Subsidence on the North Coast of Java

Over 20 cities and regencies in Indonesia are experiencing land subsidence, including several regencies and cities in Central Java Province. The coasts in this area are formed by sediments that are still young (thousands of years). Subsidence of the land surface increases the vulnerability of these areas to coastal seawater inundation. In addition, coastal areas directly adjacent to peatlands are also very vulnerable to land subsidence, such as coastal areas in Meranti Islands Regency, Riau Province.

Land subsidence is the subsidence of the ground surface from a reference plane (such as sea level, geoid, or ellipsoid). Land subsidence often occurs in coastal lowlands such as coastal cities, coastal peat areas, and oil and gas mining areas in the world, including in Indonesia. Land subsidence occurs due to anthropogenic factors, namely excessive groundwater extraction, loading effects, oil and gas exploitation, draining and oxidation of peatlands, and the impact of subsurface mining activities. Other non-anthropogenic causative factors are natural compaction and tectonic subsidence effects.

Areas experiencing land subsidence will be inundated more quickly when sea levels rise and land subsidence coincides. The subsidence rate in non-peat coastal areas can reach 1-20 centimeters annually. The rate of land subsidence is faster than the rate of sea level rise. Meanwhile, peatlands planted with acacia will experience subsidence of around 5.2 cm/year with an average groundwater depth of 70 cm^{cxxxiv}.

The series of tidal floods throughout May-June 2020 (see discussion in Appendix 6) shows that land subsidence is the main differentiator. A slight rise in sea levels, especially those triggered by high tides (astronomical aspects), causes the coast experiencing land subsidence to easily experience tidal flooding.

The northern coast of Java, especially in the Provinces of Central Java, Jakarta, and West Java, is a subsidence land formed from sediment deposits from river flows hundreds to thousands of years ago. This sloping and not-so-hard beach experiences land subsidence or subsidence of the land surface due to resident and industrial activities, including groundwater extraction. The cities of Tegal, Kendal, and Demak experienced repeated rob events during the May and June periods. The city of Tegal, for example, has a very sloping beach that experiences subsidence.

Some parts of Tegal City are several hundred meters from the current coastline, which was shallow sea waters in the past. Now, on the land formed due to the sedimentation process and then experienced subsidence, there are government offices, housing, and public facilities like other parts of the city.

Land subsidence is the result of human activities and natural phenomena. Coast of Sikka District experienced land subsidence following Flores Island's large earthquake and tsunami in 1992. Several coastal villages in Alok District, and Sikka District, experienced land subsidence to a height equal to seawater during high tides. Tidal floods up to half a meter high have been experienced every year since then. The tidal flood lasts 5-6 days and is highest on June 5, 2020, affected by high tides (mid-moon/full moon).

Appendix 6

Inundation on the Coast Caused by High Tides ('rob') in 2020

In the last twenty years, Indonesia's coastal areas have experienced coastal phenomena in the form of tidal floods. Around 112 regencies/cities across the East Coast of Sumatra, parts of the West Coast of Sumatra, the North Coast of Java, the Kalimantan Coast, and also parts of the coast of Sulawesi and Papua are indicated to have experienced tidal flooding. Tidal floods occur in several locations have even caused permanent inundation, such as happened on the East Coast of Sumatra, which is projected to lose more than two million hectares of area and in the North Coast of Java which is projected to lose tens of thousands of hectares of area. Large cities including metropolitan areas that experience tidal flooding issue include Jakarta, Tangerang, Cirebon, Tegal, Pekalongan, Kendal, Semarang, Demak, Surabaya, Pasuruan, Medan, Dumai and Pontianak.

The tidal floods in the May-June 2020 period are considered to be one of the worst and affected at least tens of thousands of families along 45 kilometers stretch, between Sriwulan (Sayung) to Kedungmutih (Wedung) in Demak. The rob incident this time adds to the burden of the community which have experienced economic pressure due to decreased income from the agricultural and fisheries sectors due to COVID-19. The aquaculture harvest, which was expected to help the community's economy, turned out to be a miss. Most of the aquaculture ponds did not have time to be harvested when the big tidal flood came.

Monitoring of tidal floods from May to June 2020 was obtained from the Recapitulation issued by the National Disaster Management Agency (NDMA/BNPB). Monitoring shows that tidal flood disasters have increased and occurred in a number of regions in Indonesia in the period from the first week of May to mid-June. From May to June 2020, there were 35 days of tidal flood events that took place in several coastal areas in Indonesia. Observations were carried out until 15 June 2020.

Tidal floods in a number of areas last for 4-6 days, where certain days are the peak of tidal floods. Tidal flooding in a number of locations is a recurring event that occurs every year, but on certain dates in May and June 2020 it was noticeably higher than the previous year. For several areas, such as Tegal, Kendal and Cilacap, tidal floods occurred again several days later. In the first week of May, the tidal flood that occurred on one date only affected the adjacent area, but in the following week until mid-June the tidal flood occurred over a wider area and on consecutive days.

On May 9, the rob incident took place in Cilacap Regency, Central Java. Then the next incident on May 13 hit other areas of Central Java, namely in Demak Regency and Tegal City. High waves at sea also accompany tidal floods in this area. At that time, according to records, the tides were not high tides due to the full moon or the transition of the moon (spring-tide). The incident took place without any puddles due to rainfall. A one-day tidal incident covering a wider area occurred later on May 27, which hit the East Java region. This time is the full moon period or the transition of the moon (spring-tide) which is marked by rising sea levels.

Furthermore, June 2-6 was a series of days with tidal floods that hit a number of areas in Indonesia in a wide area. The most extensive tidal floods occurred on June 4, 5, 6 2020, where the 5th was the peak. At that time, it was the full moon period. The floods on June 5 covered 8 regencies and cities on the north coast in the Central Java region, to the west coast of Jambi (Sriver Full City) and the coast of East Nusa Tenggara (Sikka Regency in NTT). This event is a period not only caused by astronomical aspects (position of the moon) which causes sea tides but also accompanied by meteorological aspects (high waves of sea storms).

Several media reported that tidal floods in mid-2020 occurred on the coast of Serang Regency, Tangerang Regency, Indramayu Regency, Cirebon Regency, Brebes Regency, Tegal City, Tegal Regency, Pemalang Regency, Pekalongan City, Pekalongan Regency, Batang Regency, Kendal Regency, Kota Semarang, Kendal Regency and Kolaka Regency.

Several media also reported that tidal floods occurred in several areas on the East Coast and West Coast of Sumatra. The coast of Jakarta City was not spared from tidal floods in the middle of 2020. The areas inundated by tidal floods ranged from the coastal areas of Dadap, Kamal Muara, Kamal Tanjung, Muara Angke, Mutiara Beach, Pluit, Muara Baru, Sunda Kelapa, Fish Market, Tongkol, Lodan, Ancol, Tanjung Priok, and Marunda Cilincing.

Apart from that, tidal floods also occur due to sea water that passed over the coastal embankment or due to embankments that leaked or broke. At Mutiara Beach, Jakarta, a large leak in the embankment can be seen. The tidal flood occurred for several days before the embankment was filled. The tidal flood incident on the coast of Jakarta City in the middle of 2020 was quite surprising because on the coast of Jakarta, efforts were being made to build coastal embankments and plans for sea embankments. In recent years, tidal floods seemed to have disappeared because embankments had been built in some of the most vulnerable places. However, this year the tidal floods have returned.

Land subsidence is possible as a supporting factor in the occurrence of tidal floods. Before massive land subsidence took place, tidal phenomena were still rarely encountered on Indonesian coasts. BMKG states that the high tide phenomenon occurs twice every month, namely during the new moon and during the full moon approximately three days before and after. High tide occurs because the position of the moon (and sun) and the earth are in a straight line. Because they occur periodically, high tide events can be predicted. The Hijri calendar is a tool used to determine the period when high tides arrive at sea, the highest tides and lowest low tides occur alternately in a matter of hours.

Sea waves triggered by wind speed (air pressure) in open waters (ocean) (such as on the south coast of Java and the west coast of Sumatra) are relatively higher than in inland/protected waters (such as the north coast of Java and the east coast of Sumatra). Throughout May and June 2020, as usually happens every year, wave heights on the southern coast of the Java Sea (and other parts of Indonesia that face open waters/oceans) were relatively higher than the northern coast of Java.

Regarding the tidal wave incident in mid-2020 in the coastal area of Indonesia, analysis shows that this was caused by a combination of all factors, namely high tides, sea level rise, as well as land subsidence factors, accompanied by high waves from sea storms. The tidal floods that took place in May were accompanied by high sea storm waves, accounting for around 73 percent of all recorded incidents in that month. Meanwhile, around 27 percent is normal tidal flooding. The tidal flood events in June 2020 from the NDMA/BNPB recapitulation, most of them, apart from high tides, were also accompanied by high waves from sea storms, namely around 63 percent, while around 37 percent were normal tidal floods.

Table 12 Impact of Tidal Flood in Demak Regency on Early June 2020

Village	Area* area (km2)	Size* of pond (ha)	Material damage/loss
Bedono	7.39	600.80	Almost all houses in 3 RTs in Dukuh Bedono were submerged due to tidal flood; there is damage to livestock pens; HE structure was damaged about 70%.
Timbulsloko	4.61	249	More than 200 houses were flooded; almost all of the ponds are sunk and experienced crop failure; including 20.91 ha of ponds owned by members of the BwN group suffered a production cost loss of IDR 12,440,000; the HE structure has slightly decreased; road access for residents who live some distance from the hamlet was cut off.
monument	5,13	85	The main road of Tugu Village was inundated by rob with a height of between 30-50 cm; some residential areas were inundated to a height of 70 cm; many community ponds were inundated by tidal floods and suffered losses from crop failure, including 30.27 ha of ponds belonging to members of the BwN group with a production cost of IDR 145,290,000.
Surodadi	5,10	309	More than 75% of the ponds were inundated by tidal floods and it was confirmed that the harvest had failed, of which 37.03 ha belonged to members of the BwN group with a total production cost of Rp. 79,045,000; several residential areas were inundated by the rob.

* Note: Excerpted from Paper "Indonesian Coastal Area Rob Flood Disaster: Mid-2020 Event Records" compiled by: Heri Andreas/ Bandung Institute of Technology (ITB), P. Raja Siregar/ Red Cross Red Crecent Climate Center (RCCC), Susan Lusiana/ Wetlands Foundation (Wetlands International). As material for the discussion of the Working Group on Mitigation and Adaptation of Land Subsidence in the Coastal Lowlands in 2020.

Appendix 7

Process to Identify Loss and Damage Framework for Potential Unavoidable Impacts

Various forms of climate change impacts lead to the choice of strategies for coping with loss and damage. Identification of strategic options considering the nature of impact, human resource and funding capabilities, and examples that have been partially implemented. The table presents the process of identifying and finding a framework for addressing loss and damage due to climate change for potential unavoidable impacts. The table below displays the Options of Frameworks to address the loss and damage.

MoEF/KLHK and BAPPENAS are the relevant key organizations to lead the implementation of these strategies. BAPPENAS is relevant to lead the implementation of the Adaptive Social Protection scheme and spatial planning (with the Ministry of Environment and Forestry and the Ministry of Agrarian Affairs and Spatial Planning). In accordance with laws and regulations, the Ministry of Environment and Forestry plays a role in environmental management policies. A number of sectoral technical ministries – including the Ministry of Agriculture, the Ministry of Health, the Ministry of Maritime Affairs and Fisheries – will play a role in supporting the implementation of a number of strategies for dealing with loss and damage due to climate change. The table 13 below presents the key ministry/agency estimates for implementation of the strategy and the gaps, challenges and opportunities for implementation.

Table 13 Identification of Loss and Damage Management Framework for potential unavoidable impacts

Potential Impact	Loss and Damage	Framework Addressing Loss and Damage
Increasing the reproduction and spread of mosquitoes in Indonesia	Death, illness, loss of income, mental stress	Spatial planning Climate Insurance Social Protection
Loss/decrease in biodiversity	Not yet known	Conservation, genetical engineering
Decreasing populations of species that play a role in food crops (among them pollinating bees)	Pollination inhibition, decreased production	Conservation, genetical engineering
Beach erosion/abration	Ecosystem damage, loss of cultivation land, damage to houses and infrastructure	Spatial planning Relocation Social protection Climate Insurance

		Conservation
		Technical engineering

Table 14 Options of Framework to Address Loss and Damage, Gaps, Challenges and Opportunities for Implementation and Key Ministries/Institutions

Framework in Addressing Loss and Damage	Forms of Losses and Losses Covered	Relevant Agencies	Gaps, Challenges, Opportunities
Environmental Policy: Spatial Planning	Ecosystem damage, loss of cultivation land, damage to houses and infrastructure, mental stress due to inundation on the coast and small islands sinking	MoEF/KLHK and MoAASP/NLA (ATR/BPN) Supported by BAPPENAS, NDMA/BNPB, BMKG, MoMF/KKP, BRIN, local government	Availability of district/city level climate projection data. Clarity on institutional monitoring of coastal and small island inundation rates. Synergy of land and sea spatial planning based on climate risk Coordination of coastal area authorities and status of forest areas. Legislation/policy "withdraw from the beach" (planned relocation/spatial planning) has not yet been discussed. There is no clarity on the status of the land that has sunk and been abandoned by the owner.
	Decrease in fisheries productivity and income (fishermen, wilsata) due to rising sea surface temperatures, changes in sea acidity (pH).	MoMF/KKP, MoEF/KLHK, BAPPENAS, BMKG, BRIN, local government	Long-term impacts on coral reefs and fisheries productivity are not yet known. Compared to other impacts, this impact is not a priority.
Environmental Policy: Conservation	It is not yet known with certainty the consequences of the	MoEF/KLHK, MoMF/KKP, BRIN, BMKG	The biodiversity inventory is still

(in-situ, ex-situ preservation)	impact of loss / reduction of biodiversity		ongoing. Monitoring and assessment of impacts on biodiversity is minimal or non-existent in APBN-funded programs. With limited funds and knowledge, it is necessary to prioritize key species and ecosystems for study, including those related to food crops and ecosystem stability.
	Pollination barriers, decreased production as a result of decreased populations of species that play a role in food crops	MoEF/KLHK, Ministry of Agriculture BRIN, MoMF/KKP	Idem. Priority can be given to the bee species involved in pollination.
Maritime economic transition (fishery, tourism, medical).	Decrease in fisheries productivity and income (fishermen, wilsata) due to rising sea surface temperatures, changes in sea acidity (pH)	BAPPENAS, MoMF/KKP BRIN, BMKG	Knowledge about the impact of rising sea surface temperatures, changes in sea acidity (pH) in Indonesia was first obtained.
Environmental Policy: Pause fishing	Decrease in ecosystem quality, decrease in fishermen's income due to the impact of death/bleaching of coral reefs after seasonal anomaly events	MoMF/KKP, MoEF/KLHK BRIN, BMKG, BAPPENAS	It is not yet understood the need for a fishing pause policy to reduce pressure on coral reefs that are under stress during periods of climate anomalies (El Nino, La Nina) and other sources of pressure (earthquakes, etc.).
Implementation of Genetic Bank and Genetic	It is not yet known with certainty the consequences of the impact of loss /	MoEF/KLHK, BRIN	

Engineering	reduction of biodiversity		
	Pollination barriers, decreased production as a result of decreased populations of species that play a role in food crops		
Social Protection	Death, illness, loss of income, mental stress due to the health impact of increased reproduction and spread of mosquitoes that cause malaria and DHF in Indonesia.	BAPPENAS, Ministry of Social Affairs, Ministry of Health.	Health BPJS is available. There is no protection for loss of income for the poor and mental health problems. Adaptive Social Protection needs to be implemented in high risk areas. Data provision challenges.
	Decrease in fishermen's income due to the impact of death/bleaching of coral reefs after a seasonal anomaly	MoMF/KKP, Ministry of Social Affairs BAPPENAS, Kemendagri, BMKG, Pemda,	This form of impact is not included in the basis for determining disaster status in Indonesia. So that APBD and APBN funding (Ready to Use Funds) cannot be used for impact management APBN/APBD limitations for impact monitoring activities that were not planned beforehand. Immediate monitoring of impacts on Coral Reefs is usually carried out/funded by donors through civil society organizations (CSOs).
	Ecosystem damage, loss of cultivation land, damage to houses and infrastructure, mental stress due to inundation on the coast and small	Local government, BAPPENAS, MoPWP/ PUPR, Ministry of Home Affairs, MoMF/KKP, BMKG, BRIN, Ministry of Social Affairs	Technical engineering in the form of embankments has the risk of causing erosion/abrasion of the surrounding coast.

	<p>islands sinking</p>		<p>Limited land suitable for relocation on the coast within the affected administrative area. Relocation outside the affected administrative area and national institutions for the provision of Reserve Land is required.</p> <p>Strengthening regulations regarding government spending in affected areas for land acquisition and economic programs outside the affected administrative areas, including APBD grants from the Government to Regional Governments of relocation destinations to provide relocation land and livelihood activities for displaced residents.</p> <p>Data requirements for the implementation of Adaptive Social Protection based on climate risk for such Slow Onset hazards.</p> <p>There is no clarity on the status of the land that has sunk and been abandoned by the owner.</p> <p>Insurance does not cover predictable and gradual (slow onset) hazards like these.</p>
	<p>The decrease in catch results is due to changes in fish migration patterns and spawning areas and disturbances to the diversity and</p>		<p>Temporary social protection needs to be built towards an economic transition as a long-term solution in affected areas</p>

	growth of marine species.		
Banking Policy: Special credit scheme	A decrease in fishermen's income due to the impact of coral reef death/bleaching and a decrease in farmers' income due to seasonal anomalies (El Nino, La Nina).	KKP/LPMUKP, Ministry of Agriculture, Ministry of Finance/ BPD LH, Regional Government, Ministry of Social Affairs, BAPPENAS, OJK	Special loan schemes for fishermen and farmers are available, but not yet widespread, from the BLU LPMUKP (fishery business funding trust fund from the Ministry of Maritime Affairs and Fisheries). Fast and short-term special credit schemes from banks are not yet available.
Public-Private Partnership: Business Continuity Plan	A decrease in fishermen's income due to the impact of coral reef death/bleaching and a decrease in farmers' income due to seasonal anomalies (El Nino, La Nina).	MoMF/KKP, Ministry of Agriculture, Local Government, Ministry of BUMN, KemenKop-UKM, NDMA/BNPB	This framework only applies to supply chains to the fishing industry and medium-large end consumers.
	loss of cultivation land, damage to infrastructure, industrial areas due to inundation on the coast and small islands sinking	Ministry of Finance, MoAASP/NLA (ATR BPN), Ministry of Industry, KADIN, financial industry	General insurance tends not to protect against slow onset impacts. There is no clarity on the status of the land that has sunk and been abandoned by the owner.
Strengthening the reduction of greenhouse gas emissions	Increase in greenhouse gas emissions due to land and forest fires, especially during periods of seasonal anomalies (El Nino)	MoEF/KLHK, BRGM, Ministry of Agriculture, NDMA/BNPB, BMKG, Ministry of Home Affairs	Clarity on funding for land fire emergency preparedness efforts at the district/city and village levels. Use of the Village Fund for emergency preparedness at the village level
International conventions	potential state border problems due to	Ministry of Foreign Affairs, MoMF/KKP,	

(law of the sea, fisheries and biodiversity).	inundation on the coast and small islands sinking	MoEF/KLHK, Ministry of Home Affairs, BIG	
Enhanced Adaptation Efforts	a decrease in fishermen's income due to the impact of coral reef death/bleaching and a decrease in farmers' income due to seasonal anomalies (El Nino, La Nina).	MoMF/KKP, Ministry of Agriculture, Ministry of Social Affairs, BAPPENAS, BMKG, NDMA/BNPB	
	Increase in greenhouse gas emissions due to land and forest fires, especially during periods of seasonal anomalies (El Nino)	MoEF/KLHK, BRGM, Ministry of Agriculture, NDMA/BNPB, BMKG, Ministry of Home Affairs	Clarity on funding for land fire emergency preparedness efforts at the district/city and village levels. Use of the Village Fund for emergency preparedness at the village level

(note: ministries/agencies printed in bold is deemed as relevant to be the key actor)

Appendix 8

Potential Consequences of Adaptation Efforts on Outermost Small Islands in UNCLOS

A number of archipelagic countries are affected by sea level rise. Small islands with flat slopes that are under a threat of sinking due to climate change are the background for a discussion in the Warsaw International Mechanism (WIM) for Loss and Damage. Coastal reclamation to maintain or increase the height of the island or make embankments is the main option to prevent the island from sinking. A number of small island countries, namely the Maldives, are implementing coastal strengthening, including coastal embankments, to deal with sea level rise.

Problems will arise on country borders. In an archipelagic country, the outermost small islands serve as a reference point for making the outer lines of the country's boundaries. The boundary between two archipelagic countries is a virtual line in the sea that is located right in the middle of two neighboring countries that are not separated by international waters. Efforts by archipelagic countries affected by sea level rise to protect small islands by reclamation or building embankments will potentially create new problems. A beach that has been reclaimed can be interpreted by UNCLOS as an artificial island and cannot be treated as an outer island that becomes border.

The definition of 'island' according to UNCLOS (United National Convention on the Law of the Sea), in article 121, is stated as a land area that is 'naturally formed'. Whereas 'Artificial Island' does not have territorial rights over the sea in front of it. A number of current literatures discuss the status of a country's outer islands that have been reclaimed or strengthened for climate adaptation purposes. Article 121 UNCLOS does not provide clarity regarding the status of the reclamation island. Clarity and agreement between countries need to be made on natural islands that are experiencing strengthening to avoid the impacts of climate change.

The convention of the parties to climate change (UNFCCC) can be a starting point for voicing the views of island nations, and then pushing the discussion to UNCLOS. As an archipelagic country that will be affected, the Government of Indonesia together with neighboring countries can prepare to submit views and positions to the UNFCCC and UNCLOS on this topic. Discussion on this matter in the relevant ministries is still minimal or even non-existent.

Appendix 9

The Challenges of Implementing Social Protection in Damage and Loss Due to Slow Onset Changes in Climate Parameters

A feasibility study is required to implement Adaptive Social Protection to address loss and damage due to the slow onset impacts of changes in climate parameters such as sea level rise, temperature, and rainfall. Identification of several challenges for its implementation needs to be done and overcome. Possible challenges that will be faced include:

1. Determination of the threshold for activating the provision of ASP packages to the affected vulnerable communities
2. Availability of data to support ASP activation
3. Diverse institutional coordination challenges.

Climate change impacts that occur slowly and gradually are not declared a disaster status in Indonesian laws and regulations. With the impact progressing slowly, it is still being determined under what conditions it is appropriate to declare a disaster event. Initial conditions (baseline) and current conditions (end-line) are needed to use the threshold as a reference for activating ASP for people affected by climate change.

The climate hazard or risk index has the potential to become the basis for determining thresholds. For example, there is high inundation on small islands, inundated coastal areas, and a high wave risk index. When the hazard or impact level has been reached, the ASP can be applied to the affected communities. Thus, thresholds need to be established for each different type of hazard and impact. Various types of data are required to have a number of these thresholds. Thresholds also become more complex when considering different impacts for different social aspects (e.g., the poverty rate in a region or a household).

To determine the threshold and activate the ASP when the threshold is reached, the following aspects are at least needed:

- a. Preliminary hazard or risk data and ongoing hazard and risk monitoring. Some data on the hazards and impacts of climate change are available in Indonesia, and some are not yet available.
- b. Clarity of institutions responsible for managing and monitoring data on climate change hazards and the resulting climate risks.
- c. Clarity of institutions responsible for addressing the various impacts of climate change. Several related ministries and agencies, including the MoMF/KKP, the Ministry of Health, the MoPWP/PUPR, the MoEF/KLHK, the Ministry of Social Affairs, and BAPPENAS, handle the impact of climate change on various sectors.

Data are needed to determine the target location and households to apply the ASP on the slow-onset impact of climate change. Currently, InaRisk is available, which presents disaster risk maps and indexes for all districts/cities in Indonesia, including for hydrometeorological disasters. Ina-Risk provides a risk index for the types of hazards

specified in the Disaster Management Law: floods, landslides, strong winds/hurricanes, earthquakes, high waves and aberrations, tsunamis, volcanic eruptions, and dry land fires. Several Ministries and Government Agencies generate the hazard data, including BMKG, the Ministry of Energy and Mineral Resources, KLHK, and the MoPWP/PH/PUPR.

Ina Risk is prepared based on the hazard that has taken place and the capacity of the local government. Because it does not contain hazard projection data, Ina Risk does not provide an analysis of climate-induced hazards and future risks. The impact of climate change on living resources, including coral reefs and marine fisheries, and the development sector, including agriculture and health, is not presented in Ina-Risk.

Challenges still persist in terms of the provision of data on the decline in the income of farmers and fishermen due to the impact of changes in seasonal patterns, changes in rainfall, and trends in extreme weather at sea. Maps and climate change risk indices with national coverage are also not yet available for hazard events of sea level rise, extent of tidal inundation, and extent of coastal erosion. Several hazards and impacts of climate change have yet to be understood and monitored, and there needs to be clarity regarding the ministries/agencies responsible for producing these data.

After determining the location, it is necessary to know the affected households. Data on climate hazards and risks is available at the district/city level. The following process is needed to determine the affected sub-districts, villages, and households that have been affected (reached a predetermined threshold). The biggest challenge is to determine the affected households with national coverage.

Institutional Implementation

Adaptive Social Protection (ASP) is relatively appropriate for hydrometeorological and geological (rapid-onset) disasters. The implementation of the ASP uses existing mechanisms and institutions for handling emergencies. According to the Law on Disaster Management, the status of a disaster emergency is determined by the Regency/City Government and the Provincial Government. NDMA/BNPB, LDMA/BPBD, and the Ministry of Social Affairs clearly divide roles in managing funds and activities in a disaster emergency situation.

ASP is distributed to affected communities after an emergency status is established. Questions remain about which institutions will manage the ASP funds and make decisions for its disbursement. In addition to the three government organizations mentioned earlier, Bappenas as the designer of the ASP scheme, is also relevant as the party that makes decisions for the distribution of ASP packages to ministries/agencies directly involved in the field.

ASP is relatively more difficult to implement for addressing the impacts of climate change (slow onset). The biggest challenge in the decision is determining when and if the affected people receive the ASP package. A certain level of climate hazard or risk is a reference for channeling the ASP. The challenge lies in data availability for each form of climate change hazard and risk. The institutions for making decisions and implementing ASPs for slow-onset climate change will likely differ from those for rapid-onset situations. Basic data is required, and the threshold for enabling ASP at a later time is set.

ASP will likely be used once (not repeatedly) when applied to climate change context. For example, relocation of settlements as a form of addressing the impact of coastal inundation and sinking small islands. Compared to responding to an emergency situation within a short period, tackling the impacts of climate change has a more extended period.

Appendix 10

Development of insurance related to the impact of hydrometeorological disasters in Indonesia.

Newly developed and marketed insurance products for climate-induced disasters (floods, landslides), insurance for climate-related diseases and vectors (malaria, dengue fever), insurance for crop failure (rice, maize). Insurance companies do not issue products for impacts that are expected to occur and take place gradually, including land and buildings that are submerged and lost due to gradual sea level rise. Insurance products are only for hazards whose timing and magnitude cannot be estimated (random).

ACA Insurance issues a Dengue Hemorrhagic Fever (DHF) microinsurance product with a premium of Rp. 10,000 and Rp. 50,000 per year. Micro insurance provides 'compensation' Rp. 1,000,000 and Rp. 2,000,000 respectively if the premium owner suffers from DHF.

To reduce losses to farmers who experience crop failure due to extreme weather, since 2015 the government has implemented a rice farming insurance program. Insurance products developed by PT. JASINDO, a state-owned insurance company owned by the government. The State Budget subsidizes an 80 percent subsidy of insurance product premiums costing Rp. 180,000 per hectare per season. Coverage is given when farmers experience crop failure due to extreme weather (floods and droughts). Farmers get compensation if they have implemented the cultivation techniques set by the Government. In 2021, the Ministry of Agriculture is targeting 1 million hectares of land to be registered in the Rice Farming Insurance program (AUTP) and 120,000 cows to be registered in the Cow or Buffalo Livestock Business Insurance (AUTS/K).

Since a decade ago, several local governments have allocated their regional budgets to pay insurance premiums for traditional fishermen. Coverage is given by the insurance company directly to fishermen/fisherman families in the event of an accident or death while at sea. No coverage has been provided for minimal or nil catches due to extreme weather at sea.

An insurance company from Japan, Sompo Insurance, has tried to explore the development of a parameterized insurance product to protect farmers from potential failure of rice and corn crops in Indonesia in 2015-2016. This type of parametric insurance product pays claims based on forecasts of future rainfall anomalies. Claims can be filed if there is a difference in annual rainfall within a predetermined range.

Mercy Corps Indonesia and ACA insurance started in 2015 working together to introduce a risk transfer mechanism experienced by farmers from crop failure of corn due to extreme weather. This risk transfer involves micro-insurance products for extreme weather and credit schemes involving rural banks and off-takers.

In 2020, The Nature Conservancy Indonesia/YKAN and UNDP separately at the same time conducted a feasibility study for developing insurance products to protect the impact of disasters on coral reefs in Indonesia. Earthquakes, tropical cyclones and El Nino phenomena have the potential to cause damage or death to coral reefs. Claims for damages can be used immediately to recover and prevent further damages.

The Nature Conservancy is conducting a feasibility study in 2020-2021 for the development of insurance products to protect Coral Reefs after they are impacted by climate disasters. Insurance products from Swiss-Re have been used by the local government of Quintana Roo in Mexico in collaboration with TNC. For implementation in Indonesia, YKAN Foundation/TNC conducted a study on the authority to manage coral reefs, the mechanism for withdrawing contributions, the scope of coverage and government institutions for managing insurance funds. The same study was also carried out by UNDP.

Appendix 11

Limitations of Insurance to Overcome the Impact of Climate Change

a. Insurance Exempt Coastal Inundation ('rob')

The insurance industry distinguishes between floods caused by rainfall, river runoff, and inundation on the coast caused by high tides ('rob'). An example of insurance product protection exempted from high tide inundation ('rob') is APPIK (Fisheries Insurance for Small Fish Farmers), launched in 2017 by the Ministry of Maritime Affairs and Fisheries and the Financial Services Authority.

Many parties do not realize this difference. Information for consumers on company brochures or websites always mentions insurance products that protect against floods (and other hazards). Product information generally does not mention high tide ('rob'). However, insurance products are excluded from high tide events when further explored^{cxxxv} and stated in the product sale and purchase agreement document.

This APPIK product is marketed by 9 insurance companies that form a consortium (JASINDO, ACA, and others). This insurance premium is entirely (100 percent) subsidized by the state budget for traditional farmers throughout Indonesia. That insurance coverage is excluded from tidal inundation ('rob') is stated in the document 'Shrimp Aquaculture Business Insurance Coverage Summary,' obtained during the product purchase agreement. This policy compensates for the death of shrimp and pond damage due to disease and natural disasters.

Insurance products have also stated in the information for consumers on the website that insurance coverage is excluded for inundation due to sea tides ('rob'). Examples of insurance products for heavy equipment Contractors' Plant and Equipment (CPE) cover all risks of physical damage or loss, including those caused by typhoons, storms, floods, and water damage. However, protection is not provided for damage due to high tide (rob)^{cxxxvi, cxxxvii}. In other insurance products, the exclusion of protection applies to "loss or damage caused by a decrease in quality that occurs gradually or wears out"^{cxxxviii}.

b. Policies That Drive Property Away from the Beach

The United States Federal Emergency Management Agency (FEMA) updated the insurance program, later named "Risk Rating System 2.0". Previously, a one-size-fits-all model was applied to the threat of flooding in a community in 1968. With the "Risk Rating System 2.0," buildings close to bodies of water pay a higher premium based on the risks faced. Risk Rating 2.0 considers sea level rise and climate change. Settlements in different zip codes with different risks will have different premiums^{cxxxix}.

The British Government stipulates that the UK Government's Flood Insurance Scheme will not protect property on the coast that was built after 2009. The British Government believes that housing developers and the public should already know the climate change risks that buildings on the coast will face. Information on the impact of climate change has been intensively provided more than two decades ago. Areas at risk will be difficult to live in, have declining property values, and consequently have high insurance premiums or are uninsurable. Thus the year 2009 was set as the threshold in the British

Government's Public Flood Insurance Scheme, otherwise known as "Flood Re."

The New Zealand government is following the British model. The New Zealand government is still thinking about the year that will be used as a reference not to protect property on the coast with public insurance^{cxl}. . Implementing a public insurance program with the Government's budget in high-risk locations would provide an incentive to continue building settlements and other structures on the coast. It will be considered as giving a false signal. The burden that Government will face is a risk when the community and business actors maintain the view that constructing buildings on the risky coast will always receive protection through government insurance.

Storey, et al (2020)^{cxli} mentioned that coastal properties, including in the City of Wellington, will start to lose insurance coverage in the next 10 years or even sooner than expected. Technically, if a property has a 1% chance of beach damage with the current sea levels, it will likely lose all private insurance once the chance rises to 5%. Chances of damage up to 5% can last less than 25 years.

Moving away from coastal areas in a gradual and planned manner (managed retreat) is one of the options widely discussed in New Zealand's draft of Climate Change Law. Staying away from coastal areas or relocating has been carried out by the community, including at locations affected by coastal inundation in northern Central Java. The choice is to stay away from the coast after experiencing loss and damage or to do it as a spatial planning to avoid loss and damage due to climate change soon.

Lampiran 12

Land Constraints in Relocation

Relocation is an option when settlements and cultivation land are in areas with high climate and disaster risks. It was carried out by the people affected by the tidal inundation in several coastal villages in Demak Regency, Pekalongan Regency, and Pekalongan City, locations affected by coastal abrasions in Bitung Regency and several other climate hazard-affected locations. The costs incurred by society to survive in such situation is extremely large, while losses and damages still continues. The Government also relocates communities in high-risk areas of geological disasters, including volcanic eruptions and liquifaction.

Referring to Law No. 23 of 2014 concerning Regional Government, implementing public housing is mandatory and part of the Minimum Service Standards. The Regional Government organizes a slum house/slum prevention program, where this activity follows the program terminology listed in the Minister of Home Affairs Regulation No. 90 of 2019. Construction of new houses for people in slum areas or those affected by disasters. The Uninhabitable Housing Program (RTLH) refers to Law No. 1 of 2011 concerning housing and residential areas.

Demak Regency, the City and Regency of Pekalongan, and the City of Semarang are the most prominent areas affected by tidal inundation in Indonesia. Communities affected by high tide inundation (rob) on the north coast of Central Java carry out relocations independently or relocations organized by the District Government.

The main challenge for relocating residential communities affected by the rob is the availability of suitable land. The community wanted a new settlement location close to their original settlement and out of reach of high tide inundation. Livelihood activities can continue with the land criteria.

Several cases of relocation implementation encountered the following obstacles:

- (1) District/City Governments have limited budgets and land.
- (2) The budget for housing construction is available, but the proper (City Government) land for resettlement is limited.
- (3) The district government has land for resettlement but has a limited budget for building new houses. Provincial and Central Government support is needed.

Regency and city governments in Java Island have limited land that meet the criteria expected by the people affected by the tidal inundation. Vacant land is unavailable or far from the original settlement (near the coast). Meanwhile, Regency/City Governments, Provincial Governments, and the Central Government (MoPWP/PUPR) have budgets or programs to build new houses.

Relocation between administrative areas may involve a transfer of funds between administrative areas. Regional Government-A in locations that experience inundation on the coast can provide grants from their APBD to Regional Government-B, who are willing to provide/buy land in the destination location. The funds received by Regional Government-B are used to purchase land in a suitable location. This mechanism has

been applied to a small number of examples, including a grant from the Provincial Government of DKI Jakarta to the Bogor District Government for land acquisition for the construction of a reservoir in Ciawi (reducing flooding in Jakarta) and a grant to the Government of Bekasi for the establishment of a final disposal site for waste originating from DKI Jakarta. Strengthening of regulations is needed to eliminate challenges, so that the grant process can be done rapidly yet remains accountable.

Independent relocation was once carried out by communities of the affected village in Demak Regency. The affected communities relocated to Bedono Village on land not far from their original location. The Demak Regency Government has the RUSPIN (Instant Panel System Superior House) Program in the form of new construction in the exact location and the BP2DT program in which the Regency Government provides land while houses are built with the financial assistance of Rp. Fifty million through bank credit. However, this program has yet to be realized to date.

The Provincial Government of Central Java has a budget/program for resettlement. Communities are asked to provide land independently, while the Government will construct new houses.

The Pekalongan City Government uses a rehabilitation and reconstruction program for houses using the RTLH program approach (Houses Not Livable). The Pekalongan City Government provided financial assistance of Rp. 10 million for houses that were included in the RTLH category. The Pekalongan City Government has also built Residential Flats in two locations. The RTLH program owned by the City Government can only reach a small number of affected communities.

The Pekalongan City Government hopes to collaborate with the Central Government to provide housing for people affected by the tidal inundation. The land is planned to be provided by the City Government, while the construction of houses is expected from the Central Government (PUPR). Meanwhile, programs managed by the Central Government are prioritized for housing construction outside Java.

Pekalongan Regency Government faces a challenge in relocation. The land belonging to the Pekalongan Regency government is 13 km from the location of origin of the affected communities in Simonet Hamlet. The Village Government provides village treasury land. Meanwhile, the construction of new housing through the MoPWPH/PUPR program must be carried out on land owned by the District Government (or privately owned). The program may be built on something other than village treasury land. Currently (as of March 2023), the Pekalongan Regency Government is working on procuring land with a location closer to the beach (approximately 3km). Then the land will be granted to the community. The Regional Government hopes the plan follows the housing procurement program at the MoPWPH/PUPR.

The Pekalongan City/Regency Government is trying to obtain exceptional housing support related to disasters from the MoPWPH/PUPR. However, this scheme could not be obtained because it needed an emergency disaster status or national level. Another option is to get support through a slum housing scheme. The MoPWPH/PUPR carries out the construction of houses designated by the Regional Government as slum areas.

Appendix 13

Management of Reserve Land

Cooperation between levels of Government is needed to overcome the challenges of organizing settlements for people affected by hydrometeorological and geological disasters. Relocation outside the affected government administration area must be considered. Limited land in the administrative area of the affected district/city government often occurs. The challenge of land availability will increase drastically in the next few decades as the dangers of climate change increase.

The provision of land needs to be carried out as a national program where relocation can be carried out outside the affected administrative area. The location and condition of the land are adjusted as much as possible so that the livelihood activities of the affected people stay the same.

In April 2021, the Government issued Government Regulation No. 64 of 2021 as the legal basis for establishing a Land Bank Agency^{cxlii}. Furthermore, in December 2021, Presidential Regulation Number 113 of 2021 was issued concerning the Structure and Implementation of Land Bank^{cxliii}.

The Land Bank is organized to guarantee the availability of land in the framework of public interest, social interest, national development interest, economic equality, land consolidation, and agrarian reform. The Land Bank launches the development of national strategic projects in the form of toll roads and other infrastructure developments for the public interest. The Land Bank Agency is a particular agency that manages land and functions to carry out land planning, acquisition, procurement, management, utilization, and distribution.

Land under the control of the Land Bank Agency is granted the status of Management Rights. Concerning management rights, status can be given in the form of usufructuary rights, building use rights, and usufructuary rights following the allotment of the land. Management rights owned by the Land Bank Agency can be granted to Central Government agencies, Regional Governments, BUMN/BUMD, State Owned Legal Entities. If the management period has ended, the land rights will return to the management rights holder, namely the Land Bank Agency.

Property Rights status can also be given to land recipients, including disaster-affected communities, for building houses and cultivating land. Property rights can be given to the transmigration program. It is still unknown how ample the opportunity for Freehold status to be given to individuals/families affected by the disaster. The technical provisions governing the Land Bank Agency have yet to be stipulated. Input from various parties is needed in the preparation of technical provisions. Location, condition, and land criteria are not only intended for infrastructure development or plantation/agricultural land but also suitable for various livelihood activities in communities affected by disasters and climate change, including fishermen. A large amount of land not far from the coast, with relatively high land elevation, must be included in the Land Bank inventory.

The implementation of the Land Bank refers to the Omnibus Law of the Job Creation Law Number 11 of 2020^{cxliv} regarding Land, as stated in Part Four of the Job Creation Law (Articles 125-135). The previous land administration law was considered less than optimal to address the need for extensive land areas. The Ministry of Agrarian Affairs and Spatial Planning/National Land Agency (ATR/BPN) is preparing 25,000 hectares (ha) of land as initial capital for the new institutions^{cxlv}.

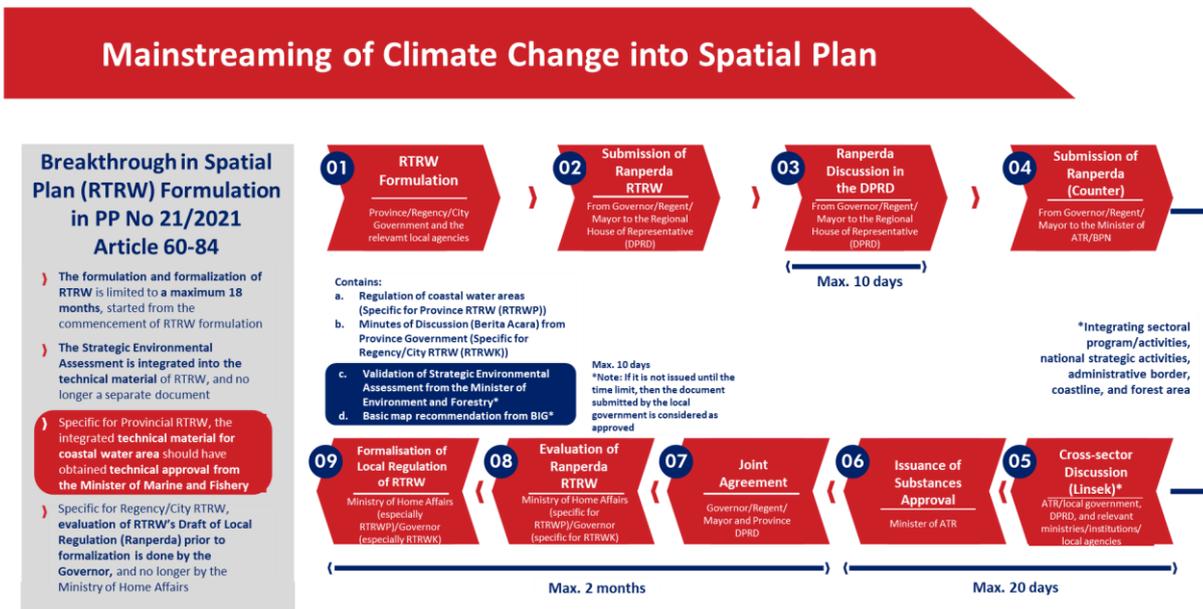
DKI Jakarta Provincial Government also plans the implementation of a land bank at the provincial level. In August 2022, the DKI Jakarta Government submitted plans to own 500 hectares of land in Rorotan Village, Cilincing, North Jakarta. This Land Bank is planned to build settlements, green open spaces, reservoirs, and other needs that still need to be determined. The DKI Jakarta administration will buy land from the people living in Rorotan^{cxlvi}.

The location for the proposed land bank is about two kilometers from the coast of Jakarta. This land bank can be used as a new settlement for fishermen affected by tidal inundation or the impact of development if there is smooth access for fishing boats, including through the East Flood River channel.

Relocation for communities affected by inundation on the coast in Indonesia will be relatively more numerous than other climate change hazards. In addition to the availability of land for relocation, developing an ecosystem for economic activity is necessary. Coastal communities can maintain their livelihood activities if relocated close to their origin. If relocation is carried out relatively far from the coast, coastal communities will be hampered by livelihood activities. The Government needs to revive economic and social systems, such as markets, fishermen's capital, financial sources, and others.

Appendix 14

Mainstreaming of Climate Change into Regional Spatial Plans



Appendix 15

Budget Tagging for Climate Change Adaptation

In 2018 the Government of Indonesia issued Government Regulation Number 17 of 2017 concerning Synchronization of the National Development Planning and Budgeting Process. These regulations are outlined in an application for Planning and Budgeting Performance Information Collaboration (KRISNA). This application supports the process of synchronizing national planning and budgeting systems. Through KRISNA, ministries/agencies have been able to carry out budget tagging since preparing the Ministries/Agencies' work plans.

The tagging of the climate change budget is one of the thematic budget tagging features of the APBN in the KRISNA system. The tagging of the climate change budget is carried out at the output level because this level has information to identify indicators of achievement of development targets and the allocated budget. This approach is to identify and assess adherence to the definition and scope of action for climate change mitigation and adaptation. The process of analysis, identification and review of outputs will be adapted to climate change mitigation and adaptation actions in accordance with the national climate change policy document (in this case RAN-GRK and RAN-API). Climate change budget tagging has been implemented starting from the 2016-2017 fiscal year. Budget tagging does not include funding sourced from the APBD.

The largest use of the budget for activities categorized as climate change adaptation since the last three years was at the Ministry of Public Works and Public Housing (PUPR), followed by the Ministry of Environment and Forestry, and the Ministry of Agriculture. The adaptation budget allocation to the MoPWPH/PUPR has reached 96.5% of the total adaptation budget for the last three years.

From this description it can be seen that infrastructure development dominates climate change adaptation activities in Indonesia. The development of water resources infrastructure has resulted in the MoPWPH/PUPR having a larger budget than other ministries dealing with food, coastal and marine security, as well as health. Meanwhile, the budget for community empowerment, institutional strengthening, technological innovation, and policy strengthening is much smaller.

In 2019 the adaptation budget fell to IDR 39.20 trillion and in 2020 it fell again to IDR 33.29 trillion. The decrease in budget allocation also occurred in climate mitigation. According to the Ministry of Finance (2021), this decline was due to the Government starting to diversify infrastructure development through other funding sources, the private sector and local governments.

The following is a brief description of the use of the climate change adaptation budget in the relevant ministries.

A. Ministry of Agriculture

Based on the type of activity, during the last three years the output and budget for climate change at the Ministry of Agriculture has mostly been for climate change mitigation^{cxlvii} activities (67.2%). Most of the budget is used for land optimization so that agricultural land is more productive and low emissions. Approximately 89.5% is spent

on the construction of tertiary irrigation networks, development of water sources, construction of agricultural reservoirs and water conservation buildings as well as anticipating climate anomalies. Some of these mitigation outputs in 2019 will become adaptation outputs. For adaptation activities over the past three years, the Ministry of Agriculture has also printed rice fields. The biggest adaptation budget allocation is for planting rice fields which reaches 98% of the total adaptation budget in 2018.

B. Ministry of Marine and Fishery

During the last three years, the Ministry of Marine and Fishery (MoMF/KKP) has carried out rehabilitation of coastal areas and ecosystems as well as small islands. Rehabilitation of coastal areas is directed at protecting and revitalizing mangrove forests, marine plants and coral reefs, and swamps so that the ocean's carbon absorption capacity is greater. In 2018, the MoMF/KKP climate change budget is only for adaptation activities. Its activities include research and formulation of climate-resilient marine policy recommendations, maintaining the resilience of coastal areas and small islands, as well as mapping coastal area resources. MoMF/KKP is not mandated to carry out mitigation actions but is currently planning to contribute to reducing GHG emissions through a 'blue carbon' scheme.

C. Ministry of Health

The Ministry of Health has started the climate change budget tagging since 2020. Referring to the RAN API document, the targets for adaptation to climate change in the health sub-sector include: (i) identifying and controlling public health vulnerabilities and risk factors, (ii) strengthening alert systems and utilizing warning systems early response to outbreaks of communicable and non-communicable diseases due to climate change, (iii) strengthening regulations, laws and institutional capacity at the central and regional levels, and (iv) increasing knowledge, technological innovation, and public participation. The Ministry of Health has a program to foster healthy districts/cities, improve malaria elimination intensification services, improve arbovirolosis disease control services,

In general, the Ministry of Health's climate adaptation relies on two vector-based diseases, namely malaria and dengue fever and one related to air quality. The activities of the Ministry in general strengthen the environmental and community health and health systems that have been carried out previously. Additional activities characterized by climate adaptation include identifying climate vulnerabilities and risk factors as well as strengthening preparedness systems and utilizing early warning systems for climate-affected diseases. Compared to other ministries, the Ministry of Health's climate change adaptation efforts are relatively small.

D. Ministry of Public Works and Public Housing

The Ministry of Public Works and Public Housing (MoPWPH/PUPR) has accumulated a climate change budget allocation of IDR 232.74 trillion over the past three years. The budget is allocated to fund 231 outputs consisting of 58 mitigation outputs, 153 adaptation outputs, and 20 co-benefit outputs. The MoPWPH/PUPR's budget allocation reaches Rp. 77.58 trillion per year (77 output per year).

Over the past three years, the MoPWPH/PUPR's budget has been almost balanced for climate change adaptation and mitigation efforts. For adaptation activities, for the past three years the MoPWPH/PUPR has supported the supply of clean water, maintained and regulated water availability, as well as food security by building dams, reservoirs, supplying raw water and irrigation. It can be seen that the PUPR budget includes activities related to the water resources and agriculture sectors. The construction of coastal protection infrastructure in the coastal sector in the coming year will also be part of the MoPWPH/PUPR's activity budget.

E. Ministry of Environment and Forestry

During the last three years, the types of activities and outputs at the Ministry of Environment and Forestry (MoEF/KLHK) were mostly for climate change mitigation activities. For adaptation activities over the last three years, the MoEF/KLHK has mainly increased production of forest products and environmental services, as well as empowered communities through social forestry. The co-benefit output is rehabilitation of forest and vegetative land.

F. Ministry of Agrarian Affairs and Spatial Planning

Referring to the RAN API document, the Ministry of Agrarian Affairs and Spatial Planning (MoAASP/ATR) has a role in the field of ecosystem resilience and the field of special area resilience. In the field of ecosystem resilience, MoAASP/ATR plays a role in formulating policies for improving/improving spatial planning and land use in the context of preserving natural ecosystems on land due to the impacts of climate change. In the area of special area resilience, its role is to integrate climate change adaptation efforts into urban spatial plans. The adaptation output for 2019 is an effort to control spatial use in watersheds (DAS) within the river region.

G. Meteorology, Climatology and Geophysics Agency

The Meteorology, Climatology and Geophysics Agency (BMKG) acts as a provider of data needed to carry out climate forecasts, climate analysis, climate information and climate change to support climate adaptation efforts. Climate projections can be carried out by BMKG, or other parties (universities, MoEF/KLHK or BAPEPPENAS). BMKG data is usually used by ministries/agencies and other stakeholders to project climate change, temperature trends, extreme climate change events, and rainfall. The data is part of an early warning system for the impacts and risks of climate change which have implications for people's lives and the stability of economic activity. BMKG outputs are generally in the form of information services such as climate change information services and applied climate information services. The two services consist of information services at the central and regional levels as well as maritime meteorological information services. BMKG also organizes Climate Field Schools (SLI) for farmers in several areas in collaboration with the local Agriculture Agencies.

H. National Disaster Management Agency (NDMA/BNPB)

NDMA/BNPB plays a role in disaster risk mitigation policies. In this case, NDMA/BNPB also plays a very important role in reducing disaster risks due to climate change, which

are generally in the form of hydrometeorological disasters. Disaster risk mitigation efforts are included in climate change adaptation activities because they seek to reduce vulnerability due to the impacts of climate change. NDMA/BNPB has started marking the climate change budget since 2019. These climate adaptation efforts include developing a disaster early warning system, providing evacuation signs and disaster information warnings, preparing documents such as disaster risk maps, disaster management plans, and disaster management. risk management, to strengthening disaster resilient villages.

Appendix 16

Key Government Ministries and Agencies to Address Loss and Damage from Climate Change

The Ministry of National Development Planning (BAPPENAS), the Ministry of Environment and Forestry, and several technical/sectoral ministries are the leading agencies in efforts to adapt to climate change in Indonesia. Because climate change also has an impact on disaster events that cause casualties and property damage, the National Disaster Management Agency (NDMA/BNPB) is also part of climate change adaptation efforts.

BAPPENAS and KLHK are two key ministries in efforts to adapt to climate change in Indonesia. The roles of the two are often seen as overlapping in terms of policy making and strategic planning, both in climate change adaptation and mitigation efforts. Climate change adaptation and mitigation is part of development activities so that BAPPENAS has a role as the coordinator for preparing the national climate change adaptation and mitigation plan.

Meanwhile, climate change adaptation is part of environmental protection and management activities. According to the environmental law, the Ministry of Environment and Forestry has the authority to set policies and coordinate the implementation of climate change adaptation. Overlapping does not occur this time. In practice, the Ministry of Environment and Forestry takes on a coordinating role to develop climate change vulnerability and risk assessments. BAPPENAS coordinates climate adaptation programs in each development sector with several related ministries.

In terms of developing climate change vulnerability and risk assessment systems and tools, the role of KLHK intersects or has the potential to overlap with NDMA/BNPB which develops disaster risk assessment systems and tools. Both assess the same thing, namely climate-related hazards such as floods, landslides, drought and land fires. However, disaster risk assessments use historical hazard data at the district and city levels, while climate risk assessments must use climate change hazard projections. At this time NDMA/BNPB and KLHK have not done anything similar.

In fact, climate projections down to the district and city levels are still minimal at this point. The data for conducting climate risk assessments is owned by the BMKG, but making climate projections is not the main task of the BMKG. Coordination between the Ministry of Environment and Forestry, BMKG and NDMA/BNPB to align the two assessment systems and tools is necessary to achieve efficiency and effectiveness in their implementation in the regions.

Climate adaptation plans and risk reduction strategies are carried out periodically by BAPPENAS and NDMA/BNPB every 5 years respectively. The government prepares a vulnerability index for each region and a vulnerability map as a basis for determining priority locations for activities. Priorities need to be set given the limited financial and human resources. NDMA/BNPB compiles the Indonesian Disaster Risk Index (IRBI) every 5 years for several types of hazards (floods, droughts, landslides, and others). The MoEF/KLHK developed SIDIK (Vulnerability Index Data Information System) for climate change. The vulnerability index in SIDIK is sourced from PODES data

(population census) conducted by the Central Bureau of Statistics^{cxlviii}. Vulnerability data in SIDIK is based on socio-economic indicators while the types of climate change hazards are not differentiated. That climate change is treated as a uniform type of hazard is a shortcoming of SIDIK. SIDIK updates that take into account various types of climate change hazards are being considered by the Ministry of Environment and Forestry. The Ministry of Maritime Affairs and Fisheries (MMAF) has plans to develop indicators of climate vulnerability in coastal and marine areas to various climate change hazards. This KKP initiative will make a real contribution to improving SIDIK.

Key government ministries and agencies to address loss and damage from climate change are as follows:

a. Ministry of Environment and Forestry (KLHK)

Environmental Law No. 32 of 2009 is a key policy that becomes a reference for tackling climate change in Indonesia. At this time there is no law that specifically regulates climate change in Indonesia. According to environmental laws and regulations, the Ministry of Environment and Forestry has the authority to set policies and coordinate the implementation of climate change adaptation.

Environmental protection and management is a key part of reducing vulnerability to climate change and the threat of disasters. This law also regulates the implementation of the Strategic Environmental Assessment (KLHS). KLHS mandates the integration of climate change and disaster risk into spatial planning

Against this background, the Ministry of Environment and Forestry (KLHK) is a key agency in implementing climate change adaptation and mitigation. In relation to the Loss and Loss management framework previously mentioned, the Ministry of Environment and Forestry is most relevant for Spatial Planning, Conservation policies and conducting UNFCCC negotiations. The Ministry of Environment and Forestry is the focal point for the Indonesian government at the Conference of the Parties on Climate Change (UNFCCC) and is responsible for reporting on the development of Indonesia's commitment to tackling climate change.

The Ministry of Environment and Forestry has played a role, together with the Ministry of Agrarian Affairs and Spatial Planning/National Land Agency (ATR/BPN) in evaluating the implementation of the KLHS in national and regional spatial planning. Ensuring that climate change is taken into consideration in spatial planning is carried out by the Ministry of Environment and Forestry, especially the Director General of Climate Change/Directorate of Climate Change Adaptation. For the integration of climate change in spatial planning, gaps are still found. Climate vulnerability data only covers socio-economic aspects of the population in general and is not yet related to sectors and individual climate change hazards. Provision of climate projection data is not explicitly stated as the main task of the KLHK organization.

The Ministry of Environment and Forestry is a key agency for efforts to protect biodiversity in Indonesia. In general, the Ministry of Environment and Forestry, through the Directorate General of KSDAE (Conservation of Natural Resources and Ecosystems), has a program that aims to (i) maintain biodiversity through conservation and similar efforts, (ii) record biodiversity and species in various ecosystems. However,

no program has been found that is specifically designed to monitor and study the impact of climate change on biodiversity or the loss of certain species. The Climate Change Adaptation Plan (now the Climate Resilience Development Plan 2020-2045) also does not contain this.

The KLHK program at a number of directorates will directly and indirectly have an impact on maintaining and increasing biodiversity. However, no studies or activities have been found that specifically examine the impact of climate change on biodiversity in Indonesia or on certain key species. The said study is not included in the 2020-2024 KLHK National Strategy.

A number of programs carried out by the Ministry of Environment and Forestry together with development partners, including USAID and GIZ, examine the impacts and risks of climate change in an area. The study includes general and simple impacts on coastal ecosystems including mangroves, and on terrestrial ecosystems.

Biodiversity monitoring can be initiated and integrated with relevant MoEF/KLHK programs. Patterning and Nature Conservation Information^{cxlix} at the Directorate General of KSDAE-KLHK is the only activity relevant to monitoring and maintaining biodiversity.

b. BAPPENAS/Ministry of National Development Planning

The formulation of climate change adaptation and mitigation plans is carried out under the coordination of BAPPENAS with a number of sector ministries and central government agencies. The Directorate of Environment is the unit responsible for coordinating the preparation of adaptation plans (RAN-API documents) and climate change mitigation plans (RAN-GRK documents).

Meanwhile, Adaptive Social Protection was developed by BAPPENAS under the coordination of the Directorate of Poverty Alleviation and Community Empowerment together with a number of Ministries/Institutions and international development partners (GIZ, UNICEF, UNDP, WFP).

For the implementation of Adaptive Social Protection, it is estimated that there will be different roles, namely (1) policy makers and fund distribution decisions, (2) fund managers and distributors, (3) fund distribution executors until they reach beneficiaries.

It is still unknown which ministries/agencies will carry out the first role (decision-making) and the second role (managing funds) of this Adaptive Social Protection later. A number of implementation technical guidelines, which were prepared after the Adaptive Social Protection Roadmap was approved by the President, will answer this question. Apart from Bappenas, NDMA/BNPB and the Ministry of Social Affairs are relevant parties who will carry out the role of making decisions on the distribution of funds. NDMA/BNPB and the Ministry of Social Affairs and a Public Service Agency (BLU) are also more relevant for the second role, as administrators of the fund. Distribution to beneficiaries can be carried out in coordination with Regional Governments and related ministries/agencies in the agriculture, fisheries, health and disaster management sectors.

To be distributed immediately to affected communities, Adaptive Social Protection program funds must be placed as Ready-to-Use Funds/Reserve Funds in the APBN or

placed in a Public Service Agency. NDMA/BNPB and the Ministry of Social Affairs are the organizations that are currently carrying out the role of channeling financial assistance and carrying out activities in emergency situations. NDMA/BNPB manages Ready-to-Use Funds sourced from the APBN. Ready-to-Use Funds are issued immediately when NDMA/BNPB approves a proposed request for financial support from the Regional Government to carry out emergency preparedness or emergency response activities. Funding support is only given if an emergency alert status or disaster status has been stipulated by the Regency/City Government or the Provincial Government.

c. National Disaster Management Agency (NDMA/BNPB)

NDMA/BNPB is a key government agency for addressing loss and damage due to climate change that takes place in the short term (rapid onset). NDMA/BNPB plays a role in disaster risk reduction policies in Indonesia. NDMA/BNPB carries out this role through the following stages of disaster management: disaster risk mitigation, preparedness, disaster early warning, emergency response, disaster rehabilitation and reconstruction. NDMA/BNPB manages DIBI (disaster data and information) which is an important reference at this time to assess losses due to hydrometeorological disasters.

d. Ministry of Public Works and Public Housing (MoPWPH/PUPR)

The MoPWPH/PUPR has played a role in organizing housing for the poor, slums and disaster-affected communities. This role is carried out together with the Regency/City and Provincial Governments as well as NDMA/BNPB and the Ministry of Social Affairs. The MoPWPH/PUPR provided new housing for the relocation of people affected by the earthquake in Palu, affected by Cyclone Seroja in East Nusatenggara, and affected by coastal aberrations in Minahasa Selatan. The development was carried out based on a post-disaster impact assessment (JITUPASNA) conducted by LDMA/BPBD and/or NDMA/BNPB. For disasters on a smaller scale, NDMA/BNPB usually hands over construction to a third party (contractor).

The choice of relocating settlements for coastal communities who experience repeated inundation will involve the MoPWPH/PUPR. Relocating community settlements affected by tidal inundation is one of the climate change adaptation strategies contained in the 2020-2045 Climate Resilience Development Plan (BAPPENAS, 2021). The MoPWPH/PUPR was mentioned as the coordinator for this achievement. The 'Large Coastal Protection Project for Five Cities on the North Coast of Java' and 'Construction of Flats (1 Million)' are programs related to tidal inundation management contained in the 2020-2024 Strategic Plan of the MoPWPH/PUPR.

The Coastal Protection Project in Five Cities of the North Coast of Java prioritizes the construction of infrastructure to block seawater from entering the mainland, including a sea wall. The construction of the toll road which also functions as a sea wall which is currently underway along the coast of Demak to Semarang City is one of the projects undertaken by the MoPWPH/PUPR.

Through the 'Development of Flats (1 Million)' program, the MoPWPH/PUPR can be involved in the construction of new houses, including for communities affected by

disasters. Regency/City and Provincial Governments affected by inundation on the coast have asked for the support of the MoPWPH/PUPR to build new houses for affected communities.

Provision of land for these settlements is not part of the main task of the MoPWPH/PUPR. District/City Governments, and may be assisted by Provincial Governments, are responsible for providing land for new settlements. In this position, the MoPWPH/PUPR is waiting for the local government to take the initiative to organize relocation. In handling communities affected by coastal inundation (rob) in Demak Regency, Pekalongan City and Pekalongan Regency, the availability of suitable land for coastal communities (especially fishermen) is a major challenge. Several plans for relocation of settlements by the Regency/City Government have not even materialized due to the absence of suitable land for coastal communities. The community wants new settlements to be built in locations not far from the beach.

e. Ministry of Agrarian Affairs and Spatial Planning – National Land Agency

The Ministry of Agrarian Affairs and Spatial Planning-National Land Agency (MoAASP/NLA or ATR/BPN), to be precise the Directorate General of Spatial Planning, is responsible for carrying out national spatial planning, and preparing guidelines for local governments to carry out regional spatial planning plans. The Directorate General of Spatial Planning was previously under the Ministry of Public Works and Public Housing

Together with the Ministry of Environment and Forestry, the MoAASP/NLA is pushing for the integration of aspects of climate change and disasters into regional and national spatial planning. The MoAASP/NLA in 2018 has prepared a draft of technical guidelines for mainstreaming climate change into regional spatial planning. The same guidelines have previously been developed separately for disaster risk. The integration of disaster risk and climate change into spatial planning is mandated by Law No. 32 of 2009 on the Environment. Disaster risks and climate change are included in the Strategic Environmental Assessment (KLHS).

The MoAASP/NLA in the 2017-2018 period compiled guidelines for integrating disaster risk and climate change into regional spatial planning. These guidelines as of 2019/2020 are still in draft form.

Currently, disaster risk assessments do not use climate hazard projections. The hazard component used is a hazard event that has taken place. This is a challenge to carry out integration with climate risk studies which must use climate hazard projections. For local governments that have limited budgets and human resources it will be difficult to organize a diverse consultancy process. Study and consultancy documents for mainstreaming disaster risk into spatial planning have the potential to be carried out separately from the integration of climate change into spatial planning. Likewise, discussions on land (terrestrial) spatial plans were carried out at different periods and processes from spatial planning for coastal and marine areas.

Procurement of land for the future relocation of disaster-affected community settlements will involve the role of the MoAASP/NLA. The MoAASP/NLA acts as a member of the Committee on the newly formed Land Bank Agency in 2021. The Committee is directly

responsible to the President. The Land Bank has the potential to overcome obstacles to providing land for the relocation of people affected by climate change and disasters. In order to provide sufficient suitable land for coastal communities, especially fishermen, input needs to be provided in the preparation of technical provisions for land acquisition.

f. Ministry of Marine and Fishery

Especially for the protection of marine biodiversity, the Ministry of Marine and Fishery (MoMF/KKP) is a key agency. Through the Directorate General of Maritime and Fishery Resources Supervision, the MoMF/KKP Area which is the authority of the KKP.

Meanwhile, the Ministry of Environment and Forestry manages coral reefs in the Marine National Park.

Studies on key ecosystems or species that are visibly affected by climate change, including marine fisheries are not found in the ministry's strategic plans and annual work plans at this time. The study of the impact of climate change on biodiversity, both on land and in sea waters, has begun to be transferred to the new institution of the National Research and Innovation Agency (BRIN). This study can be carried out in collaboration between the MoMF/KKP as the manager of the conservation area and BRIN.

The MoMF/KKP together with the Regency/City and Provincial Governments are the agencies responsible for fostering and improving the welfare of coastal communities, especially fishermen. This role is carried out through the Directorate General of Capture Fisheries, the Directorate General of Aquaculture and the Directorate General of Marine Spatial Management.

Moratorium after El Nino takes place aims to reduce pressure on coral reef ecosystems that are currently vulnerable. The decision to make a Pause-Utilization should be issued by the official managing the National and Regional Marine Protected Areas or the Directorate General of Marine Spatial Management at the location where Coral Reefs are expected to be affected. To anticipate the reduced income of fishermen or coastal communities due to the implementation of the Pause-Utilization, financial assistance needs to be provided. An Adaptive Social Protection Scheme needs to be provided. The Directorate General of Capture Fisheries together with the Local Marine and Fishery Agency are the relevant parties to distribute it in the field.

The Adaptive Social Protection Scheme is also relevant given to fishermen who have difficulty going to sea in extreme weather. Adaptive Social Protection can not only be provided in the form of direct cash to fishermen, but also in the form of fishermen credit subsidies or guarantees for credit to fishermen. To develop credit subsidy schemes or loan guarantees, Adaptive Social Protection managers need to build partnerships with financial institutions that extend credit to fishermen.

The Maritime and Fishery Business Capital Management Institution (LPMUKP) is one of those that distributes credit to fishermen. The Public Service Agency (BLU) under the MoMF/KKP was established in 2019. LPMUKP aims to increase access to capital for the marine and fisheries community. LPMUKP has the main task of managing loans or financing of assisted revolving funds for Micro, Small and Medium Enterprises in the

marine and fisheries sector. LPMUKP also plays a role in encouraging fisheries actors to implement sustainable fishing practices.

g. Ministry of Finance and BPDH

Another scenario option, Adaptive Social Protection program funds are disbursed annually and placed in a Public Service Agency (BLU). BLU was established to provide flexible government services while maintaining accountability. BLU overcomes program funding constraints through the APBN mechanism which is bound to the fiscal year period. The BPDH (Environmental Fund Management Agency) under the Ministry of Finance is currently the most relevant to manage this kind of fund. BPDH is planned to manage funds from various sources for activities related to environmental protection, climate change and disaster management. The Ministry of Finance is not planning to create a new BLU.

At BLU, budgets that are not used in the current year can be accumulated in the following fiscal year. Implementation of Adaptive Social Protection using BLU vehicles allows mobilization of funds from other sources (donors, private, investment, individuals) to support this program.

The Environmental Fund Management Agency (BPDH) was established through Presidential Regulation number 77 of 2018 and officially operating on January 1, 2020. As a Public Service Agency, BPDH is designed to be more autonomous than government agencies, but more regulated than state-owned enterprises. BLU can be more flexible and effective in managing funds from domestic and foreign sources. The main capital is obtained from the APBN and other sources (APBD, grants, loans, investments, profits). BPDH was originally formed by the Ministry of Finance and the Ministry of Environment and Forestry to manage funding for the environmental sector.

In its development, BPDH also manages funds intended for disaster management. The Ministry of Finance is managing a disaster insurance program that protects state property (particularly central government government buildings). The Minister of Finance does not want to form a new BLU. Furthermore, BPDH is also intended to manage funding for climate change countermeasures.

BPDH collects, fertilizes and distributes funds. Fundraising is obtained from the APBN, APBD, grants and donations and other legitimate sources. Funding is done through banking instruments, capital market instruments and other instruments. Distribution of Funds through carbon trading, loans, grants, subsidies and other mechanisms. Carbon Tax Revenue can be used to increase development funds, environmentally friendly investments, as well as support for low-income communities in the form of social assistance^{cl}.

BPDH's initial funding came from the Reforestation Fund. BPDH then receives results-based payments from reducing greenhouse gas emissions from avoided deforestation and forest degradation^{cli}. Forestry businesses financed by the Reforestation Fund - Revolving Fund Facility (FDB) include on farm forestry businesses, including financing for forestry plant production businesses, postponement of forestry plant cutting, forestry plant harvesting and forestry off farm businesses.

The revolving fund scheme (known as the Revolving Fund Facility) is distributed to a number of community groups for forestry businesses. As of 30 June 2021, the total funds that had been disbursed until the end of 2020 amounted to IDR 1.434 trillion (equivalent to USD 100 million) to 27,509 debtors in 30 provinces who submitted proposals, including strengthening crab cultivation in mangrove ecosystems. The expected impact of this FDB is increasing forest and land cover, reducing greenhouse gas emissions from the forestry sector and increasing people's welfare.

The role of the Ministry of Finance is not only through the Environmental Fund Management Agency (BPDLH). The Fiscal Policy Agency (BKF)-Ministry of Finance is the Designated Authority for the Green Climate Fund (GCF) in Indonesia. BKF gives approval for proposed climate change adaptation and mitigation projects in Indonesia. Every year, since 2019, BKF has sent invitations to submit concept notes to Ministries, Government Agencies, Regional Governments, civil society organizations and the private sector. The Green Growth Global Institute (GGGI) assists BKF in the process of selecting, managing funds and climate change programs in Indonesia.

h. Meteorology, Climatology and Geophysics Agency

Monitoring of almost all climate components is carried out by the BMKG. Monitoring of the level of sea acidity (pH) has not been carried out by the BMKG at this time. Projecting the dangers of climate change in the future is not the main task of the BMKG, but can be done upon request at a cost by the proposer. BMKG has made projections for the next few years for temperature and rainfall at the national level and a number of regions. Projections on maritime climate parameters, such as sea level rise and wave height, have so far been made only by experts from universities (ITB).

BMKG is the main supporting organization for ministries and other government agencies in conducting climate change impact studies and adaptation efforts. BMKG provides data for a joint study by the Ministry of Health-FKM UI-ICCTF to study the impact of climate change on susceptibility to malaria and dengue, provides data for studies on the availability of water resources and the impact of climate change on food crops, provides data for projecting wave height and sea level.

BMKG is currently releasing information on forecasts of flood impacts and forecasts of tidal floods on the coast. To be able to carry out these projections, other data is needed which is the responsibility of other ministries/agencies. Information on forecasting the impact of flooding requires land cover/use data and river data managed by the MoPWP/PUPR. The tidal flood forecast information on the coast provides an estimate of when tidal floods will occur. The forecast has not provided the extent/reach of the tidal inundation that will occur. In order to be able to estimate the extent/reach of tidal inundation, it is necessary, among other things, to collect coastal land elevation data and seafloor contours (bathymetry).

i. National Research and Innovation Agency (BRIN)

Research activities on natural resources were previously part of the main tasks of the Research and Development Agency in each ministry. The study function in a number of ministries and central government agencies then shifted to the National Research and

Innovation Agency (BRIN), which was established in 2019. A number of existing research institutions, including LIPI, BPPT, LAPAN, BATAN and others, then merged into BRIN. The table below presents some of the research centers at BRIN. This research center is relevant for conducting climate change impact studies and adaptation efforts.

Relevant for impact assessment	Relevant for climate change adaptation
Remote Sensing Research Center	
Center for Ecological Disaster Research	
Center for Climate and Atmospheric Research	Genetic Engineering Research Center
Limnology and Water Resources Research Center	Food Crops Research Center
Center for Oceanographic Research	Horticulture and Plantation Research Center
Deep Sea Research Center	Animal Husbandry Research Center
Fisheries Research Center	
Marine and Inland Water Resources Conservation Research Center	
Center for Ecology and Ethno-biology Research	

In theory, the merging of a number of research institutions into BRIN will improve the coordination and synergy of research in Indonesia. Research needs in a number of ministries and government agencies are part of BRIN's responsibility. However, in the first few years, BRIN was still preoccupied with building institutions and the scope of each research center and research group. Researchers who join BRIN are currently still working hard to get to know the new culture, mechanism and work environment.

From informal and formal conversations with BRIN researchers, work productivity is currently experiencing greater challenges. Researchers are still trying to identify this new organization, find out the work plan and research budget it has. Researchers are currently concentrating on producing scientific publications as the main performance indicator. With this description, in the first few years of BRIN activities to monitor the impact of climate change and adaptation efforts will experience greater challenges.

BRIN has not yet received an assignment to conduct a study on the impact of climate change, which was previously the responsibility of a number of ministries and government agencies. There is no National Program regarding this matter in the BRIN strategic plan and program at this time. In 2024 it is hoped that the consolidation of the

BRIN institution will have been completed, and at that time a climate change impact assessment can begin to be prepared. BRIN is currently exploring cooperation to study and apply technology with various parties pihak^{clii}.

Appendix 17

Civil Society Organizations Examine the Loss and Damage

Loss and damage from climate change is not a theme the organization is concerned with. At this time only Mercy Corps Indonesia is conducting studies, involved in dialogue with the Ministry of Environment and Forestry and also participating in international negotiations (UNFCCC-Subsidiary Body Meeting). There are at least three organizations that have current activities that can support policy dialogue on Loss and Damage.

IRID (Indonesia Research Institute for Decarbonization) which conducts studies on aspects of international financing for climate change. IRID is a newly formed organization concerned with decarbonization and climate resilience. A number of individuals who are members of IRID have long experience in studies, policy dialogues and campaigns for reducing greenhouse gas emissions from the energy sector. The study currently being conducted by IRID does not cover aspects of policy, institutions and strategies for disaster management and climate change adaptation in Indonesia. Collaboration needs to be explored between Mercy Corps and IRID on the topic of financing.

CARII, an organization that analyzes disaster data, is monitoring trends in reports and policy briefs related to loss and damage in the ASEAN region. The study was conducted on the data available on the internet that contains this information in ASEAN countries. The study does not include information at the national (Indonesian) level.

Samdhana was involved with the regional coalition in Southeast Asia in compiling a policy paper and advocating with the international coalition on the theme of Loss and Damage Management. Samdhana has been known as an organization that conducts studies on forestry policies, forest products and supports indigenous peoples

Appendix 18

Examples of programs related to adaptation and natural resources protection funded by the Corporate Social Responsibility Program in Indonesia

A number of companies operating in Indonesia, both nationally and internationally, support efforts to protect the environment and manage natural resources in Indonesia. This program directly aims to strengthen environmental capacity in dealing with the impacts of climate change. Legislation even requires State-Owned Enterprises (BUMN) to set aside part of their CSR programs for activities related to environmental protection and natural resource management.

State oil company PT. PERTAMINA^{cliii} and the state electricity company PT. Indonesia Power and PT. PLN (State Electricity Company)^{cliv} it can be said that the source of funding for most of the mangrove planting activities in almost all parts of Indonesia. PT. Pertamina and PT. Indonesia Power operates on the coast. PT. Pertamina has several times had a negative impact on coastal ecosystems. The CSR program can be part of a strategy to build relationships with the community and restore or maintain the coastal environment. PT. Indonesia Power has collaborated for several years with UKM Keset for mangrove rehabilitation and processing of mangroves into food and beverages^{clv}.

Not only local communities and environmental organizations, humanitarian organizations such as the Indonesian Red Cross and Dompot Dhuafa also have mangrove rehabilitation programs, and the processing of non-timber mangrove forest products into raw materials for drinks, food and traditional medicines.

The insurance company Prudential is participating in providing funding to the Indonesian Red Cross for reducing the risk of flood disasters in Bogor Regency for the 2019-2020 period. One of the activities carried out by PMI Bogor Regency is conducting flood alert group training and making simple flood early warning tools with the community. This insurance company support can also be said as part of risk reduction for the company. The higher the community's ability to reduce disaster risk, it will indirectly reduce the possibility of insurance claims from the community.

The KEHATI Foundation in 2022 will establish communication with foreign companies from South Korea for the rehabilitation of mangrove forests and Japanese companies for the use of PVC pipes for the rehabilitation of coral reefs in Banten Province. Rehabilitation in Banten, where the company operates, is seen as an investment to continue the company's operations in a province prone to earthquakes, tsunami hazards, strong winds and high tides.

End Note

- ⁱ IPCC. (2022). *Climate Change 2022: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change* [H.-O. Pörtner et al. (eds.)], Cambridge University Press, Cambridge, UK and New York, NY, USA, 3056 pp. <https://www.ipcc.ch/report/ar6/wg2>
- ⁱⁱ Zurich Flood Resilience Alliance. (2023). *Falling through the Gaps. How Global Failures to Address the Climate Crisis are Leading to Increased Loss and Damages. Evidence from Bangladesh, Indonesia and Nepal.*
- ⁱⁱⁱ Zurich Flood Resilience Alliance. (2023). *Falling through the Gaps. How Global Failures to Address the Climate Crisis are Leading to Increased Loss and Damages. Evidence from Bangladesh, Indonesia and Nepal.*
- ^{iv} Jovel, Roberto J.; Mudahar, Mohinder. 2010. *Damage, Loss, and Needs Assessment Guidance Notes: Volume 2. Conducting Damage and Loss Assessments after Disasters.* © World Bank, Washington, DC. <http://hdl.handle.net/10986/19046> License: CC BY 3.0 IGO
- ^v Mechler, R., Bouwer, L., Schinko, T., Surminski, S. and Linnerooth-Bayer, J. (eds) (2019) *Loss and damage from climate change. Concepts, methods and policy options.* <https://doi.org/10.1007/978-3-319-72026-5>.
- ^{vi} Refer to DIBI in the following website: <https://dibi.bnppb.go.id/>
- ^{vii} KLHK. (2020). *Roadmap Nationally Determined Contribution (NDC) Climate Change Adaptation.* Jakarta (ID): The Republic of Indonesia Ministry of Environment and Forestry. Source: http://ditjenppi.menlhk.go.id/reddplus/images/adminppi/adaptasi/dokumen/Roadmap_NDC_API_opt.pdf
- ^{viii} WRI (2022), can be accessed in the following link: <https://www.wri.org/insights/current-state-play-financing-loss-and-damage>
- ^{ix} Source: <https://us.boell.org/en/unpacking-finance-loss-and-damage>
- ^x Source: <https://www.sei.org/projects-and-tools/projects/designing-a-loss-and-damage-fund/>
- ^{xi} Source: <https://us.boell.org/en/unpacking-finance-loss-and-damage>
- ^{xii} Source: <https://www.sei.org/projects-and-tools/projects/designing-a-loss-and-damage-fund/>
- ^{xiii} Source: <https://unfccc.int/news/cop27-reaches-breakthrough-agreement-on-new-loss-and-damage-fund-for-vulnerable-countries>
- ^{xiv} Source: <https://unfccc.int/news/cop27-reaches-breakthrough-agreement-on-new-loss-and-damage-fund-for-vulnerable-countries>
- ^{xv} Source: <https://unfccc.int/news/cop27-reaches-breakthrough-agreement-on-new-loss-and-damage-fund-for-vulnerable-countries>
- ^{xvi} Source: <https://www.wri.org/insights/current-state-play-financing-loss-and-damage>
- ^{xvii} GRiF was launched in October 2018 by the World Bank Group in partnership with the German and UK governments. It became fully operational in 2019 and has supported one global project and four countries around the world. Contributions of USD 200 million were promised by the German Government (BMZ) and the British Government (DFID). Investment projects have been implemented in Malawi, Jamaica, Sierra Leone and Mozambique, and implement Crisis Risk Financing at a global level (See link: Source: <https://www.insuresilience.org/news/the-global-risk-financing-facility-grif/>).
- ^{xviii} Source: <https://www.globalriskfinancing.org/about-us>
- ^{xix} See link: <https://www.bmz.de/en/issues/climate-change-and-development/global-shield-against-climate-risks>
- ^{xx} Geological disasters include earthquakes, tsunamis, volcanic eruptions, land movements.
- ^{xxi} Hydrometeorological disasters include flood, landslide, cyclone, drought, tropical cyclone, land fire, and erosion/abrasion
- ^{xxii} The term 'impact' referred to here is the consequences of climate change that is taking place at the moment and in the future. However, in a number of regulations, the term 'impact' refers to the consequences of climate change that is currently taking place. Meanwhile, the terms 'potential impact' and 'risk' are used to explain the consequences of climate change that will take place in the future. 'Potential impact' refers to the (qualitative) conditions resulting from a change, while risk is the (quantitative) probability of that impact occurring on humans or systems by considering several factors (capacity, exposure, vulnerability).
- ^{xxiii} Data on sea water acidity (pH) parameters across Indonesia are not provided by BMKG. It is assumed that such monitoring was not carried out.
- ^{xxiv} Can be provided by the BMKG if requested, but not as an annual routine task funded by the APBN. Projections on sea temperature are also carried out by a small number of universities in Indonesia that have meteorology program, namely ITB and IPB.
- ^{xxv} idem

^{xxvi}Wave height projections are only carried out during the preparation of the National Climate Adaptation Plan (or currently as the 2020-2045 Climate Resilience Development Plan document) and are carried out by no more than five experts from ITB and BIG.

^{xxvii}There has not been any publication regarding tidal projections, either by the Dishidros TNI-AL or other parties. However, historical data of sea tides is one of the data needed to project sea level and calculate the area of seawater inundation on the coast.

^{xxviii}The sea level projection analysis was carried out by a small number of experts from ITB and BIG using historical data provided by BMKG as well as global data. Sea level projections are carried out during the preparation of the National Climate Adaptation Plan (or currently as a 2020-2045 Climate Resilience Development Plan document) and studies conducted by the Ministry of Environment and Forestry-JICA. The sea level projection requires not only historical sea level data, but also historical data on tides, seabed appearance near the coast (bathymeteri), and coastal slope. Therefore, sea level projections require collaboration with BMKG, Dishidros TNI-AL, BIG and LAPAN (now part of BRIN).

^{xxix}BMKG provides data on seawater salinity at 0 meters (surface), depths of 50 m, 100 m and 150 m.

^{xxx}Source: <https://darilaut.id/berita/bmkg-perpuh-layanan-formasi-cuaca-maritim-di-selat-makassar>

^{xxxi}It is not yet known whether the BMKG has the capacity and able to make sea water salinity projection.

Compared to atmospheric climate monitoring, BMKG's experience in maritime climate monitoring is relatively new. Projections of salinity at the global level are also limited. BRIN has the potential to become a party involved with BMKG in projecting seawater salinity.

^{xxxii}Rainwater pH monitoring is carried out by BMKG:

http://202.90.199.61:81/BMKG_Pusat/Klimatologi/Informasi_Kimia_Air_Hujan.bmkg

^{xxxiii}Drought and land fires are relatively long-lasting hazards compared to other hazards but are limited to one season only.

^{xxxiv}The study was mainly carried out on vector- and water-borne diseases. The earlier stages, namely the effect of climate change on disease vectors, especially malaria and dengue, are almost unavailable/found in Indonesia. The study of the impact of climate change on health begins with two vector-borne diseases, namely malaria and dengue. The Climate Resilience Development Plan 2020-2045 also includes pneumonia. Studies on the impact of climate change on the development and distribution of mosquitoes are limited or not yet available. While studies on the number of cases of malaria and DHF during the rainy and transitional seasons are available.

^{xxxv}The study was conducted by a number of doctoral students at the University of Indonesia in collaboration with a team from the UK and the US on the impact of climate change on orchids, tropical forests, birds and mammals.

^{xxxvi}Studies on this topic are limited and barely funded by the state budget (APBN), but studies by universities are available, including by Buchory, D. et al 2022. Beekeeping and Managed Bee Diversity in Indonesia: Perspective and Preference of Beekeepers. View link:<https://www.mdpi.com/1424-2818/14/1/52>, accessed December 16, 2022, 19L 44 ECT.

^{xxxvii}Studies and efforts to control agricultural pests have been carried out for decades by the Ministry of Agriculture with sources from the state budget (APBN) and universities with various funding sources for studies.

^{xxxviii}The current water balance and projections for the reduction of water availability at the national and major island levels in Indonesia for the next few years have been carried out.

^{xxxix}Projections on the decline in production of food crops, particularly rice and maize, at the national level and food production centers in Indonesia for the next few years have been carried out.

^{xl}Data on fishermen's catches is recorded at the Fish Auction Place (TPI). Some fishermen's catches are not recorded at TPI, because (1) they do not land fish at TPI, (2) they do not sell fish through TPI, including traditional fishermen handing over the fish they catch directly to capital owners/juragan and direct buyers (including restaurants, supermarkets and exporters). Analysis of fish caught at a location related to weather conditions at that time (wave height, wind speed and currents) is carried out at only a few locations and is project-based (depending on the availability of the study project budget).

^{xli}Coastal areas experiencing erosion/abrasion in certain provinces or regencies/cities are available, but for all of Indonesia they are not available. The first and last map of coastal erosion for all of Indonesia was published by the Ministry of Maritime Affairs and Fisheries in 2009. Projections of coastal areas that will experience erosion/abrasion in the future for all regions of Indonesia are not currently available.

^{xlii}The inundated coastal area for all of Indonesia is not yet available. A small number of regencies and cities in the north of Java Island, especially those experiencing land-subsidence, already have maps of inundated coastal areas for now and projections for the future.

^{xliii}Coastal areas experiencing erosion/abrasion in certain provinces or regencies/cities are available, but for all of Indonesia they are not available. The first and last map of coastal erosion for all of Indonesia was published by the

Ministry of Maritime Affairs and Fisheries in 2009. Projections of coastal areas that will experience erosion/abrasion in the future for all regions of Indonesia are not currently available.

^{xliv}The National Mangrove Map (2021) contains the latest condition of mangroves down to the district and city level, including information on the extent of mangroves that are experiencing erosion/abrasion.

^{xlv}A number of global literature reviews on this topic are available. Studies for Indonesian waters have not been carried out/reports are not available. Meanwhile, studies on the impact of climate anomalies, namely the El Nino and La Nina periods, on the catches of fishermen (especially the main pelagic fish such as tuna and tuna) were carried out by IPB, BPPT and then the Agricultural Research and Development Agency of the Ministry of Maritime Affairs and Fisheries. The study was carried out on a limited number of El Nino and La Nina events (1-3 years of occurrence), in one or two specific marine waters.

^{xlvi}A number of global literature reviews on this topic are available. Studies for Indonesian waters have not been carried out/reports are not available

^{xlvii} Bappenas (2023). Development Plan of Coastal Area with High Risk of Coastal Inundation. Presented by Irfan D. Yananto, SE, MEREC, Direktorat Lingkungan Hidup Kementerian PPN/Bappenas during Focus Group Discussion “Loss and Damage from Climate Change” held by Mercy Corps Indonesia 9 Mei 2023

^{xlviii} Ten (10) out of 34 provinces have the largest economic losses due to climate hazards on coastal sector. Around 34% of Indonesia cities and regencies, or 176 cities/regencies, are included as part of the the priority locations for adaptation actions in the Climate Resilient Development Plan 2020-2045

^{xlix} The potential of population migration due to the rising of sea levels in Sumatera Island: 43 cities/regencies; in Java-Bali: 30 cities/regencies; in Nusa Tenggara: 7 cities/regencies; in Borneo: 19 cities/regencies; in Sulawesi: 44 cities/regencies; in Maluku: 11 cities/regencies; and in Papua: 5 cities/regencies.

^l Individual interview with Prof. Dr. Chairil Anwar Siregar, researcher at the Forestry Research and Development Agency (now joined as a researcher at the National Innovation Research Agency/BRIN).

^{li} Brief information from Prof. Dr. Jatna Supriatna on the Thamrin School Whats App Group on February 12, 2023.

^{lii} El Nino Anomaly Triggers Coral Reef Bleaching | Lembaga Ilmu Pengetahuan Indonesia (lipi.go.id)

^{liii} Wouthuyzen et al. (2017). A comparison between the 2010 and 2016 El-Ninō induced coral bleaching in the Indonesian waters. Global Colloquium on GeoSciences and Engineering 2017. IOP Conf. Series: Earth and Environmental Science 118 (2018) 012051

^{liv} Written communication with Abrar (P2O LIPI researcher, now a part of BRIN) on 16 November 2022.

^{lv} Gaol, JL (2003) and Syamsuddin, F., Laksmi, M., Amri, K. & Andiastruti, R. (2003)

^{lvi} Several literatures show that climate change has the potential to cause a shift/change in the depth of the sea water column, which is the path for fish migration, to become deeper. The length of a fisherman’s fishing line, for example, also needs to be adjusted. Changes also affect reproductive locations and rearing/enlarging areas for fish fry.

^{lvii} See the following links: <https://klikhijau.com/terdampak-perubahan-iklim-populasi-lebah-menurun-drastis> ; and also: <https://kumparan.com/urbanid/populasi-lebah-madu-sumatra-menurun-akibat-perubahan-iklim-1vVQpLf2nXq>

^{lviii} See the following link: <https://jateng.tribunnews.com/2022/05/25/tiga-hari-bencana-banjir-rob-pekalongan-status-tanggap-darurat-belum-ditetapkan-ini-alasannya>

Also: <https://pekalongankota.go.id/berita/pemkot-belum-tetapkan-status-tanggap-darurat-bencana-banjir-rob.html>

^{lix} See the following link: <https://news.detik.com/berita-jawa-tengah/d-5041716/kota-pekalongan-tetapkan-tanggap-darurat-banjir-rob-hingga-17-juni>

Also: <https://sindikasi.republika.co.id/berita/qbek0e459/pemkot-pekalongan-ingatkan-warga-potensi-rob-maksimum>

^{lx} See the following link: <https://mediaindonesia.com/nusantara/318921/bpbd-demak-anggap-rob-bukan-bencana>

Lihat juga: <https://bangko-independent.com/read/2019/01/28/6949/banjir-rob-disebut-bukan-bencana/>

And: <https://bkpp.demakkab.go.id/2020/06/banjir-rob-demak-diminta-menjadi.html>

Further discussion by Gumilang (2018) “Coastal Flooding is ‘Not Recognized’ as A type of Disaster ?” can be seen in the following link: <https://kumparan.com/ragil-satriyo/banjir-rob-tidak-diakui-sebagai-jenis-bencana-alam/full>

^{lxi} Different opinions see that the hazards mentioned in Law Number 24 of 2007 is an example. Damage and losses caused by other hazards are also part of the disaster management framework. Thus, disaster status and emergency management need to be carried out.

^{lxii} Source: http://perpustakaan.menlhk.go.id/pustaka/home/index.php?page=detail_news&newsid=768

^{lxiii} The Nationally Determined Commitment (NDC) document contains a commitment to reduce greenhouse gas emissions (mitigation) and a general commitment to reduce economic losses due to climate change. NDC is not an

operational reference for climate change adaptation efforts. NDC reporting includes the impacts of climate change and the achievements of climate change adaptation and mitigation efforts.

^{lxiv} BNPB's role in disaster management covers disaster risk reduction, preparedness, warning and emergency management, and post-disaster management. BNPB's role does not include efforts to prevent and reduce the disaster hazard. This role, especially those occur as a result of a decline in environmental quality, is primarily carried out by the Ministry of Environment and Forestry.

^{lxv} Previously, adaptation plan was contained in the National Action Plan for Climate Change Adaptation (RAN API) 2013.

^{lxvi} In 2021, the Ministry of Health with the support of the World Health Organization (WHO) prepared a Health-National Adaptation Plan (HNAP). This adaptation plan provides data on the status of climate change impact assessment on health and a very comprehensive climate adaptation plan of health sector. However, there is still a large gap between the plans in the HNAP and the adaptation efforts that will be implemented in the Ministry of Health's Strategic Plan 2020-2024.

^{lxvii} The study of the impact of climate change on health begins with two vector-borne diseases, namely malaria and dengue. The Climate Resilience Development Plan 2020-2045 also includes pneumonia. Studies on the impact of climate change on the development and distribution of mosquitoes are limited or not yet available. While studies on the number of malaria and DHF cases during the rainy and transitional seasons are available, most of them are carried out as theses for students of the master's and doctoral programs. Studies linking the development and distribution of mosquitoes to the number of cases of malaria and DHF are not yet available. Currently, spatial maps of the distribution of malaria and DHF cases down to the village or sub-district level are not yet available.

^{lxviii} Adaptation efforts in the form of early warning based on season forecasts in a number of areas, environmental sanitation, mosquito nest eradication movements in almost all parts of Indonesia. An early warning system for health problems based on weather forecasts has not yet been developed. However, early warning of a potential increase in cases of malaria and dengue is given based on forecasts ahead of the start of the rainy and transition seasons.

^{lxix} Counseling, eradicating plant pests and setting cropping patterns

^{lxx} Some local governments provide subsidies. Part or all of the insurance programs protect against accidents at sea for small-scale fishers. Meanwhile, the impact of bad weather that is more often experienced by small fishermen is reduced fish catches.

^{lxxi} Data on fishermen's catches is recorded at the Fish Auction Place (TPI). Some fishermen's catches are not recorded at TPI, because (1) they don't land fish at TPI, (2) they don't sell fish through TPI, including traditional fishermen handing over the fish they catch directly to capital owners/juragan and direct buyers (including restaurants, supermarkets). and exporters). Analysis of fish caught at a location related to weather conditions at that time (wave height, wind speed and currents) is carried out at only a few locations and is project-based (depending on the availability of the study project budget).

^{lxxii} If the fish catch is minimal due to bad weather at sea, fishermen need a new initial capital to carry out the next fishing. Access to financial institutions for micro loans with low interest is obtained by some fishermen, while others still depend on middlemen/owners of capital with higher interest rates or fish catch sharing mechanisms.

^{lxxiii} Coastal areas experiencing erosion/abrasion in certain provinces or regencies/cities are available, but for all of Indonesia they are not available. The first and last erosion/aeration map on the Indonesian coastline was published by the Ministry of Maritime Affairs and Fisheries in 2009. Erosion/aeration is caused by sea waves. Projected maps of coastal areas that will experience erosion/abrasion in the future for all regions of Indonesia are not currently available.

^{lxxiv} Rehabilitation of coastal erosion is carried out in a small number of affected areas. Rehabilitation by planting mangrove seedlings was carried out in areas that were previously mangrove ecosystems. Rehabilitation of the sand substrate ecosystem has been minimal. Erosion prevention on sandy substrates is carried out by using wave-breaking concrete, sandbags and tires, as well as beach embankments. In general, the rehabilitation currently being carried out covers a small portion of the entire coastal area affected by coastal erosion/abrasion.

^{lxxv} The impact of climate change on marine aquaculture (mari-culture) is mainly experienced by seaweed cultivation and demersal marine fish (grouper and other) aquaculture. Most of the adaptation programs are aimed at reducing the impact on seaweed cultivation, including by adjusting the schedule for installing seaweed seeds and the depth of position of the seaweed seeds. The choice of adaptation efforts for marine fish farming is relatively limited.

^{lxxvi} The inundated coastal area for all of Indonesia is not yet available. A small number of regencies and cities in the north of Java Island, especially those experiencing land-subsidence, already have maps of inundated coastal areas for now and projections for the future.

^{lxxvii} A small part of the total 514 regencies and cities in Indonesia have adaptation plans to anticipate seawater inundation on the coast. This process is carried out with the support of the Central Government (BAPPENAS) and programs from development partners managed by international CSOs. No more than five cities/regencies are making efforts to prevent the danger of seawater inundation with physical structures in the form of embankments, namely Jakarta, Semarang, Pekalongan, and Demak. At the same time, the area referred to is also experiencing a land-subsidence process.

^{lxxviii} Coastal areas experiencing erosion/abrasion in certain provinces or regencies/cities are available, but for all of Indonesia they are not available. The first and last erosion/aeration map on the Indonesian coastline was published by the Ministry of Maritime Affairs and Fisheries in 2009. Erosion/aeration is caused by sea waves. Projected maps of coastal areas that will experience erosion/abrasion in the future for all regions of Indonesia are not currently available.

^{lxxix} Efforts to overcome coastal erosion are carried out by some cities and districts in Indonesia, while some others do not make any real prevention efforts. Mangrove rehabilitation, use of sediment traps, breakwaters are common forms of erosion prevention. This form of activity can be carried out and financed by the District/City Government. Forms of large infrastructure such as a sea wall are beyond the financing capabilities of the district/city government and even the provincial government.

Most of the mangrove rehabilitation activities for erosion prevention are carried out partially or not completely. In almost all mangrove rehabilitation programs, settlement of land status is not done first. Short process taken. Many mangrove seedlings are planted outside the tidal zone (in front of the front zone or behind the back zone) which are not suitable for mangrove growth.

^{lxxx} The National Mangrove Map (2021) contains the latest condition of mangroves down to the district and city level, including information on the extent of mangroves that are experiencing erosion/abrasion.

^{lxxxi} Mangrove rehabilitation has been and is being carried out in most parts of Indonesia by the Government, the private sector, development partners and civil society organizations and community groups. Some other damaged mangrove ecosystems are still neglected and not rehabilitated.

^{lxxxii} Personal Communication with Muhammad Abrar/BRIN (16 November 2022), Triez B.Razak/IPB (22 August 2021), Rizya Ardiwijaya/YKAN (29 July 2021).

^{lxxxiii} Rehabilitation has been and is being carried out in some critical coral reef ecosystems in Indonesia. Critical mangrove conditions are mostly caused by human actions (destructive fishing, pollution and sedimentation). Monitoring and rehabilitation immediately after coral reefs are affected by extreme weather at sea (El Nino) is difficult for the Government to do with the regular state budget mechanism (APBN). Most of the immediate monitoring and rehabilitation activities were carried out by international civil society organizations and donor-funded programs (such as Coremap's CTI Program). There is not yet available knowledge and efforts to mitigate the effects of temperature rise, changes in pH and salinity that take place slowly in the long term on the life of coral reefs.

^{lxxxiv} Source: Report on Changes of Mitigation and Adaptation Budget, Fiscal Policy Agency, Ministry of Finance, see: <https://fiskal.kemenkeu.go.id/files/buku/file/CBT-NATIONAL-2018-2020.pdf> ; accessed on 23 February 2022 at 13:45 CET

^{lxxxv} Bappenas (2023). Development Plan of Coastal Area with High Risk of Coastal Inundation. Presented by Irfan D. Yananto, SE, MEREC, Direktorat Lingkungan Hidup Kementerian PPN/Bappenas during Focus Group Discussion "Loss and Damage from Climate Change" held by Mercy Corps Indonesia 9 Mei 2023

^{lxxxvi} Same as above

^{lxxxvii} Same as above

^{lxxxviii} Source: <https://www.cnnindonesia.com/ekonomi/20210122134022-532-597138/hadapi-bencana-indonesia-utang-rp7-triliun-dari-bank-dunia>

^{lxxxix} The Adaptive Social Protection (ASP) Roadmap document is not yet available to the public. The above conclusions were drawn by the author based on a separate individual semi-structured interview with Dr. Saut Sagala (ITB, consultant for preparing the ASP Road Map for GIZ) on 15 October 2022 and Annisa T. (UNICEF, supporting the dialogue process for preparing the Road Map).

^{xc} In the Road Map, the ASP scheme will be added to existing social protection programs, including the Family Hope Program (PKH), recipients of the Living Allowance scheme, and other programs. ASP also appears to be will be provided for a new group of recipients, namely people who are approaching the poverty line. The loss and damage suffered due to the disaster caused them to fall into the group of poor families (Personal Interview with Dr. Saut Sagala/ITB on 15 October 2022, and Annisa Srikandini/UNICEF on 3 August 2022)

^{xci} The APBN mechanism cannot receive funds from insurance claims and also has challenges in disbursing them quickly

- ^{xcii} See: <https://www.antaraneews.com/berita/1189952/kemenkeu-terima-polis-asuransi-barang-milik-negara>
- ^{xciii} Source: <https://www.cnnindonesia.com/ekonomi/20210122134022-532-597138/hadapi-bencana-indonesia-utang-rp7-triliun-dari-bank-dunia>
- ^{xciv} Ministry of Finance. 2023. Development of Innovative Financing for Loss and Damage from Climate Change. Fiscal Policy Agency-Ministry of Finance. Presented virtually at the Focus Group Discussion “Loss and Damage from Climate Change” on 8-9 May 2023
- ^{xcv} See: https://www.djkn.kemenkeu.go.id/berita_media/baca/13269/Wow-Klaim-Asuransi-Barang-Milik-Negara-Tembus-Rp-8399-M.html
- ^{xcvi} A discussion with Dewa Putu Ekayana, Fiscal Policy Agency-Ministry of Finance, on 17 January 2023
- ^{xcvii} The national mangrove rehabilitation program is currently underway. The program has challenges in terms of planting seeds and rehabilitating mangrove ecosystems on the suitable land. The program does not have the time and capacity needed to negotiate with land managers (especially the aquaculture pond owners) to allow some of their ponds be converted back into mangrove forests.
- ^{xcviii} Dismantling of building structures and reverting coastal land to its natural condition needs to be done first so that the ecosystem can develop towards land naturally.
- ^{xcix} The dry season is longer and rainfall is lower than normal during the El Nino phenomenon, causing sea surface temperatures to be higher. Coral polyps are under stress and some are leaving coral colonies for cooler waters. In different locations, some coral reef ecosystems can live normally when El Nino occurs. The use of fisheries resources by the community and tourism activities around coral reef ecosystems adds pressure to coral reefs.
- ^c Wicaksono (2021) Source: <https://www.qubisa.com/article/pengebab-island-di-indonesia-tenggelam#showContent> ;accessed on May 18, 2022 at 12:30 CEST
- ^{ci} See link: <https://theconversation.com/hasil-climate-change-menaikan-air-laut-near-melahap-island-small-sepanjang-aceh-papua-170870> ;accessed on May 18, 2022 at 14:23 CEST
- ^{cii} See link: <https://kkp.go.id/djprl/p4k/infografis-detail/5794-111-island-island-small-terluar-ppkt-di-indonesia>; accessed on April 22, 2022 at 21:34 CEST
- ^{ciii} See link: <https://pu.go.id/berita/pulau-nipah>
- ^{civ} See link :<https://harianrakyataceh.com/2018/11/26/menyoroti-reklamasi-singapura-makin-kaya-indonesia-makin-sengsara/>
- ^{cv} The definition of an island according to UNCLOS (United National Convention on the Law of the Sea), in article 121, is stated as a land area that is formed naturally. Meanwhile, 'Artificial Islands' do not have territorial rights over the sea in front of them. A number of literatures currently discuss the status of the outermost islands of a country that have been reclaimed. Discussion regarding this matter in the relevant ministries is still minimal or non-existent. Source: https://www.griffith.edu.au/__data/assets/pdf_file/0033/1378437/RO66-Strating-and-Wallis-web.pdf ; and <https://cil.nus.edu.sg/wp-content/uploads/2018/03/Panel-4-Session-2-Nilufer-Oral.pdf> ; accessed on April 4, 2002 at 14: 64 CEST
- ^{cvi} Integrated Social Welfare Data (DTKS) is a social record that contains information about the socio-economic conditions of individuals and households. Household socio-economic data, including names of household members, addresses, household composition. DTKS is the center for collecting and storing data on beneficiaries and potential beneficiaries of various government programs and activities. DTKS supports the determination of eligibility for Social Protection programs. DTKS currently has not integrated data on vulnerable populations in high risk locations for disasters and climate change. However, there is an opportunity to provide registration and determination of eligibility for programs related to Adaptive Social Protection if integration is carried out and data updates at the regional level are carried out
- ^{cvi} InaRisk is a disaster risk information system that covers all provinces and cities/districts in Indonesia. This information contains hazard, capacity and vulnerability components which are the basis for calculating the Indonesian Disaster Risk Index (IRBI) for each regency and city. The hazard component in InaRisk is a disaster event that has already occurred (historical). InaRisk has not yet used future hazard data (projections).
- ^{cvi} DiBi (Indonesian Disaster Information Data) provides data on geological and hydrometeorological disaster events at the regency and city levels as well as their accumulation at the provincial and national levels. DiBi presents infrastructure damage and losses incurred as a result of the ongoing disaster. Data on disaster events and the damage and losses experienced are submitted by the Regional Disaster Management Implementation Coordination Unit (abbreviated as SATKORLAK).
- ^{cix} SIDIK presents a socio-economic vulnerability map. This socio-economic map is a capacity component in climate vulnerability assessment. The socio-economic map comes from data produced by the PODES (Village Potential) census. The Climate Vulnerability Index also covers hazard component. However, SIDIK has not provided projections of the various climate change hazards such as rising temperatures, changes in rainfall, sea level rise, and floods.

^{cx} Drought is an example of climate variability. Drought is often not included in the rapid onset category, but it is also not appropriate to be included in the long-term climate change category. Meteorological drought disasters are extreme weather events that last for a short period (in one season). In the following year, there is a chance that the dry season will be wetter, normal or drier. Due to its fluctuating nature, the risk of disasters caused by drought can be protected by insurance products.

^{cx} Example of discussion on the "Global Shield" initiative to address the impact of damage and loss due to climate change. The financial scheme discussed is aimed more at overcoming the immediate, short-term impacts of climate change, namely the impact of hydrometeorological disasters. See the following link:

<https://www.bmz.de/en/issues/climate-change-and-development/global-shield-against-climate-risks>

^{cxii} See:

<https://kilaskementerian.kompas.com/kementan/read/2020/07/17/201500526/berkat.asuransi.pertanian.petani.di.aceh.yang.kena.banjir.rob.bisa.ajukan.klaim>

^{cxiii} Sourcer: <https://www.sciencedaily.com/releases/2021/02/210225113237.htm>

^{cxiv} <https://johnenglander.net/does-flood-insurance-cover-rising-seas/>

^{cxv} Source: <https://peraturan.bpk.go.id/Home/Details/166624/pp-no-64-tahun-2021>

^{cxvi} The latest information is that as of 2019/2020 it is still a draft that has not been approved by the Minister.

^{cxvii} The dry season is longer and rainfall is lower than normal during the El Nino phenomenon, causing sea surface temperatures to be higher. Coral polyps are under stress and some are leaving coral colonies for cooler waters. In different locations, some coral reef ecosystems can live normally when El Nino occurs. The use of fisheries resources by the community and tourism activities around coral reef ecosystems adds pressure to coral reefs

^{cxviii} Coral reef ecosystems in conservation areas are managed by the Central Government. KLHK and KKP share authority based on the status of the conservation area. Meanwhile, ecosystems in non-conservation areas are the authority of the Provincial Government. The knowledge and capacity of the Provincial Government are still relatively minimal compared to the Central Government.

^{cxix} Law Number 31 of 2009 on Meteorology, Climatology and Geophysics

^{cx} BMKG carry out maritime weather predictions for the next 7 (seven) days which encompass the following parameters: wave height, wind direction, wind speed, ocean current direction, ocean current speed and swell

^{cxxi} Individual conversation with Jakub Nugraha from PT. Asuransi Central Asia (ACA) in 2018.

^{cxii} Information about the PISAgro program can be seen at the link:

<https://www.pisagro.org/images/uploadsfiles/PISAgro-Newsletter-JFSS-18-Nov-18.pdf>, viewed on October 18, 2022, at 15:08 CET

^{cxiii} Geological disasters include earthquakes, tsunamis, volcanic eruptions, ground movements.

^{cxiv} Hydrometeorological disasters include floods, landslides, strong winds/hurricanes, droughts, tropical cyclones, land fires, and erosion/abrasion.

^{cxv} These threats are: 1. Earthquake 2. Tsunami 3. Flood 4. Landslides 5. Volcanic eruptions 6. Extreme waves and abrasion 7. Extreme weather 8. Drought 9. Forest and land fires 10. Building and residential fires 11. Epidemic and Plague Disease 12. Technology Failure 13. Social Conflict.

^{cxvi} abrasions/ocean waves on the coast are included in IRBI. This hazard lasts in the long term. Long-term erosion events are not monitored within the framework of disaster management. Damage to houses and other things caused by erosion/ocean waves is the basis for including it as a disaster event.

^{cxvii} See the Rapid Appraisal Guidance during emergency response state

here: <https://bnpb.go.id/uploads/migration/pubs/48.pdf>; accessed on tanggal 1 Mei 2022 at 16:33 CEST

^{cxviii} Sumber: <https://bpbd.jogjakota.go.id/assets/instansi/bpbd/files/perka-no-15-tahun-2011-tentang-pedoman-pengkajian-kebutuhan-pasc-2101.pdf>; accessed on 13 May 2022 at 15:25 CEST

^{cxix} Source: <https://bnpb.go.id/uploads/migration/pubs/48.pdf>; accessed on 13 April 2022 at 21:03 CEST

^{cxx} Sumber: http://ditjenppi.menlhk.go.id/reddplus/images/adminppi/permen/P.7_2018.pdf, accessed on 4 Mei 2022 at 11:43 CEST

^{cxxi} Data limitations are also the reason for assessments of ecosystem damage and loss were not carried out in the National Commitment Roadmap/NDC (2020) document prepared by the Ministry of Environment and Forestry.

^{cxxii} Source: <https://lcdi-indonesia.id/2022/01/11/bappenas-prediksi-kerugian-akibat-perubahan-iklim-rp-544-t-begini-rinciannya/>; accessed on May 7, 2022 at 14: 54 CEST

^{cxxiii} Source: <https://ekonomi.bisnis.com/read/20211014/9/1454339/kerugian-perubahan-iklim-bisa-capai-rp544-triliun-bappenas-dorong-program-ini>; accessed on May 7, 2022 at 14: 54 CEST

^{cxxiv} Source: Road Map of Land Subsidence Mitigation and Adaptation in Coastal Lowland, link:

<https://indonesia.wetlands.org/id/publikasi/peta-jalan-road-map-mitigasi-dan-adaptasi-amblasan-subsiden-tanah-di-dataran-rendah-pesisir/>

- ^{cxv} Based on communication with Chubb insurance marketing staff on 15 November 2023 regarding insurance product for property protection (house, vehicles) located in coastal area prone to tidal flood
- ^{cxvi} <https://estika.id/product-peralatan-berat.php>
- ^{cxvii} <http://avristgeneral.com/Brosur%20AGI%20NEW/BROSUR%20ASURANSI%20HEAVY%20EQUIPMENT.pdf>
- ^{cxviii} <https://axa-mandiri.co.id/documents/1415637/1443288/Polis-Asuransi-Alat-Berat-Heavy-Equipment.pdf>
- ^{cxix} <https://www.sciencedaily.com/releases/2021/02/210225113237.htm>
- ^{cx} Source: <https://www.canterbury.ac.nz/news/2021/with-seas-rising-and-storms-surging-who-will-pay-for-new-zealands-most-vulnerable-coastal-properties.html>
- ^{cxli} Storey, B., Owen, S., Noy, I. & Zammit, C. (2020). Insurance Retreat: Sea level rise and the withdrawal of residential insurance in Aotearoa New Zealand. Report for the Deep South National Science Challenge, December 2020, see the link: <https://deepsouthchallenge.co.nz/wp-content/uploads/2021/01/Insurance-Retreat-December-2020-Final-Report.pdf>
- ^{cxlii} Source: <https://peraturan.bpk.go.id/Home/Details/166624/pp-no-64-tahun-2021>
- ^{cxliii} Source: <https://ekonomi.bisnis.com/read/20211231/47/1483860/resmi-dibentuk-ini-struktur-dan-fungsi-bank-tanah>.
- ^{cxliv} On 25 November 2021, the Constitutional Court stated that the creation of the Job Creation Law was in contrary to the 1945 Constitution and did not have conditionally binding legal force as long as it was not interpreted as 'no improvements have been made within 2 (two) years since this decision was pronounced'. The Constitutional Court stated that the Job Creation Law was still in effect until improvements were made in accordance with the given time limit. Then, on December 30 2022, the President signed Government Regulation in Lieu of Law (Perppu) Number 2 of 2022 concerning Job Creation. Perppu Number 2 of 2022 is a replacement for Law Number 11 of 2020 on Job Creation.
- ^{cxlv} Source: <https://nasional.kontan.co.id/news/kementerian-atrbpn-siapkan-25000-ha-modal-awal-bank-tanah>
- ^{cxlvi} Source: <https://metro.tempo.co/read/1624237/bank-tanah-di-rorotan-wagub-dki-beberkan-rencana-pengembangan-kawasan>
- ^{cxlvii} Initially the Ministry of Agriculture included a number of activities, including the development of tertiary irrigation networks, into the climate mitigation category, and then the objectives of subsequent activities were included in the climate adaptation category.
- ^{cxlviii} See SIDIK at :<http://sidik.menlhk.go.id/>; and http://ditjenppi.menlhk.go.id/reddplus/images/resources/buku_sidik/BUKU_SIDIK_FINAL.pdf; accessed on 30 Maret 2022 at 12:31 CEST
- ^{cxlix} Indicators: Area of forest areas that is being inventoried and verified with high diversity values in a participatory (cumulative) manner and the Number of biodiversity clearing house mechanisms.
- ^{cl} In 2021, the Government issued Presidential Regulation Number 98 of 2021 concerning the Implementation of the Economic Value of Carbon which became the legal basis for implementing carbon trading or carbon credits in Indonesia. The carbon value trial was first applied to several power plants managed by PLN (State Electricity Company) and its partners (Independent Power Producers). The Ministry of Energy and Mineral Resources set emission limits for the power plants. Power plants that succeed in reducing emissions below a specified limit can sell their credits to companies that produce emissions above that limit.
- ^{cli} Result Based Payment (RBP) from the World Bank' FCPF Carbon Fund collaboration in East Kalimantan Province was provided for the performance of GHG emission reduction from REDD+ activities of 22 million tons of CO₂eq with a value of 110 million US dollars for 3 payment stages between 2021-2025. The Ministry of Environment and Forestry and the World Bank have signed an emission reduction purchasing agreement (ERPA). BPD LH is also planned to receive funds from the BioCarbon Fund (BCF) amounting to 60 million US dollars to improve environmental quality in Jambi until 2025. In 2022, the Ford Foundation provided funds amounting to 1 million USD to strengthen BPD LH institutions.
- ^{clii} Head of Climate and Atmospheric Research -BRIN, Dr. Albert Sulaiman, during Virtual Focus Group Discussion held by Mercy Corps Indonesia on 8-9 May 2023.
- ^{cliii} Source: <https://www.gerbangaltim.com/2020/01/31/pertamina-resmikan-rumah-pembibitan-mangrove-margomulyo/>; accessed on 7 Agustus 2021, at 21.25 CET
- ^{cliv} Source: <https://news.klikpositif.com/baca/7502/antisipasi-abrasi-pln-tanam-delapan-ribu-mangrove-di-siberut>; accessed on 7 Agustus 2021, at 21.45 CET
- ^{clv} Source: <https://kesemat.or.id/2019/09/20/selamatkan-pesisir-semarang-pt-indonesia-power-dan-kesemat-tanam-6000-bibit-mangrove-di-mangunharjo/>; accessed on 7 Agustus 2021, at 22.025 CET