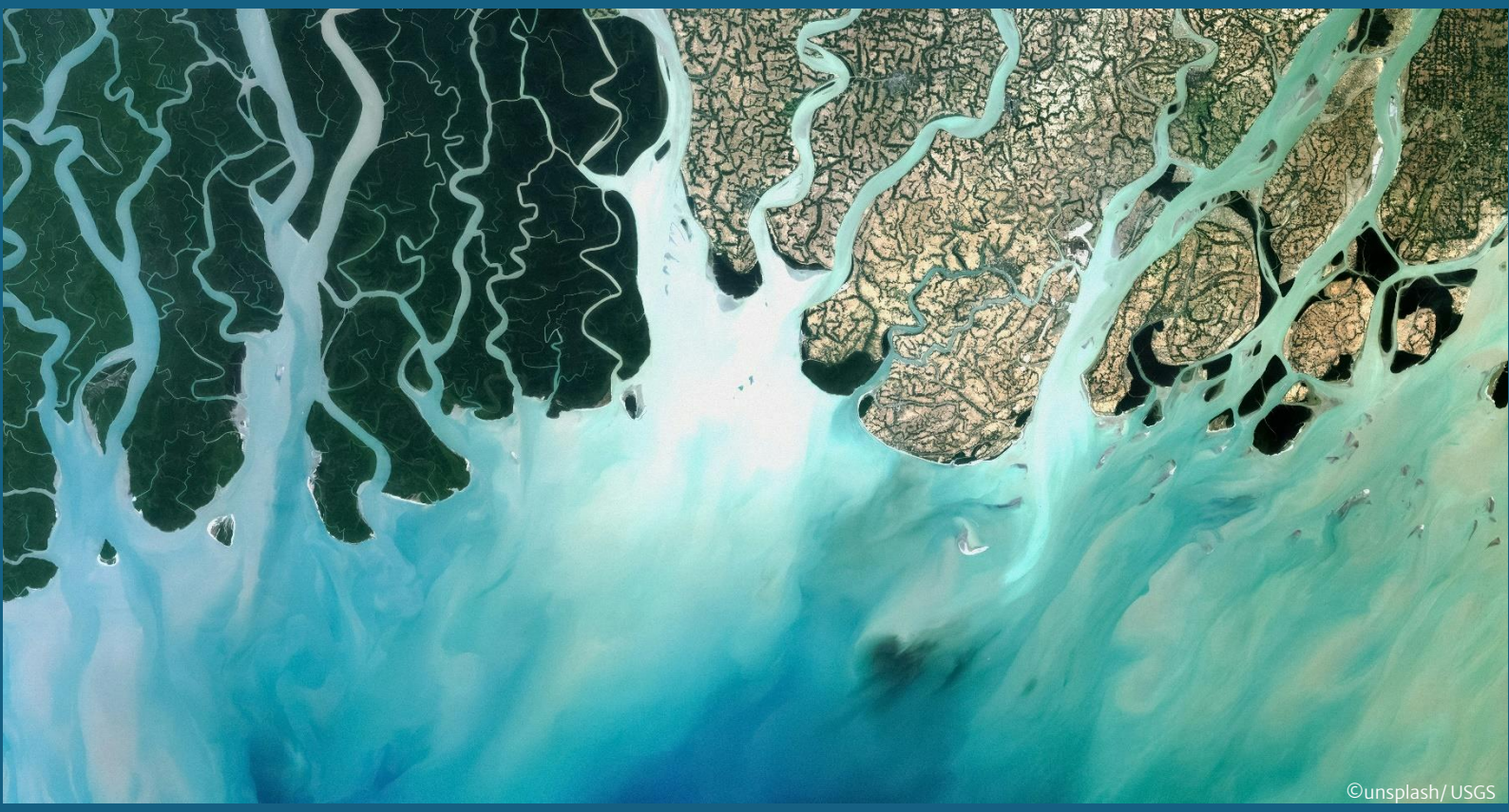
CGE
Consultative Group of Experts
The Constituted Body for MRV & ETF

United Nations
Climate Change

Compilation of information reported in biennial transparency reports related to enhancing understanding, action and support to avert, minimize and address loss and damage associated with climate change impacts



©unsplash/ USGS

November 2026

2026 United Nations Climate Change Secretariat

All rights reserved.

This publication is issued solely for public information purposes, including any references to the Convention and the Paris Agreement, and any relevant decisions with respect thereto. No liability is assumed for the accuracy or uses of information provided.

For further information contact:

United Nations Climate Change Secretariat

Platz der Vereinten Nationen 1

53113 Bonn, Germany

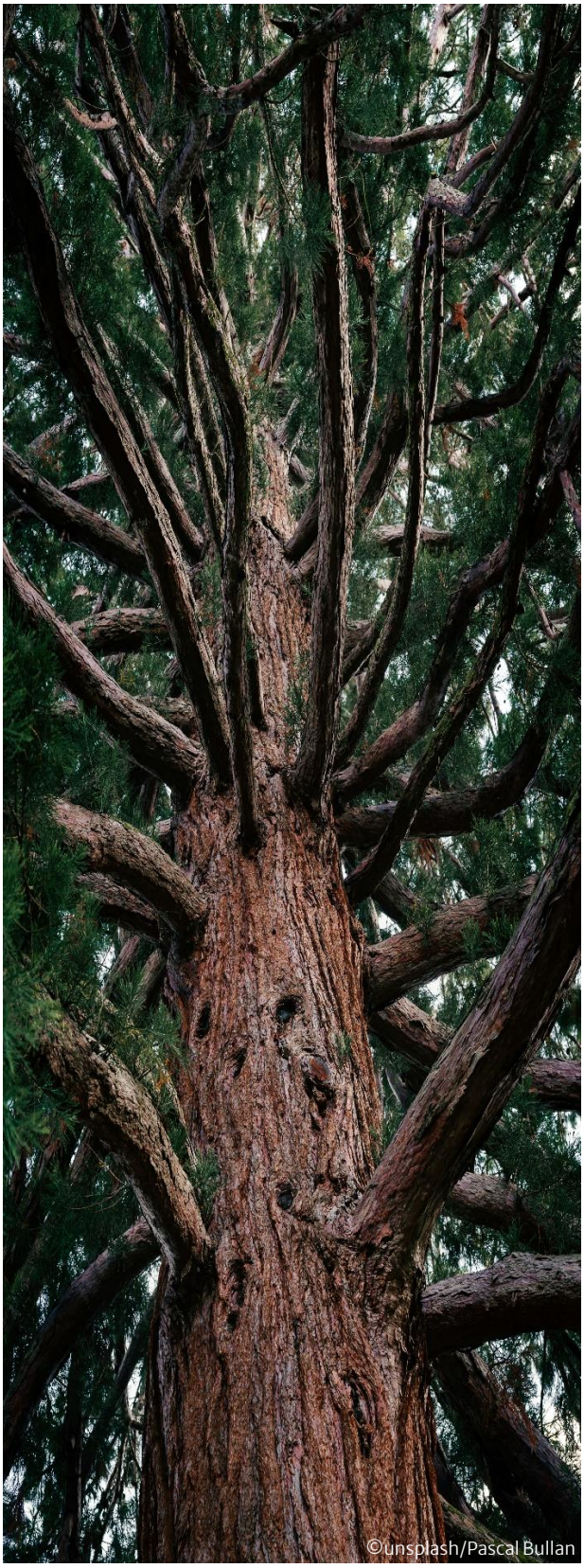
Telephone +49 228 815 10 00

Telefax +49 228 815 19 99

https://unfccc.int

For more information on CGE:

https://unfccc.int/CGE


©unsplash/Pascal Bullan

Introduction

Article 13 of the Paris Agreement provides the core structure of the enhanced transparency framework (ETF), which includes reporting, technical expert review (TER) and facilitative, multilateral consideration of progress (FMCP).

The ETF is implemented on the basis of modalities, procedures and guidelines (MPGs)[1] that apply to all Parties, with flexibility to those developing country Parties that need it in the light of their capacities.[2]

Article 8 of the Paris Agreement recognizes the importance of averting, minimizing and addressing loss and damage associated with the adverse effects of climate change, including extreme weather events and slow onset events. It further provides that Parties should enhance understanding, action and support, including through the Warsaw International Mechanism for Loss and Damage, as appropriate, on a cooperative and facilitative basis. [3]

In accordance with paragraph 115 of the MPGs, each interested Party may provide, as appropriate, information related to enhancing understanding, action and support to avert, minimize and address loss and damage associated with climate change impacts, taking into account projected changes in climate-related risks, vulnerabilities, adaptive capacities and exposure. Such information may include:[4]

- Observed and potential climate change impacts, including those related to extreme weather events and slow onset events, drawing upon the best available science;
- Activities related to averting, minimizing and addressing loss and damage associated with the adverse effects of climate change; and
- Institutional arrangements that facilitate the implementation of activities related to averting, minimizing and addressing loss and damage.

[1] The MPGs are contained in the annex to decision 18/CMA.1. Guidance for operationalizing the MPGs, including the corresponding reporting formats and outlines, is contained in decision 5/CMA.3 and its annexes.
[2] Decision 18/CMA.1, annex, chapter I.C, paragraphs 4–6.
[3] Paris Agreement, Article 8, paragraphs 1 and 3.
[4] Decision 18/CMA.1, annex, chapter IV.G, paragraph 115(a–c).

Decision 5/CMA.3 further emphasizes that each interested Party may provide such information, as appropriate, in chapter IV of its biennial transparency report (BTR), pursuant to paragraph 115 of the MPGs.[5] The outline for BTRs contained in annex IV to decision 5/CMA.3 includes a dedicated section for information related to averting, minimizing and addressing loss and damage associated with climate change impacts. The reporting of this information is voluntary and is not subject to mandatory technical expert review under the ETF. [6]

The Consultative Group of Experts (CGE) is the main channel for the provision of technical assistance and support to developing country Parties in fulfilling their reporting requirements in relation to measurement, reporting and verification under the Convention and the enhanced transparency framework under the Paris Agreement.

This compilation represents an effort by the CGE to assist developing country Parties in implementing the ETF, with the aim of presented examples of information as reported by Parties in BTRs, related to averting, minimizing and addressing loss and damage associated with climate change impacts. It seeks to facilitate the sharing of experience and illustrate different approaches taken by Parties in presenting such information.

It is important to note that this compilation presents verbatim excerpts from first BTRs and does not capture the full scope of information reported by Parties on loss and damage in their BTRs. More comprehensive and detailed information can be found in the respective reports (https://unfccc.int/first-biennial-transparency-reports).



[5] Decision 5/CMA.3, paragraph 24.
[6] Decision 18/CMA.1, annex, paragraphs 115; decision 5/CMA.3, paragraph 35.

Overview of provisions related to reporting on loss and damage

This chapter provides an overview of the information that each interested Party may provide, as appropriate, in accordance with paragraph 115 of the MPGs, to enhance understanding, action and support, on a cooperative and facilitative basis, to avert, minimize and address loss and damage associated with climate change impacts, taking into account projected changes in climate-related risks, vulnerabilities, adaptive capacities and exposure, including, as appropriate, on:

(a) Observed and potential climate change impacts, including those related to extreme weather events and slow onset events, drawing upon the best available science;

(b) Activities related to averting, minimizing and addressing loss and damage associated with the adverse effects of climate change;

(c) Institutional arrangements to facilitate the implementation of the activities referred to in paragraph 115(b) above.

Table: Overview of provisions related to reporting on loss and damage as per the annex to decision 18/CMA.1

Reference in the MPGs	*Provision in the MPGs*
Paragraph 115 -Information related to averting, minimizing and addressing loss and damage associated with climate change impacts	Each interested Party may provide, as appropriate, information related to enhancing understanding, action and support, on a cooperative and facilitative basis, to avert, minimize and address loss and damage associated with climate change impacts, taking into account projected changes in climate-related risks, vulnerabilities, adaptive capacities and exposure. Information related to the areas identified in paragraphs 115(a)–(c), as appropriate.
Paragraph 115(a) -Observed and potential climate change impacts	Information on observed and potential climate change impacts, including those related to extreme weather events and slow onset events, drawing upon the best available science.
Paragraph 115(b) - Activities related to averting, minimizing and addressing loss and damage	Information on activities related to averting, minimizing and addressing loss and damage associated with the adverse effects of climate change.
Paragraph 115(c) — Institutional arrangements	Information on institutional arrangements that facilitate the implementation of activities referred to in paragraph 115(b).



Examples of information reported in BTRs

This chapter presents selected examples of information reported by Parties in their biennial transparency reports (BTRs) on averting, minimizing and addressing loss and damage associated with climate change impacts, in accordance with paragraph 115 of the MPGs.

The examples are extracted directly from the respective BTRs and reproduced verbatim, without modifications to the original text, to accurately reflect the information as reported by Parties.

Azerbaijan

6. INFORMATION RELATED TO AVERTING, MINIMIZING AND ADDRESSING LOSS AND DAMAGE ASSOCIATED WITH CLIMATE CHANGE IMPACTS

As noted, Azerbaijan is vulnerable to various climate-related risks, including extreme heat, droughts, floods, landslides, and coastal erosion, which are exacerbated by climate change. These hazards have led to significant losses in the agricultural sector, damaged infrastructure, and threatened biodiversity. Notably, the central and lowland areas experience increased frequency and severity of droughts, while mountainous regions face heightened landslide risks. The economic costs associated with these impacts are substantial, with flood-related damages alone estimated at $18–25 million annually in affected regions.

The Ministry of Emergency Situations of the Republic of Azerbaijan prepares an overview of the actions taken against natural hazards occurring in the country and sends it to the relevant institutions. The Ministry provides annual statistics of the work done against dangerous events such as fires, floods, and droughts.

To reduce the risks and impacts of climate-related loss and damage, Azerbaijan has implemented various strategies focused on resilience building and risk mitigation. The National Hydrometeorology Service has prioritized developing and implementing early warning systems and disaster preparedness plans for floods, landslides, and other extreme events. These systems enhance community readiness and improve response times, thereby reducing loss and damage.

The country Azerbaijan has adopted measures to improve water use efficiency and drought resilience, especially in agriculture. Programs include modernizing irrigation infrastructure, promoting water-saving techniques, and diversifying water sources to address shortages and minimize water-related loss and damage.

Reforestation and sustainable land management practices are being implemented to restore degraded lands and enhance natural buffers against climate impacts, particularly in areas prone to erosion and landslides.


©unsplash/ Orkhan Farmanli

The country is actively engaged in international collaborations to enhance its capacity to address loss and damage. Through partnerships with organizations such as the United Nations Development Programme (UNDP) and the Global Environment Facility (GEF), Azerbaijan accesses technical support and funding for adaptation projects. These collaborations support the country in developing climate-resilient infrastructure and enhancing its disaster risk reduction frameworks.

Limited financial resources and competing budget priorities, especially given the country's economic reliance on fossil fuels, can restrict the scale and scope of adaptation measures. The government has recognized the need for financial mechanisms to support communities affected by climate-related loss and damage. Insurance Programs has already achieved significant positive results, however, further improvements needed to align existing funds with needs of the farmers.

Bangladesh

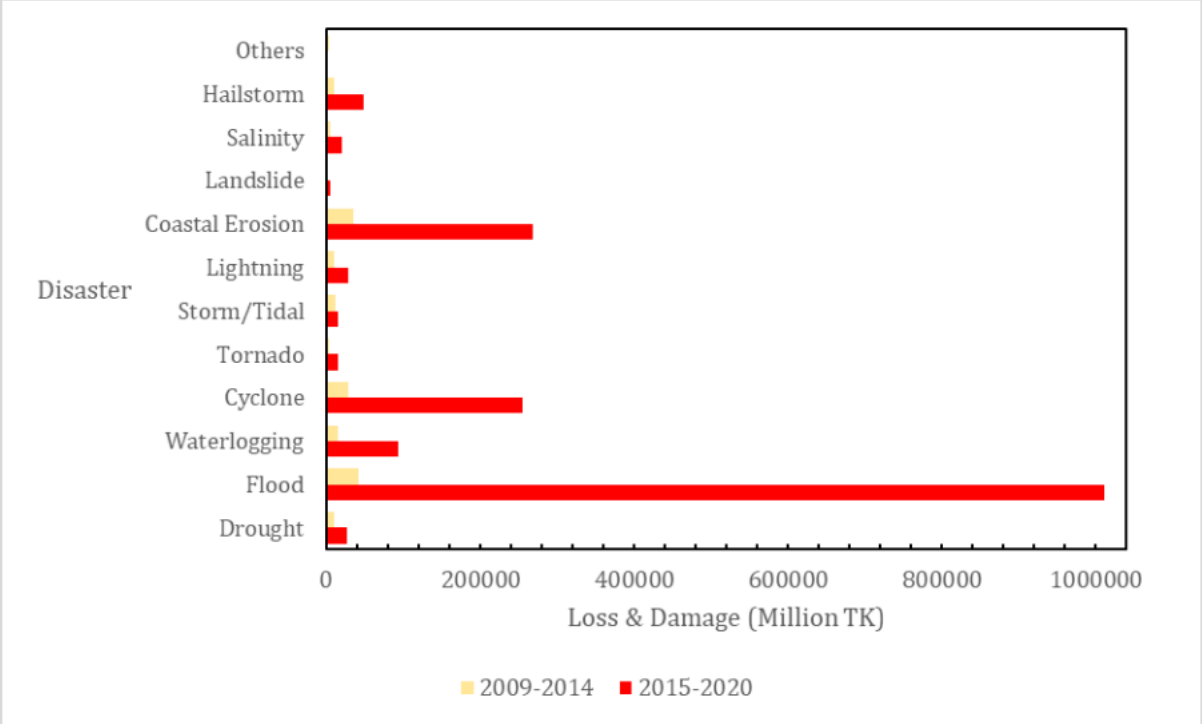
3.7 Information Related to Averting, Minimizing, and Addressing Loss and Damage Associated with Climate Change Impacts

3.7.1 Observed and Potential Loss and Damage in Bangladesh

3.7.1.1 Observed Economic Loss and Damage

Bangladesh, due to its geographical location and dense population, remains highly vulnerable to a range of climate-change-induced hazards, including cyclones, floods, riverbank erosion, landslides, earthquakes, droughts, and sea-level rise. According to the Bangladesh Bureau of Statistics (BBS) report "Bangladesh Disaster-Related Statistics 2021", total household economic loss and damage due to natural disasters rose nearly tenfold, reaching BDT 1,791,988 million (Approximately USD 14.68 billion) for the period 2015 to 2020. The estimated loss and damage were BDT 184,247 million (Approximately USD 1.51 billion) for the 2009-2014 period. Floods accounted for 56.4% of the economic loss and damage during the 2015-2020 period, with the remainder attributed to cyclones, erosion, hail, and other factors. During that period, 1.72 million people were reported to have been injured by disasters, and 2.59 million fell ill due to disaster-induced sickness. There were 9950 disabilities due to disasters, and 8108 reported deaths. The approximate treatment cost for sick, injured, or disabled people was estimated at 2412389 million BDT or 574.4 million USD.

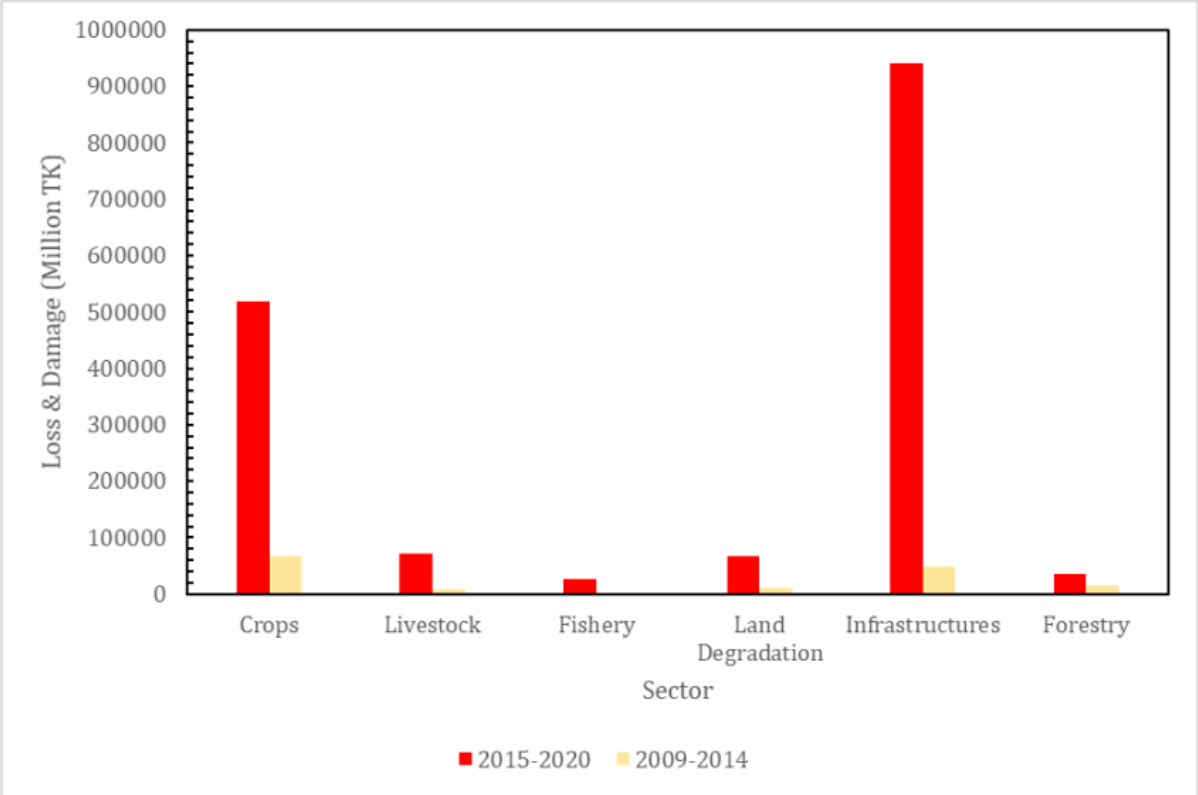
Figure 3.35: Disaster-wise Loss & Damage in Bangladesh



Source: (BBS, 2021)

Notably, losses and damage due to climate-change-induced disasters, such as floods, cyclones, waterlogging, drought, erosion, and salinity, have seen a significant rise over the years (Figure 3- 36).

Figure 3.36: Sector-wise Loss & Damage in Bangladesh



Source: (BBS, 2021)

3.7.1.2 Observed Non-Economic Loss and Damage

The Internal Displacement Monitoring Centre (IDMC) estimates that more than 4.7 million people were displaced due to disasters in Bangladesh between 2008 and 2014. Mid-year figures of 2019 of the same organization estimate that about 1.7 million people were evacuated across 23 districts in Bangladesh, mostly in coastal areas such as Bhola, Khulna, and Patuakhali (MoDMR, 2021).

3.7.1.3 Loss and Damage Due to Notable Recent Disasters

Between 2021 and 2025, Bangladesh experienced multiple major disasters, dominated by cyclones, floods, heatwaves, and landslides, causing extensive human, economic, and environmental losses. Cyclone Remal (May 2024) was among the most severe, killing 18 people, affecting 4.6 million, damaging over 173,000 homes, and causing an estimated $600 million in losses, along with major agricultural damage across 62,783 hectares (UNOCHA, 2025). The same year, a record 24-day heatwave in April brought temperatures above 40°C, causing 10 heatstroke deaths, large-scale crop failures, water shortages, and widespread disruptions (IFRC, 2024).

Floods were particularly devastating in 2024, with three major events between June and August affecting over 14 million people across the northeast, north, and eastern regions. These floods caused dozens of deaths, displaced more than a million people, severely damaged WASH facilities, destroyed hundreds of thousands of water points and latrines, and resulted in significant agricultural, livestock, and fisheries losses,

leaving millions in need of food assistance (UNOCHA, 2025). Landslides triggered by intense monsoon rainfall in 2024 caused at least 15 deaths, severe damage in Cox's Bazar, Sylhet, Khagrachhari, and Chattogram, and frequent disruptions of critical road networks (RRRB, 2024).

Earlier, catastrophic flash floods in 2022 affected 7.2 million people across 18 districts, caused 141 deaths, and led to $629 million in damages, particularly impacting the Haor region and sharply reducing household incomes (UNRC, 2022). Cyclone Amphan (May 2020) also caused large-scale devastation, affecting 2.6 million people, killing 26, and damaging over 205,000 houses and key infrastructure across 26 districts. Collectively, these events highlight Bangladesh's extreme vulnerability to climate-induced disasters and the growing scale of humanitarian and economic impacts (IFRC, 2024).

3.7.1.4 Potential Loss & Damage

The climatic impacts identified above manifest in both measurable and non-measurable losses and damages across Bangladesh. The Asian Development Bank (2014) projects that the annual economic impact of climate change will reach 2% of Bangladesh's GDP by 2050 and could escalate to as much as 9.4% by 2100. These economic threats are primarily linked to increasing incidences of floods, cyclones, droughts, heat stress, land loss, and a decline in growing seasons, all of which jeopardize food security and agricultural livelihoods. Hertel (Hertel, 2010) further estimate that climate change may result in a 15% rise in poverty by 2030.

In addition to these quantifiable economic impacts, qualitative research highlights significant non-economic losses and damages (NELD), including the erosion of biodiversity, cultural traditions, physical and mental health, education, and ecosystem services. Recent estimates suggest that by 2050 one in every 45 people in the world and one in every seven people in Bangladesh will be displaced by climate change. According to a projection by RMMRU and SCMR based on population census (2013) estimates that from 2011 to 2050, as many as 16 to 26 million people would move out from their places of origin in Bangladesh due to many climatic hazards. These flows would include both internal displacement and other forms of labor migration predominantly within the country.

3.7.2 Activities related to Addressing Loss and Damage

To reduce disaster impacts and associated losses, Bangladesh has implemented comprehensive legal, strategic, technological, and infrastructural interventions aligned with the Sendai Framework (2015–2030) and the National Plan for Disaster Management (NPDM) 2021–2025. A strong regulatory foundation for disaster risk reduction has been established through various acts and policies, including the National Strategy on the Management of Disaster and Climate Induced Internal Displacement (2021), along with guidelines for post-disaster dead body management and disaster research.

Bangladesh also participates actively in global and regional disaster governance bodies such as ADRC, RIMES, AMCDR, and INSARAG. Multi-hazard contingency plans for Dhaka, Chattogram, and Sylhet target earthquakes, cyclones, and urban floods, supported by technical outputs such as debris management plans and storm surge risk maps, with government agencies trained under the National Contingency Plan.

Disaster education has been integrated into school curricula (Grades 3–12) and 41 training institutes, while 28 universities offer specialized programs in disaster management and climate change. Capacity building is supported through the Harmonized Training Module and the establishment of the DNA and MRVA Cells, which enhance evidence-based planning. Digital systems such as the Emergency Operational Dashboard, the Disaster Management Knowledge Portal, IVR-based early warning dissemination via 1090, and the DDM-MIS for managing social safety nets have strengthened data-driven disaster governance, alongside e-GP procurement, the GIS-based Shelter Information Management System, and the MRVA Atlas.

Under the UNOSAT-NORAD initiative, national geospatial capabilities have improved further. Infrastructure development includes the construction of 327 cyclone shelters, 406 flood shelters, 75 killas, 60 disaster warehouses, and the retrofitting of 85 cyclone shelters, as well as the construction of over 8,038 km of HBB roads and 270,460 meters of bridges and culverts and widespread drainage upgrades.

Emergency response capacity has been enhanced by providing districts with water ambulances, rescue boats, satellite phones, and pickup vans, while the Fire Service received specialized equipment for earthquake and building collapse response; 60 disability-friendly rescue boats and additional communication and safety equipment were also deployed.

Social safety nets have expanded significantly, with Tk. 1,16,731 crore allocated in FY 2025–26 (14.78% of the national budget), supporting programs such as Kabikha, TR, EGPP, and EGPP+, and enabling the construction of rural infrastructure and seasonal employment opportunities.

The Ashrayan housing program has provided 157,939 disaster-resilient houses to landless and homeless families since 2018–19. Between 2015–2020, Tk. 1,736,394 million in relief and rehabilitation support was provided, with VGF and GR programs delivering food, cash, and essential items to disaster-affected families.

It is also worth mentioning that, a new earthquake-resistant National Emergency Operations Center (NEOC) is planned in Dhaka to strengthen national command and coordination during major disasters.

3.7.3 Loss and Damage Assessment Framework

No framework for Loss and Damage assessment exists in Bangladesh yet. Under the Ministry of Environment, Forest and Climate Change, the Department of Environment is in the process of formulating a comprehensive national L&D assessment framework through implementing a project titled "Formulation of a Loss and Damage Framework, Conducting Preparatory Works for Accessing L&D Finance, and Assessing Climate Change Driven Internal Displacement in Coastal Areas in Bangladesh".

The framework will introduce a multi-tiered assessment process, incorporating immediate (2–3 days), intermediary (14–21 days), and long-term (3–6 months) post-disaster evaluations. Two primary hazards-likely a cyclone and a slow-onset threat, such as salinity intrusion-will be selected for pilot case studies to ground-test the proposed methods, data collection tools, and analytical models.



Brazil

4.5 Information related to preventing, minimizing and dealing with loss and damage associated with the impacts of climate change

Under the Paris Agreement, the topics of loss and damage (Article 8) and adaptation (Article 7) are treated differently, although both are directly related to the impacts of climate change. Loss and damage refer to climate effects that cannot be avoided or completely mitigated, even with the adoption of adaptation measures, and their severity is such that they require differentiated responses.

Extreme and unprecedented events in recent years illustrate that loss and damage are already a reality in the country. The intensification of the frequency and magnitude of climate-related impacts demonstrates the importance of incorporating loss and damage at the national level. Brazil recognizes the importance of this issue, but it still needs to strengthen its institutional, financial and technical capacities to address loss and damage in a more structured way and present systematized data and information that can reflect the national circumstances.

Although the topic is still being incorporated in the country, some bodies and systems already deal with data and response actions, as presented in the previous subchapters. As a result of severe and critical damage, new strategies have been developed to support the recovery of people, infrastructure and businesses.

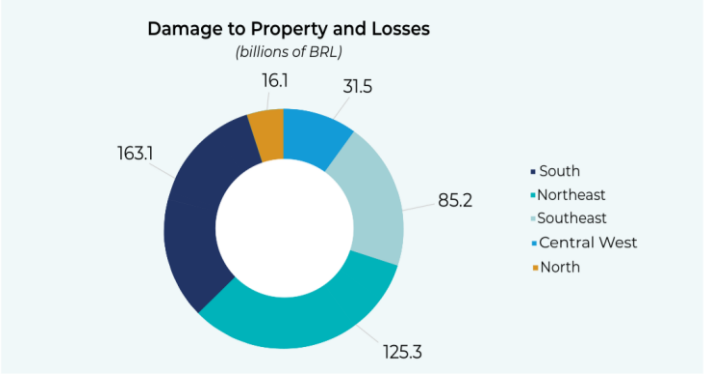
The following is a compilation of data on loss and damage to the country caused by disasters and two recent cases that illustrate the magnitude of the impacts of extreme events in opposite regions of the country: the floods in the south and the droughts in the north. In terms of future projections, the main results of a study on the cost of inaction will be presented, based on modeling that considers changes in average temperature and impacts on energy, food and water security to estimate changes in the country's GDP in a scenario of inaction.

4.5.1 Historical loss and damage

In the 10-year period between 2014 and 2023, Brazil accumulated more than BRL 421 billion in material damage and losses (USD 84 billion). The South of the country accumulated the greatest material damage and losses (38.7%), followed by the Northeast (29.7%) and the Southeast (20.23%) (Chart 4.2) The last three years, the period from 2020 to 2023, concentrated 55% of the total loss and damage (BRASIL, 2024).

Material damage refers to the amounts corresponding to the damage or destruction caused to housing units, public facilities for health, education, other services, community use and sites with public infrastructure. Loss refers to the estimated value of public economic losses related to damaged essential services and private losses related to losses in the agriculture, livestock, industry, trade and services sectors as a direct result of the effects of disasters. The recorded losses are related to the value of the loss caused by the disaster, and not the amount needed, for example, to restore or recover the damaged roads, which is classified as material damage.

Chart 4.2 Distribution of material damage and losses by region, caused by disasters between 2014 and 2023



Source: Digital Atlas of Disasters (2024a)

Case: Flooding in Rio Grande do Sul – April and May 2024

The state of Rio Grande do Sul (RS), located in the southern region of Brazil, was hit by massive flooding between April and May 2024. According to historical records, this would have been one of the most severe climatic events of heavy rainfall in the state in recent decades (ZUFFO et al., 2024). It is estimated that by June 27, 2024, the impact area will have reached an area of approximately 16,126 km^2 and will have affected 484 (93%) of the state's 497 municipalities (Ipea - Institute of Applied Economic Research (Instituto de Pesquisa Econômica Aplicada), 2024).

The state of Rio Grande do Sul has an estimated population of 10.9 million inhabitants, which represents 5.3% of the Brazilian population. The state's GDP accounts for 6.5% of the national GDP, and this share is highest in agriculture (12.7%) and the manufacturing industry (8.4%). The areas most affected by the rains represent 48.5% of the population and 53.3% of the GDP of Rio Grande do Sul (BC - Brazil's Central Bank (Banco Central do Brasil), 2024).

In order to promote transparency in the budget implementation of extraordinary expenses incurred as a result of this event, the Ministry of Planning and Budgeting created a display panel of the amounts involved based on the establishment of a budget identifier. By August 2024, the table showed an allocation of more than BRL 48 billion (USD 9.6 billion) in extraordinary credits to the state, with this figure being updated constantly.

It is not yet possible to estimate all the impacts caused by this event, but some published studies provide specific data and conclusions. In the 418 municipalities in a state of calamity or emergency, it is estimated that at least 23.3 thousand private establishments (9.5% of the total) and more than 334.6 thousand (13.7% of work places) have been directly affected. This estimate was made by cross-referencing the georeferenced information on the addresses of the establishments with the flooded area affected by floods and landslides. The result was used as an input for the emergency income transfer program for workers with a formal job contract who were affected by the floods in the state, developed by the Ministry of Labor (IPEA, 2024).

Among other measures taken by the Federal Government after the disaster was the creation of financial support for displaced or homeless families in municipalities in Rio Grande do Sul in a state of public calamity or emergency recognized by the federal Executive Branch. According to Provisional Measure No. 1219, of May 15, 2024, the financial support is aimed at tackling the public calamity and its social and economic consequences resulting from climatic events in the state of Rio Grande do Sul and consists of a single payment of BRL 5,100 (five thousand one hundred reais) per family, preferably paid to women. It should be noted that in order to identify the areas affected by floods and mass movements for the payment of aid, a joint effort was made by several Brazilian institutions using satellite images and computer models, such as INPE, CEMADEN, UFRGS - Federal University of Rio Grande do Sul (Universidade Federal do Rio Grande do Sul), the Brazilian Army and the Government of the state of Rio Grande do Sul (INPE, 2024).

Another measure adopted to support the families who lost their homes was the adaptation of an existing housing program, the "Minha Casa, Minha Vida" (My Home, My Life) Program (PMCMV, Programa Minha Casa, Minha Vida). Since its implementation in 2009, the Program has become one of the country's main housing policies and is focused on reducing the quantitative housing deficit by increasing the housing stock, and it prioritizes low-income families (BRASIL, 2020). In the context of the event that occurred in the state of Rio Grande do Sul, an Ordinance from the Ministry of Cities established the procedures to be adopted for defining the families eligible for housing assistance under the Program, as a result of the emergency or state of public calamity, benefiting families with a gross monthly income of up to BRL 2,400.00.

The Central Bank of Brazil (Banco Central do Brasil) and the National Monetary Council (CMN, Conselho Monetário Nacional) have also developed measures to better mitigate the economic effects of the public calamity situation on the National Financial System (SFN, Sistema Financeiro Nacional). Those measures include the implementation of more robust procedures to monitor supervised entities whose headquarters are located or who carry out important work in the region, whose reports were submitted to a crisis monitoring group in a timely manner. Within the scope of the Agricultural Activity Guarantee Program

(Proagro, Programa de Garantia da Atividade Agropecuária), considering the travelling difficulties, the technical surveys necessary for the payment of the program's indemnities can now be carried out using remote sensing and parametric data on the productivity of the municipalities, with the aim of speeding up the payment of indemnities to farmers affected by the floods (BC, 2024).

In addition to government public policies, there are private initiatives that can help minimize damage and losses, such as insurance. Climate adaptation insurance transfers, in specific situations, the risk from an insured person, object or organization to an insurer (EU, 2018). In Brazil, for example, 17% of Brazilian households are covered by a home insurance policy, but less than 1% are covered against flooding (CNSeg – National Confederation of Insurers (Confederação Nacional das Seguradoras), 2024).

Case: Droughts in the Pantanal and Amazon – 2020 to 2024

Recurrent severe fire seasons in the Pantanal began in 2019, with 7 million hectares burned between 2019 and 2020 (50% of its area) (BARNES, SANTOS, LIBONATI et al., 2024). By the beginning of the second half of 2024, the burnt area had reached more than 2 million hectares. Studies indicate that the fires of 2024 were 40% more severe due to climate change (BARNES, SANTOS, LIBONATI et al., 2024). Fire caused by drought is part of the natural dynamics of the biome, but the severity and duration of the 2020 fires were abnormal (BARNES, SANTOS, LIBONATI et al., 2024, WWF, 2021). Socio-economic impacts related to the fires have been identified, such as the overcrowding of health centers and hospitals and the overloading of urban infrastructure and equipment (BARNES, SANTOS, LIBONATI et al., 2024, GUARDIAN, 2024).

The drought has also hit the Amazon Biome, with severe impacts on the population and biodiversity. Using the United States drought monitoring classification system, in 2023 the Amazon experienced exceptional drought (D4), and according to attribution studies it would have been a "severe drought" (D2) without the effects of climate change (CLARKE et al., 2024). In addition, there was an intensification of wildfires and burning events, which affected an area of 107,572 km^2 in the biome in 2023, 36% more than the area burned in the same period in 2022.



Highly vulnerable populations were disproportionately affected by this drought. Small farmers, indigenous, rural and riverine communities throughout the region were among the most vulnerable due to high poverty rates and high dependence on agricultural food production, freshwater availability and imports of goods transported by rivers (CLARKE et al., 2024). The sharp drop in river levels has had a significant impact on the lives of the region's inhabitants, making it difficult for riverside populations to travel and transport people, food and other essential supplies by river, as well as impacting on the transportation of goods from the ports of the state of Amazonas to other ports in the country via cabotage (domestic transportation via coastal waters), destined for other countries (export) (BC, 2024).

Another impact was the sharp decrease in the amount of resources imported by the state of Amazonas, due to the bottleneck in river navigation, making it impossible for ships to arrive with essential inputs for industrial production in the Manaus Free Trade Zone, negatively impacting the export of electronic products, motorcycles and beverages. The Industry Center of the State of Amazonas (CIEAM, Centro da Indústria do Estado do Amazonas) estimates the loss to be of BRL 1.4 billion for the industry in the State of Amazonas due to extraordinary logistics expenses, such as trans-shipment, stay and freight, caused by the interruption of large-scale shipping to Manaus, which lasted almost 60 days. This had a negative impact on industrial production, leading to a 7.3% drop in the state's industry in the quarter ending in November 2023 and mainly affecting the rubber and plastics, computer equipment, electronic and optical products, machinery, electrical appliances and materials, other transportation equipment (two- wheeled equipment) and miscellaneous products segments.

In 2024, the drought became severe again, with the following impacts: the suspension of navigation, the declaration by the National Water and Sanitation Agency of critical seasons of scarcity in some bodies of water and the declaration of a state of emergency in the entire state of Amazonas, six municipalities in Acre and 18 in Rondônia in June 2024. In the state of Amazonas alone, approximately 287,700 people - or 71,900 families - were affected by August 2024.

Case: Hydropower crisis in the 2020-2021 biennium

Looking at the scenario of the 2020-2021 biennium, in which Brazil faced a situation of severe water shortage, coinciding with the start of the dry season, the reservoirs in the Southeast and Center-West, responsible for, approximately, 70% of the country's storage, reached a historic low level of 26%.

The inflows to the power stations located in some of the basins that make up the SIN – Brazilian Interconnected System (Sistema Interligado Nacional) were below the historical average, and, in some cases, the worst hydrological sequences in the entire 91-year flow history (1931/2021) were seen. Considered in an aggregated manner, the flows to the entire SIN, in the period between December 2020 and November 2021, consisted in the worst hydropower condition ever seen for this period in history.

In this context, it is worth noting the unfavorable hydrological situation of the Paraná river basin, which includes the Paranaíba, Grande, Tietê and Paranapanema river basins, considering the Itaipu Power Plant as a point of interest, and in which the main regularization reservoirs of the SIN are located. These power plants and their respective reservoirs are extremely important for the operation of the SIN, as the resources stored in them are capable of guaranteeing power supply during dry periods, when there are no significant contributions from the plants installed in the north of the country, which greatly help to meet the SIN's load during rainy periods.

The reservoirs of the plants located in the Paraná River basin account for 76% of the maximum storage capacity of the Southeast/Center-West Subsystem and just over half (53%) of the storage capacity of the entire SIN.

After evaluating this scenario, the Electricity Sector Monitoring Committee (CMSE, Comitê de Monitoramento do Setor Elétrico), at its 248th Extraordinary Meeting, held on May 27, 2021, decided to "Recognize the severity of the current hydropower situation in the main hydrographic basins of the SIN, which recorded the worst hydrological period from September 2020 to May 2021, with the risk of

compromising the generation of electricity to serve the SIN, and, in view of the serious specific situation experienced in the region covered by the Paraná River Basin, to recommend to the National Water and Basic Sanitation Agency – ANA that a situation of water shortage be recognized in the Paraná River Basin, also encompassing the Grande, Paranaíba, Tietê and Paranapanema Rivers."

On the same date, the first Water Emergency Alert was issued by the National Meteorology System (SNM, Sistema Nacional de Meteorologia), according to a Joint Note from INMET/INPE/CENSIPAM – Management and Operational Center of the Amazon Protection System (Centro Gestor e Operacional do Sistema de Proteção da Amazonia), associated with a shortage of precipitation for the Paraná Basin Hydrographic Region, which covers the states of Minas Gerais, Goiás, Mato Grosso do Sul, São Paulo and Paraná for the period from June to September 2021. Subsequently, the National Water and Basic Sanitation Agency (ANA) declared the critical situation of quantitative shortage of water resources in the Paraná Hydrographic Region, through ANA's Resolution No. 77/2021, of June 1, 2021.

Thus, the extremely exceptional water shortage experienced in 2021 in the SIN indicated the need for coordination at a level beyond the electricity sector, which motivated the establishment of the Chamber for Exceptional Rules for Hydropower Management (CREG, Câmara de Regras Excepcionais para Gestão Hidroenergética), through Provisional Measure (MP, Medida Provisória) No. 1,055, of June 28, 2021, based on the need for greater coordination between bodies and entities responsible for activities dependent on water resources – including the management of multiple uses of water, energy generation, the environment, agriculture and transport. This was aimed at the adoption of exceptional measures to preserve the security and continuity of the electricity supply, with the purpose of making energy, water resources and environmental policies compatible.

CREG was made up of the State Ministers of Mines and Energy, who chaired it; Economy; Infrastructure; Agriculture, Livestock and Food Supply; Environment; and Regional Development, and its remit was to define mandatory guidelines for the establishment of exceptional and temporary conditions for the operation of the reservoirs of the country's hydroelectric plants, involving definitions for limits on use, storage and flow. In order to deal with these adverse conditions, since October 2020 the Electricity Sector Monitoring Committee (CMSE) has indicated the need for exceptional measures, and throughout 2021, the additional actions issued by CREG to guarantee the security of supply have been implemented with the necessary timing, based on technical studies, assessing their effectiveness, associated costs and the relevance of decision-making. These measures include:

- Activation of additional thermoelectric generation and enabling of additional generation supply to the system;
- Energy imports from Argentina and Uruguay;
- Flexibilization of hydraulic restrictions, in order to preserve the governability of the SIN's hydraulic cascades and the multiple uses of water;
- Flexibilization of the limits of exchanges between regions, with a corresponding increase in the transfer of power between them;
- Rational use of electricity by the population based on awareness campaigns and incentives;
- Anticipation of generation and transmission works;
- Publication of Ordinance No. 22/2021, on August 23, 2021, establishing guidelines for the Voluntary Electricity Demand Reduction – RVD (Redução Voluntária de Demanda) to serve the Brazilian Interconnected System – SIN (program for free consumers);
- Implementation of the program for the incentive to the voluntary reduction of electricity consumption for regulated consumers, for the period from September to December 2021;
- Implementation of a specific level of the Tariff Flag, entitled "Water Shortage";
- Specific guidelines regarding the generation from thermoelectric plants, as well as resources not ordered by the ONS – National Electric System Operator (Operador Nacional do Sistema Elétrico).

The exceptional measures indicated by the CMSE and CREG were fundamental for guaranteeing the security of service to the SIN and enabled significant storage gains of around 14 percentage points of the maximum

stored energy of the Southeast/ Central-West subsystem, assessed up to September 2021. As assessed, without the actions taken by the CMSE and CREG, the adverse hydrological conditions experienced in 2021 would have led to severe difficulties in guaranteeing the country's electric power supply.

Therefore, with these measures, the security of supply to Brazilian electricity consumers and the management of water use have been guaranteed, while complying with the necessary legal certainty in the implementation of the necessary actions for the benefit of Brazilian society, through the synergistic and coordinated action of all those who can contribute to the solutions (bodies, entities and concessionaires), seeking to reduce the impacts on the environment and water resources.

Impacts of climate change on the Commodity Index – Brazil (IC, Índice de Commodities –Br)

Climate change has had a significant impact on the Commodities Index - Brazil (IC-Br), reflected in higher prices of various agricultural products, such as coffee, oranges, cocoa, wheat and in natura products in general. In addition to the observed increase, the GDP projection for 2024 was reduced due to irregular rainfall and high temperatures in Brazil's main producing regions (BCB – Brazil's Central Bank (Banco Central do Brasil), 2024).

Climatic phenomena intensified by climate change, El Niño and La Niña (Figure 4.8) have had an impact on agricultural production, affecting the IC-Br. In 2021 and 2022, La Niña caused severe water shortages and increased prices of commodities, with heavy rains in the last quarter of 2022. The transition to El Niño in 2023 brought additional risks for the agricultural sector and food prices in 2024, highlighting negative impacts on the global productivity of corn, rice and wheat. El Niño has been identified as a significant risk for the Supply of Agricultural Commodities, affecting rice and sugar prices due to drier weather in Southeast Asia. Imports into the Northern region of Brazil were hampered by drought in the Amazon basin in 2023 (BCB, 2024).



4.5.2 Potential loss and damage

Building resilience by overcoming socioeconomic challenges

Building Brazilian resilience is directly related to overcoming socio-economic challenges. Working Group II of Assessment Report 6 - AR6 emphasized the importance of combating hunger, poverty and inequalities in order to strengthen the capacity of communities to face and adapt to these adversities of climate change. Communities with fewer economic and social resources are more vulnerable to the impacts of climate change, so overcoming challenges, such as poverty and inequality is essential to reducing this vulnerability. This involves guaranteeing access to basic resources, such as drinking water, food, healthcare and education, which are fundamental to resilience (IPCC, 2022).

In addition, social cohesion and effective governance are pillars for climate resilience. Cohesive societies, in which there is trust in institutions and community participation, are better able to implement adaptation strategies and mobilize resources and mutual support in extreme events. This includes implementing policies that promote equal opportunities and social inclusion, ensuring that all members of society have access to the resources they need to thrive (IPCC, 2022).

Strengthening the capacity of communities to respond to extreme events is also crucial. This can be achieved through investments in resilient infrastructure, early warning systems and environmental education focused on climate risks. By enabling communities to prepare for and respond effectively to disasters, it is possible to minimize negative impacts and speed up post-event recovery (IPCC, 2022). Building resilience is, therefore, not just a matter of physical infrastructure, but also of social and economic strengthening. By addressing socio-economic challenges in an integrated way, it is possible to create a more resilient, fair and sustainable environment.

The Cost of Inaction As described in section 4.2. Impacts, risks and vulnerabilities, climate-related impacts have been intensifying in Brazil, with future worsening scenarios. These impacts directly affect people's lives and ecosystems, as well as key sectors of the country's economy. The integrated modeling study of the economic impacts of climate change in Brazil shows that the impacts of climate change on the water, energy and food systems generate cross-cutting and cumulative effects (SCHAEFFER et al., 2022).

This includes medium- to long-term damage, as well as obstacles to economic development, due to restrictions on the availability of and access to resources and services, which results in limitations to production chains. Scenario with and without mitigation and adaptation actions. The future scenario of possible impacts on water, energy and food security without the implementation of adaptation actions in the country was projected based on computable general equilibrium (CGE) models and integrated assessment models (IAM). The result is lower productivity, higher production costs and higher prices for these three securities. The effects on agricultural activity are among the most relevant from an economic point of view, as they interfere with the capacity to generate income and employment locally, as well as with food prices, increasing the cost of living for families. In addition to the climate effect, changes in land use can increase deforestation by displacing agricultural activities.

The impact scenario (scenario without actions) was compared to a scenario in which mitigation actions on a national and global scale would be implemented, and climate impacts would not worsen (scenario with actions). The difference in economic indicators between the two scenarios corresponds to the cost of inaction, i.e., the economic impact of the country not promoting adaptation or mitigation. The comparative scenario shows that by not taking mitigation and adaptation measures, the country would have a 20.6% lower accumulated growth in its GDP, which corresponds to 0.35% less per year on average. In addition, 3.4 million jobs would no longer be created in the country by 2050, around 112,000 jobs per year. All regions of the country would be significantly negatively affected by inaction.

> It has been estimated that the cost of inaction would represent a difference of BRL 1.8 trillion in Brazil's GDP by 2050.

In terms of GDP and jobs, the CenterWest and Southeast would be the regions with the biggest losses. Due to the high dependence on agricultural activity and the growing demand for water, the results indicate that the North, Northeast and Center-West regions would potentially be the most affected in these indicators. The costs of inaction are much higher than the costs of action. However, we need to start immediately, because the window of opportunity to avoid serious economic, social and environmental losses, guaranteeing a livable and sustainable future, is getting smaller and smaller. Although actions to tackle climate change involve substantial initial investments and can cause significant changes in the economic structure, these challenges can be mitigated through appropriate public policies (IPCC, 2023).

Despite including important dimensions for the Brazilian circumstances when considering the impact of security, the study does not address possible costs related to the occurrence of disasters, such as impacts on infrastructure, industry and housing. The costs related to the impacts on public health, among other widely affected sectors, were also not included in the model. Therefore, the study makes great progress in understanding the possible impacts of climate change on the Brazilian economy, but it presents results that are underestimated in relation to the cost of inaction for adaptation actions in a more comprehensive way and in different sectors.

It is, therefore, important to advance methodologies and studies that make projections of the potential loss and damage caused by climate change. Such projections require greater efforts to systematize existing data scattered across different databases and sectors and to produce those that are not yet available. This information is fundamental to better communicate the impacts of climate change on the national territory and for institutions and society to be adequately prepared to deal with them.



Egypt

4.7 Information Related to Averting, Minimizing, and Addressing Loss & Damage Associated with Climate Change Impacts

Egypt's efforts to avert, minimize, and address loss and damage associated with climate change are grounded in the need to respond to projected climate-related risks, vulnerabilities, and adaptive capacities across various sectors. Observed and potential impacts, including extreme weather events such as floods and heatwaves, along with slow onset events like desertification and sea- level rise, pose severe threats to critical areas, especially the Nile Delta. These challenges threaten key sectors like agriculture and water resources, which are vital to Egypt's economy and food security.

Over the last 20 years, natural hazards have killed nearly 1,500 people, causing $346.7 million in economic damages. Notable events include a deadly 2009 rockslide in Cairo and severe flooding in 2010 that displaced thousands of people and damaged over 4,000 houses. Climate change is expected to increase the potential impact of hazards. (GFDRR, 2019). Data from the Emergency Event Database: EM-Dat database, presented in Table 75, indicates Egypt has experienced various natural disasters, including floods, landslides, epidemics, and storms from 1900 to 2020 (GFDRR, 2019).

Table 75: Natural Disasters in Egypt, 1900 – 2020 (Source: https://thinkhazard.org)

Natural Hazard	Subtype	Events Count	Total Deaths	Total Affected	Total Damage ('000 USD)
Earthquake	Ground Movement	5	594	92,996	1,200,000
Epidemic	Bacterial Disease	1	10,276	0	0
	Viral Disease	2	15	143	0
Extreme Temperature	Cold Wave	1	3	105	0
	Heat Wave	3	164	66	0
Flood	Flash Flood	2	13	468	0
	Riverine Flood	6	638	167,960	140,000
Storm	Convective Storm	6	109	47,807	126,000
Mass Movement (dry)	Rockfall	1	98	697	0
	Subsidence	1	34	300	0



Scientific assessments reveal the vulnerabilities of Egypt's coastal regions, where rising sea levels and salinization directly threaten agricultural productivity. Between 1993 and 2010, the Mediterranean Sea rose by 2.6 centimeters per decade, a significant trend expected to worsen, with sea levels projected to increase by 22 centimeters by the end of the century. This escalation has left Egypt's coastline, particularly in areas like Rosetta, highly vulnerable to erosion, saltwater intrusion, and increased soil salinity. The salinity of Rosetta's coast rose sharply from 27 percent in 1964 to over 29 percent by 2015, contributing to the deterioration of cultivated land and the degradation of freshwater resources (Al-Mailam et al., 2023).

These coastal issues increase water scarcity and pose a direct threat to agricultural productivity in the Nile Delta, one of Egypt's most crucial agricultural regions. Increased soil salinity and declining freshwater availability have led to significant crop damage and reduced yields, affecting national food security.

In response to these impacts, Egypt has embarked on several adaptation initiatives. Agricultural production in vulnerable regions, such as the Nile Delta, is being enhanced through targeted interventions, with projected investments of $4 billion. Similarly, $2 billion has been allocated for the rehabilitation of agricultural areas in the Northern Delta affected by sea-level rise. Egypt is also focused on increasing resilience in climatically vulnerable areas by combating desertification and rehabilitating degraded pastures, with a budget of $3.5 billion dedicated to these activities. Improving water management is another priority, with projects such as the development of on-farm irrigation in the Nile Valley and Delta estimated at $4 billion. Additionally, supporting early warning systems, agricultural weather forecasting, and establishing agricultural insurance are expected to cost $1.5 billion.

Water resource management is also a significant area of focus, with cross-cutting projects such as water desalination using solar energy allocated $625 million. Natural protection efforts along the Rosetta shoreline using innovative techniques like the sand motor will cost $120 million, while the rehabilitation of irrigation canals to enhance agricultural resilience will require $4.5 billion. Coastal protection and development efforts in three Mediterranean cities, integrating climate adaptation into urban planning, are set to receive $2 billion, while scaling up solar-powered irrigation projects is expected to cost $50 million.

Furthermore, infrastructure projects such as building a breakwater at the Port of Alexandria to mitigate the impacts of rising sea levels will receive $108 million in funding. The total cost of implementing these adaptation measures is estimated at $50 billion, forming part of Egypt's broader climate strategy. However, the country's ability to implement these measures is conditional on receiving adequate international financial support. As outlined in Egypt's second updated NDC, $50 billion is required for adaptation.

Egypt has also taken significant steps to mitigate the adverse effects of climate change through various initiatives. The Integrated Coastal Zone Management (ICZM) Plan aims to develop climate-resilient strategies that link land use planning with coastal protection measures over the next 10-15 years. The government has also integrated Disaster Risk Reduction (DRR) strategies into national planning, focusing on developing hazard maps and early warning systems to reduce the vulnerability of communities and critical infrastructure, particularly against extreme weather events like floods.

Despite significant efforts by the Egyptian government to mobilize resources through domestic public and private channels, meeting these targets will not be possible without substantial international support. Egypt emphasizes the need for developed countries to fulfill their commitments under Article 9 of the Paris Agreement, which mandates financial support to developing countries. This support should be delivered through international and regional development partners, funds, and private investors using a variety of financial modalities, including blended finance, green bonds, and grants (EEAA, 2023).

Institutional arrangements within Egypt, such as the National Council for Climate Change, alongside key ministries, continue to drive national climate efforts. These institutions collaborate with international partners to ensure that Egypt's adaptation and mitigation plans are effectively implemented. Egypt remains committed to its sustainable development goals as part of its Vision 2030, which integrates climate action into the country's broader developmental objectives, ensuring that loss and damage from climate impacts are adequately addressed.



.

Ghana

4.7 Information related to averting, minimising and addressing loss and damage associated with climate change impacts

4.7.1 Understanding loss and damage in Ghana's Context

Loss and damage associated with climate change refers to the adverse effects of climate change that cannot be avoided through mitigation and adaptation measures. These impacts often result in the destruction of infrastructure, displacement of populations, and the erosion of ecosystems, leading to severe socioeconomic consequences. In the context of Ghana, a developing country highly vulnerable to climate change, particularly in sectors such as agriculture, water resources, health, and coastal zones, the need for comprehensive strategies to avert, minimise, and address loss and damage is critical.

Ghana is highly vulnerable to the impacts of climate change due to its reliance on climate-sensitive sectors such as agriculture, energy, and water resources. The primary impacts of climate change in Ghana include increased rainfall variability and droughts, leading to agricultural production and water supply disruptions. Flooding from heavy rains and rising sea levels affect coastal cities like the national capital, Accra.

Erosion and salinisation of land in coastal regions undermine agricultural productivity. Health risks, such as the spread of vector-borne diseases (e.g., malaria) due to shifting climate patterns, are prevalent. Reduced food security due to unpredictable agricultural yields and changing farming seasons. Loss and damage manifest in several forms, including economic losses from crop failure, destruction of infrastructure, and increased health costs. Non-economic losses also include loss of cultural heritage, livelihoods, and ecosystem services. Displacement and migration due to severe weather events, particularly flooding and droughts, also occur

4.7.2 Strategies for averting, minimising, and addressing loss and damage

4.7.2.1 Averting and minimising loss and damage in Ghana

In Ghana, proactive measures to prevent or reduce the severity of climate impacts on people, economies, and ecosystems through risk reduction measures and disaster preparedness have targeted mitigation efforts to limit emissions. Ghana has made strides through its NDCs, focusing on renewable energy development, energy efficiency, and forest conservation. Reducing greenhouse gas emissions through transitioning to renewable energy (solar, wind, and hydropower) is essential for averting global warming. Implementing climate-resilient agricultural practices (e.g., drought resistant crops, improved water management, agroforestry) has helped reduce the impact of changing weather patterns. Additionally, shifting to low-carbon agricultural practices can prevent future climate impacts.

Promoting climate-smart infrastructure through climate-resilient infrastructure development, particularly in vulnerable sectors like coastal defence, water systems, and housing, aims to avert significant losses. Green infrastructure, such as mangrove restoration and rainwater harvesting systems, has also been effective. Ghana has invested in early warning systems for extreme weather events, including floods and droughts. Expanding these systems and ensuring timely communication to vulnerable communities, can help minimise the damage caused by these events. Empowering local communities to develop and implement adaptation strategies is also crucial. Community-based adaptation approaches allow people to use indigenous knowledge to build resilience and reduce vulnerability. For example, introducing climate-resilient crops, improving irrigation practices, and reinforcing traditional flood defences can reduce the impacts of climate related events.

In minimising loss and damage, Ghana should enhance water management strategies to address droughts and flooding. This includes improving water storage capacity, promoting efficient irrigation, and ensuring water supply systems are resilient to climate change. Coastal communities in Ghana face risks from rising sea levels and erosion. Restoring coastal ecosystems (such as mangroves) and constructing sea walls and flood defences can help reduce coastal erosion and protect livelihoods. Also, developing climate risk insurance schemes for farmers and vulnerable communities, can help minimise the financial losses associated with climate impacts. Ghana can also explore climate risk bonds and other innovative financial tools to manage the economic burden of extreme weather events.

4.7.2.2 Addressing loss and damage

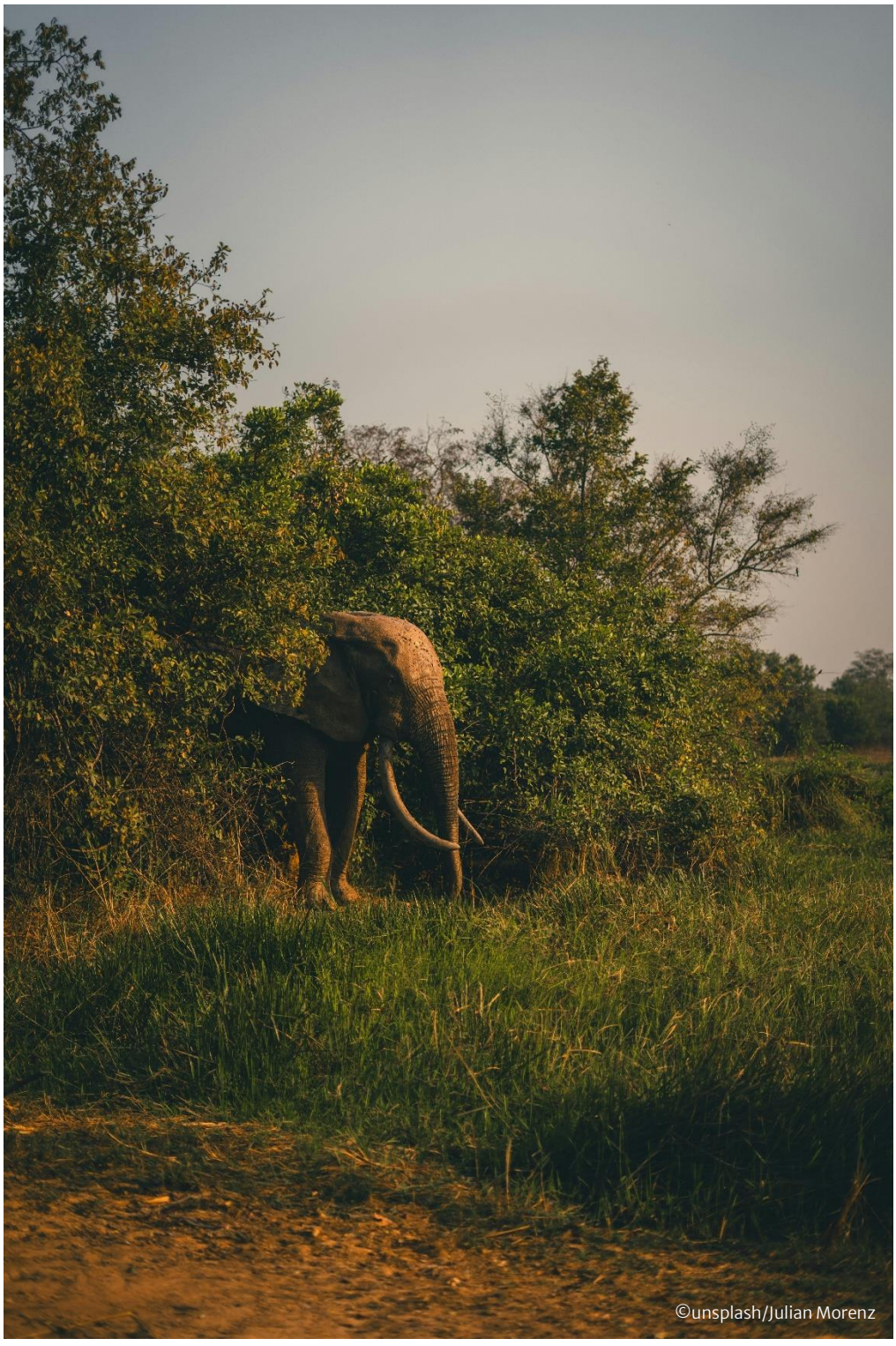
Addressing loss and damage refers to providing support and recovery mechanisms for those affected by climate change. In Ghana, addressing loss and damage could involve:

- **Financial support and compensation:** Ghana can advocate for financial support from the international community through mechanisms like the Loss and Damage Finance Facility (a component of the Paris Agreement). These funds can assist affected populations and communities with recovery efforts, including rebuilding homes, restoring crops, and relocating displaced populations.
- **Loss and damage insurance schemes:** Implementing loss and damage insurance schemes would help communities in Ghana cope with the adverse effects of climate change. This can include agricultural insurance for farmers whose crops are destroyed due to unpredictable weather events or health insurance for communities affected by climate-induced diseases.
- **Climate migration and resettlement programs:** Migration and resettlement programs should be developed for communities displaced by rising sea levels or extreme weather. These programs must ensure that displaced populations are supported in finding sustainable livelihoods and rebuilding their communities in less vulnerable areas.
- **Restoration of ecosystems and livelihoods:** Ghana should implement ecosystem restoration programs to rehabilitate affected areas after major climate impacts such as flooding or droughts. This includes restoring degraded land, replanting forests, and supporting affected livelihoods, particularly agriculture and fisheries.
- **Institutional capacity building:** Addressing loss and damage requires strong institutions capable of managing disaster responses and recovery efforts. Ghana should strengthen its disaster management agencies, improve data collection and risk assessment capacities, and ensure that local governments are well-equipped to handle the aftermath of climate impacts.
- **Psychosocial support for affected communities:** Climate change impacts often result in significant psychological and social stress, particularly among displaced persons or those who have lost livelihoods. Ghana must prioritise mental health and psychosocial support in disaster response and recovery plans.

4.7.3 Policy and institutional outlook for loss and damage in Ghana

Ghana's policy and institutional framework for addressing loss and damage builds upon its existing climate action efforts, including the National Climate Change Policy, NDCs, and the national adaptation planning process. The National Development Planning Commission can incorporate loss and damage considerations into the country's long-term development plans to support loss and damage efforts. Integrating loss and damage into the Medium-Term Development Framework will ensure that adaptation and recovery strategies are aligned with national growth goals. Ghana must improve the accessibility and efficiency of climate finance mechanisms to support loss and damage.

This could involve tapping into international funding sources such as the Green Climate Fund and ensuring that funds are directed toward effective adaptation, risk reduction, and recovery efforts. Institutions at all levels (national, regional, and local) must be trained to manage loss and damage, from disaster risk management to financial mechanisms. Building local resilience through community-based approaches and improving institutional coordination is key. Ghana can also benefit from regional cooperation within the West African region. Collaborative strategies for tackling transboundary risks such as desertification, droughts, and floods will help minimize the impacts and share resources for recovery.



India

3.7 Information related to averting, minimizing and addressing loss and damage associated with climate change impacts

3.7.1 Observed and potential climate change impacts, including those related to extreme weather events and slow onset events, drawing upon the best available science.

In the following, a brief overview of the key natural hazards in the Indian context is presented. While heat waves, floods, and droughts in the hydrometeorological context are also discussed in detail elsewhere in the report, they are included here for completeness. It may be noted that loss and damage, under the rubric of disaster management, is a subject that is very actively studied with reference to India, which would be difficult to capture in its entirety in this chapter, except to note some key highlights and provide an overview.

To provide an authoritative account, in the following, relevant information is compiled from the web pages of the National Disaster Management Authority (NDMA, n.d.) and other related institutions, which is the statutory authority within the Government of India and the nodal agency for disaster management in the country.

Heat Waves

A Heat Wave is defined as a period of abnormally high temperatures exceeding the normal maximum temperature typically observed during the summer season in the north-western parts of India. Heat Waves generally occur between March and June and, in some rare instances, extend up to July. The elevated temperatures and associated atmospheric conditions negatively impact the population in these regions by causing physiological stress, which can sometimes lead to fatalities.

The IMD has established the following criteria for declaring Heat Waves:

- A Heat Wave is not considered until the maximum temperature at a station reaches at least 40°C in plains and at least 30°C in hilly regions.
- When the normal maximum temperature of a station is less than or equal to 40°C, a Heat Wave is declared if the departure from normal temperature is between 5°C and 6°C; a Severe Heat Wave is declared if the departure from normal is 7°C or more. y When the normal maximum temperature of a station exceeds 40°C, a Heat Wave is declared if the departure from normal temperature is between 4°C and 5°C; a Severe Heat Wave is declared if the departure is 6°C or more.
- A Heat Wave is also declared when the actual maximum temperature reaches or exceeds 45°C, irrespective of the normal maximum temperature.

Globally, higher daily peak temperatures and longer, more intense heat waves are becoming increasingly frequent due to climate change. India is experiencing this trend, with increasing instances of more intense heatwaves each year, resulting in severe health impacts and a higher number of heatwave-related casualties.

This pattern of rising temperatures and intensifying heat waves continues to affect India, causing considerable adverse effects on human health and increasing the frequency of heat-related mortality.

Floods

Several regions in India are significantly vulnerable to flooding. Of the total geographical area of 329 million hectares, more than 40 million hectares are considered flood prone. Floods are a recurring phenomenon that result in significant loss of life and cause extensive damage to livelihood systems, property, infrastructure, and public utilities. There is cause for concern as flood-related damages have shown an increasing trend over

time. For instance, the average annual flood damage during the decade from 1996 to 2005 was INR 47.45 billion, considerably higher than the average of INR 18.05 billion recorded over the preceding 53 years. This increase can be attributed to multiple factors, including rapid population growth, accelerated urbanization, expanding development and economic activities in floodplains, and the possible effects of global warming.

On average, floods affect approximately 7.5 million hectares annually, resulting in the loss of around 1,600 lives each year and causing damage to crops, housing, and public utilities estimated at INR 18.05 billion. The highest number of fatalities occurred in 1977, with 11,316 lives lost. Major floods tend to occur more frequently than once every five years. In recent times, floods have also affected areas previously not recognized as flood prone.

Approximately 80 percent of annual precipitation occurs during the monsoon months, from June to September. Rivers transport heavy sediment loads from their catchment areas, which, in conjunction with the reduced carrying capacity of the rivers, contribute to flooding, drainage congestion, and riverbank erosion. Cyclones, cyclonic circulations, and cloudbursts trigger flash floods, causing substantial losses. Moreover, some rivers are responsible for flood damage in India originate in neighbouring countries, which adds complexity to flood management efforts.

The following table provides data on the flood-affected area at the State level during the period 1998-2022 (National Remote Sensing Centre, 2023).

Table 3.21: Flood affected area at state level during period 1998-2022

State	No. of districts affected	Flood affected area (Ha)
Andhra Pradesh	24	738,200
Arunachal Pradesh	5	3373
Assam	35	2,464,958
Bihar	38	3,976,861
Chhattisgarh	12	12,029
Delhi	7	5,848
Gujarat	16	517,770
Haryana	9	67,852
Jammu & Kashmir	10	43,022
Jharkhand	2	2,966
Karnataka	26	280,156
Kerala	10	79,377
Madhya Pradesh	30	210,809
Maharashtra	20	233,590
Manipur	9	88,352
Meghalaya	2	8,787
Odisha	23	1,424,313
Rajasthan	10	155,144
Tamil Nadu	24	552,010
Telangana	24	102,318
Uttar Pradesh	72	2,662,942
Uttarakhand	2	7,604
West Bengal	20	1,969,750
TOTAL	435	15,750,723

Urban Floods

Urban flooding differs significantly from rural flooding because urbanization leads to developed catchments that increase flood peaks by a factor of 1.8 to 8 times and flood volumes by up to 6 times. This results in flooding occurring very rapidly, often within minutes, due to shorter flow times. Urban areas tend to be densely populated, and residents in vulnerable locations suffer from flooding, sometimes resulting in loss of life. Beyond the immediate flooding, secondary effects such as increased exposure to infections also contribute significantly to human suffering, loss of livelihood, and, in severe cases, mortality.

In recent years, urban flood disasters have shown an increasing trend across India, greatly affecting major cities. Some of the most notable incidents include flooding in Hyderabad (2000), Ahmedabad (2001), Delhi (2002 and 2003), Chennai (2004), Mumbai (2005), Surat (2006), Kolkata (2007), Jamshedpur (2008), Delhi again in 2009, and both Guwahati and Delhi in 2010.

A distinctive feature of India's climate is the heavy rainfall during the monsoon season. Besides monsoons, other weather systems also contribute considerable rainfall, while storm surges frequently impact coastal cities and towns. The sudden or uncontrolled release of water from dams can also cause severe flooding. Furthermore, the urban heat island effect has led to increased rainfall over urban areas. Changes in weather patterns due to global climate change have resulted in more frequent episodes of intense rainfall over shorter durations. Additionally, the threat of sea-level rise endangers all coastal cities. Cities and towns located along the coast, on riverbanks, upstream or downstream of dams, inland urban centres, and those in hilly areas are all susceptible to flooding.

Historically, stormwater drainage systems were designed to handle rainfall intensities of 12 to 20 millimeters per hour. However, these capacities are frequently overwhelmed during events of higher intensity rainfall. Moreover, drainage systems often fail to perform at designed capacities due to inadequate maintenance. Encroachments have also become a significant issue in many cities and towns. Natural streams and watercourses have formed over thousands of years due to the flow of water within their watersheds.

As human settlements expanded into towns and cities alongside rivers and watercourses, the volume of runoff increased in proportion to urbanization. Ideally, natural drains should have been widened to accommodate the increased stormwater flows, much like roads are widened to handle greater traffic. Contrary to this, large-scale encroachments on natural drains and river floodplains have occurred, reducing the capacity of drainage channels and leading to increased flooding. Improper disposal of solid waste, including domestic, commercial, and industrial refuse, along with the dumping of construction debris into drains, significantly contributes to the reduction of their capacity. Therefore, improved operational and maintenance measures are imperative to address these challenges.

Landslides

Landslides and avalanches represent significant hydro-geological hazards that impact extensive regions of India, including the Himalayas, the Northeastern hill ranges, the Western Ghats, the Nilgiris, the Eastern Ghats, and the Vindhyas, collectively covering approximately 15 percent of the country's land area. The Himalayas experience landslides of varying types and scales, ranging from large to small, rapid to slow-moving, and including both ancient and recent occurrences. The Northeastern region faces a diverse array of landslide challenges. Specific areas such as the Darjeeling district in West Bengal, along with Sikkim, Mizoram, Tripura, Meghalaya, Assam, Nagaland, and Arunachal Pradesh, encounter persistent landslide issues that cause recurring economic losses amounting to billions of rupees. In the Western Ghats and Nilgiris, a distinct category of landslides characterized by a lateritic cap consistently threatens these areas, particularly on steep slopes overlooking the Konkan coast.

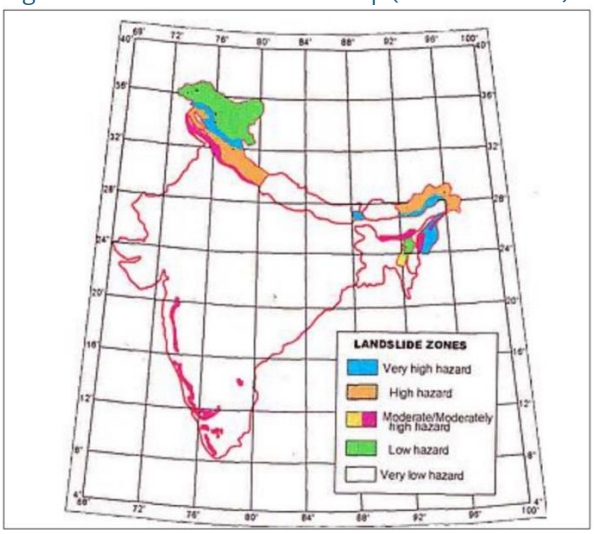
Several prominent landslide events have been documented, including the Varnavat landslide in Uttarkashi District, the Malpha landslide in Pithoragarh District, the Okhimath landslide in Chamoli District, and occurrences in the Darjeeling District as well as in Sikkim and Aizawl, Mizoram. These examples illustrate

some of the more recent landslide incidents. Addressing this issue effectively requires targeted mitigation and management efforts, starting with the identification of landslide hazard zones. Specific landslides need to be stabilized and managed through appropriate interventions, complemented by the establishment of monitoring systems and early warning mechanisms at selected vulnerable sites.

A general landslide hazard map for India delineates various hazard zones across different states, demonstrating notably high vulnerability in the Northwestern and Northeastern Himalayas, as well as the Western Ghats, which are recognized as regions highly susceptible to landslides.

The NDMA guidelines are employed for the preparation of Landslide Hazard Zonation (LHZ) maps, which are produced at a scale of 1:50,000 and at progressively larger scales for specific high-risk areas. Multiple institutions, including the National Remote Sensing Centre (NRSC), the DST, the CSIR, Indian Institutes of Technology (IITs), and various universities, have made significant contributions in this domain.

Figure 3.34: Landslide hazard map (Source: NDMA)



The NRSC has developed a detailed atlas covering selected corridors in Uttarakhand and Himachal Pradesh, providing valuable resources for landslide assessment and management. Furthermore, the DST has supported over 30 research projects across India through different academic institutions; reports from these projects can be obtained from the DST, as referenced by the NDMA.

Cyclones

The Indian subcontinent is one of the most cyclone-affected regions globally. With an extensive coastline measuring 11,099 km, it is exposed to nearly 10 percent of the world's tropical cyclones. A majority of these cyclones originate over the Bay of Bengal and predominantly make landfall along the eastern coast of India. On average, five to six tropical cyclones form each year, of which two or three may reach severe intensity. Cyclones occur more frequently in the Bay of Bengal than in the Arabian Sea, with an approximate ratio of 4:1. Both the western coast (Arabian Sea) and the eastern coast (Bay of Bengal) experience cyclonic activity regularly. An analysis of cyclone frequency between 1891 and 1990 indicates that around 262 cyclones affected a 50-kilometer-wide strip along the eastern coast, with 92 classified as severe. In comparison, the western coast experienced 33 cyclones during the same period, including 19 severe events.

In India, cyclones are classified based on three parameters: the strength of associated winds, storm surges, and exceptional rainfall occurrences. The IMD has formulated criteria for classifying low-pressure systems in the Bay of Bengal and Arabian Sea, which is adopted by the World Meteorological Organization (WMO). These classifications are as follows:

Table 3.22: Criteria for classifying low-pressure systems in Bay of Bengal and Arabian sea (Source: NDMA)

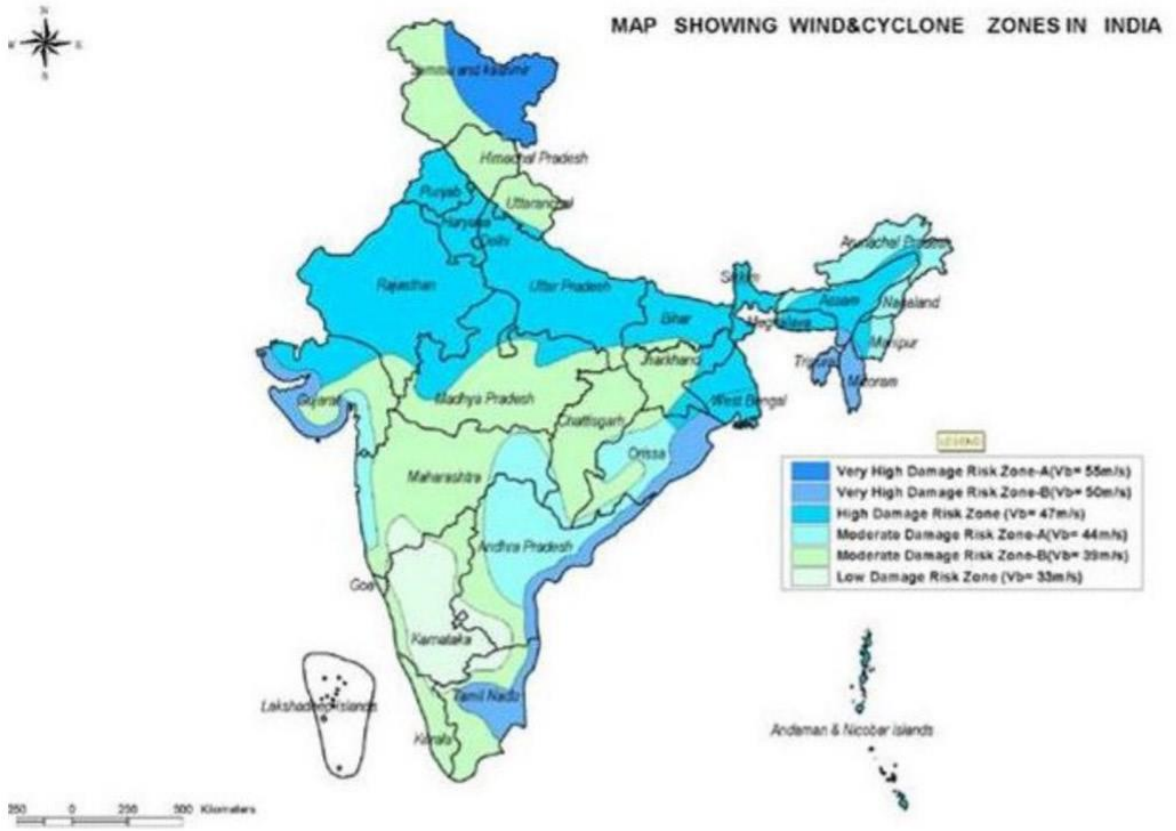
Type of Disturbances	Wind Speed in Km/hr	Wind Speed in Knots
Low Pressure	Less than 31	Less than 17
Depression	31-49	17-27
Deep Depression	49-61	27-33
Cyclonic Storm	61-88	33-47
Severe Cyclonic Storm	88-117	47-63
Super Cyclone	More than 221	More than 120

Tropical cyclones generally occur during the months of May-June and October-November. In the North Indian Ocean, cyclones of severe intensity and frequency exhibit a bi-modal distribution pattern, with a primary peak in November and a secondary peak in May. The disaster potential is particularly high during landfall in this region, which includes the Bay of Bengal and Arabian Sea, due to the combined effects of destructive winds, storm surges, and torrential rainfall. Of these, storm surges contribute the most damage by flooding low-lying coastal areas with seawater, leading to extensive floods, erosion of beaches and embankments, destruction of vegetation, and degradation of soil fertility.

Cyclones vary in diameter from 50 to 320 kilometers but can impact thousands of square kilometers of ocean surface and the lower atmosphere. While their perimeter may extend to 1,000 kilometers, the core energy, or "powerhouse," is generally confined within a 100-kilometer radius. Near the eye of the cyclone, wind speeds can reach up to 320 kilometers per hour. Tropical cyclones, characterized by these destructive winds, heavy rainfall, and storm surges, disrupt normal life and are commonly accompanied by floods resulting from exceptional rainfall and storm surge penetration into inland areas. These cyclones have significant destructive potential, damaging structures such as houses, lifeline infrastructure including power and communication towers, hospitals, food storage facilities, roads, bridges, culverts, and crops. The majority of fatalities related to cyclones result from storm surges and the flooding of low-lying coastal regions caused by torrential rains.

The map below shows the cyclone zones in India categorized by damage risk.

Figure 3.35: Wind, Cyclone zones in India Source: NDMA (n.d.)



Estimates of damages from hydrometeorological disasters

The table below gives the estimates of damages from weather disasters during the period 2022-2024 (DTE, 2025). The disasters considered are heavy rains, floods, landslides, lightning & storms, heatwaves, cold waves, cloudbursts, snowfall, and cyclones.

Table 3.23: Estimates of damages from weather disasters (2022-2024)

State/Union Territory	Human Deaths (2022–2024)	Crop Area Affected (ha) (2022–2024)	Property Damaged (2022–2024)	Animal Deaths (2022–2024)
Andhra Pradesh	147	4,24,686	85,998	532
Arunachal Pradesh	55	105	1,406	60
Assam	554	3,42,433	3,85,578	56,515
Bihar	1,093	3,37,000	1,486	0
Chattisgarh	331	18,180	4,798	832
Delhi	7	30	216	3
Goa	8	175	364	0
Gujarat	224	40,000	20,500	100
Haryana	55	2,500	2,000	20
Himachal Pradesh	675	500	150	35
Jammu & Kashmir	400	15,000	6,000	150
Jharkhand	260	15,000	1,500	450
Karnataka	190	60,000	30,000	900
Kerala	520	70,000	28,000	320
Madhya Pradesh	430	25,000	5,000	480
Maharashtra	380	1,00,000	40,000	1,200
Manipur	45	300	800	20
Meghalaya	60	2,000	900	40
Mizoram	25	150	700	10
Nagaland	40	100	600	15
Odisha	800	1,10,000	50,000	1,000
Punjab	55	1,200	800	25
Rajasthan	300	7,000	2,200	100
Sikkim	30	70	400	5
Tamil Nadu	140	33,000	18,000	700
Telangana	90	25,000	14,000	300
Tripura	35	200	800	15
Uttar Pradesh	500	50,000	10,000	150
Uttarakhand	250	15,000	3,500	120
West Bengal	750	1,20,000	55,000	1,000

3.7.2 Activities related to averting, minimizing and addressing loss and damage associated with the adverse effects of climate change


©unsplash/Sandip Jana

India's disaster risk reduction (DRR) framework is anchored in the Disaster Management (DM) Act, 2005, which provides the legal and institutional basis for a comprehensive and coordinated approach to disasters. The Act mandates the preparation of the National Disaster Management Plan (NDMP), first formulated in 2016 and subsequently revised in 2019, which integrates prevention, preparedness, response, recovery, and reconstruction. The NDMP provides a comprehensive strategy for all phases of the disaster management cycle and is aligned with the Sendai Framework for Disaster Risk Reduction, the SDGs, the Paris Agreement (2015), and the Prime Minister's 10-Point Agenda. It brings together ministries, departments, and agencies across central, state, and district levels, clearly defining their roles and responsibilities to minimise ambiguity and strengthen disaster-resilient efforts. Complementing this, the National Policy on Disaster Management (NPDM) of 2009 envisions building a safe and disaster-resilient India through a holistic, multi-disaster and technology-driven approach based on prevention, mitigation, preparedness, and response.

Additionally, India established the National Platform for Disaster Risk Reduction (NPDRR) in 2013 as a multistakeholder, multi-sectoral mechanism to enhance participatory decision-making in disaster management. NPDRR brings together the Central and State Governments, local authorities, civil society, private sector, academia, and community representatives. Its functions include reviewing the progress of disaster management, appraising the implementation of policies, and advising on coordination among governments and stakeholders. The third session of NPDRR, held in 2023 on the theme "Building Local Resilience in Changing Climate", highlighted priorities such as mainstreaming DRR into social and economic sectors, improving risk governance, building a national integrated response system, capacity building, strengthening local resilience, and fostering technology & innovation in DRR.

The NDMA is the apex body responsible for policy, planning, and coordination. It issues guidelines, frameworks, and oversight. So far, NDMA has issued 38 guidelines for the management of hazard-specific disasters on various thematic and cross-cutting issues. Additionally, the NIDM supports research, capacity building, training, risk/vulnerability assessments and development of DRR and climate change adaptation integration tools. The subsequent section summarises key activities, measures, initiatives and schemes in this domain that are currently in place.

Measures, Initiatives and Activities:

1. **Technology, Data and Early Warning Dissemination Systems (EWDS):** Technology has been integrated into India's disaster preparedness framework through tools such as the Web-based Dynamic Composite Risk Atlas (Web-DCRA) and Decision Support System (DSS), which has been used effectively in planning for cyclones such as Biparjoy (June, 2023) and Michaung (December, 2023), improves risk assessment and overall response planning for cyclones in advance. The India Disaster Response Network (IDRN) maintains an updated database of disaster response equipment at the district level to facilitate quick mobilisation. Early warning systems have also been significantly upgraded under NCRMP, providing timely alerts to coastal communities. Early warning and technological innovations have been prioritised through initiatives such as the Common Alerting Protocol (CAP)-based Integrated Alert System (SACHET) developed by Centre of Development of Telematics (C-DOT), which modernises disaster alerts and ensures last-mile reach by integrating multiple agencies and disseminating of geo targeted early warnings/alerts related to disasters to the citizens of India for all 36 States/UTs in regional languages using various disseminating medium like SMS, TV, Radio, Indian Railways, Costal Sirens, Cell broadcast, Internet (RSS feed & Browser Notification), Satellite Receiver of GAGAN & NavIC etc.

2. **Institutional Strengthening and Response Capacity through National Disaster Response Force (NDRF):** India has progressively built its disaster response capacity by expanding the NDRF, which now has 16 fully operational battalions for immediate response. NDRF regularly conducts mock drills in all 36 states/UTs on disaster awareness. To ensure a systematic approach to training, the foundation stone for an NDRF Academy was laid in 2020. Additionally, the government has also institutionalised the practice of deploying Inter-Ministerial Central Teams (IMCTs) immediately after a natural calamity, ensuring quicker assessments and support without waiting for a formal memorandum from affected states. In case of a disaster of a 'severe nature', additional financial assistance is extended from the National Disaster Response Fund, based on the visit and assessment by IMCT.

3. **International cooperation through Coalition for Disaster Resilient Infrastructure (CDRI):** A major initiative in strengthening resilience has been the establishment of the CDRI, launched by India at the United Nations General Assembly (UNGA) Climate Action Summit in 2019. It is a collaborative effort of various national governments, international organisations, and the private sector that aims at enhancing the resilience of infrastructure systems to climate and disaster risks. With 39 countries and 7 international organisations as members, the CDRI has developed specialised programmes, such as the Infrastructure for Resilient Island States (IRIS), to deliver resilience and climate adaptation solutions to Small Island Developing States (SIDS), launched at COP-26 in 2021.

4. **Capacity Building, Training and Community Awareness:** Training and capacity building are central to India's disaster risk reduction efforts. Under the National Cyclone Risk Mitigation Project (NCRMP), through 925 capacity building trainings, nearly 24,007 government officials across priority sectors such as health, education, Panchayat Raj Institutions, Urban Local Bodies, and Rural Development, as well as 68,988 community representatives, have been trained in critical disaster response skills, including first aid, search and rescue, and shelter management. The NDRF regularly conducts mock exercises in all states and union territories, covering hazards such as floods, cyclones, earthquakes, landslides, and other emergencies. Additionally, special School Safety Programmes are carried out to impart training on disaster response to children in vulnerable schools.

5. **Knowledge and Research Networks:** Recognising the role of education and research, the Indian Universities and Institutions Network for Disaster Risk Reduction (IUINDRR-NIDM) was established under the National Institute of Disaster Management. It now brings together over 300 universities and institutions to develop curricula, training modules, and collaborative research on disaster resilience. It also provides a platform and opportunities for dialogue between the government, experts, and community representatives.

6. Relief and Financial Assistance Mechanisms: Financial assistance for disasters is primarily provided through the State Disaster Response Fund (SDRF), which covers relief for twelve notified disasters. In situations of 'severe nature' of disasters, additional support is extended through the NDRF, based on assessments by IMCT after visiting the disaster-affected region. These funds are designed to provide immediate relief rather than compensation.

7. Recognition and Motivation: To encourage excellence in disaster management, the GoI instituted the Subhash Chandra Bose Aapda Prabandhan Puraskar in 2018–19. This annual award recognises outstanding contributions by individuals and institutions in the field of disaster management, and is announced on 23rd January, the birth anniversary of Netaji Subhash Chandra Bose.

Schemes for Disaster Risk Reduction and Response:

1. Aapda Mitra Scheme: The Aapda Mitra Scheme focuses on building community-level capacity by training one lakh volunteers across 350 multi-hazard prone districts across all States and UTs. These volunteers, known as Aapda Mitra or Aapda Sakhi, undergo two weeks of intensive training, receive Emergency Responder Kits (ERK), and are provided with insurance cover for five years. Each district also provided with an Emergency Essential Resource Reserve (EERR) to support these volunteers during disasters.

2. National Landslide Risk Mitigation Programme (NLRMP) & Landslide Risk Mitigation Scheme (LRMS): The NLRMP has been approved with an outlay of INR 10 billion to support 15 landslide-prone states/UTs in implementing landslide risk mitigation projects/activities. This programme enables states to develop area-specific measures to reduce risks, with priority given to highly vulnerable regions such as Kerala's Wayanad district. In addition, the Government had also initiated the Landslide Risk Mitigation Scheme (LRMS) in 2019 with a total financial outlay of INR 439.1 million, which provides central assistance to four vulnerable States, viz. Sikkim, Mizoram, Nagaland and Uttarakhand, for disaster preparedness and build their capacity to take up other landslide mitigation projects in future.

3. National Cyclone Risk Mitigation Project (NCRMP): The NCRMP is a major initiative to undertake suitable structural and non-structural measures to mitigate the effects of cyclones as well as reduce cyclonerelated risks in cyclone-prone coastal states of India. Implemented in multiple phases, it includes four major components, namely, the Early Warning Dissemination System (EWDS), Cyclone Risk Mitigation Infrastructure (CRMI), Technical Assistance for Capacity Building on Disaster Risk Management and Project Management and Monitoring.

4. Common Alert Protocol (CAP) Scheme: The CAP scheme with an initial financial outlay of INR 3.5483 billion in March 2021, provides geo-targeted disaster alerts to citizens, including in regional languages, through various disseminating medium like SMS, television, radio, Indian Railways, coastal sirens, internet feeds, and satellite receiver of GAGAN and NavIC, across all States/UTs of India. By mid-2025, more than 43 billion alerts have been disseminated successfully, enhancing India's ability to provide timely warnings.

5. Emergency Response Support System (ERSS – Dial 112): The ERSS offers a single nationwide emergency number (112) to handle all types of distress calls, including those related to disaster emergencies. The system leverages technology for quick response, thereby reducing potential loss of life and property.

6. National Disaster Response Reserve (NDRR): Set up with a corpus fund of INR 2.5 billion, on the recommendation of the 13th Finance Commission in 2014, the NDRR maintains essential relief materials to provide immediate assistance to up to 0.4 million affected people, ensuring rapid availability of critical resources in disaster-hit areas. Its main aim is to maintain an inventory of necessary relief equipment from Central resources for at least a population of 0.25 million in the plain areas and for a minimum of 0.15 million population in hilly areas.

7. National Disaster Mitigation Fund (NDMF) and State Disaster Mitigation Fund (SDMF): Constituted in 2021 as a part of the 15th Finance Commission Grants, the NDMF and SDMF provide dedicated financial

resources for proactive mitigation. With allocations of INR 136.93 billion and INR 320.31 billion for NDMF and SDMF, respectively, these funds support structural and non-structural measures aimed at reducing disaster risks. The fund is mainly designated for planning and executing hazard-specific mitigation projects and programs, focusing on local and community-level initiatives to enhance resilience within communities.

8. **Modernisation of Fire Services Scheme:** To strengthen state fire services, the Government has allocated INR 50 billion for their expansion and modernisation. This scheme, supported under the preparedness and capacity-building window of the NDRF, ensures better equipment, training, and resources for managing urban and industrial hazards. In this context, the Model Fire Bill was circulated in 2019 to amend fire safety legislation across all States/UTs.

9. **National Disaster Management Information System (NDMIS):** The NDMIS is an integrated online platform that tracks expenditure under SDRF and NDRF, monitors contributions from both the Centre and States, and captures disaster damage and loss data. It also facilitates monitoring of targets A, B, C and D under the Sendai Framework for Disaster Risk Reduction, as well as implementation progress of the Sendai Framework for Disaster Risk Reduction across all States/UTs.

3.7.3 Institutional Arrangements to Facilitate Implementation of Loss & Damage Activities

As noted in the opening paragraphs of 3.7.2 above, India's institutional framework for disaster management operates through a multi-level structure established under the Disaster Management Act, 2005 (GOI, 2005), which provides the institutional foundation for addressing loss and damage from disasters and climate impacts. Within this framework, DRR constitutes a core aspect, aimed at minimising loss and damage, while response and recovery mechanisms address residual impacts. The institutional mechanism operates through national, state, district, and local levels with defined roles and responsibilities at each tier as specified in the DM Act 2005. This structure has evolved significantly since its inception to facilitate both ex-ante preventive measures and ex-post response and recovery activities for addressing loss and damage. Together, these arrangements mean that the institutional structure created under the DM Act serves as the primary channel through which India operationalises its commitments to minimising and addressing loss and damage, with the national, state, and district authorities functioning as the key implementing arms.

National Level Institutional Mechanisms

The overall coordination of disaster management is vested with the Ministry of Home Affairs, while the Cabinet Committee on Security and the National Crisis Management Committee function as key committees for top level decision-making (NDMA, 2019). The NDMA, established under Section 3 of the DM Act 2005 with the Prime Minister as Chairperson and up to nine nominated members, serves as the apex body responsible for laying down policies, plans, and guidelines for disaster management (GOI, 2005). The NDMA approves the NDMP and disaster management plans of central ministries and departments, coordinates their enforcement and implementation, and takes measures for prevention, mitigation, preparedness and capacity building for disaster situations (NDMA, 2019). The institutional structure represents coordination for decision-making and communication with central agencies participating on request from state governments.

The National Executive Committee, chaired by the Union Home Secretary, comprises secretaries from ministries including Agriculture, Atomic Energy, Defence, Drinking Water and Sanitation, Environment Forests and Climate Change, Finance, Health and Family Welfare, Power, Rural Development, Science and Technology, Space, Telecommunications, Urban Development, and Water Resources, along with the Chief of Integrated Defence Staff (GOI, 2005). The NEC assists NDMA in the discharge of its functions, coordinates and monitors implementation of the National Plan and policies, ensures compliance with central government directions, and coordinates response during disaster situations (NDMA, 2019). The NEC directs relevant ministries, departments, and state governments regarding measures for disaster response, coordinates with armed forces, Central Armed Police Forces (CAPF), and NDRF for response operations, and ensures coordination with scientific institutions for early warning and monitoring.

The NIDM, constituted under Chapter VII of the DM Act 2005, functions as the institute for capacity development with nodal responsibilities for human resource development, capacity building, training, research, documentation, and policy advocacy in disaster management (GOI, 2005). NIDM operates within the framework of policies and guidelines laid down by NDMA, provides technical support to state governments through Disaster Management Centres in Administrative Training Institutes, and maintains strategic partnerships with central, state, and local governments, academic institutions, and international agencies (NIDM, 2023). The institute designs and implements training programmes, undertakes research, formulates human resource development plans, develops educational materials for dissemination, and assists in national policy. State and

State and Local Level Arrangements

According to the DM Act 2005, each state and Union Territory shall establish its own institutional framework for disaster management, with a nodal department for coordinating disaster management, referred to as the DM department, although the name varies across states (NDMA, 2019). The Act mandates that each state/ UT shall take necessary steps for the preparation of disaster management plans, integration of measures for prevention or mitigation into development plans, allocation of funds, and establishment of early warning systems (GOI, 2005). Each state prepares its own State Disaster Management Plan aligned with national guidelines while incorporating state-specific requirements.

State Disaster Management Authorities function under Chapter III of the DM Act with the Chief Minister as Chairperson, except in Union Territories where the Lieutenant Governor or Administrator serves as Chairperson (GOI, 2005). For the UT of Delhi, the Lieutenant Governor and Chief Minister serve as Chairperson and Vice Chairperson, respectively, while in UTs with a Legislative Assembly except Delhi, the Chief Minister chairs the Authority (NDMA, 2019). The SDMA lays down policies and plans for disaster management in the state, approves dis- aster management plans prepared by departments, approves the State Plan in accordance with NDMA guidelines, coordinates implementation of the State Plan, recommends provision of funds for mitigation and preparedness measures, and reviews developmental plans of different departments to ensure integration of prevention, preparedness and mitigation measures (GOI, 2005).

State Executive Committees (SEC) assist SDMAs in the performance of their functions, headed by the Chief Secretary to the State Government (NDMA, 2019). The SEC coordinates and monitors implementation of the National Policy, National Plan, and State Plan while providing information to NDMA relating to different aspects of disaster management (GOI, 2005). These committees ensure coordination across state departments and facilitate integration of disaster risk reduction into state development planning processes.

District Disaster Management Authorities, established under Chapter IV of the DM Act for every district, are headed by the District Collector, Deputy Commissioner, or District Magistrate with the elected representative of the local authority as Co-Chairperson (GOI, 2005). The State Government appoints an officer not below the rank of Additional Collector, Additional District Magistrate, or Additional Deputy Commissioner as Chief Executive Officer of the District Authority (NDMA, 2019). The DDMA acts as the planning, coordinating, and implementing body for disaster management at the district level, takes all necessary measures for disaster management in accordance with guidelines laid down by NDMA and SDMA, prepares the disaster management plan for the district, and monitors implementation of all relevant national, state, and district policies and plans (GOI, 2005). DDMAs ensure that guidelines for prevention, mitigation, preparedness, and response measures laid down by NDMA and SDMA are followed by all district-level offices of various departments of the State Government.

Sectoral Integration Mechanisms

The institutional framework recognizes that disasters impact multiple sectors and therefore requires sectoral integration for effective loss and damage minimization. Key ministries have established dedicated disaster management cells that develop sector-specific contingency plans and coordinate with NDMA for an integrated response. The Ministry of Agriculture's Crisis Management Plan (MoAFW, 2021) addresses

drought and pest attacks that affect agricultural production and farmer livelihoods. The Ministry of Water Resources, through the Central Water Commission, manages flood forecasting and warning systems covering major river basins (Central Water Commission, 2024). The Ministry of Earth Sciences coordinates multiple technical agencies, including the India Meteorological Department for meteorological disasters and the Indian National Centre for Ocean Information Services for coastal system warnings (INCOIS, 2022).

Scientific and technical institutions play an important role in providing the knowledge base for disaster risk reduction activities. The IMD operates early warning systems for cyclones, extreme weather events, and climaterelated hazards with increasing accuracy and lead time (IMD, 2024a). The CWC maintains a network of flood forecasting stations (Central Water Commission, 2024), providing real-time information for flood management. The Geological Survey of India conducts landslide susceptibility mapping in hilly regions, while the Indian Space Research Organization provides critical support through emergency communication systems and satellite-based damage assessment capabilities, enabling rapid response and recovery planning.

Financial Institutional Mechanisms

The financial framework for disaster management in India is shaped both by statutory provisions under the DM Act 2005, and by successive recommendations of the Finance Commissions. The Act provides for the creation of dedicated response and mitigation funds at both national and state levels, while the Finance Commissions determine the size of these funds and the Centre–State sharing patterns.

For the 2021–26 period, the 15th Finance Commission recommended a total corpus of INR 1.60153 trillion for the State Disaster Risk Management Fund (SDRMF) (Fifteenth Finance Commission, 2021a). This corpus is divided into the SDRF with 80% of the allocation and the SDMF with the remaining 20%. Funding for the SDRMF follows a cost-sharing pattern in which the GoI contributes 75% for general category states and 90% for special category states, with the balance provided by the states (Fifteenth Finance Commission, 2021b). SDRFs are managed by the SEC, chaired by the Chief Secretary, and serve as the primary resource for providing relief to affected populations. If the scale of a disaster exceeds the coping capacity of a state, additional assistance may be sought from the national-level funds.

At the national level, the current Finance Commission recommended a separate allocation of the National Disaster Risk Management Fund (NDRMF), to be split in the same 80:20 ratio between the NDRF and the NDMF (Fifteenth Finance Commission, 2021c). The NDRF is constituted under Section 46 of the Disaster Management Act and is operated by the Ministry of Home Affairs (MHA). Releases are made on the recommendations of the MHA and with the approval of a High-Level Committee chaired by the Union Home Minister (GOI, 2005; MHA, 2012). Financing of NDRF is through budgetary provisions of the GoI, with the Ministry of Finance facilitating the release of funds as grants-in-aid once approval is accorded.

The creation of dedicated mitigation funds (SDMF and NDMF) is an important policy shift toward proactive investment in risk reduction, complementing the traditional focus on relief and response. While the NDMF has not been fully operationalized, mitigation projects are supported through allocations recommended by successive Finance Commissions and approved by the Empowered Committee under the MHA (MHA, 2022). This integrated system of response and mitigation funds ensures that resources are available for both immediate disaster relief and long-term resilience building.

Implementation of Sendai Framework for Disaster Risk Reduction

India implements the Sendai Framework for Disaster Risk Reduction 2015–2030 through institutional arrangements led by the Ministry of Home Affairs and coordinated with the National Disaster Management Authority, states, and sectoral ministries. The national focal point for Sendai reporting is the Ministry of Home Affairs (UNDRR, 2023a), and India has documented its progress in the Voluntary National Report for the Sendai Midterm Review, which outlines institutional responsibilities for monitoring and data flows (GOI, 2024). Progress in Sendai is reported through the Sendai Framework Monitor (SFM), UNDRR's online platform for tracking the seven global targets (UNDRR, 2023b). Within India, the MHA and NDMA coordinate

inputs from central ministries and states, supported by the National Database for Emergency Management (NDEM), operated by NRSC—ISRO, which provides geospatial data layers and decision-support tools across all disaster phases (ISRO, 2023; NRSC, 2023). States and line departments submit administrative statistics through systems such as the NDMIS and State Emergency Operation Centres, with central consolidation by MHA/NDMA as described in official training and reporting materials (GOI, 2024; NDMA, 2023a).

Indicator production under the Sendai Framework relies on multiple sources. Mortality statistics (Target A) are derived from the Health Management Information System maintained by the MoHFW (GOI, 2024; MoHFW, 2022). Data on affected populations (Target B) are compiled from state-level submissions and consolidated centrally, supported by geospatial layers from NDEM (GOI, 2024; NRSC, 2022). Economic loss and infrastructure damage (Targets C and D) are estimated in consultation with the Ministry of Finance and relevant infrastructure ministries, following United Nations Office for Disaster Risk Reduction (UNDRR's) indicator methodology, while NDMA guidance standardizes field protocols for rapid damage assessments (GOI, 2024). NDMA also oversees the monitoring of national, state, and local disaster risk reduction strategies (Target E) and reports these through the SFM (GOI, 2024). International cooperation and early warning capacities (Targets F and G) are coordinated by MHA and NDMA with the Ministry of External Affairs.

Finally, alignment with the SDGs is ensured through India's SDG monitoring framework, led by NITI Aayog via the SDG India Index, which provides a bridge between Sendai indicators and national development priorities (NITI Aayog, 2024a). Together, these arrangements demonstrate that India's implementation of the Sendai Framework is based on an integrated system combining administrative statistics, geospatial tools such as NDEM, and the UNDRR's global monitoring platform, enabling consistent progress tracking and policy course-correction.

Coordination Mechanisms for L&D Activities

The effectiveness of institutional arrangements depends significantly on coordination mechanisms operating both vertically and horizontally. Vertical coordination ensures the flow of information and resources from national to state to district to local levels (NDMA,2019). The top-down flow involves translation of national guidelines into state-specific implementation strategies, cascading of financial resources through established channels, and provision of technical support from specialised agencies to field-level functionaries. Conversely, the bottom-up flow ensures that damage, loss and needs assessments initiated at village and block levels are aggregated through district and state authorities and, when required, compiled into a state relief plan for consideration by central government agencies (NDMA,2020), thereby enabling evidence-based resource allocation and policy adjustments grounded in local realities.

Horizontal coordination mechanisms are critical for integrating disaster management efforts across ministries, states, and non-governmental stakeholders. At the national level, inter-ministerial coordination is led by the National Executive Committee, chaired by the Union Home Secretary, which brings together senior officials from key ministries to ensure coherence of disaster response and preparedness measures. In the event of major calamities, the Cabinet Secretariat, under the Prime Minister's Office, provides high-level coordination to align the actions of central ministries with national priorities. This arrangement ensures that disaster management responsibilities are shared across all relevant departments rather than concentrated in a single agency. Interstate coordination is facilitated by mechanisms supported by the Inter-State Council Secretariat, which help states address transboundary disasters such as floods and cyclones that cut across administrative boundaries.

Beyond the public sector, the private sector contributes through public—private partnerships and initiatives under corporate social responsibility. NDMA guidelines on private sector engagement provide a framework for mobilising resources, technical expertise, and innovation, thereby expanding the national capacity for disaster risk management.

Strengthening Measures and Way Forward

India's disaster management system has evolved considerably since the enactment of the DM Act, 2005, but important challenges remain. Capacity gaps at local levels, particularly in remote and rural areas, continue to limit effective implementation of disaster risk reduction measures, as acknowledged in recent policy discussions (MHA,2023). Mainstreaming disaster risk reduction into development planning has been a stated national priority since the NDMP 2019, and India's Sendai Midterm Review (2024) highlights that this remains an ongoing area requiring further strengthening across sectors. There are budgetary and implementation shortfalls in the disaster management domain, underscoring the need for stronger institutional follow-through (PSC, 2023). In addition to these resource and delivery constraints, there is insufficient attention to non-economic losses, such as losses not captured by market valuation, which also restricts comprehensive impact assessments. The Sikkim Conclave "Loss and Damage" document of NDMA defines non-economic losses as "items that are not commonly traded in markets" and calls for better inclusion of these in assessments (NDMA,2023b). In many cases, private sector engagement in India's disaster risk management has been largely via corporate social responsibility programs. This constrains the use of private capital and specialist expertise in preparing for disasters.

To address the gaps, several measures are underway. The Aapda Mitra programme currently aims to train around 6,000 community volunteers (200 per district in 30 particularly flood-prone districts) to strengthen local-level preparedness. A scheme launched more recently Yuva Aapda Mitra, seeks to train 237,326 youth volunteers in 315 districts to act as first responders (PIB, 2024). Disaster risk reduction and climate change adaptation are also being mainstreamed into flagship development programmes such as the Smart Cities Mission, AMRUT, and Pradhan Mantri Awas Yojana, as shown in the MHA-UNDP study on flagship schemes (MHA & UNDP, 2019). Additionally, frameworks for climate risk assessment, such as the District-Level Climate Risk Assessment (DST) and the "Framework for India Climate Risk Management" developed by NIDM, help to better integrate disaster and climate risks into planning and policy (Dasgupta et al, 2024).

These initiatives reinforce India's multi-level institutional framework and connect national disaster risk reduction measures with global commitments under the Sendai Framework. Going forward, sustained investment in local capacities, systematic integration of DRR into sectoral development policies, explicit accounting of non-economic losses, stronger financial dissemination to frontline institutions, and deeper private sector participation beyond corporate social responsibility will be critical for minimising and addressing loss and damage in the context of intensifying climate and disaster risks.



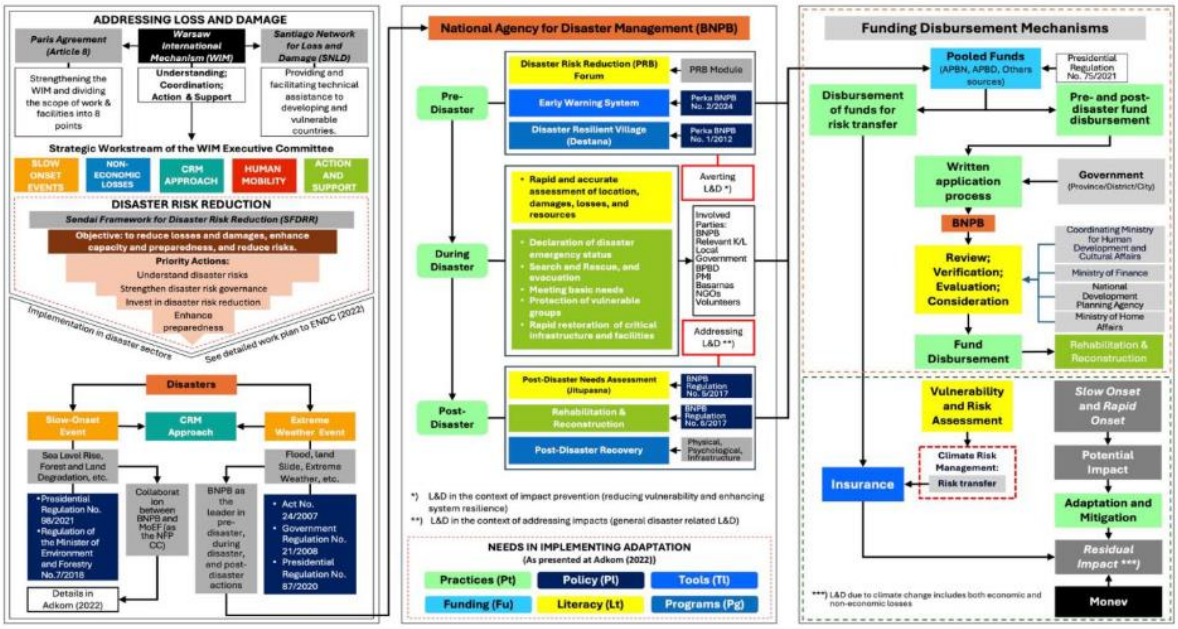
Indonesia

3.7 Information related to averting, minimizing, and addressing loss and damage associated with climate change impacts

Loss and Damage denotes the consequences of climate change that remain unavoidable despite efforts in mitigation and adaptation, attributable to the presence of adaptation limits, leading to residual impacts (Tschakert et al., 2017; Addison et al., 2022). Adaptation limits are categorized into soft limits, where adaptation is feasible but obstructed by social, financial, or institutional barriers, and hard limits, where adaptation becomes unfeasible, leading to irreversible impacts such as biodiversity loss or coastal submergence (IPCC, 2022). Identifying adaptation limits presents a challenge due to the intricate and interconnected factors involved. This necessitates additional research and specialized methodologies to accurately determine these limits, particularly in relation to climate change.

Addressing loss and damage in Indonesia is intricately connected to the disaster management policy framework, with the BNPB serving as the principal stakeholder (Figure 3-27); however, the quantification of residual impacts remains inadequately integrated. Disaster management in Indonesia involves cross-sectoral collaboration and is underpinned by funding mechanisms established in Perpres No. 75/2021 regarding disaster pooling fund. This funding includes risk transfer mechanisms like insurance (Box 7-1); however, insurance coverage is restricted and fails to encompass all risks, especially non-economic losses. Article 10, Paragraph 1 of Perpres No. 75/2021 regulates the distribution of risk transfer funds via insurance mechanisms. This insurance mechanism is consistent with Article 8 of the Paris Agreement, which aims to mitigate the impacts of climate change.

Figure 3- 27 Workflow of the loss and damage framework in Indonesia



BOX 7-1

MECHANISM FOR DISBURSING INSURANCE FUNDS TO ADDRESS RESIDUAL IMPACT

1. Climate Vulnerability and Risk Assessment

The initial stage entails evaluating climate vulnerability and risk to discern regions exhibiting differing levels of vulnerability, ranging from high to low. Risks are evaluated through the interplay of climate hazards, whether they are slow-onset or rapid-onset events, alongside the vulnerability and exposure of a region, as well as the probability and potential severity of an event's impact. This assessment establishes a fundamental basis for improved decision-making in risk management, particularly regarding the timing and application of risk transfer mechanisms. In the absence of a proper risk assessment, risk transfer strategies may exhibit reduced efficacy or fail to achieve their intended objectives.

2. Climate Risk Management

Following the vulnerability and risk assessment, climate risk management is executed to mitigate or manage risks associated with climate change through strategies of mitigation, adaptation, and risk transfer. This assessment identifies priorities in risk management, including the most vulnerable communities or regions that require additional protection, and facilitates the design of risk transfer strategies. Risk transfer mechanisms, such as insurance, are chosen according to risk assessments, which aid in establishing premium pricing based on the probability of climate-related disasters. Additionally, areas with high vulnerability necessitate more extensive insurance coverage.

3. Risk Transfer through Insurance

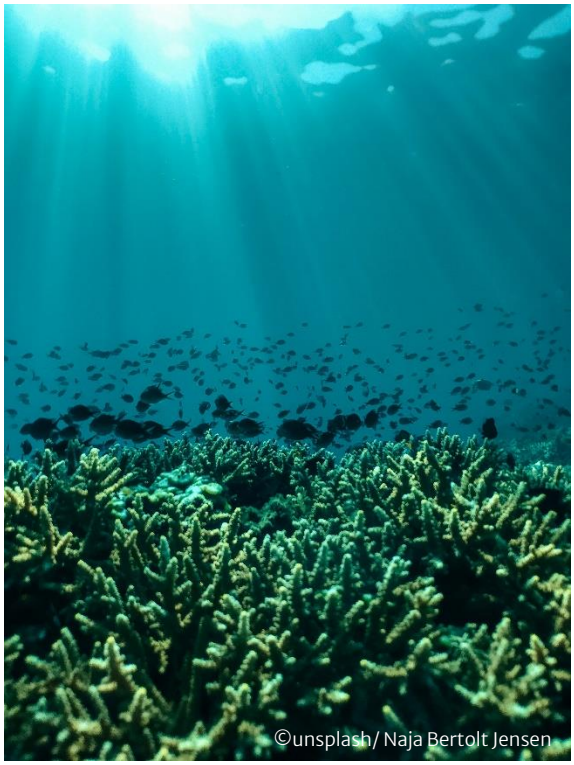
Insurance functions as a mechanism for risk transfer, offering financial resources to mitigate losses from anticipated disasters, as determined by risk assessment. Insurance alleviates the unavoidable financial burden that adaptation or mitigation cannot fully address, and assists in managing the residual impacts, albeit not completely. The Indonesian government has implemented risk transfer through insurance, exemplified by the Rice Farming Business Insurance (AUTP). The management of this insurance is conducted by PT Asuransi Jasa Indonesia (Jasindo) pursuant to a mandate from the MoA in accordance with Act No. 19/2013 concerning Farmer Protection and Empowerment. AUTP offers safeguards for farmers against the risks associated with crop failure stemming from floods, droughts, pests, and plant diseases. Private entities have developed insurance products as a risk transfer mechanism. For instance, PT Asuransi Central Asia (ACA) offers protection to farmers against crop failure risks stemming from drought, tornadoes, specific natural disasters, pests, and plant diseases through Risk Mitigation-Based Micro Plant Insurance.

4. Potential Impacts and Residual Impacts

Despite the implementation of adaptation, mitigation, and risk transfer strategies, residual impacts persist as certain risks or losses cannot be entirely mitigated. Insurance covers financial losses resulting from impacts such as slow-onset events like sustained climate change effects on agriculture or rapid-onset events like hydrometeorological disasters.

5. M&E

Monitoring and evaluation are performed to assess the efficacy of the insurance fund disbursement mechanism. It is crucial to evaluate the effectiveness of the insurance fund disbursement in targeting appropriate recipients and to determine if the risk transfer mechanism has effectively alleviated the financial burden associated with climate impacts.



3.7.1 Loss and damage from extreme weather/climate and slow-onset events

Loss and Damage encompasses the effects of climate change resulting from two categories of events: Slow-onset events and rapid-onset (extreme weather) events. Slow-onset events encompass rising temperatures, desertification, biodiversity loss, land degradation, glacier reduction, ocean acidification, sea level rise, and salinization. In contrast, rapid-onset/extreme weather events include phenomena such as floods, droughts, storm surges, and tropical cyclones. Indonesia, as a developing country susceptible to climate change, faces diverse geographical impacts from various events. These include a rise in average air temperature from 1981 to 2023, sea level rise in Jakarta, Pekalongan and cities along the northern coast of Java, glacier reduction in the Papua mountains, coral reef degradation in the Gili Matra waters of West Nusa Tenggara, salinization in Indramayu, ocean acidification in several Indonesian waters, and desertification in the Nusa Tenggara region. Extreme weather events, including floods in Jakarta, droughts in Java, Bali, and Nusa Tenggara, as well as tropical cyclones in East Nusa Tenggara, have resulted in substantial losses and damage.

BNPB reports that from 2008 to 2022, there has been a notable increase in the occurrence of hydrometeorological disasters, including floods, extreme weather events, landslides, and droughts. These disasters have led to millions of displaced individuals, numerous fatalities, and significant damage to infrastructure (BNPB Infographic Publication). According to data from BNPB, hydrometeorological disasters resulted in economic losses and damages amounting to IDR 48.90 trillion. Indonesia necessitates specific actions to mitigate and adapt to the impacts of climate change, along with strategies to address loss and damage.

3.7.2 Programs and activities to address loss and damage

The effects of slow-onset events and extreme weather events in Indonesia necessitate responses focused on prevention, reduction, and management of losses and damages across multiple levels. The Government of Indonesia has implemented strategic measures consistent with Article 8 of Paris Agreement, focusing on enhancing EWSs, emergency preparedness, and comprehensive risk management. EWSs that have been developed include the Flood EWS (FEWS), Landslide EWS (LEWS), and CEWS. Furthermore, adaptation programs including the Disaster Risk Reduction, Safe Schools from Disasters, and the Fishermen's Weather Field School (SLCN) seek to improve community resilience to disasters.

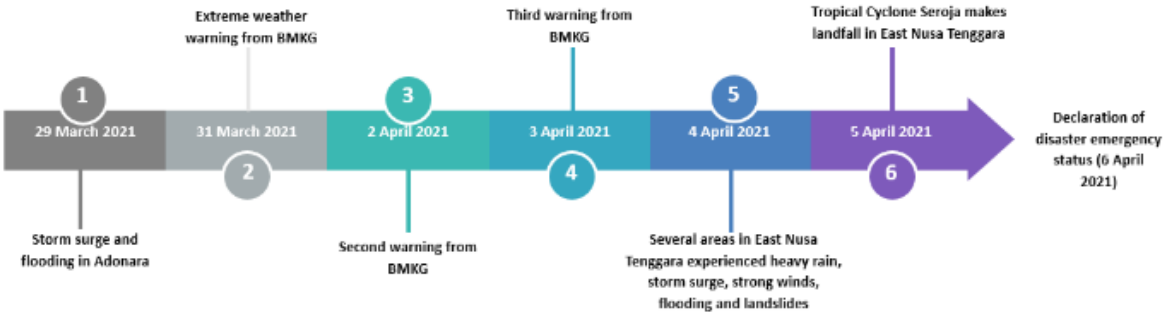
The government implements nature-based programs, including peatland rehabilitation in Riau and mangrove restoration in the Thousand Islands, alongside infrastructure initiatives such as sea wall construction in Jakarta. Public campaigns, including the Disaster-Aware Culture Movement, along with community-based initiatives such as Destana and ProKlim, are essential for enhancing awareness and fostering community resilience to the impacts of climate change. The calculation of loss and damage is conducted by BNPB via the Jitupasna, which assesses post-disaster economic losses and formulates rehabilitation plans. BNPB has calculated economic loss from tropical cyclone Seroja occurred in 2021 in Eastern Nusa Tenggara approximately IDR 7.3 trillion. This program was implemented in the rehabilitation and reconstruction efforts following tropical cyclone Seroja in East Nusa Tenggara (Box 7-2), with BNPB supporting the recovery of 16 affected districts and cities.

BOX 7-2

TROPICAL CYCLONE SEROJA

Conditions for the Occurrence of Tropical Cyclone Seroja

Over the past 40 years, the East Nusa Tenggara (NTT) province has frequently experienced climate-related disasters, including strong winds (30%) and floods (26%). Tropical cyclones represent a significant meteorological hazard in this region, forming over warm waters with temperatures exceeding 26°C and exhibiting wind speeds greater than 63 km/h. NTT is situated in a latitude that is susceptible to tropical cyclones. Tropical Cyclone Seroja, which occurred in 2021, inflicted considerable damage in NTT and was one of 17 cyclones that have impacted the region since 1908 (BPBD NTT, 2021). The timeline of Tropical Cyclone Seroja and the subsequent declaration of a disaster emergency status is illustrated in the following figure.



Impacts of Tropical Cyclone Seroja

The SIAP SIAGA program reported that over 95% of the East Nusa Tenggara (NTT) region was affected by Tropical Cyclone Seroja, resulting in 180 deaths, 40 individuals missing, 85,000 displaced persons, and 13,000 homes damaged (PSA, 2021). The cyclone resulted in damage to mangroves and coral reefs, though the extent of this damage has yet to be assessed. The total loss and damage from this disaster amounted to IDR 7.3 trillion, necessitating a recovery of IDR 6.7 trillion—approximately 4.5 times the NTT Regional Revenue (BNPB, 2021). The elevated risk of future tropical cyclones necessitates enhanced mitigation and adaptation efforts.

Activities for Averting, Minimizing, and Addressing Impacts

Activities aimed at averting, minimizing, and addressing losses and damages from extreme climate events in East Nusa Tenggara have been carried out through collaboration among BNPB, Provincial Disaster Management Agency, BMKG, the Ministry of Social Affairs, and the other provincial agencies. Activities encompass the construction of disaster-resilient infrastructure, exemplified by the Waiburak 2 bridge, the establishment of EWSS, the enhancement of the Fishermen's Weather Field School, and the formulation of disaster management policies by the East Nusa Tenggara BPBD. The primary focus for impact reduction is the Disaster Resilient Village (Destana) program and the enhancement of economic resilience in response to extreme climate threats. Impact management activities are conducted via rehabilitation and reconstruction efforts.

Barriers, Challenges, and Lessons Learned

Barriers and challenges in disaster management in NTT encompass constrained regional budgets, inadequate community access to BMKG early warnings, and insufficient disaster mitigation facilities in Oesapa Fishing Village. The Fishermen's Weather Field School (SLCN) program initiated by BMKG serves as an exemplary model of best practices. Mr. Dewa, an alumnus, effectively rescued 120 residents from the effects of Tropical Cyclone Seroja by disseminating weather information from BMKG. The SLCN has been implemented multiple times, both prior to and following Tropical Cyclone Seroja.

3.7.3 Institutional Arrangements and Activity Facilitation

The institutional framework for addressing loss and damage entails coordination across various ministries and agencies, with the Coordinating Ministry for Human Development and Cultural Affairs/Kementerian Koordinator Pembangunan Manusia dan Kebudayaan (Kemenko PMK) serving as the central coordinating body to harmonize the functions of BNPB, MoEF, BMKG, MoF, Kemendagri, Bappenas, and Kemen PUPR. BNPB oversees disaster management operations and coordination, employing data from BMKG for early warning purposes. MoEF is dedicated to reducing environmental impacts, whereas the Ministry of Finance / Kementerian Keuangan (Kemenkeu) oversees financial management, including disaster insurance. Kemendagri oversees local governments to ensure effective implementation of national policies at the local level. Bappenas integrates climate change and disaster considerations into medium-term and long-term development planning, whereas the Kemen PUPR focuses on constructing disaster resilient infrastructure.

The government's institutional regulatory framework facilitates the implementation of various disaster management programs and activities. The legal framework for disaster management is established by Act No. 24 of 2007. PP No. 21 of 2008 governs the execution of disaster management at the Government Regulation level. Presidential Regulations, including Perpres No. 73 of 2018, outline a comprehensive master plan for disaster management extending to the year 2044. Institutions like BNPB issue regulations to facilitate program implementation, including BNPB Regulations No. 5 and No. 6 of 2017, which govern post-disaster rehabilitation and reconstruction plans and their execution. BNPB Regulation No. 1 of 2012 establishes general guidelines for the Disaster Resilient Village/Desa Tangguh Bencana (Destana).

3.7.4 Findings and follow up

The key findings and subsequent actions regarding learning and development in the context of climate change in Indonesia are outlined as follows:

1. Extreme events are, to some extent, effectively managed through current emergency response mechanisms; however, there remain deficiencies in addressing slow-onset events and non-economic losses, which have not been fully recognized or addressed.
2. Specific policies are required to govern the management of slow-onset events within Indonesia's climate change strategy, alongside the development of suitable methodologies for quantifying non-economic losses to enhance a more comprehensive loss and damage response.



Kenya

3.6. Information related to averting, minimizing and addressing loss and damage associated with climate change impacts

3.6.1. Observed and potential climate change impacts, including those related to extreme weather events and slow onset events, drawing upon the best available science.

Heavy rains, floods, droughts, soil erosion, and sea level rise put both urban and rural infrastructure at risk, particularly for poor and vulnerable groups. Environmental degradation, altered water resources, and loss of biodiversity and ecosystem services constitute serious obstacles to the country's continued development, of particular relevance to the country's tourism sector. In addition, rising temperatures will have a negative impact on key parts of the economy, e.g. forestry, agriculture, and livestock. Changes in precipitation patterns can have far-reaching consequences for ecosystems and biodiversity, food production, the water industry and rivers.

The majority of Kenyan agriculture relies on seasonal rains for production and the projected changes in precipitation patterns are expected to directly increase the likelihood of short-term crop failures and long-term production declines. Rain-fed agriculture remains the dominant source of staple food production and is the foundation of livelihoods for the majority of the rural poor in Kenya. The high inter-annual variability of precipitation is already having devastating consequences on rural livelihoods, with droughts and floods a frequent occurrence in both the arid and semi-arid lands and key agricultural zones.

3.6.2. Activities related to averting, minimizing and addressing loss and damage associated with the adverse effects of climate change.

Loss and damage refer to impacts of climate change that are unavoidable by adaptation, mitigation, and other strategies like disaster risk reduction. It is focused on long-term, irreversible losses, like the loss of life and means of subsistence, biodiversity, culture, etc. Loss and damage addresses effects that adaptation alone is unable to sufficiently address as a policy response.

Under the UNFCCC, loss and damage is categorized as the remaining costs that cannot be avoided even with adaptation and mitigation and can be further divided into economic loss and non-economic loss. These more specifically refer to the negative consequences of the unavoidable risks of climate change, like rising sea levels, prolonged heat waves, desertification, and extreme events, such as bushfires, species extinction and crop failures. These have all been observed in Kenya and as the climate change progresses these events more frequently and their consequences will become more severe considering the high levels of vulnerability in the country.

A brief overview analyzing the nature of Loss and Damage in Kenya highlights that the country has experienced various natural hazards that have resulted in huge losses and caused serious damage to the existing infrastructure, lives and livelihoods. Economic losses attributed to climate change impacts are estimated to be between 3% – 5% of the GDP per year with projections indicating it may rise to about 9% of the GDP per year in 2050. Table 3.16 summarizes some activities being implemented across some sectors in Kenya that may help avert, minimize or generally address loss and damage.

Table 3.16: Loss and Damage per Priority Sector in Kenya

Sector	Loss & Damage
Disaster Risk Management	• Water levels of lakes in Kenya's Great Rift Valley increased significantly, hurting local communities and ecosystems. Losses and damages associated with the rising water levels in Kenyan lakes include submerging of land resulting in losses, damage to properties and businesses/livelihoods, and displacement of households. • Several sectors were affected by floods resulting from the March - April – May (MAM) rainfalls of 2024. Overall, 35 counties were affected, 315 people died, 188 people injured, 35 people missing, 58,641 House Holds displaced, 412,763 people affected, 291 Internally displacement camps (IDP) were created, over 10,131 people were rescued. • Preliminary livestock mortality estimates of 2.6 million deaths of assorted livestock was recorded at the peak of the 2021 – 2023 drought. During this period, drought response consumed over KSh .70 billion (GoK KSh. 22 billion; Non-state Actors KSh. 48 billion), a significant diversion of resources that would be otherwise support development and resilience/preparedness investments. • For this sector, the total estimated recovery budget for the sector is Ksh. 1,697,140,000 with agriculture and livestock budgets amounting to Ksh. 525,140,000 and Ksh. 1,172,000,000 respectively.
Food and Nutrition Security	• In the livestock sub-sector, the poor rains, combined with the effects of the prolonged dry spell and drought due to climate change have affected rangeland and water availability for pastoralists, resulting in diminished forage and livestock deaths, reduced household incomes, and increased food insecurity. • Recent flooding event during the 2024 MAM long rains led to total of 9,637 livestock being washed away in thirteen (13) Counties. These included 5,856 poultry, 372 cattle, 2,480 goats, 524 sheep, 2 donkeys, 22 camels and 318 pigs. • An estimated 298,673 acres of agricultural land was heavily affected by floods in 26 Counties. Over 52,707 households were directly affected by MAM 2024 Long Rains floods with an estimated loss of Ksh. 5,252,000,841 in agricultural investment.
Environment (Ecosystems and Biodiversity)	• Submerging of riparian vegetation due to water rise in Great Rift Valley lakes with dire impacts on the existing fauna and flora.
Health, Sanitation and Human Settlements	• The rising water levels of the Rift Valley lakes led to loss of lives and livelihoods, injury, and outbreak of diseases. • During the 2024 MAM rains, sixty-eight (68) Health facilities were affected in twelve (12) counties by flooding, road closures, leaking roofs, destroyed pit latrines, and collapsed perimeter walls. The health sector infrastructure affected, and the recovery cost is estimated at Ksh. 8,435,000.
Energy and Transport	• The Kenyan railway network consists of 592 km Standard Gauge Railway (SGR) and 2,046 km Meter Gauge Railway (MGR). Both were adversely affected by flooding at various points in 2023, including extensive erosion of embankments, cut slopes and culvert outlets. Total cost of damage for MGR was KSh 1,297,908,422. Total cost of damage for SGR was estimated at Ksh 851,347,200. • A total of 799 road sections/links have been severely damaged by flooding in 2023. The estimated cost of the damage to roads network was Ksh 26,805,056,121.
Wildlife and Tourism	• Change in water levels rendered most parts of the Rift Valley lakes less aesthetic, hurting income from tourism. • Bursting of Telek River, Mara River and Sand River in recent 2024 flooding episodes caused submersion of hotels and lodges in Mara Game reserve while also destroying bridges connecting to settlement and tourist facilities. The flooding also affected 26 camps with minor destructions out of the over 150 camps in the Mara.

Activities related to averting, minimizing and addressing loss & damage

The loss and damage from rain-related flooding led to the formation of a National Floods Emergency Response Secretariat based at the National Disaster Operation Centre (NDOC) which was mandated to:

i. Document and report all flood disaster information from across the country.

ii. Provide Early Warning information, flood alerts, flood preparedness, safety and emergency response information to stakeholders and the public.

iii. Mobilize resources and combine capacities at all levels of government to respond to crises. Other actions taken to address loss and damage include:

iv. modernization of the NDOC to enhance Early Warning Systems taking advantage of widespread access to ICT and other technology that provides avenues for collection, collation, processing and timely dissemination of information done by July 2023.

v. Strengthened climate information dissemination by KMD. For example, during the MAM rainfall in 2024, KMD issued daily, weekly and monthly updates as well as 9 Flash Messages for emergency. Over 35 million Short Message Services (SMS) communications were also delivered for early warning targeting vulnerable areas.

3.6.3. Institutional arrangements to facilitate the implementation of the activities

In response to the pressing need to tackle loss and damage, Kenya proposes the establishment of National Loss and Damage Focal Points (or Focal Institutions). These entities, with advice and guidance from the Technical Expert Group (TEG), would be responsible for ensuring the operationalization of loss and damage initiatives on the ground. These initiatives would be aligned with thematic areas agreed upon in Decision 2/CMA.2.

These include:

a. Risk assessments, including long-term risk assessments, of climate change impacts.

b. Approaches to averting, minimizing and addressing loss and damage associated with the risk assessments referred to in (a).

c. Resources available for supporting such approaches.

d. Monitoring systems for assessing the effectiveness of these approaches.



Lao People's Democratic Republic

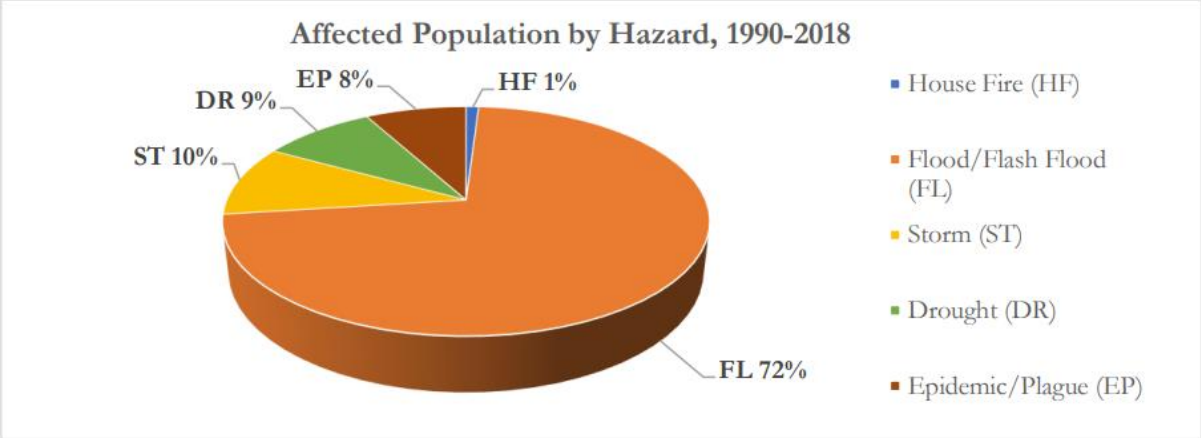
4.7. Information related to averting, minimizing and addressing loss and damage associated with climate change impacts

4.7.1. Loss and damage in Lao PDR

Lao PDR has a mountain topographical in the northern part and floodplains within the remaining areas. Its climate is divided into two distinct seasons: the rainy season from May to October and the dry season from November to April. The main hazards in Lao PDR encompassed flash floods, landslides, forestry and community fire, acute water shortage, windstorms and typhoons. This has destroyed various sectors, including agriculture, forestry and land use planning, water resources, energy and mine, industrial and commerce, public work and transportation, public health, education, and cultures. Due to its geographical conditions and the country's location, Lao PDR has a high risk of natural disasters and climate change, such as floods, droughts, storms, landslides, epidemics, etc. These events are escalating and exacerbated by climate change, leading to significant loss and damage in various sectors, encompassing the Productive sector (agricultural: crops, livestock, fisheries, forestry, and irrigation; Industry and commerce, Tourism), Social sectors (housing and settlement, education, health, and nutrition, and culture), and Infrastructure sectors (Transport, electricity, water supply, and waterways).

(Figure 43) shows that flooding was the highest impacted to the population, accounting for 72 %, followed by Storm accounted for 10% while the impact from Drought, Epidemic/Plague, and House Fire to the population, accounting for 9%, 8%, and 1% respectively.

Figure 43: Affected population by Hazard, 1990–2018



Between 2009 and 2019, communities across the Lao PDR have been increasingly affected by the adverse impacts of climate change, which have exacerbated poverty, deteriorated public health, and limited access to essential services and facilities such as education, healthcare, markets, agriculture, cultural resources, settlements, infrastructure, and tourism. Over the past decade, the country has suffered substantial economic losses and damages due to recurrent flooding and drought events. The estimated annual economic losses were approximately USD 94 million in 2009, USD 200 million in 2011, USD 219 million in 2013, and USD 371.5 million in 2018—an amount equivalent to 2.1 percent of the nation's projected gross domestic product (GDP) for 2018.

4.7.2. Lao PDR's efforts to address loss and damage

In addressing the loss and damage from disasters, The Lao PDR has developed the law on Disaster Management, Decree on Implementation and Movement of the Disaster Committee, National Financial Protection Strategy against Disaster Risks, National Strategy on Disaster Risk Reduction (2021-2030), and Early Warnings for All Road Map 2024-2027. These aims to align with the National Socio-Economic Development Plans, Sectoral plans in each period, and the Sendai Framework. The details of Law, Decree, Strategy, and Vision is presented as follows:

The Law on Meteorology and Hydrology: This law was developed in 2017, aiming to prevent and reduce the impacts of natural disasters on the lives and properties of the state, the public, and individuals. Its purpose is to ensure timely and accurate data provisions that can be integrated at a regional and international level, contributing to national socio-economic growth. Its main content covers Meteorology and hydrological data, meteorology and hydrological station, construction of meteorology and hydrological station, data management and sharing of information; meteorology and hydrological station; construction of meteorology and hydrological station, data management and sharing of information, and meteorology and hydrological station, construction of meteorology and hydrological station, data management and sharing of information.

Law on Disaster Management: This law was developed in 2020, aiming to surveillance and reduce disaster impact on health, state, and communal property, people, environment, and infrastructure, as well as recovery, restoration, and rehabilitation after disasters. It consists of Disaster Prevention, such as determining risk zones, mapping and developing an information system on risk, access, and use of information, risk assessment, risk reduction, disaster response preparedness, early warning, evacuation announcement, and prevention measures. In addition, it consists of disaster control, which ensures safety, emergency, exploration or search and rescue, and initial rapid damage. Moreover, it consists of Post-Disaster Recovery, such as need assessment, disaster recovery plans, disaster recovery operations, and post-recovery monitoring and inspection. Finally, it encompasses Disaster Management Committees include the central level disaster management committee, provincial-level disaster management committee, district disaster management committees, and village disaster management committee. Engage with different stakeholders.

National Disaster Risk Reduction Strategy (2021-2030): This strategy was developed in 2021, aiming to:

1. Disseminate and implement the Disaster Management Law, establish a disaster risk reduction system at the central and local levels, and coordinate disaster management and regional and internal cooperation;
2. Integrate DRR into development planning and implementation by mainstreaming DRR into sector plans and the National Socio-Economic Development Plan;
3. Progressively develop and implement provincial DRR Strategies and Plans and Local DRR plans in high-risk areas, alongside providing capacity building and resources for implementation;
4. Develop capacity, undertake risk mapping and assessment, manage and share disaster risk data and information efficiently within and between ministries and agencies, and meet international reporting requirements;
5. Build and maintain more resilient infrastructure to disasters and understand the sources of vulnerability in catastrophe to increase the resilience of the identified vulnerable groups and communities;
6. Reduce loss of life, property, and livelihoods from floods, storms, drought, and landslides through prevention action, early warning systems, and support community preparedness for rapid evacuation;
7. Expand national capacity for rapid and effective humanitarian response to disasters to reduce immediate suffering and loss of life;
8. Ensure the socio-economic needs of affected communities, physical reconstruction, and future resilience in compliance with the Sendai Framework Commitment to "Build back better";

9. Clarify roles and responsibilities of the sectors in DRR, preparedness and response to different hazard types, and recovery in compliance with the DM law and sector mandates;
10. Increase DRR capacity for civil servants and community leaders in a sustainable way by using training and education resources with Lao PDR;
11. Develop a new mechanism for engaging non-governmental stakeholders in DRR to support a whole-of-society approach by the Sendai Framework, including the private sector; and
12. Ensure sufficient state budget for regular DRR and disaster management activities within MLSW and other concerned ministries.

National Financial Protection Strategy against Disaster Risks (2022-2023): The strategy was developed in 2022, aiming to strengthen the resilience of Lao PDR by providing cost effective financing for the prevention of, preparedness for, response to, and recovery from disaster and climate risks by ensuring the availability of funds when required. The main content covers current disaster risk financing in Lao PDR, Policy and legal framework, Institutional framework, data and analysis, public sector disaster and climate risk financing framework, private sector disaster, international cooperation, and public and private sector risk financing targets.

Early Warning for All Road Map 2024-2027: This road map was developed in 2024, aiming to provide the national and local governments with a structured blueprint for fortifying people centric EWS in Lao PDR through targeted action and source allocation. This roadmap is developed under the leadership of the Department of Methodology and Hydrology, Ministry of Natural Resource and Environment (MONRE), Department of Social Welfare, and Ministry of Labor and Social Welfare (MLSW). The input was obtained from various consultation workshops with concerned stakeholders, including relevant line ministries, UN agencies, International Non-Governmental Organization (INGO), Red Cross Red Crescent, Donors, and Private Sectors. The main content of his road map covers four pillars such as (1) Disaster risk knowledge, (2) Detection, Observation, Monitoring, Analysis, and Forecasting of Hazards, (3) Warning Dissemination and Communication, and (4) Preparedness and Response Capabilities. In addition, it also included the coordination mandate, implementing entities, investment and funding arrangement, and Monitoring and Evaluation.



Malawi

4.15 Information related loss and damage

"Loss and damage" is a general term used in UN climate negotiations to refer to consequences of climate change that go beyond what people can adapt to. For example, the loss of homes and lives during extreme floods. "Loss and damage" may result from extreme weather events such as cyclones, heavy storms, strong winds, droughts and heatwaves, as well as from slow-onset changes such as sea level rise, desertification, glacial retreat, land degradation, ocean acidification and salinization. Damages arising from the effects of climate change can be divided into two categories, namely: economic and non-economic, although oftentimes there is an overlap between the two. Economic losses and damages are those affecting resources, and goods and services that are commonly traded in markets, such as damage to critical infrastructure and property or supply chain disruptions. This can happen at an international, national, as well as a local scale, e.g., impacts on individual farmers or communities. Non-economic losses and damages maybe defined as occurrences such as the incalculable toll of losing family members, the disappearance of cultures and ways of living, or the trauma of being forced to migrate from ancestral homes.

COP 16 (2010) established a work programme on loss and damage with a view to considering approaches to address loss and damage, including impacts of extreme weather events and slow onset events in developing countries that are particularly vulnerable; and to strengthen international cooperation and expertise in order to understand and reduce loss and damage. The Subsidiary Body on Implementation (SBI) undertook technical work in the areas of: (i) assessing the risk of loss and damage; (ii) a range of approaches to address loss and damage; (iii) and the role of the Convention in addressing loss and damage.

At COP19 held in November 2013 in Warsaw, Poland, the Warsaw International Mechanism (WIM) for Loss and Damage associated with Climate Change Impacts (Loss and Damage Mechanism) was established in order to address loss and damage associated with impacts of climate change. The WIM is the main vehicle in the UNFCCC process to address loss and damage associated with climate change impacts in developing countries that are particularly vulnerable to climate change in a comprehensive, integrated and coherent manner. It is mandated, inter alia, to: facilitate support of action to address loss and damage; improve coordination; promote the development of, and compile, analyze, synthesize and review information; provide technical guidance and support; and make recommendations.

Under the international Paris Agreement on climate change, countries recognized the importance of "averting, minimizing and addressing" loss and damage. Loss and damage can be "averted" and "minimized" by curbing greenhouse gas emissions (mitigation) and by taking preemptive action to protect communities from consequences of climate change (adaptation). Climate change adaptation measures include protecting communities from sea level rise by helping them move to higher ground, preparing for extreme weather disasters by investing in early warning systems, protecting food supplies, switching to drought-resistant crops and much more.

Loss and damage is linked to adaptation and mitigation because it happens when efforts to reduce emissions are not ambitious enough and when adaptation efforts are unsuccessful or impossible to implement. The second instalment of the Intergovernmental Panel on Climate Change (IPCC) 6th Assessment Report, published in February 2022, acknowledges that as the magnitude of climate change increases, so does the likelihood of exceeding adaptation limits. It differentiates between "soft" limits — when adaptation options exist but communities don't have the financial resources needed to pursue them — and "hard" limits, where "there are no reasonable prospects for avoiding intolerable risks." These limits are particularly acute in vulnerable communities that lack the resources needed to implement effective adaptation options.

One reason why loss and damage has been so contentious historically is due to developed countries' concerns that compensating for losses and damages caused by adverse impacts of climate change may be construed as an admission of legal liability, triggering litigation and compensation claims on a major scale. As such, developed countries fought to include language in the Paris Agreement to prevent them from being legally responsible to provide compensation. In light of the above, a decision was reached at COP28 which states that "funding arrangements, including a fund, for responding to loss and damage are based on cooperation and facilitation and do not involve liability or compensation." This provided the assurance that developed countries were looking for to continue negotiations and set the loss and damage fund in motion.

Action to address loss and damage could span a range of activities and should be shaped by the communities experiencing climate change impacts. Examples include weather-indexed crop insurance for farmers or proactively setting aside funds to rebuild critical infrastructure when disaster strikes. It may also entail providing immediate humanitarian assistance after an extreme weather event; offering relief and rehabilitation to victims through provision of basic amenities; enabling social protection systems to provide emergency cash transfers to the poor; and enhancing microcredit institutions to provide financing for livelihood restoration. Loss and damage funding could also help people rebuild when their homes are destroyed. The UNFCCC has created a Loss and Damage Fund to help countries and communities that are most affected by climate change. The fund provides grant-based finance to these countries. To access these funds, developing countries considered "particularly vulnerable" to climate change can apply through the established mechanisms, likely involving the submission of proposals detailing their climate-related losses and damage, with eligibility and access procedures determined by the Fund's governing board, which will consider factors such as vulnerability, impact of climate events, and existing adaptation efforts.

Details about Loss and Damage that the Government of Malawi has incurred over the past 10 years has been discussed in Section 2.0, starting with severe floods of 2015. The January 2015 rainfall was the highest on record for Malawi, with a 1 in 500-year return period. The floods caused 106 deaths, displaced 230,000 people and affected more than 1 million population in 15 districts. The Post-Disaster Needs Assessment (PDNA) estimated damage and losses amounting to USD335 million, equivalent to approximately 5.0 percent of Gross Domestic Product, and recovery and reconstruction needs at USD494 million. This was followed by the El Nino and Southern Oscillation (ENSO) phenomena induced drought episode in 2016, resulting in estimated losses of USD500 million - approximately a 1.7 percent reduction in the country's GDP. Then came Cyclone Idai and Cyclone Kenneth in 2019, which displaced tens of thousands of families, leaving many in need of basic supplies like food and water. The two cyclones brought widespread flooding and the destruction of almost 780,000 hectares of agriculture crops. Post-disaster needs assessments following Cyclone Idai and Cyclone Kenneth and the ensuing floods estimate total recovery needs for Malawi at USD370.5 million USD. The damage caused by Tropical Storm Ana amounted to an estimated USD3.2 million. Cyclone Ana knocked off 30 percent of Malawi's electricity generating capacity by destroying the pond at Kapichira Hydropower Station, with an estimated 945,000 people required humanitarian assistance due to the storm's effects. Cyclone Gombe in 2022 caused an estimated USD17 million in damages in Malawi, primarily impacting the agricultural sector with widespread crop damage and reduced yields while Tropical Cyclone Freddy in 2023, affected over 2.5 million people, causing over 600 fatalities, economic damage estimated at USD506.7 million and substantial agricultural losses.

In 2024 the rising water levels of Lake Malawi caused damage to property and loss of tourism business. An assessment of the damage to physical infrastructure and equipment of the tourism businesses along the shores of Lake Malawi due to the rising lake levels was estimated at MWK6.36 billion and MWK 2.5 billion in lost revenue (Jamal et al., 2024). The loss of business was caused by booking cancellation, cost clearing debris, repairs to damaged infrastructure (Jamal et al., 2024). Apart from causing permanent damage to the tourism infrastructure, the rising lake levels also affected the flow of international tourist to Lake Malawi (Jamal et al., 2024), and probably the integrity of most buildings as their foundations and structures were compromised.

From the preceding discussion, it is clear that Malawi is vulnerable to a number of natural disasters caused by such hazards as floods, droughts and strong winds whose frequency of occurrence and magnitude will increase with climate change. As such, the Government of Malawi has invested a lot in improving early warning systems as well as the construction of infrastructure such as dykes to minimise loss and damage. Several hydrometerological stations have been rehabilitated and new ones established in order to enhance the early warning system. Two buoys have been installed on Lake Malawi to collect weather and climate data as well as water quality. A number of dykes have been constructed in flood prone districts of Nsanje, Chikwawa, Salima and Karonga in order to mitigate flood disasters. Oftentimes, the Government provides basic amenities and cash (through social cash transfers) to people affected by disasters. All loss and damage issues in Malawi are handled by the Department of Disaster Management Affairs (DoDMA) in collaboration with other relevant MDAs, NGOs, development partners, CSOs and local communities.

The following is a list of projects that have been or are being implemented in Malawi since 2021 to address "Loss and Damage" in the country:

Project 1: Malawi Catastrophe Deferred Drawdown Option (Cat DDO)
Type: Development Policy Financing with Cat DDO
Years Active: 2021–2025
Total Cost: $70 million
Description: This instrument supported policy and institutional reforms to strengthen disaster risk management (DRM) and climate resilience. It was activated in response to events such as Tropical Storm Ana (2022), Cyclone Freddy (2023), and the ongoing El Niño drought (2024). The Cat DDO also supported the implementation of the Malawi DRM Bill and the National Meteorology Policy.

Project 2: Contingency Emergency Response Project (CERP)
Type: Emergency Response Mechanism
Years Active: 2024–2025
Description: The CERP was designed to provide rapid financing for emergency expenditures following disasters. It builds on lessons from previous CERCs and is aligned with the IPF policy for urgent needs.

Project 3: Malawi Resilience and Disaster Risk Management Project (MRDRMP)
Type of Project: Disaster Risk Management and Infrastructure Rehabilitation
Years: 2021–2025
Total Cost: $80 million
Description: This project focuses on rehabilitating critical infrastructure damaged by past disasters, such as irrigation schemes and drainage systems. It includes components to enhance drought and flood risk management, particularly in the Shire River Basin, and to strengthen disaster risk management capacities at national and local levels.

Project 4: Malawi First Growth and Resilience Development Policy Operation with Catastrophe Deferred Drawdown Option (Cat-DDO)
Type of Project: Policy Reform and Contingent Financing
Years: 2023–2025
Total Cost: $137 million ($80 million immediate support; $57 million Cat-DDO)
Description: This operation supports structural reforms aimed at strengthening fiscal sustainability, stimulating private sector growth, and increasing resilience to shocks. The Cat-DDO provides immediate liquidity in the event of a natural disaster, enabling swift response to crises such as food insecurity exacerbated by climate events.

Project 5: Regional Climate Resilience Program for Eastern and Southern Africa 2 (RCRP-2)
Type of Project: Regional Climate Resilience and Disaster Risk Management
Years: 2023–2028
Total Cost: $250 million ($240 million for Malawi; $10 million for the African Union)
Description: RCRP-2 aims to protect nearly two million people from water-related climate shocks through resilient infrastructure, improved disaster risk management, and social protection systems. In Malawi, the project prioritizes the management of the Shire River Basin and enhances coordination with neighbouring countries to improve early warning systems and information sharing.

Project 6: Malawi Drought Recovery and Resilience Project (MDRRP)
Type of Project: Post-Disaster Recovery and Resilience Building
Years: 2021–2025
Total Cost: $104 million
Description: MDRRP supports the restoration of agricultural livelihoods and the construction of flood protection infrastructure. It aims to enhance the resilience of communities affected by droughts and floods, contributing to long-term recovery and adaptation efforts.

Project 7: Malawi Watershed Services Improvement Project (MWASIP)
Type of Project: Watershed Management and Rural Livelihoods
Years: 2020–2025
Total Cost: $157 million
Description: MWASIP focuses on restoring degraded landscapes and improving watershed services to enhance water availability and agricultural productivity. The project includes the construction of water infrastructure and supports sustainable land management practices to build resilience against climate-induced disasters.

Project 8: Kapichira Hydroelectric Power Station Rehabilitation
Type of Project: Energy Infrastructure Rehabilitation
Years: 2022–2025
Total Cost: $60 million
Description: Following damage from Tropical Storm Ana, this project involves the rehabilitation of the Kapichira Hydroelectric Power Station to restore 130 MW of generation capacity, which is critical for national energy security and resilience.

Project 9: Social Cash Transfer Program (SCTP) with Climate Risk Financing
Type of Project: Social Protection and Climate Risk Financing
Years: 2023–2025
Total Cost: $142 million ($125 million IDA grant; $17 million from the Global Risk Financing Facility)
Description: The SCTP includes mechanisms to scale up support to vulnerable households in response to climate-induced shocks, such as droughts. It leverages parametric insurance products and contingency financing to provide timely assistance, enhancing the resilience of poor and vulnerable populations.

Project 10: Mpatamanga Hydropower Project
Type of Project: Renewable Energy Development
Years: 2025–2030
Total Cost: Over $1.5 billion (including a $350 million World Bank grant)
Description: This public-private partnership aims to construct a 358 MW hydropower facility along the Shire River, doubling Malawi's current hydropower capacity. The project is expected to provide electricity to over one million households and contribute to climate mitigation efforts by expanding renewable energy sources.

Project 11: Malawi Agricultural Commercialization 1
Type: Agriculture Productivity Development
Years Active: April 2018–December 2024
Total Cost: $95 million
Description: The objective is to increase the volume, value and diversity of agricultural exports. The project had a CERC that was activated twice during its implementation, providing a total of US$23.7 million ($20 million and $3.7 million) to address damages and losses.

Project 12: Malawi Food Systems Resilience Project (AGCOM II)
Type: Agriculture Productivity Development
Years Active: November 2024–August 2029
Total Cost: $376 million
Description: The objective of the Project is to increase the resilience of food systems and the Recipient's preparedness for food insecurity. The Project has a CERC, which has been activated twice, providing a total of US$50 million ($20 million and $30 million) to address damages and losses.

Project 13: Governance to Enable Service Delivery
Type: Local Authority Governance
Years Active: 2020–2026
Total Cost: $135 million
Description: The objective is to improve the institutional capacity and performance of central and local governments to deliver basic services. The Project has a CERC, which has been activated once, providing a total of US$35 million to address damages and losses.



Maldives

4.10 Information Related to Averting, Minimising and Addressing Loss and Damage Associated with Climate Change Impacts

Loss and damage and climate related hazards pose significant threats to the Maldives due to its fragile ecological profile, low elevation and narrow economic base. The country's limited capacity to address the increasing frequency and intensity of extreme events further exacerbate these vulnerabilities. The Maldives scored 72.2 in the Multidimensional Vulnerability Index (MVI) as the second most vulnerable country, which comprehensively takes into account its structural vulnerability and lack of structural resilience. These inherent vulnerabilities have been apparent predominantly in slow-onset events, but are more damaging during extreme events. In recent history, there have been numerous events in which the country faced disastrous situations, such as the 1987 event known locally as the Great Wave or Bodu Raalhu, when a tidal surge affected 66 islands across 13 atolls, with most of the damage reported in the capital, Male'. It resulted in the loss of livelihoods and damaged critical infrastructure such as the country's sole airport, breakwaters, harbours, and radio antennae among others (UNDRO, 1987).The 2004 Indian Ocean tsunami, while not climatic in nature, illustrated the level of destruction and demonstrated the magnitude of the threat that sea level rise poses to the country. With 26 people missing, 82 dead and over 2000 homes destroyed, the tsunami caused an unprecedented level of destruction in the Maldives. Total damages from the event amounted to 62% of the country's GDP (MEE, 2016).

Severe tidal swells in 2007 affected 88 islands, impacting all basic services such as water, electricity, and sanitation in affected households (NDMC, 2007). Similar events are recurrent and have a debilitating effect on the affected communities and their livelihoods. However, due to the limited availability of information and a lack of historical data, it is challenging to quantify the loss and damage experienced in the country.

Since the 1980s, severe erosion has become more frequent across the country (MEE, 2016), and land loss to sea level rise has been among the most significant losses observed in the Maldives. Coastal erosion continues to be a daily reality for many Maldivian island communities, and with land already being a limited resource, this poses a multitude of challenges. Given the frequency and severity of erosion, the Government expends large portions of the limited domestic budget to undertake coastal adaptation measures such as revetments and sea walls among others. The 2004 tsunami was a turning point in the Maldives' work towards coastal adaptation. While the Government has long been reinforcing coastlines in the country, its experience with the tsunami signaled the need for more resilient and sustainable measures for coastal adaptation. However, these preferred methods come at a greater cost, with some studies indicating a cost of approximately USD 4,100 per linear metre in 2015 (MEE, 2015g). The cost of these critical investments has increased significantly over time; for example, the ongoing coastal protection project in Gn. Fuvahmulah costs USD 8,000 per linear metre.

Measures to address land scarcity in the country consider current and future climate impacts, largely in line with the projected sea level rise scenarios by the IPCC, as considered in the development of Hulhumale'. The island was developed to a height of 1.8 metres above mean sea level, whereas 80% of the natural islands lie less than 1 metre above mean sea level. While land expansion is a costly investment, the additional elevation required to withstand climate impacts necessitates an even greater investment. However, these costly efforts are observed to have been worthwhile investments, as coastal flooding is not reported in these islands.

The issue of land loss and coastal inundation also raises the matter of loss of culture and heritage. The Maldives' centuries long history is evident in its unique local language, cultural heritage sites, and traditional food and attire. The identity of the country and its people are tied to these cultural elements, which in turn, are connected to their ancestral islands that are facing coastal erosion due to sea level rise. There are cases where entire communities in the Maldives have been relocated from their original islands to other inhabited

islands due to environmental degradation and climate challenges, causing their distinctive cultural features to fade.

A case study looking at loss and damage in the Maldives from a cultural perspective also found that various sites of historical and cultural significance are at risk due to coastal erosion. This includes the country's oldest cemetery, which is located near the eroding coastline of S. Meedhoo, featuring ancient carved coral gravestones and other elements of significant historical, cultural and communal value. Its location and the worsening erosion in the island have gradually exposed the cemetery to storm surges and tidal swells (MCCEE and SLYCAN Trust, 2023). The Government has enacted emergency coastal protection measures around the area, but it is observed that these are insufficient, and sustainable measures are required to safeguard the site. Parts of a mosque complex in N. Kuredhivaru in the north of the country have already been submerged due to coastal erosion (Maritime Asia Heritage Survey, 2022), underscoring that the loss of heritage to climate change is not only forthcoming, but a present reality that requires urgent attention. Much like the highlighted cases, there are several sites of heritage and cultural significance threatened by climate change, which need to be protected for the sake of preserving them for future generations.



Nigeria

3.7. G. Information related to averting, minimizing and addressing loss and damage associated with climate change impacts

Observed and potential climate change impacts, including those related to extreme weather events and slow onset events based on data from the EM-Dat database, show the country has endured various natural hazards, including droughts, floods, landslides, epidemics, and storms are provided in Table 3.3.

Table 3.3 Natural disasters and their impacts in Nigeria between 1990 and 2020

Natural hazard	Sub type	Events count	Total deaths	Total affected	Total damage ('000 USD)
Drought	Drought	1	0	3,000,000	71,103
Epidemic	Bacterial Disease	27	17,278	163,378	0
Epidemic	Viral Disease	24	8,233	182,474	0
Extreme Temperature	Cold Wave	1	18	Data not available	0
Extreme Temperature	Heat Wave	1	60	Data not available	0
Flood	Flash Flood	6	330	109,165	7,805
Flood	Riverine Flood	28	1,110	10,275,064	636,717
Insect	Grasshopper	1	Data not available	Data not available	0
Insect	Locust	1	Data not available	Data not available	0
Storm	Convective Storm	3	54	16,012	1,000
Landslide	Landslide	3	32	1,800	0

** Reproduced from CLIMATE RISK COUNTRY PROFILE: NIGERIA (WB)*

Activities related to averting, minimizing and addressing loss and damage associated with the adverse effects of climate change are reliable and well distributed systematic observations over the whole territory of the country, operational well developed early warning systems, good awareness of the population, access to information and communication systems, preparedness of the population and well-structured support systems. However, these activities are not yet fully operational due to lack of resources, namely finance, equipment, capacity, and the latest technologies.



Institutional arrangements fall under the purview of the NCCC at the topmost level with the MDAs, states, and local governments operating within this framework. But due to the barriers enumerated above, it remains difficult if not almost impossible to really avert, minimize and address loss and damage in an efficient and timely manner.

Oman

4.6. Information related to averting, minimizing and addressing loss and damage associated with climate change impacts

Oman is increasingly at risk from extreme weather events, such as cyclones, floods and heatwaves, which are becoming more frequent and severe due to climate change. Over the past two decades, these events have caused significant damage, particularly to infrastructure, agriculture, and public health. From 2002 to 2021, Oman suffered economic losses totalling approximately $7.30 billion, primarily due to severe cyclones like Cyclone Gonu in 2007 and Cyclone Mekunu in 2018, which caused billions in damages and significant loss of life.

Observed and potential climate change impacts

The best available science shows that Oman is facing growing climate-related risks, including cyclones, floods, heatwaves and droughts. These extreme weather events have increased in frequency and severity, causing significant economic and social damage. By 2040, projected economic losses due to these events could reach $13.14 billion, with infrastructure damage potentially accumulating to $9 billion. Agriculture, a vital sector in Oman, particularly date palm exports, is also highly vulnerable, with projected losses of $540 million due to extreme heat and drought. Public health costs, mainly from heat-related illnesses, are expected to rise to $1.17 billion. The energy grid could incur an additional $150 million in costs due to increased demand during heatwaves, while water scarcity could lead to further losses of $360 million. If no action is taken, the cumulative GDP loss due to reduced productivity and other factors could reach $72 billion by 2040.

Activities to avert, minimize and address loss and damage

Oman recognizes the need to enhance its early warning systems and build climate resilience to avert and minimize future loss and damage. The National Multi-Hazard Early Warning Centre (NMHEWC), managed by the Directorate General of Meteorology, is a critical component of the country's disaster risk reduction strategy. Established in 2015 with support from the Intergovernmental Oceanographic Commission of UNESCO (IOCUNESCO), NMHEWC aligns with the Sendai Framework for Disaster Risk Reduction. While the system effectively monitors water-related hazards such as cyclones, floods and tsunamis, it faces significant challenges, including outdated technology and gaps in coverage for emerging climate risks like heatwaves, droughts and dust storms.

To address these vulnerabilities, Oman plans to upgrade NMHEWC by integrating cutting-edge technologies, expanding its coverage to include a wider range of climate related risks and strengthening human and technical capacities. This upgrade would improve the accuracy of weather predictions and broaden hazard monitoring, enabling better preparedness and response to future climate risks. Oman also seeks support from GCF to finance these upgrades, which would include developing robust data integration platforms, enhancing forecasting tools and implementing comprehensive training programmes.

Institutional arrangements for implementation

NMHEWC, aligned with global disaster frameworks, is central to Oman's climate adaptation strategy. However, gaps in its technological infrastructure and hazard coverage limit its full potential. Enhancing the system will require coordinated efforts between government agencies, international partners and technical experts. Support from GCF is essential for realizing these ambitious improvements. Through financial and technical backing, Oman aims to implement the necessary upgrades to NMHEWC, ensuring it can handle future climate risks and provide timely, accurate early warnings.

Investing in these improvements will align Oman's climate resilience efforts with its national priorities, protecting infrastructure, reducing economic losses, and safeguarding public health. Additionally, by bolstering early warning systems, Oman can better meet its international climate commitments and potentially secure $500 million in climate funding, further supporting its sustainable development goals.



Solomon Islands

Loss and Damage: Information related to averting, minimizing and addressing loss and damage associated with climate change impacts

As the impacts of climate change become increasingly evident, the concepts of loss and damage (L&D) emerge as critical components of understanding and addressing this global crisis. Although there is no clear definition for the term. A general accepted meaning for Loss refers to the permanent or irreversible impacts of climate change, such as the extinction of species, the destruction of ecosystems, and the loss of cultural heritage. While damage pertains to the monetary and physical impacts, such as property destruction, loss of livelihoods and degradation of infrastructure.

For the Solomon Islands, importance of recognizing loss and damage cannot be overstated. To give an example, fully functional and liveable islands such as Kale, Fanalei and Walande have gone under water in the lifetime of a first-year student at Solomon Island National University and people have been displaced. Sea level rise and other climate change impacts have taken away an irreplaceable part of livelihood, life and culture that once thrived there. The loss of these islands is just a sub-set of a broader cluster of L&D issues arising from both rapid and slow on-set impacts of climate change affecting both natural and human systems.

PAST DISASTERS EM-DAT 1970-2021

Disaster	Number of events (Events)	Number of deaths (People)	Number of affected (People)	Number of damaged (USD, Millions)
Drought	3	–	380	–
Floods	5	–	90,080	26.0
Tropical cyclone	14	164	472,771	22.0
Tsunami	3	262	5,713	2.0
Earthquake	4	35	12,397	–

Figure 10: Solomon Island Disaster Data 1970-2021(ESCAP)

Observed and current Loss and Damage

According to reports form United Nations Economic and Social Commission for Asia and the Pacific (ESCAP)21 data from the International Disaster Database (EM-DAT) covering the period 1970–2021, tropical cyclones have been the most frequent and damaging hazard in the Solomon Islands, with 14 events affecting over 472,000 people and resulting in economic losses of approximately 22 million USD. Floods have also caused significant destruction, leading to the highest recorded financial damage at around 26 million USD and impacting more than 90,000 people. Moreover, disaster risks in Pacific Small Island Developing States (SIDS), including the Solomon Islands, are being reshaped by interconnected and compounding hazards within a growing disaster-climate-health nexus. This evolving risk is driven largely by an increase in climate-related hazards, such as tropical cyclones, droughts and floods in recent years. This raises concerns that progress in Climate change adaptation and disaster risk reduction may be undermined by escalating climate variability.

Figure 11: Solomon Island Average Annual Loss due to disasters (ESCAP)

Country	Total AAL, Millions of US Dollars	GDP, 2017, Millions of US Dollars	Total AAL as a Percentage of GDP
Solomon Islands*	79.00	909.3	8.69

Source: ESCAP calculations based on probabilistic risk assessment.
** Note: The figures for Papua New Guinea and Solomon Islands do not include losses due to agricultural drought.*

Solomon Islands faces significant economic losses due to natural and climate-related hazards. ESCAP estimates the country's average annual loss (AAL), which include both losses due to intensive risk and those due to extensive risk, indirect losses and slow-onset disasters. The Solomon Islands Total Average Annual Losses (AAL) due to climate change is 79 million USD, equivalent to 8.69 % of the nation's GDP. This figure does not account for losses from other hazards such as floods and droughts, suggesting that the total AAL could be higher.

A single extreme weather event can wipe out developmental progress that take several years to achieve. Notably, the 2014 floods alone resulted in damages estimated at 107.8 million USD, equivalent to 9.2% of the Solomon Islands' GDP at the time.

Type of Loss and Damage

Loss and damage caused by climate events can be divided into two categories Economic and Non-Economic:

- Economic loss and damage: as the name indicates, this category focuses on loss and damages that can be assigned a monetary value and include, for example, the loss of earnings or productivity and damages to property or GDP.
- Non-economic loss and damage – loss and damage that are difficult to assign a monetary value for example losses to biodiversity and cultural heritage, health and mental trauma, loss of life. These are the intangible impacts of climate change on the people and ecosystems.

In the Solomon Islands, climate change has led to both economic and non-economic losses and damages, with impacts expected to intensify in the coming decades. Some examples under both categories have been mentioned below.

Economic Losses

- Infrastructure Damage: Extreme weather events such as the 2014 flash floods caused damages exceeding 107.8 million US and about 9.2% of national GDP—destroying approximately 675 houses and the food gardens, roads, bridges and schools.
- Agriculture and Fisheries: Saltwater intrusion, droughts, and changing rainfall patterns reduce crop yields and fish stocks, affecting food security and income for rural communities. The Asian Development Bank study estimated an economic loss of up to 4.7% of annual GDP in Solomon Islands by 2100 brought on climate-linked impacts on agricultural and fishing industries.

Non-Economic Losses

- Loss of Land and Habitats: Rising seas have submerged entire islands and eroded coastlines, leading to permanent loss of ancestral land and ecosystems. In 2016, 5 uninhabited islands in Solomon Islands, were reportedly completely submerged. Others, inhabited by very small communities, were significantly eroded leading to permanent displacement. In 2007 around 4.6% of the population (24,000 people) was displaced as a result of a tsunami, leading to significant damage to the country's economy as well as loss of life.
- Cultural and Social Disruption: Displacement and land loss threaten traditional customs, community cohesion, and spiritual values tied to the land.

Actions planned or implemented to address loss and damage

Government in its NCCP 2023-2032 has the mission to scale up adaptation and risk resilience actions, address loss and damage and strengthen low emission pathways by 2032. The policy outlines six main objectives. Given the intensity of L&D in Solomon Islands, the government has allocated one of the policy objectives specifically to: address Loss and Damage. The aim is to address L&D by advocacy and mobilization of external and domestic resources. Key strategies focusing on Loss and Damage under the National Climate Change Policy include:

- Developing local and national capacity and knowledge of loss and damage from both rapid and slow onset impacts and assess options for intervention.
- Strengthen Advocacy for the operationalization of loss and damage funding mechanism and speedy mobilization of resources for targeted actions and interventions.
- Proactively engage with key external and internal partners to mobilize resources for relocation of vulnerable communities such as low-lying atolls and coastal areas.
- Empower Government relevant ministry - Ministry of Lands, Housing and Survey- to facilitate identification of land for relocation of vulnerable communities.
- Facilitate means of implementation including finance, science and technology, and capacity building for loss and damage through national and international support.

While the Solomon Islands National Climate Change Policy recognizes importance of Loss and damage due to climate-related risks, they do not provide a concrete framework for addressing loss and damage. The lack of a national mechanism or fund specifically for addressing irreversible and unavoidable climate losses leaves a critical gap in the climate governance structure.

Currently there is no dedicated governing body or specific government institutional structure solely responsible for "Loss and Damage" in the Solomon Islands. Existing climate change-related responsibilities are typically handled through broader environmental and disaster management institutions. Ministry of Environment, Climate Change, Disaster Management and Meteorology (MECDM) is the primary body responsible for climate change policy, disaster risk management supported by National Disaster Management Office (NDMO) and Climate Change Division.

The Solomon Islands has been active in international climate negotiations under the UNFCCC in proactively and strongly advocating for the establishment of a global loss and damage fund, especially through the Alliance of Small Island States (AOSIS). At COP 28 in Dubai, the Loss and Damage Fund was operationalized. The operationalization of Loss and Damage Fund unlocks financial resources to address a variety of challenges associated with the adverse effects of climate change, such as climate-related emergencies and means to address loss and damage due to both extreme weather events and slow onset events.

Despite global progress domestic institutional arrangements remain fragmented and insufficient, especially in terms of addressing non-economic loss, permanent displacement, and slow-onset events.

As climate change continues to pose significant risks, effective government policies and proactive actions are essential for safeguarding the environment, economy, and cultural heritage. The lack of external funding and ambition in the Nationally Determined Contributions by major emitters and those with historical responsibility will increase L&D in Solomon Islands.

Examples of national and local actions for addressing economic and non-economic loss and damage due to Climate Change

Addressing loss and damage	Action/program/Activity	Coverage (economic and noneconomic Loss and Damage)
In 2020, the Government launched its National Disaster Management Plan and established a National Disaster Management Office	The plan outlines a comprehensive strategy to enhance disaster risk reduction, emergency response, and post-disaster recovery. Serves as a guiding framework for coordinated action across ministries and sectors during and post disaster events. National Disaster Management Office (NDMO) assigned as central coordinating body for disaster management.	As a measure to reduce economic losses due to extreme weather events. Short- and long-term recovery and rehabilitation actions, Social and environmental protection actions, including post-disaster support.

Addressing loss and damage	Action/program/Activity	Coverage (economic and noneconomic Loss and Damage)
Early warning infrastructure is the Solomon Islands Meteorological Service (SIMS)	Vital role in monitoring natural hazards and disseminating lifesaving information to vulnerable communities. National Weather Forecasting Office was opened, which will enable SIMS to deliver early warning services.	Enable timely actions and evacuation reducing impacts of both economic and non-economic losses (loss of life, biodiversity).
The Integrated Disaster Risk Management project	Project aimed to decentralize and strengthen disaster risk reduction at provincial and community levels. A key success was in Temotu, where dedicated staff significantly enhanced local capacity to implement the national disaster management plan. This capacity was effectively mobilized during a series of tropical cyclones in late 2023 and early 2024, enabling coordinated response and recovery efforts for affected communities.	Effective measure for addressing economic losses due to extreme weather events such as Floods, Cyclones etc. Helps post disaster rebuilding damaged infrastructure and rehabilitation.
Choiseul Provincial Emergency Operations Centre	Coordinate emergency response and recovery efforts. Equipped with advanced communications and information management systems, the Centre serves as a critical hub for disaster operations.	Actions for addressing both economic and non-economic loss and damage. Preparations to help ensure future well-being following loss. Assessment of loss and repair of damage needed.
Established the National Disaster Recovery Framework.	National Disaster Recovery Framework, outlines clear roles and responsibilities for various government agencies, as well as detailed procedures for assessing damage, mobilizing resources, and implementing recovery programs following a natural disaster. Importantly, the disaster recovery process is designed to be inclusive and participatory, with local communities playing a central role in decision-making and implementation. Strengthen the coordination capacities of provincial disaster committees (PDCs) and provincial disaster operations centers (P-DOCs).	This measure addresses economic and non-economic loss and damage as caused due to climate-related disasters.

Case studies highlighting extent of Loss caused due to climate induced extreme events and natural Hazards

Flash Flood, April 2014

Heavy rain brought by the tropical depression which subsequently upgraded to Tropical Cyclone Ita in early April 2014 caused some of the worst flash flooding in the history of the Solomon Islands. The rains caused river systems to overflow, sending torrents of water through the capital Honiara and villages across Guadalcanal Province. Homes and infrastructure were washed away, including one of only two bridges linking the east and west of Honiara. At least 22 fatalities and over 50,000 affected – almost 10 % of the country's total population. Honiara and the rest of Guadalcanal were declared disaster areas on 4 April. "The floods were not just the worst I have seen in my 14 years with the National Disaster Management Office, but in my whole life," said Loti Yates, former Director of the NDMO. James, from Koa Valley, is living in the Mbokonavera School in Honiara with his wife and two children, and over 70 members of his community. The family lost everything in the floods, except the clothes they wore when they fled their home. When asked if

he wants to rebuild in the same place next to the Mataniko River, he is adamant it is not safe to return. "There is no need to go back because too many people died," he says. "It is too dangerous for us to live there".

Sea Level Rise

A coastal dynamic study from the Western Province using time series aerial and satellite imagery from 1947 to 2014 of 33 islands, along with historical insight from local knowledge carried out by a group of scientists from Australia have identified five vegetated reef islands present in 1947, ranging in size from 1 to 5 hectares, had completely disappeared by 2014. Another six islands had shrunk by 20 to 62 per cent in the same period, confirming anecdotal reports of people living in the area. The most populated of these, Nuatabu Island, is home to 25 families, who have witnessed 11 houses washed into the sea since 2011.

Tropical Cyclone (TC) Freda 2010

Solomon Islands region is regarded as a cyclogenesis area where the cyclone period occurs from November to April coinciding with the wet season. However, a few cyclones may occur outside of the season including some of the devastating ones such as Tropical Cyclone Namu. In late 2012, the country experienced impacts from Tropical Cyclone Freda. The Cyclone developed on the northern part of Santa Cruz Islands, Temotu Province and intensified as it tracked southwest past Makira Ulawa Province and Rennell Bellona Province. The cyclone was fully developed as category 1 between the two above named Provinces and slowly travelled further south with speed of 6-7knots. The system developed into a category 4 as it passed the Solomon Islands territory.

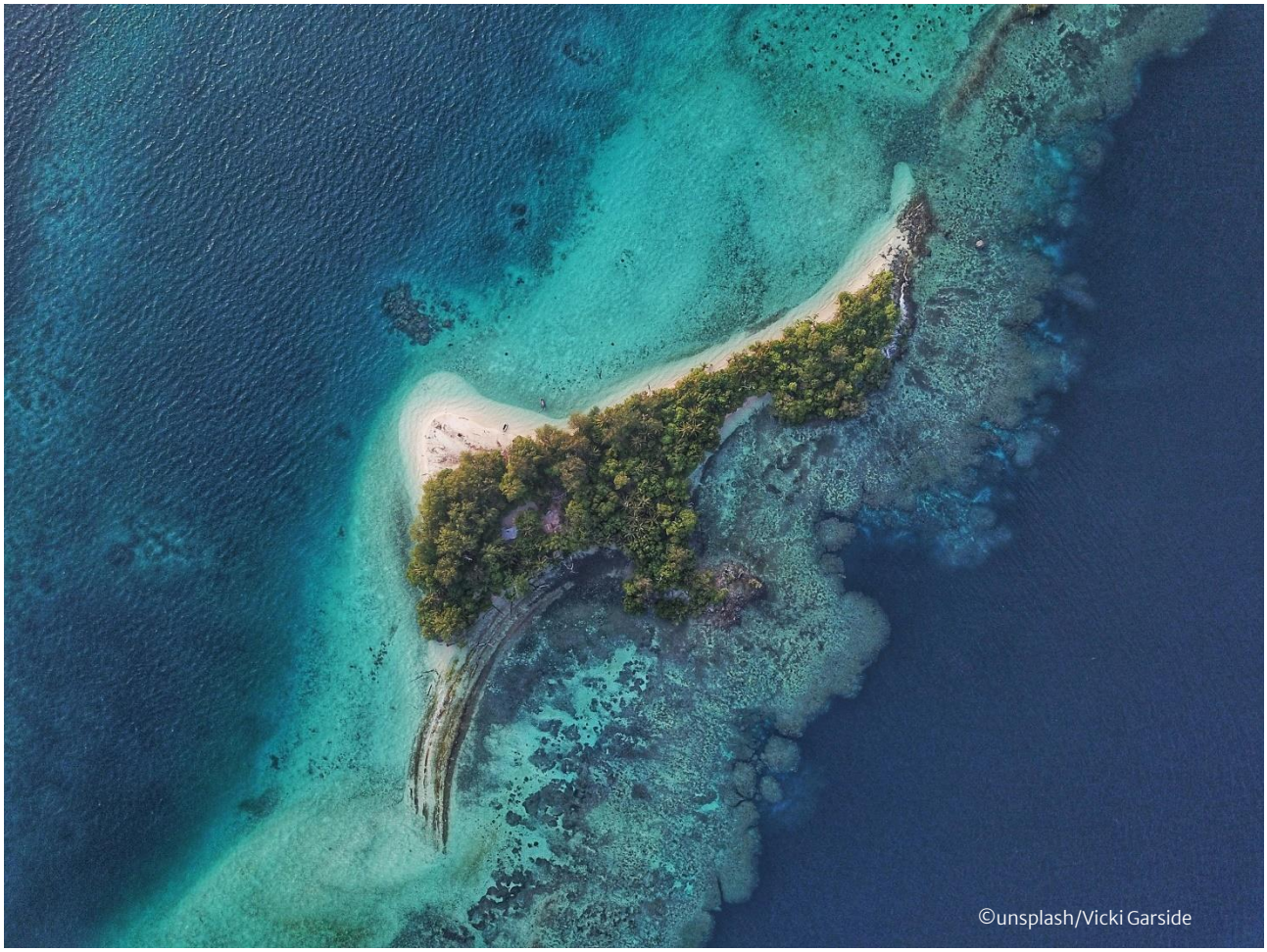


Table 9: Other disaster events between 2009 to 2019 and losses caused

Year	Type of Disaster/ Name	Loss / Scale Impacts
2010	Cyclone Freda	Tropical Cyclone Freda caused severe damages to some of the key sectors such as Agriculture (food gardens, Cocoa and banana plantations, etc.), Infrastructure (bridges, roads, community water supply including dams, communications, etc.) and Shelter (dwelling houses). The most impacted areas were Makira, and Guadalcanal Provinces and cost of about USD400,000 for relief supplies.
2014	Flash Flood	Three days of heavy rain caused severe flash floods in early April 2014. More than 100,000 people were affected in Honiara and Guadalcanal, 10,000 people displaced, 22 were killed and it caused major damages to infrastructure, shelter, Education, Health and Agriculture. The total economic damages and losses were estimated at USD108,000,000.
2015	Cyclone Pam	Tropical Cyclone Pam caused severe damage in Temotu, Malaita and Isabel Province. The worst affected province is Temotu where damages to livelihood, water & sanitation; the estimated affected people is about 30,000.
2015	Cyclone Raquel	Tropical Cyclone Raquel caused damages to the Islands of Western, Choiseul, Isabel, and Malaita. 1,047 communities were affected, total population affected was 126,187 and total household affected was 24,329, and relief cost of more than USD600,000.
2016	Drought (El Nino)	El Nino caused many impacts to the Islands of Renell & Bellona, Temotu and Makira/Ulawa Province. The sectors affected were Agriculture, Education and water supply then it cost approximately USD400,000 in relief supplies.
2017	Cyclone Dona Cat. 3	Tropical Cyclone Dona caused minimal damages to the Island of Temotu. 10,000 people affected Tikopia, Temotu Province. Sectors affected: Health, Education, Fisheries, Shelter, Agriculture and RWASH. Economic loss is estimated to be approximately USD400,000.
2018	Cyclone Liua	Tropical Cyclone Liua caused minimal damages to the food gardens, water systems and critical infrastructures through flooding and landslides.
2018	Tropical Depression	The tropical depression caused minimal damages to the provinces in Solomon Islands.
2019	Tropical Storms	Three storm systems in two weeks had inundated much of the country with heavy rain that caused flooding, landslides, and the destruction of homes and food crops for up to 22,000 people.

South Africa

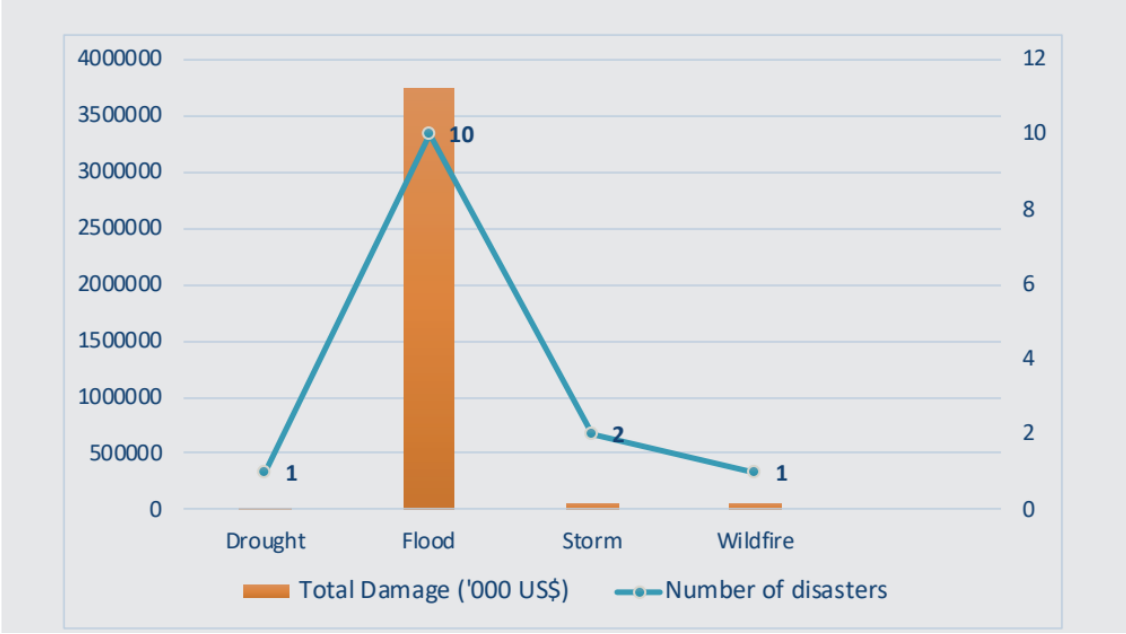
3.9 Information Related to Averting, Minimizing and Addressing Loss and Damage Associated with Climate Change Impacts

3.9.1 Observed and potential climate change impacts from extreme weather and slow onset events in South Africa

Climate change impacts and associated disasters pose significant economic, social, and environmental costs to South Africa. The country's vulnerability to climate change stems from its diverse geography, exposure to extreme weather events, and socio-economic challenges. The costs of climate change impacts and disasters in South Africa manifest across various sectors, including agriculture, water resources, infrastructure, health, and biodiversity. South climate related disasters and associated economic impacts that have occurred during 2021 and 2022 in South Africa.

Floods are the most frequent and widespread climate disaster, while droughts, veldfires, storms and heatwaves are the other significant extreme weather types contributing to loss and damage in South Africa (Figure 3.11)

Figure 3.11. Number of declared climate related disasters and associated economic damage for the period 2021-2022 over South Africa (EM-DAT, 2024)



South Africa has experienced more frequent and intense floods, particularly along the eastern coast. In April 2022, Durban, Kwa-Zulu Natal, experienced devastating floods that caused widespread destruction and loss of life. Rainfall more than 350 mm over two days caused flash floods and mudslides, with flood water flowing through streets and settlements. At least 435 people lost their lives, and more than 40,000 people in total were affected by the floods and landslides. The cost of infrastructure and business losses amounted to an estimated US$2 billion (Grab and Nash, 2023).

During 2021/2022 the Eastern Cape province endured severe drought conditions, leading to water shortages that affected agriculture and daily life. The prolonged dry spell prompted the government to declare a state of disaster in the region. Heat waves are also becoming more frequent and intense.

The South African Weather Service reported record breaking temperatures in some regions during over the past few years. In January 2023, a severe heatwave affected regions like Gauteng and KwaZulu-Natal, with temperatures soaring up to 39 °C. This extreme heat posed serious health risks, especially for vulnerable groups such as infants, the elderly, and outdoor workers (SAWS). During November 2023, temperatures reached unprecedented highs, with Augrabies Falls recording 46.7 °C on November 27. This marked one of the highest temperatures recorded in the Southern Hemisphere for that month (SAWS).

Using published peer-reviewed methods, scientists from various countries collaborated to assess to what extent climate change contributed to the flooding in Kwa-Zulu Natal (Pinto et al., 2022). They found that climate change approximately doubled the probability of such extreme rainfall events, and they estimated that the intensity of the rainfall event was increased by 4-8% due to climate change. The report highlights that heavy rainfall events are projected to increase in frequency and magnitude in the future with additional global warming.

A climate change attribution study done by Liu et al (2023) on the 2021 wildfire in Cape Town that caused an estimated R1-billion in damages to the University of Cape Town alone found that climate change played a role and has significantly increased the chances of such devastating fires occurring in Cape Town. According to the study, CMIP6 models suggest that the extreme fire weather associated with the April 2021 Cape Town wildfire has become 90% more likely in a warmer world.

These mentioned extreme weather events that were attributed to human induced climate change clearly illustrates the vulnerability of South African society and economy to global warming. Assessing loss and damage from severe climate events serves as a critical tool for understanding the true costs of climate change, informing effective responses, and promoting equitable solutions.

3.9.2 Activities related to averting, minimizing and addressing loss and damage associated with the adverse effects of climate change

South Africa is implementing a variety of strategies to avert, minimize, and address loss and damage from climate change, including policy frameworks, disaster risk reduction initiatives, ecosystem restoration, infrastructure development, and international collaboration.

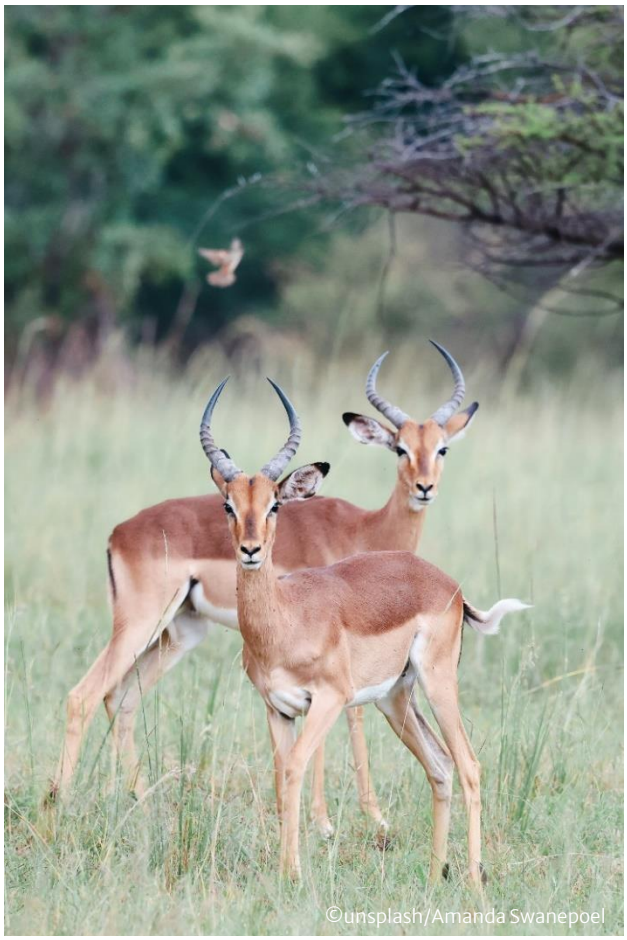
Policy frameworks: The National Climate Change Adaptation Strategy (NCCAS) provides a national approach to building climate resilience across sectors, with specific actions to reduce vulnerabilities to climate impacts.

Disaster risk reduction: South Africa's National Disaster Management Centre (NDMC) plays a pivotal role in reducing loss and damage from climate change by coordinating disaster risk reduction (DRR) initiatives at national, provincial, and local levels. The NDMC leads efforts to strengthen preparedness, response, and resilience across the country, with a focus on early warning systems, risk assessments, and community-based disaster management. The NDMC also supports comprehensive risk assessments to identify the most climate-vulnerable areas and populations, which informs targeted DRR strategies and resource allocation.

Ecosystem restoration and conservation: Projects under the Expanded Public Works Programme (EPWP) focus on restoring degraded ecosystems, which protect communities from climate-related disasters such as floods and droughts.

Early warning systems and climate-resilient infrastructure: Investments in early warning systems improve preparedness for extreme weather events, and climate-resilient infrastructure projects are being developed to withstand long-term climate impacts.

International collaboration and funding: South Africa participates actively in global climate efforts, including support for the UNFCCC's Loss and Damage Fund, which provides financial assistance to countries vulnerable to severe climate impacts.



3.9.3 South Africa's approach to reporting loss and damage from climate events

3.9.3.1 Policy context

While there's no national policy specifically on Loss and Damage in South Africa, the National Disaster Management Act (2002) lays the foundation for disaster risk management in South Africa. It emphasizes a multi-hazard, multi-sectoral approach which includes assessing the impacts of disasters. The disaster management act also mandates the NDMC to submit a report to the Minister (who must table the report in Parliament) on the disasters that occurred, the classification, magnitude and severity of the disasters, as well as the effects they had. Organs of state must also report quarterly to the NDMC on the disasters, their impact and the expenditure incurred. The National Disaster Management framework outlines a coordinated approach to disaster risk management, including post-disaster needs assessments (PDNA). The PDNA is a crucial tool for evaluating the social, economic, environmental, and infrastructure impacts of disasters, including those related to climate change. The National Climate Change Adaptation Strategy (NCCAS) acknowledges the need for improved data collection and monitoring of climate change impacts. Implicitly, this includes assessing the impacts of climate-related disasters. Internationally, South Africa is also a signatory to the Sendai Framework for Disaster Risk Reduction (2015), which promotes a comprehensive approach to disaster risk management, including assessing disaster risks and losses.

3.9.3.2 Institutional context

In South Africa, the Department of Forestry, Fisheries and Environment acts as the leading government agency responsible for coordinating and overseeing the national climate change response, which include loss and damage from extreme climate events. Assessment of loss and damage through data collection, analysis and database development involves a collaborative effort between various government departments (national, provincial, and local levels) scientific institutions and the private sector.

Important role players at National level are the National Disaster Management Centre (NDMC) and the South African Weather Services. The NDMC serves as the national focal point for disaster response, coordinating the efforts of various government departments, provincial disaster management centres, and other stakeholders. The NDMC coordinates and supports damage assessments in the aftermath of extreme climate events. This involves evaluating the extent of damage to infrastructure, property, and livelihoods, which is crucial for allocating resources and planning recovery efforts. This ensures a comprehensive and standardized approach to gathering information.

The South African Weather Services (SAWS) plays a central role in assessing extreme climate events in South Africa by providing vital data, issuing early warnings, conducting climate analysis, disseminating information, and fostering collaboration. SAWS works closely with the National Disaster Management Centre (NDMC) and other government departments to develop a national Loss and Damage (L&D) reporting systems. They share weather information and forecasts to facilitate effective disaster preparedness, response, and recovery efforts.

Despite these extensive and dedicated efforts to collect, assess and analyze loss and damage related data in South Africa, there remains several gaps and challenges. These relate to limited human capacity and technical expertise, insufficient collaboration between different stakeholders involved in data collection and analysis, data fragmentation and inconsistency as well as limited focus on the indirect or intangible ripple effects of climate change that occur over time and can be more complex to quantify such as cultural and historical damage, mental health impacts and loss of ecosystem services.

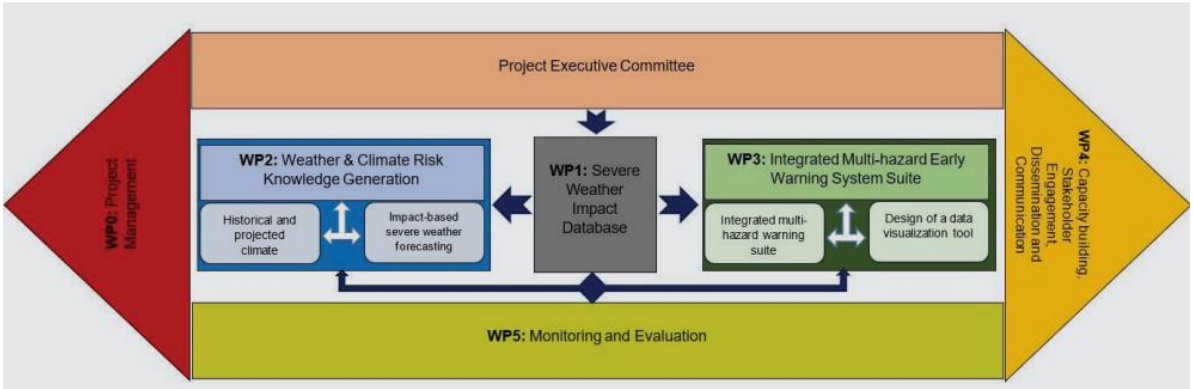
3.9.4 Existing loss and damage monitoring systems

South Africa's National Disaster Management Framework (NDMF) seeks the development of a comprehensive information and communications management system with links to relevant role players reporting on disasters. As part of the response and recovery component of the NDMF it requires the collection of disaster data related to the area affected, the type of event (classification by type, magnitude and severity), analysis of status of critical lifeline infrastructure and analysis of reported impacts and monitoring of progress. The NDMC therefore collects data on loss and damage in line with international guidelines and tools such as the Sendai Framework for Disaster Risk Reduction and the newly developed UNDRR hazardous event and disaster losses and damages tracking system which will replace the existing DesInventar system.

South Africa as a country is therefore aligning its country level data collection initiatives to the available international loss and damage databases to allow for international reporting. Assessing the true cost of climate disasters is important to equip South Africa with data-driven arguments when negotiating for increased funding and support within the Loss and Damage framework.

The South African Weather Services is updating and improving its Severe Weather Impact Database. The Severe Weather Impact Database (SWID) is a comprehensive database maintained by the South African Weather Service (SAWS) that records and archives information on severe weather events and their impacts across South Africa (Figure 3.12). It includes data on various types of severe weather phenomena such as storms, floods, droughts, heatwaves, and wildfires, along with their associated impacts on infrastructure, agriculture, economy, and human lives. It is a standardized platform of archiving extreme weather systems, events and their impacts. It builds on the Caelum database which is a historical record of notable weather events that have impacted South Africa.

Figure 3.12: Severe Weather Impact Database (SWID)



3.9.5 National Dialogue on Loss and Damage

South Africa is an active participant in international discussions on L&D under the Warsaw International Mechanism for Loss and Damage associated with Climate Change Impacts. South Africa has emerged as a leading voice for developing countries in international negotiations for the establishment of a Loss and Damage Fund to address climate change impacts. The country acts as a bridge between the developing countries and developed nations, facilitating dialogue and seeking common ground on L&D issues.

This role is crucial for achieving progress in negotiations. South Africa emphasizes the specific needs of African countries facing the brunt of climate change impacts, such as sea level rise, extreme weather events, and desertification. This helps build a strong case for targeted financial assistance. Securing compensation for climate-induced loss and damage remains a complex issue. While the Loss and Damage Fund offers a promising step forward, South Africa will need to pursue a combination of approaches to ensure it receives adequate support for the losses and damages it experiences from climate change.

DFFE has therefore embarked on a process to improve the ability of South Africa to better report on loss and damage in the country. In this context, DFFE has initiated a National Dialogue on Loss and Damage. The primary objective of this initiative is to develop a comprehensive Loss and Damage Programme of Work for South Africa, ensuring a collaborative and coordinated response that aligns with global momentum on this issue. In pursuit of this objective, the DFFE, in partnership with various stakeholders, hosted three workshops aimed at establishing a coherent national approach to addressing loss and damage.

These workshops facilitated discussions on the most effective strategies for South Africa, with specific goals to enhance knowledge and understanding of approaches to address loss and damage; improve access to support, including finance, technology, and capacity-building; and strengthen dialogue, coordination, coherence, and synergies among relevant stakeholders.

The workshops resulted in several key outcomes, including: fostering stakeholder partnerships and collaboration to address loss and damage; identifying and mapping various economic and non-economic interventions at the national level; developing a comprehensive approach to implementing loss and damage interventions in South Africa; exploring innovative financial mechanisms to overcome institutional constraints in funding these initiatives; identifying research areas and strategies for managing and sourcing relevant data; and outlining processes for integrating loss and damage into monitoring and evaluation systems, as well as into national, subnational, and climate change policies and planning tools.



Tuvalu

4.18 Tuvalu's Vulnerability to Climate Change and Loss and Damage

Tuvalu, a small island nation in the Pacific Ocean, is increasingly recognized as one of the most vulnerable countries to the adverse effects of climate change. The nation's unique geographical characteristics, coupled with its socio-economic realities, make it particularly susceptible to various climate-related challenges. This comprehensive overview discusses the observed and potential climate change impacts in Tuvalu, actions taken to mitigate these impacts, and the institutional arrangements supporting these efforts, with a focus on enhancing understanding, action, and support for loss and damage associated with climate change.

4.18.1 Observed and Potential Climate Change Impacts

Tuvalu is facing severe consequences from climate change, which can be classified into immediate, long-term, and potential future impacts.

4.18.1.1 Coastal Erosion and Sea-Level Rise

- Geographical Context: Tuvalu consists of nine islands, predominantly coral atolls with an average elevation of just two meters above sea level. This geographic vulnerability places the islands at high risk from rising sea levels, which have been recorded globally due to melting polar ice and thermal expansion of seawater.
- Current Coastal Erosion: Extensive studies by the Tuvalu Meteorological Service and the national government have documented coastal erosion, which has accelerated in recent years. Coastal communities are witnessing significant land loss, with many structures and traditional lands becoming uninhabitable. This loss not only threatens housing but also impacts agricultural land and traditional fishing grounds, vital for food security.
- Projected Sea-Level Changes: Future projections indicate that if current trends continue, Tuvalu could see a rise in sea levels of up to several meters by the end of the century, leading 268 to increased flooding and more frequent inundation of low-lying areas, particularly in Funafuti, Tuvalu's capital.

4.18.1.2 Saltwater Intrusion

- Impact on Freshwater Supply: Rising sea levels lead to saltwater intrusion, significantly affecting freshwater aquifers. Reports from the Tuvalu Water Authority indicate that the quality of groundwater is deteriorating, rendering traditional water sources brackish and unsuitable for consumption.
- Agricultural Challenges: Saltwater intrusion compromises agriculture, particularly subsistence crops such as pulaka (a traditional root crop) and coconuts, which are sensitive to salinity. The deterioration of these crops due to salinity stress threatens food security and the cultural practices of the Tuvaluan people.
- Economic Consequences: As local food production decreases, communities are increasingly reliant on imported goods, which are often more expensive and less nutritious. This reliance further strains household budgets and exacerbates the risk of food insecurity.

4.18.1.3 Increased Frequency and Intensity of Extreme Weather Events

- Cyclone Vulnerability: Tuvalu has experienced an increase in the frequency and intensity of cyclones over recent decades, as evidenced by historical records and meteorological data. The devastation wrought by Cyclone Pam in 2015, which affected several islands and caused extensive damage to infrastructure and agriculture, exemplifies the dangers posed by extreme weather events.

- Projected Future Risks: Climate models predict that Tuvalu will face a growing risk of severe tropical storms, leading to heightened challenges for disaster preparedness and response. The anticipated increase in storm intensity and frequency will likely overwhelm existing infrastructure and strain emergency response capabilities.

4.18.1.4 Droughts and Water Scarcity

- Changes in Rainfall Patterns: The region has seen alterations in rainfall patterns, with increasing variability and unpredictability. Periods of intense rainfall are followed by prolonged dry spells, leading to water scarcity during critical agricultural periods.
- Community Impacts: Water scarcity has profound implications for daily life, affecting drinking water availability and sanitation. The National Health Services of Tuvalu have reported increased health risks due to inadequate access to clean water and sanitation facilities during drought periods.
- Adaptation Needs: Community reliance on traditional rainwater harvesting systems is becoming less reliable, necessitating investment in alternative water supply systems and better resource management practices.

4.19 Activities Related to Averting, Minimizing, and Addressing Loss and Damage

To tackle the pressing issues of loss and damage associated with climate change, Tuvalu has implemented various strategies aimed at enhancing resilience and reducing vulnerability.

4.19.1 Advocacy for Loss and Damage Financing

- International Leadership: Tuvalu has taken a proactive stance in international climate negotiations, advocating for a dedicated Loss and Damage Financing facility. This advocacy has been particularly pronounced at the Conference of the Parties (COP) meetings, where Tuvalu emphasizes the need for financial mechanisms to support vulnerable nations. 269
- Need for Clear Frameworks: The absence of universally accepted definitions of loss and damage complicates Tuvalu's advocacy efforts. Tuvalu stresses the necessity for clear, actionable frameworks that outline eligibility for loss and damage financing, ensuring that affected communities can access support effectively.

4.19.2 Tuvalu Climate Adaptation Project (TCAP)

- Comprehensive Adaptation Efforts: The TCAP focuses on multifaceted strategies aimed at increasing climate resilience: o Water Resource Management: Initiatives include enhancing rainwater harvesting systems, constructing water storage facilities, and improving groundwater recharge methods to counteract saltwater intrusion and ensure a stable water supply.
- Coastal Defence Initiatives: Projects involve the construction of seawalls and the restoration of mangrove forests, which provide natural barriers against erosion and flooding. The government collaborates with NGOs and international partners to implement these strategies effectively.
- Sustainable Agriculture: Programs promote the use of climate-resilient crops and agricultural practices that improve soil health and reduce vulnerability to saltwater intrusion. Training workshops help farmers adopt sustainable practices, increasing their capacity to adapt to changing climatic conditions.

4.19.3 Disaster Risk Reduction (DRR) Strategies

- National Disaster Risk Management Framework: Tuvalu has developed a comprehensive National Disaster Risk Management Plan, which integrates climate adaptation strategies into disaster preparedness efforts.

- Community Training Programs: Local communities receive training on disaster preparedness and response, including simulations and drills that improve resilience and readiness for extreme weather events.
- Investment in Resilient Infrastructure: Government efforts prioritize the construction and reinforcement of infrastructure such as schools, hospitals, and roads to withstand climate-related disasters.

4.19.4 Community-Led Adaptation Initiatives

- Empowerment of Local Communities: Community engagement is central to Tuvalu's adaptation strategy. Local organizations are encouraged to develop and implement initiatives that reflect the unique cultural and environmental contexts of their areas.
- Promotion of Sustainable Practices: Community gardens and cooperative farming initiatives foster local food production, reducing dependence on imports and enhancing food security.
- Ecosystem Restoration Projects: Grassroots initiatives to restore coastal ecosystems, such as mangrove planting, not only protect shorelines but also enhance biodiversity and provide additional resources for local communities.

4.19.5 Innovative Financial Instruments

- Climate Risk Insurance Schemes: Tuvalu is exploring innovative insurance mechanisms to provide rapid financial assistance after climate-related disasters. Such schemes can facilitate quicker recovery efforts and enhance overall resilience.
- Establishment of a National Adaptation Fund: The government aims to create a dedicated fund to support local adaptation projects, ensuring that communities have access to resources for implementing climate resilience initiatives.

4.20 Institutional Arrangements

Robust institutional frameworks are critical for effectively implementing strategies to address loss and damage associated with climate change.

4.20.1 National Climate Change Policy (2021-2030)

- Strategic Vision: The National Climate Change Policy outlines a strategic vision for Tuvalu's climate resilience efforts, establishing priorities for both adaptation and mitigation.
- Goals and Objectives: Key objectives include enhancing community resilience, protecting natural resources, and integrating climate considerations into all areas of national development planning.

4.20.2 Climate Change Department (CCD)

- Central Coordinating Body: Operating under the Ministry of Home Affairs, Climate Change and Environment (MHACCE), the CCD coordinates all climate initiatives, facilitating the flow of information and resources for effective implementation.
- Data Management and Research: The CCD collects climate data, monitors impacts, and assesses the effectiveness of adaptation measures, providing vital information for informed decision-making.

4.20.3 National Advisory Council on Climate Change (NACCC)

- Multi-Stakeholder Engagement: The NACCC brings together representatives from government agencies, civil society, and the private sector, fostering collaborative decision making in climate action.

- Oversight and Accountability: The council monitors the implementation of climate policies, ensuring transparency and accountability in the management of resources allocated for climate adaptation and resilience.

4.20.4 Partnerships with Regional and International Organizations

- Collaboration and Capacity Building: Tuvalu collaborates with regional organizations, such as the Pacific Islands Forum, and international entities, including the United Nations Development Programme (UNDP), to enhance its capacity for climate resilience.
- Technical Assistance and Resource Mobilization: These partnerships facilitate access to technical expertise, best practices, and financial resources necessary for implementing adaptation initiatives.

4.20.5 Community-Based Adaptation Networks

- Local Knowledge Sharing: Grassroots organizations and community networks play a crucial role in facilitating knowledge sharing and capacity building, enabling communities to learn from successful adaptation initiatives.
- Training and Empowerment: Programs aimed at empowering local communities to implement effective adaptation strategies foster ownership and enhance resilience at the community level.





CGE
Consultative Group of Experts
the Constituted body for MRV & ETF

United Nations
Climate Change

November 2026