



THE SOCIALIST REPUBLIC OF VIET NAM  
MINISTRY OF NATURAL RESOURCES AND ENVIRONMENT

# REPORT NATIONAL ADAPTATION PLAN FOR THE PERIOD 2021-2030, WITH A VISION TO 2050



*Ha Noi, December 2022*



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# ABBREVIATIONS

ADB	Asian Development Bank
AFD	French Development Agency (Agence française de développement)
CC	Climate Change
CCA	Climate Change Adaptation
COP	Conference of the Parties to the United Nations Framework Convention on Climate Change
DRR	Disaster Risk Reduction
EbA	Ecosystem-based Adaptation
FDI	Foreign Direct Investment
GCF	Green Climate Fund
GDP	Gross Domestic Product
GHG	Green House Gas
ICM	Integrated Crop Management
IMHEN	Vietnam Institute of Meteorology, Hydrology and Climate Change
IPCC	Intergovernmental Panel on Climate Change
KfW	German Development Bank
M&E	Monitoring & Evaluation
MARD	Ministry of Agriculture and Rural Development
MIC	Ministry of Information and Communication
MOC	Ministry of Construction
MOD	Ministry of Defence
MOF	Ministry of Finance
MOFA	Ministry of Foreign Affairs
MOH	Ministry of Health
MOIT	Ministry of Industry and Trade
MOJ	Ministry of Justice
MONRE	Ministry of Natural Resources and Environment
MOST	Ministry of Science and Technology

MOT	Ministry of Transport
MPI	Ministry of Planning and Investment
MPS	Ministry of Public Security
NAP	National Adaptation Plan
NDC	Nationally Determined Contributions
NDPC	Natural Disaster Prevention and Control
NTP	National Target Program
ODA	Official Development Assistance
PPP	Public-Private Partnership
RCP	Representative Concentration Pathways
SDGs	Sustainable Development Goals
SMART	Specific, Measurable, Attainable, Relevant, Time-bound
TCVN	National standards
UN Women	United Nations Entity for Gender Equality and the Empowerment of Women
UNDP	United Nations Development Programme
UNFCCC	United Nations Framework Convention on Climate Change
VNDMA	Viet Nam Disaster Management Authority Viet Nam Climate Innovation Centre
WHO	World Health Organisation
WMO	World Meteorological Organisation
WTO	World Trade Organisation

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# *Executive Summary*

## **1. The necessity of the National Adaptation Plan**

Viet Nam is a country that is particularly vulnerable to the impacts of climate change (CC). Viet Nam has a coastline of about 3,260 km and a sea area of about 1 million km<sup>2</sup>, including Paracel and the Spratly archipelagos along with over 3,000 large and small islands along the coast. The area of Viet Nam's mainland territory is about 331,230.8 km<sup>2</sup> with three quarters being hills and mountains; the rest are alluvial plains, of which two large deltas are densely populated and particularly vulnerable to climate change, especially sea level rise.

That was the reason why Viet Nam needed a National Adaptation Plan (NAP) for the period 2021-2030, with a vision to 2050. This NAP is grounded on the provisions on climate change in the Law on Environmental Protection (LEP), the National Strategy on Climate Change to 2050 and current policies on climate change. The NAP was developed based on the guiding documents of the United Nations Framework Convention on Climate Change (UNFCCC).

## **2. Key contents of the Report on NAP**

**Chapter I. Introduction:** Presents an overall introduction of the Viet Nam national context, legal grounds, methodology and process for developing the NAP.

**Chapter II. Climate change in Viet Nam:** Presents the trend of climate change according to monitoring data and future climate change scenarios; the increase in climate risks; the impacts of climate change on different sectors, regions and social groups in Viet Nam; the current and estimated future climate change-induced losses and damages for Viet Nam.

**Chapter III. Achievements and gaps in climate change adaptation:** Assesses and analyses the achievements in policies, actions and in the mobilisation of financial resources for climate change adaptation as well as gaps in the climate change adaptation at the country, sectoral and provincial levels, covering different aspects including institutions, policies, finance, science and technology; climate change adaptation (CCA) integration into development plans; coordination among ministries, sectors and provinces; regional linkages; social engagement; and international cooperation.

**Chapter IV. NAP:** Presents objectives, tasks and priority solutions specifically identified for different sectors, fields and regions to adapt to climate change in the period 2021-2030 based on the analysed achievements, gaps and vulnerabilities as well as the coordination mechanism among ministries, sectors, provinces and external organisations in implementing these solutions; management and implementation of the Plan; NAP monitoring and evaluation system; periodic reviews and updates; financial resources for the NAP implementation.

**Chapter V. Challenges and needs for international support:** Analyses difficulties and challenges and assesses potential economic, social and environmental impacts of the implementation of the NAP; analyses the potential contributions of the NAP to the achievement of the Sustainable Development Goals (SDGs); identifies the needs for international assistance in finance and capacity building to improve Viet Nam's CC resilience and adaptability.

### 3. Objectives and scope

- **Overall objective:** Mitigate vulnerability and risks from the negative impacts of climate change by strengthening the resilience and adaptive capacity of the natural, economic and social systems; minimise losses and damages caused by increasing natural disasters and climate extremes and CC-induced sea level rise; promote the integration of CCA into the strategy and planning systems.

- **Specific objectives:** (i) Strengthen the resilience and adaptive capacity of natural, economic and social systems through investing in adaptation actions, science and technology, capacity building and awareness raising to be ready to adapt to CC; (ii) Reduce natural disaster risks and minimise damages, be readily prepared to response to increasing CC-induced natural disasters and climate extremes; (iii) Improve the effectiveness of CCA through intensifying the State management of CC response and promoting the integration of CCA into strategies and plans.

- **Coverage:** The NAP is implemented throughout the whole mainland and territorial waters of Viet Nam.

### 4. Tasks and solutions

#### ***a) Enhance resilience and adaptive capacity of natural, economic and social systems, ensure sustainable livelihoods***

Enhance resilience and adaptive capacity of natural, economic and social systems, ensure sustainable livelihoods by investing in adaptation actions to effectively use and prevent the reduction and degradation of water and land resources; developing CCA and climate-smart agriculture; protecting and developing forests and ecosystems; developing infrastructure systems; strengthening medical and health care systems; ensuring social security and gender equality.

Specific tasks and solutions include: Effectively use and prevent the reduction and degradation of water and land resources, with five groups of tasks, solutions and 13 specific tasks; Develop climate-resilient and -smart agriculture, with six groups of tasks, solutions and 28 specific tasks; Manage forests and ecosystems, with nine groups of tasks, solutions and 19 specific tasks; Develop CCA infrastructure, with six groups of tasks, solutions and 21 specific tasks; Strengthen the medical and health care systems, with five groups of tasks, solutions and 7 specific tasks; Ensure social security and gender equality, with two groups of tasks, solutions and six specific tasks.

#### ***b) Mitigate natural disaster risks, minimise damages caused by increasing natural disasters and climate extremes, contributing to addressing the CC-induced losses and damages***

Mitigate natural disaster risks, minimise damages and be ready to respond to increasing CC-induced natural disasters and climate extremes by capacity building in forecasting, early warning of natural disasters and extreme climatic and weather conditions; improving natural disaster risk management systems to minimise vulnerability and increase preparedness to respond to climate extremes; implementing solutions to minimise losses and damages due to short-term, medium-term and long-term CC-related impacts in the future.

Specific tasks and solutions include: Make forecasts and early warnings, with five groups of tasks, solutions and 14 specific tasks; Construct and upgrade works serving natural disaster prevention and control, with four groups of tasks, solutions and 12 specific tasks; Ensure the safety of people's lives and properties, reduce CC-induced losses and damages, with four groups of tasks, solutions and 13 specific tasks.

#### ***c) Complete institutions, promote potentials and resources to effectively adapt to climate change***

Strengthen the State management of CC, complete policies and systems of strategies and plannings related to CC, and promote the integration of CCA into the system of strategies and plannings to improve CCA effectiveness; promote CCA activities that generate co-benefits, improve public awareness and participation in CCA activities through communication and training on climate change, strengthen scientific research and develop technologies, mobilise financial resources for climate change and international cooperation on climate change.

Specific tasks and solutions include: Develop and complete institutions and policies, with five groups of tasks, solutions and 28 specific tasks; Communicate, raise awareness and promote public engagement, with three groups of tasks, solutions and nine specific tasks; Develop human resources, with four groups of tasks, solutions and seven specific tasks; Develop science and technology, with six groups of tasks, solutions and 12 specific tasks; Mobilise financial resources for CCA, with four groups of tasks, solutions and six specific tasks; Promote international cooperation in climate change response, with three tasks, solutions and eight specific tasks.

#### ***d) Tasks and solutions for each region***

Due to the typical characteristics of each region, the CC impacts and CC-induced risks in different regions are different. Based on the overall tasks and solutions, the NAP has identified the CCA tasks and solutions that need prioritising for implementation in each region, namely: Northern midland and mountainous region, with five groups of tasks and solutions; Red River Delta, with four groups of tasks and solutions; North Central and Central Coast, with five groups of tasks and solutions; Central Highlands, with four groups of tasks and solutions; South East, with three groups of tasks and solutions; and Mekong Delta, with seven groups of tasks and solutions.

## **5. Implementation phases**

***Period 2021-2025:*** Focuses on the following activities: complete CCA mechanisms and policies; prepare the legal grounds and technical conditions to promote the integration of CC into policies, strategies and plannings; implement prioritised CCA tasks and solutions, build capacity in responding to natural disasters, minimising damages caused by natural disasters and erratic changes in climate and weather.

***Period 2026-2030:*** Further strengthen the State management of CC, collaborate and integrate activities in the implementation of tasks and solutions to build capacity of sectors/industries, fields and economic sectors, communities and ecosystems to enhance resilience and readiness to adapt to CC.

***Vision to 2050:*** The period 2030-2050 promotes the achievements gained in 2021-2030, further strengthens the CCA capacity of citizens, infrastructure and natural systems.

## **6. Coordination of the implementation of the National Adaptation Plan**

The NAP coordination role was assigned to the Ministry of Natural Resources and Environment and the Ministry of Planning and Investment; the implementation responsibility was also assigned to relevant ministries, People's Committees of provinces and Centrally-run cities.

## 7. Monitoring and evaluation

The progress and achievements in CCA activities mentioned in the NAP are monitored and evaluated using a monitoring and evaluation (M&E) system, with a set of specific indicators; The effectiveness of the NAP will be, and lessons learned will be drawn to enhance the integration of CCA into the systems of plannings and strategies.

## 8. Financial resources for the implementation of the National Adaptation Plan

The need for investment in CCA in Viet Nam was assessed in a number of ways. Public expenditures over the past 10 years, including official development assistance (ODA), were assessed. The assessment results show that investments in CCA are substantial; however there remains a large unmet financial gap. The business sector has also made certain investments in building resilience and adaption capacity, yet such investments remain pretty limited.

Financial resources for the NAP implementation are mobilised from various channels, in compliance with the Law on State Budget, Law on Public Investment, Law on Investment and other relevant legal documents. Some channels of resources include the State budget (including Central budget and local budget); international assistance; private sector; and public contributions.

## 9. The need for international assistance for the implementation of the NAP

### *a) Financial support*

The financial need for CCA in 2030 is estimated to exceed 3-5% of GDP in 2020. It is estimated that in the period 2021-2030, about USD 54.99-91.65 billion is needed, at the 2020 net present value and the discount rate of 10%. If in the period 2021-2030, Viet Nam continues to implement the plan to spend 1.5% of GDP on CCA, then on average, it needs to mobilise about USD 2.75-6.42 billion from non-State budget per year, or about USD 27.5-64.16 billion for the period 2021-2030. Therefore, along with resources mobilisation and attracting investments from domestic economic sectors, the international financial and technological support resources are crucial in implementing CCA activities.

### *b) Some priority areas needing support to improve resilience and adaptive capacity*

- Strengthen policy capacity and human resources for CCA:

+ *Develop policies on CC*: Support the development of the Law on CC and its sub-law documents; formulate mechanisms and policies on climate insurance and risk sharing; formulate mechanisms and policies to integrate CC in the system of strategies and plannings; develop national standards, specialised technical guidelines for different fields to enhance the resilience and adaptive capacity of the natural, economic and social systems.

+ *Train staff*: Support to train State managerial staff at all levels in planning, implementing, monitoring and evaluating CCA actions; train highly qualified/senior scientific and technical staff in the field of CC response; train staff in handling CC-induced losses and damages.

- Enhance resilience and safety given increasing CC-induced natural disasters:

+ *Improve forecasting and early warning capacity*: Forecast and warn on natural disasters and climate extremes; prioritise the development of quantitative rain forecast technologies; make warnings and forecasts on flash floods and landslides; make impact-based forecasts; forecast diseases for plants

and animals given CC conditions; monitor, forecast and warn on the CC impacts on health and newly emerged diseases due to impacts of CC. In addition, there remain many challenges in the warning and forecasting of CC impacts on health, especially short-term forecasting and early warning.

+ *Improve CCA infrastructure*: Plant and protect forests, with priority given to watershed protection forests, mangrove forests and coastal protection forests; conserve biodiversity, conserve ecosystems, give priority to the development of marine and coastal protected areas; improve resilience to natural disasters and impacts of CC in coastal areas; upgrade and ensure the safety from increasing CC-induced natural disasters of lakes and dykes, the system of river and sea dykes; prevent erosion of riverbanks and coasts; construct and upgrade storm sheltering anchorages; control inundation in big cities, especially Hanoi, Ho Chi Minh City and Can Tho; build/develop storm- and flood-resilient houses for people in high-risk areas; provide further equipment for search and rescue work.

+ *Research on and transfer CCA technology*: Study to address CC-induced losses and damages; research and transfer advanced technology on climate-resilient and -smart agriculture development; develop and transfer CC-resilient plant and animal varieties; research and transfer technology to prevent coastal and riverbank erosion, technology on economical and efficient use of water, technology to combat degradation and pollution of water sources; research and transfer cooling solutions in urban areas; plan and design CCA- -smart cities; prevent and control forest fires.





# *CHAPTER I.* **INTRODUCTION**

<b>1.1. Country context</b>	<b>1</b>
<b>1.2. Methodology for the preparation of the National Adaptation Plan</b>	<b>1</b>
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# I. Introduction

## 1.1. Country context

Viet Nam is located in Southeast Asia, borders China to the North, Laos PDR and Cambodia to the West; and the East Sea to the East and South. Viet Nam has a coastline of about 3,260 km and a sea area of about 1 million km<sup>2</sup>, including Paracel archipelagos (in Da Nang city) and Spratly archipelagos (in Khanh Hoa province) along with over 3,000 large and small islands along the coast. The area of Viet Nam's mainland territory is about 331,230.8 km<sup>2</sup>, with three quarters being hills and mountains; the rest are alluvial plains, of which the Mekong River Delta and the Red River Delta are densely populated in the whole country and particularly vulnerable to CC, especially sea level rise.

Viet Nam's population in 2021 was estimated to be 98.5 million, in which 36.6 million or 37.1% lived in urban areas, 61.9 million or 62.9% in rural areas; the average population density was 297 people/km<sup>2</sup>, the average life expectancy was 73.6 years old. The economic structure of Viet Nam in 2021 consisted of the following shares: 12.56% from the agriculture-forestry-fishing sector, 37.47% from the industry and construction sectors, 41.21% from the service sector, 8.76% from the product taxes less subsidies on production. GDP per capita was about USD 3,717.

Viet Nam experiences a tropical and monsoon climate, with an average temperature of about 28°C. Average rainfall in populated areas ranges from 1,400 mm to 2,400 mm. Viet Nam often suffers storms, tropical depressions, floods, inundation and droughts. In recent years, under the impacts of CC, extreme weather events tend to increase in both quantity and intensity, severely affecting the stability and sustainable development of the country.

## 1.2. Methodology for the preparation of the NAP

### 1.2.1. Legal grounds for the preparation of NAP

The development of the National Adaptation Plan (NAP) was based on the following legal grounds:

- Decision No. 2053/QĐ-TTg dated October 28, 2016, on the promulgation of the Plan on the implementation of the Paris Agreement, in which, the Ministry of Natural Resources and Environment was assigned to develop the NAP.
- According to the Article 90 of the Law No. 72/2020/QH14 on Environmental Protection in 2020, the Ministry of Natural Resources and Environment was assigned to assume the prime responsibility for, and coordinate with other ministries and ministerial-level agencies in, submitting the NAP to the Prime Minister for promulgation, and periodically review and update every 5 years.

- Viet Nam's Nationally Determined Contribution (NDC) (*updated in 2020*) submitted to the Secretariat of the United Nations Framework Convention on Climate Change, July 2020.
- Decision No. 896/QĐ-TTg dated July 26, 2022 of the Prime Minister approving the National Strategy on Climate Change to 2050.
- Viet Nam's 2022 updated Nationally Determined Contribution (NDC 2022) submitted to the Secretariat of the United Nations Framework Convention on Climate Change in 2022.

### 1.2.2. Steps of developing the NAP

The NAP was drafted based on the guiding documents of the United Nations Framework Convention on Climate Change (UNFCCC). Drafting steps include:

**- Step 1. Collect information and data:** Information on the current status and trends of CC and data serving the study and assessment on the impacts and vulnerability, and assessment of Viet Nam's current needs for CCA were reviewed and gathered from such sources as climate change and sea level rise scenarios, action plans to respond to CC of ministries, sectors and provinces, and results of scientific studies on CC by domestic and foreign research institutes and universities, activities related to CCA, annual reports of ministries, sectors and provinces submitted to the National Committee for Climate Change. The Ministry of Natural Resources and Environment also conducted field trips to survey and assess the status as well as the CC response work nationwide.

**- Step 2. Analyse and assess CC impacts, identify challenges and gaps in CCA, based on that, propose tasks and solutions to adapt to CC:** Research and assessments on CC impacts and vulnerability to CC of different sectors, fields and provinces based on data on the current CC situation, the 2020 Viet Nam updated CC scenarios, sectorial development plans, socio-economic development plans of provinces, etc. The analysis and assessments identified sectors and fields that are more affected by and vulnerable to CC, identified needs for priority adaptation activities, including agriculture, natural disaster prevention and control (NDPC), environment and biodiversity, water resources, infrastructure (transport, construction and urban, industry, energy) and others (public health, labour-society, culture-sport-tourism). The desk review of relevant documents also showed frequent barriers in the CCA implementation, i.e., limitations in human resources, technology, and budget allocated for adaptation activities, and the complicated developments of CC in Viet Nam.

The results of analysis and assessments were used as a basis to determine the tasks and priority solutions for CCA activities of ministries, sectors and provinces. The CCA tasks and solutions for each field were synthesised and proposed in the NAP in order to achieve the overall objective as well as the specific objectives of the Plan, which was phased into three periods i.e., 2021-2025 and 2026-2030, and a vision to 2050.

**- Step 3. Develop the National Adaptation Plan:** Viet Nam's CCA tasks and solutions were proposed to be implemented in order to achieve the objectives set out in the NAP. CCA activities were proposed by sectors and fields. Regarding the sequence, in the first stage of implementation, activities including review, development and updates of institutions, policies, and urgent activities to adapt to CC are focused and prioritised. Construction and renovation activities are focused throughout the entire period. Scaling up of adaptation models receive attention in the later stage of the NAP. The tasks and solutions of the NAP shall not be separated from and rather must be integrated into the overall socio-economic development plan in each period.

### **1.2.3. Approach for identification of priority adaptation tasks**

The CCA tasks and priority solutions were identified based on a combination of approaches:

- a. Reduce vulnerability through activities to reduce the sensitivity, improve resilience and adaptive capacity of natural, economic and social systems and to some extent, reduce the exposure to CC.
- b. Mitigate damages caused by increasing CC-induced natural disasters and climate extremes.
- c. Aim at the implementation of CCA goals identified in Viet Nam's National Strategy on Climate Change to 2050 and Viet Nam's National Determined Contribution updated in 2022.
- d. Harmonise, co-benefit and integrate into socio-economic development and operation, management plans.

## **1.3. Development process of the NAP**

The development of the NAP actively involved various ministries, sectors, provinces, experts, research agencies, non-governmental organisations (NGOs), businesses and development partners through many concentrated working sessions and consultation workshops at all levels. Many concentrated working sessions have been organised to aim at planning on the implementation, developing the outline, assigning tasks, identifying the activities, detailing the contents, developing and completing the draft.

Official data, good experiences, best practices, good domestic and international lessons, and valuable studies have been evaluated, analysed, and used as inputs for the development of the NAP of Viet Nam.

### **1.3.1. Management process**

The Ministry of Natural Resources and Environment, in collaboration with relevant agencies from ministries, sectors, national and international expert groups, organised many working sessions, held consultation meetings with the participation of scientists, representatives of many provinces, organisations, international experts, etc. to exchange and get comments on the contents of the NAP.

### **1.3.2. Technical process**

The Ministry of Natural Resources and Environment, in collaboration with relevant agencies from ministries, sectors, national and international expert groups, organised many technical meetings, many working sessions with managerial officers and experienced experts; organised consultation meetings with the participation of scientists, representatives of some provinces, organisations, international experts, social organisations, etc. to exchange, discuss and collect comments on the major contents of the NAP.

To prepare the contents for the formulation of the draft NAP, the MONRE sent official letters to the relevant ministries and sectors, the People's Committees of the provinces and cities requesting them to propose tasks to develop the NAP. Based on these proposals, MONRE collaborated with experts in developing and finalising the draft NAP.

### **1.3.3. Consultation process**

The Ministry of Natural Resources and Environment organised many consultation workshops to exchange, provide information, and use relevant research findings. In addition to the consultation

workshops mentioned above, a number of ministries, sectors and provinces also held separate consultation workshops to propose tasks of the NAP. Relevant ministries, sectors and provinces proactively identified and proposed tasks within their respective aspects and management, serving as the basis for tasks proposed in the NAP.

Through consultation workshops, the Drafting Committee, group of experts and ministries, sectors and provinces agreed on the layout of the NAP Report which consists of five chapters: (i) Introduction; (ii) Climate change in Viet Nam; (iii) Achievements and Gaps in Climate Change Adaptation; (iv) NAP; (v) Effectiveness of the NAP.

After the consultation workshops and working sessions, the draft NAP was completed. The Ministry of Natural Resources and Environment requested, in writing, relevant ministries, sectors and provinces nationwide for comments for the last time. The ministries, sectors and provinces all agreed on the objectives and contents of the draft NAP. The Ministry of Natural Resources and Environment received, studied and explained on the comments from ministries, sectors and provinces, and completed the draft NAP and submitted it to the Prime Minister.

## 1.4. Structure of the Report

With an approach in line with the UNFCCC technical guidelines and the objectives of the Cancun Adaptation Framework, the NAP was structured into five chapters with the main contents as follows:

**1) Chapter I. Introduction:** Presents an overall introduction of the Viet Nam national context, legal grounds, methodology and process for developing the NAP.

**2) Chapter II. Climate change in Viet Nam:** Presents the trend of CC according to monitoring data and future CC scenarios; the increase in climate risks; the impacts of CC on different sectors, regions and social groups in Viet Nam; the current and estimated future CC-induced losses and damages for Viet Nam.

**3) Chapter III. Achievements and Gaps in climate change adaptation:** Assesses and analyses the achievements in policies, actions and mobilisation of financial resources for CCA as well as gaps in CCA at the country, sectoral and provincial levels, covering different aspects including institutions, policies, finance, science and technology; CCA integration into development plans; coordination among ministries, sectors and provinces; regional linkages; social engagement; and international cooperation.

**4) Chapter IV. NAP:** Presents objectives, tasks and priority solutions specifically identified for different sectors, fields and regions to adapt to climate change in the period 2021-2030 based on the analysed achievements, gaps and vulnerabilities as well as the coordination mechanism among ministries, sectors, provinces and external organisations in implementing these solutions; management and implementation of the Plan; NAP monitoring and evaluation system; periodic reviews and updates; financial resources for the NAP implementation.

**5) Chapter V. Challenges and needs for international support:** Analyses difficulties and challenges and assesses potential economic, social and environmental impacts of the implementation of the National Adaptation; analyses the potential contributions of the NAP to the achievement of the Sustainable Development Goals; identifies the needs for international assistance in finance and capacity building to improve Viet Nam's CC resilience and adaptability.

## 1.5. Summary of the NAP

**Table 1.1.** Summary of the NAP

<b>Title</b>	<b>National Adaptation Plan</b>
<b>Coordination agency</b>	Ministry of Natural Resources and Environment
<b>Coverage</b>	Whole mainland and territorial waters of Viet Nam
<b>Duration</b>	3 phases: 2021-2025; 2026-2030, and a long-term vision to 2050
<b>Context where the NAP was developed</b>	<p>Viet Nam is considered as one of the countries heavily impacted by CC. The Government of Viet Nam has made a strong commitment to CCA and GHG emission reduction at the 26<sup>th</sup> UN Climate Change Conference (COP 26) and joined the Alliances for Climate Action (ACA); The Prime Minister of Viet Nam ratified the National Strategy on Climate Change to 2050, demonstrating Viet Nam’s efforts and determination in CC response. Viet Nam has implemented many CCA policies and actions and gained important achievements, yet still there remain many shortcomings and gaps in CCA.</p> <p>The Report on NAP includes detailed and specific contents of CCA contribution in the 2022 updated NDC of Viet Nam, which will be deployed in the medium term and long term, in order to implement the National Strategy on Climate Change to 2050.</p>
<b>Overall objective</b>	Mitigate vulnerability and risks from the negative impacts of CC by strengthening the resilience and adaptive capacity of the natural, economic and social systems; minimise losses and damages caused by increasing natural disasters and climate extremes and sea level rise due to CC; promote the integration of CCA into the strategies and master plans.
<b>Specific objectives</b>	<ul style="list-style-type: none"> <li>• Strengthen the resilience and adaptive capacity of natural, economic and social systems through investing in adaptation actions, science and technology, capacity building and awareness raising to be ready to adapt to CC.</li> <li>• Reduce natural disaster risks and minimise damages, be readily prepared to respond to increasing CC-induced natural disasters and climate extremes.</li> <li>• Improve the effectiveness of CCA by intensifying the State management of CC response and promoting the integration of CCA into the strategy and planning systems.</li> </ul>

<p><b>Tasks and solutions</b></p>	<p>1) Enhance resilience and adaptive capacity of natural, economic, and social systems, ensure sustainable livelihoods</p> <ul style="list-style-type: none"> <li>- Effectively use and prevent the reduction and degradation of water and land resources</li> <li>- Develop Climate-resilient and smart agriculture</li> <li>- Manage forests and ecosystems</li> <li>- Develop CCA infrastructure</li> <li>- Strengthen the medical and health care systems</li> <li>- Ensure social security and gender equality</li> </ul> <p>2) Mitigate natural disaster risks, minimise damages caused by increasing natural disasters and climate extremes, contributing to addressing the CC-induced losses and damages</p> <ul style="list-style-type: none"> <li>- Make forecasts and early warnings</li> <li>- Construct and upgrade works serving natural disaster prevention and control</li> <li>- Ensure the safety of people's lives and properties, reduce CC-induced losses and damages</li> </ul> <p>3) Complete institutions, promote potentials and resources to effectively adapt to CC</p> <ul style="list-style-type: none"> <li>- Develop and complete institutions and policies</li> <li>- Communicate, raise awareness and promote public engagement</li> <li>- Develop human resources</li> <li>- Develop science and technology</li> <li>- Mobilise financial resources for CCA</li> <li>- Promote international cooperation in CC response</li> </ul> <p>4) Tasks and solutions for each region</p> <ul style="list-style-type: none"> <li>- Northern midland and mountainous region</li> <li>- Red River Delta</li> <li>- North Central and Central Coast</li> <li>- Central Highlands</li> <li>- South East</li> <li>- Mekong Delta</li> </ul>
<p><b>Implementation phases</b></p>	<ul style="list-style-type: none"> <li>• Period 2021-2025</li> <li>• Period 2026-2030</li> <li>• Vision to 2050</li> </ul>
<p><b>Specific programs, schemes, projects</b></p>	<p>1) Enhance resilience and adaptive capacity of natural, economic and social systems, ensure sustainable livelihoods</p> <ul style="list-style-type: none"> <li>- Effectively use and prevent the reduction and degradation of water and land resources</li> <li>- Develop Climate-resilient and smart agriculture</li> <li>- Manage forests and ecosystems</li> <li>- Develop CCA infrastructure</li> <li>- Strengthen the medical and healthcare systems</li> <li>- Ensure social security and gender equality</li> </ul>

<p><b>Specific programs, schemes, projects</b></p>	<p>2) Mitigate natural disaster risks, minimise damages caused by increasing natural disasters and climate extremes, contributing to addressing the CC-induced losses and damages</p> <ul style="list-style-type: none"> <li>- Make forecasts and early warnings</li> <li>- Construct and upgrade works serving natural disaster prevention and control</li> <li>- Ensure the safety of people's lives and properties, reduce CC-induced losses and damages</li> </ul> <p>3) Complete institutions, promote potentials and resources to effectively adapt to CC</p> <ul style="list-style-type: none"> <li>- Develop and complete institutions and policies</li> <li>- Communicate, raise awareness and promote public engagement</li> <li>- Develop human resources</li> <li>- Develop science and technology</li> <li>- Mobilise financial resources for CCA</li> <li>- Promote international cooperation in CC response</li> </ul>
<p><b>Coordination and monitoring of the implementation</b></p>	<ul style="list-style-type: none"> <li>• Ministry of Natural Resources and Environment</li> <li>• Ministry of Planning and Investment</li> <li>• Ministries, ministerial-level agencies, Government agencies, People's Committees of provinces and centrally run cities</li> </ul>
<p><b>Monitoring and Evaluation (M&amp;E)</b></p>	<ul style="list-style-type: none"> <li>• Objectives, contents of monitoring and evaluation</li> <li>• Set of monitoring and evaluation indicators</li> <li>• Organisation of M&amp;E and agencies in charge of M&amp;E</li> </ul>
<p><b>Periodic review and updates</b></p>	<ul style="list-style-type: none"> <li>• Review and update the NAP</li> <li>• Review, evaluate the implementation of the NAP</li> </ul>
<p><b>Financial resources for implementation</b></p>	<ul style="list-style-type: none"> <li>• State budget (recurring expenditure, investments in development); integration in national programs and projects</li> <li>• Funding for scientific research and CCA technology development</li> <li>• Mobilise international assistance for CCA</li> <li>• Mobilise financing from businesses</li> <li>• Mobilise from the community/public contributions</li> </ul>
<p><b>Difficulties, challenges and impacts of the NAP, and the need for international assistance</b></p>	<p>1) Difficulties, challenges in the implementation of the NAP</p> <p>2) The potential economic, social and environmental impacts of the implementation of the NAP; The NAP's contribution to Viet Nam's sustainable development goals (SDGs)</p> <p>3) The need for international assistance</p> <ul style="list-style-type: none"> <li>- Financial support</li> <li>- Strengthened policy capacity and human resources for CCA</li> <li>- Improved resilience and safety from increasing CC-induced natural disasters</li> </ul>





## *CHAPTER II.* **CLIMATE CHANGE IN VIET NAM**

<b>2.1. The trend of climate change observed in Viet Nam</b>	<b>11</b>
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<b>2.3. Impacts of CC on Vietnam</b>	<b>19</b>



## II. Climate change in Viet Nam

### 2.1. The trend of climate change observed in Viet Nam

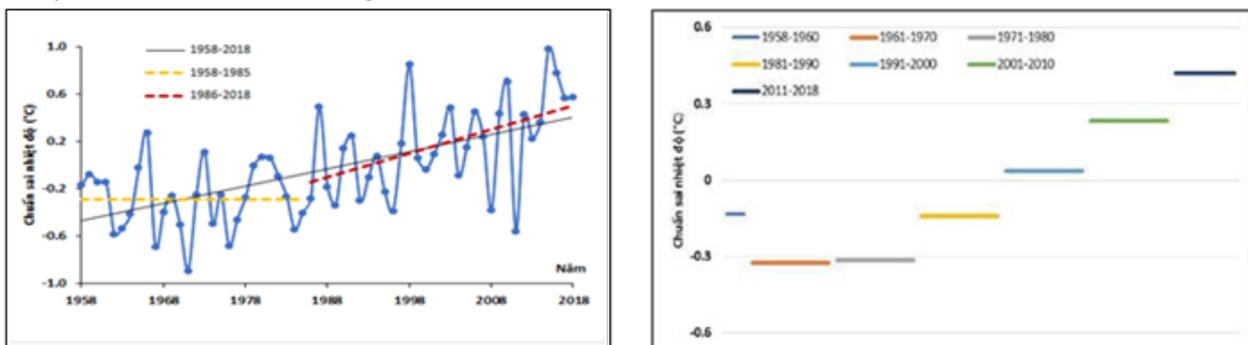
#### 2.1.1. Trends of change in climate factors

##### 1) Change in temperature

##### a) Change in mean temperature

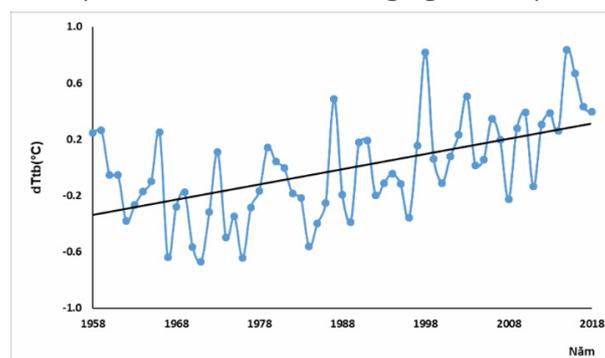
On a national average, the total temperature increase was  $0.89^{\circ}\text{C}/60$  years (1958-2018), averaging  $0.15^{\circ}\text{C}$  per decade, which was at the low end of the global mean temperature increase of  $0.15\text{-}0.2^{\circ}\text{C}$  per decade in the recent period (IPCC, 2018). However, the increase rates were very different when considering two half periods: in the first 27 years (1958-1985) the increase was very little, by only  $0.15^{\circ}\text{C}$ , averaging  $0.056^{\circ}\text{C}$  per decade. However, in the later 33 years (1986-2018) the increase was up to  $0.74^{\circ}\text{C}$ ; averaging  $0.22^{\circ}\text{C}$  per decade (Figure 2.1a).

While the overall increase of the annual mean temperature was gradual over the decades, the strongest increase was in the last decade (2011-2018). In particular, the most recent years were considered to be the years with the average max temperatures of the country since the monitoring data was initially collected in 1958, with over 30% of the stations nationwide recording the maximum temperatures in Viet Nam (Figure 2.1b).



**Figure 2.1.** Standard deviation of mean temperature in a year and a period nationwide  
*Source: (Ministry of Natural Resources and Environment, 2021b)*

The annual mean temperature observed at coastal and island stations increased in line with the national trend, by  $0.67^{\circ}\text{C}$  in the period 1958-2018, averaging  $0.11^{\circ}\text{C}$  per decade. (Figure 2.2).



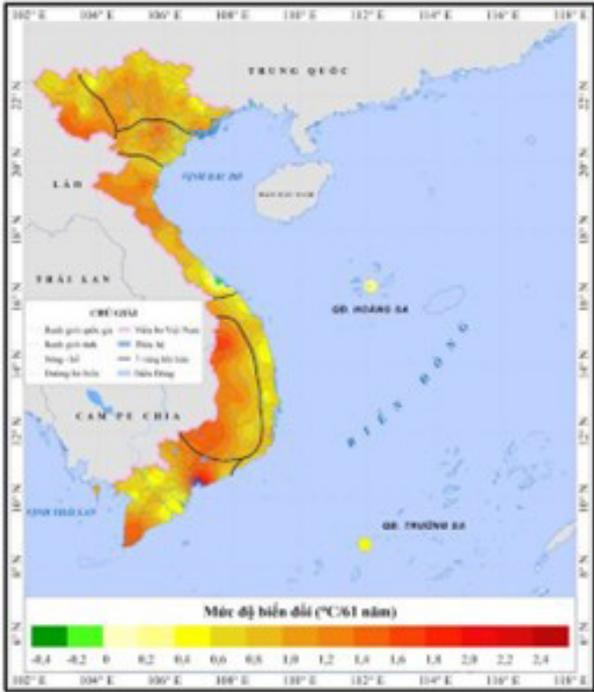
**Figure 2.2.** Standard deviation of annual mean temperature at coastal and island stations of Viet Nam, 1958-2018  
*Source: (Ministry of Natural Resources and Environment, 2021b)*

The annual mean temperature increased at most of the monitoring stations, mostly ranging from 0.4 to 1.6°C in 61 years. In mountainous regions located deep in the mainland, the temperature increased faster than in coastal plains and islands (Figure 2.3). Temperatures increased the most in autumn and least in summer and spring (Table 2.1).

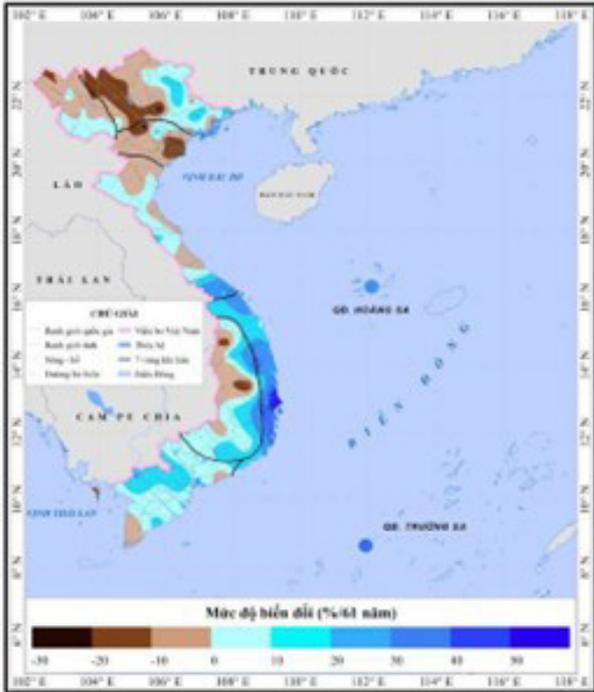
**Table 2.1.** Mean temperature change (°C) over 61 years (1958-2018), by climate zones

Climate zones	Winter	Spring	Summer	Autumn
North West	1.1	0.8	0.9	1.3
North East	1.0	0.8	0.8	1.1
Northern Delta	0.9	0.9	0.7	1.2
North Central	0.8	0.9	0.8	1.3
South Central	0.6	0.4	0.6	0.9
Central Highlands	1.3	0.7	1.0	1.4
South	0.8	0.9	1.1	1.1

Source: (Ministry of National Resources and Environment, 2021b)



**Figure 2.3.** Annual mean temperature changes in 1958-2018



**Figure 2.4.** Annual rainfall changes in 1958-2018

Source: (Ministry of National Resources and Environment, 2021b)

## **b) Change in temperature-related extremes**

- *The max temperature of the year* increased in most of the country, mostly by 0.2-1.7°C; increased relatively much in the Northern Delta, in the South of the Northeast region, in the North of the North Central region, and in the East of the South region, up to 2.1°C in some places; increased relatively little in the Northwest region, in the South Central region and in the West of the Central Highlands.

Most max temperatures were recorded in recent years: 43.0°C in April 2019 at Tuyen Hoa station (Quang Binh); 41.8°C on May 22, 2020, at Lao Cai station. Viet Nam's highest temperature record was 43.4°C on April 20, 2019, at Huong Khe station (Ha Tinh). Temperature records were mainly observed in El Nino years (1987, 1997, 2010, 2015, 2017, 2019).

- *The min temperature of the year* increased nationwide with the most increase of 1.8°C in the Central Highlands, 1.5°C in the Northwest, 1.3°C in the North Central Coast, 1.2°C in the Northeast and the South; and with the least increase of 1.0°C in Northern Delta and South Central Coast regions.

The record for the min temperature was -4.7°C on January 2, 1974 at Co Noi station (Son La). In 2008, the North of Viet Nam experienced an extreme and damaging cold spell lasting 38 days (from January 13 to February 20): ice and snow appeared on top of Mau Son mountain (Lang Son) and Hoang Lien Son mountain (Lao Cai), the min temperature was as low as -2-3°C. The 2015-2016 winter experienced a widespread extreme and damaging cold in the North on the high mountains, the min temperature in Sa Pa was -4.2°C, Mau Son -4.4°C, Pha Din -4.3°C; ice and snow appeared in many places, including places such as Ba Vi (Hanoi) and Ky Son (Nghe An province) for the first time ever.

- *The number of hot days* (days with  $T_x > 35^\circ\text{C}$ ) increased in most of climate regions, commonly 10-40 days, relatively many in the South of the Northeast region, the Northern Delta, the North Central and the South Central regions.

- *The number of extreme and damaging cold days*: The number of extreme cold days (mean temperature  $< 15^\circ\text{C}$ ) decreased remarkably, mostly 10-25 days/58 years. The number of damaging cold days (mean temperature  $< 13^\circ\text{C}$ ) decreased in the Northern climate zone, mostly 5-20 days/58 years.

## **2) Change in rainfall**

### **a) Changes in total rainfall**

The annual mean rainfall of the country increased slightly, with an increase of 2.1% over the period of 61 years; it increased in almost all the Southern area, the most in the South Central region; and decreased in most of the Northern region and Western parts of the Central Highlands region (Figure 2.4).

Rainfall increased the most in winter, and decreased in autumn and summer in Northern climate zones (Table 2.2).

**Table 2.2.** Rainfall changes (%) in climate zones, 1958-2018

Climate zones	Winter	Spring	Summer	Autumn
North West	41.4	9.9	-4.3	-17.3
North East	34.3	-0.7	1.4	-16.0
Northern Delta	13.8	2.7	-0.9	-27.1
North Central	16.8	13.0	8.6	-12.1
South Central	82.2	23.0	8.9	11.3
Central Highlands	40.3	14.6	0.5	7.4
South	97.4	7.5	2.5	3.8

Source: (Ministry of Natural Resources and Environment, 2021b)

### b) Changes in rain-related extremes (1961-2018)

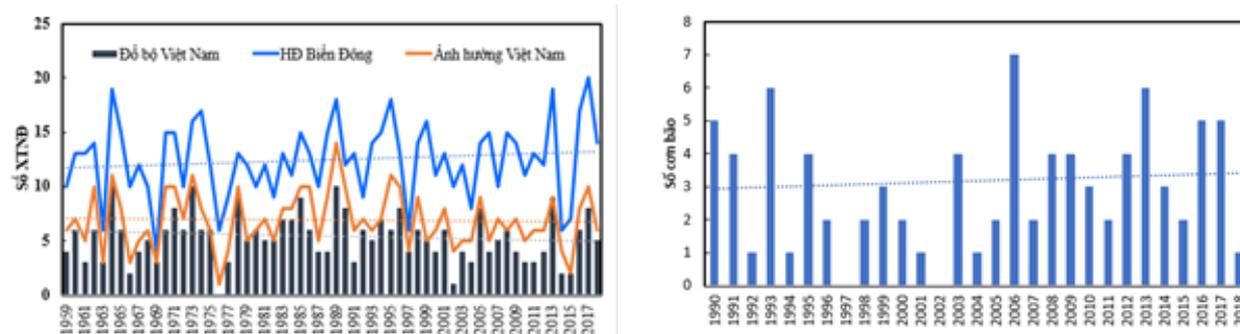
- *The number of heavy rain days (rainfall  $\geq 50$  mm):* Increased in North, North Central, South Central regions, and decreased in Central Highlands and Southern regions; common fluctuation level (increase/decrease) ranged from 3-day decrease to 5-day increase. The number of days with heavy rain increased the most (10.4 days) at Ba To station (Quang Ngai) and decreased the most (12.8 days) at Cang Long station (Tra Vinh).

- *Extreme rainfall:* The maximum 1-day rainfall (Rx1day) increased in the centre of the Northeast, most of the Central Coastal provinces, the Central Highlands and the Southeast region, commonly by 20-60%; and decreased in most of the provinces in the Northern Delta, part of the North Central Coast, the Southernmost Central Coast and the South West regions.

The maximum 5-day rainfall (Rx5day) increased in most of the country, commonly by 5-40%, increased the most in the Central region; decreased in the Northwest, part of the Northeast, Thanh Hoa, Quang Tri, Northern provinces in the Central Highlands, and South West, commonly by 2-20%.

### 3) Changes in storms and tropical depressions

The number of storms and tropical depressions occurring in the East Sea fluctuated over the years. The annual highest numbers of storms were 20 in 2017; 19 in 1964 and 2013; 18 in 1989 and 1995; only 4 in 1969, and 6 in 1963, 1976, 2014, 2015 (Figure 2.5a). The number of storms and tropical depressions that made landfall or directly affected Viet Nam also fluctuated similarly.



**Figure 2.5.** Frequency of storms and tropical depressions in 1959-2018 and frequency of strong storms in 1990-2018 in the East Sea

Source: (Ministry of Natural Resources and Environment, 2021b)

#### Box 2.1. Summary of the extent and trend of climate change in Viet Nam

- The annual average temperature nationwide increased by 0.89°C in 1958-2018, it increased by 0.74°C in 1986-2018.
- Annual rainfall across the country increased by 2.1% in 1958-2018; increased in Southern climate zones but decreased in Northern climate zones.
- Maximum temperature increased mostly over the country, many temperature records were recorded in recent years.
- The number of hot days increased across the country.
- The number of extreme and damaging cold days decreased in the Northern climate zones.
- The number of drought months increased in the North, decreased in the Central and South, with the largest increase in the Northern Delta, and the largest decrease in the South Central Coast.
- Maximum rainfall (Rx1day, Rx5day) decreased in the Northern Delta and increased significantly in the South Central Coast and Central Highlands.
- The number of strong storms tended to increase.

Source: (Ministry of Natural Resources and Environment, 2021b)

The number of storms and tropical depressions happening in the East Sea tended to increase slightly while the number of storms and tropical depressions that directly affected and made landfall to Viet Nam did not show a clear trend. In the period 1990-2018, there were 86 strong storms (level 12 and above); on average there were 2-3 storms per year. Strong storms tended to increase slightly (Figure 2.5b) and happen later in the year, with a more deviated path to the South, and make landfall more often in the South.

The occurrence of storms and tropical depressions that impact Viet Nam in recent years was unusual. Storms named Son Tinh (Ofel) (October 2012) and Haiyan typhoon (October 2012) had unusual trajectories as they made landfall in the North at the end of the storm season.

### 2.1.2. Trends of sea level change

- *Sea level change, according to monitoring data at oceanographic stations:* The sea level at most of the monitoring stations (13/15) increased, with the largest increase rate of about 6 mm/year at Cua Ong, Bach Long Vy and Con Dao stations. Meanwhile, it decreased at Co To and Hon Ngu stations. On average, along the coastline of Viet Nam, the sea level increased by about 2.7 mm/year (Figure 2.6).

- *Sea level change, according to satellite data:* The mean sea level in the whole East Sea increased by 4.1 mm/year in the period 1993-2018. The largest increase of 7.2 mm/year was in the Central part of the East Sea. The area with less increase was the Northeast of the East Sea (west of Luzon island) and the area of the Spratley Islands.

The water level along the coast of Viet Nam increased the most in the provinces from Quang Ngai to Binh Thuan (4.2--5.8 mm/year); increased less in provinces from Ho Chi Minh City to Tra Vinh (2.2--2.5 mm/year). On average, the water level of the entire coastal strip of Viet Nam increased by about 3.6 mm/year (Figure 2.7).

#### Box 2.2. Summary of sea level change trends in Viet Nam

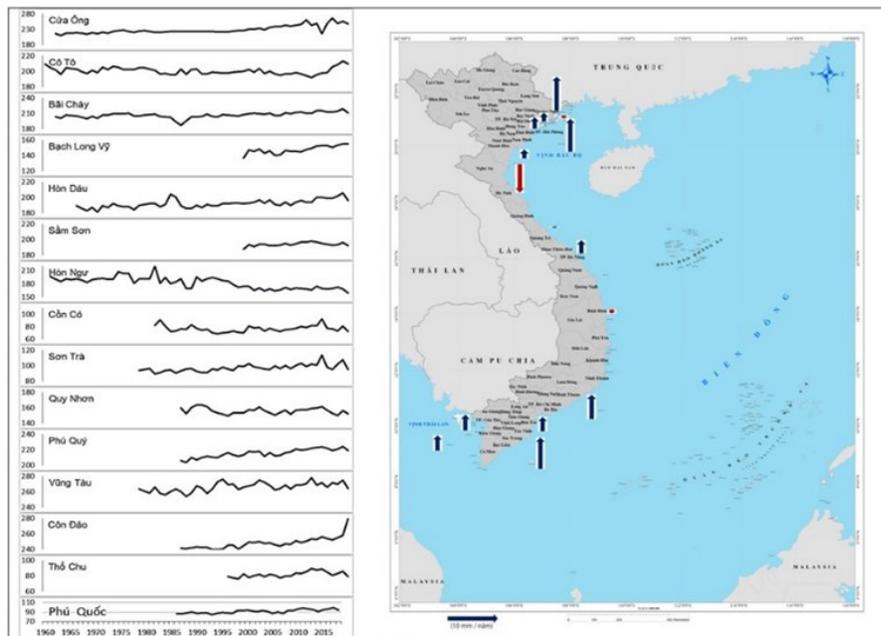
##### **According to monitoring data at oceanographic stations:**

- Water level at most stations increased.
- Cua Ong station saw the highest increase (6.5 mm/year).
- Hon Ngu and Co To stations saw a decrease trend (5.7 and 0.6 mm/year).
- Con Co and Quy Nhon stations did not show a clear trend.
- On average, the water level at stations increased by about 2.7 mm/year.
- In the period 1993 - 2018, the mean water level increased by about 3 mm/year.

##### **According to satellite data for the period 1993- 2018:**

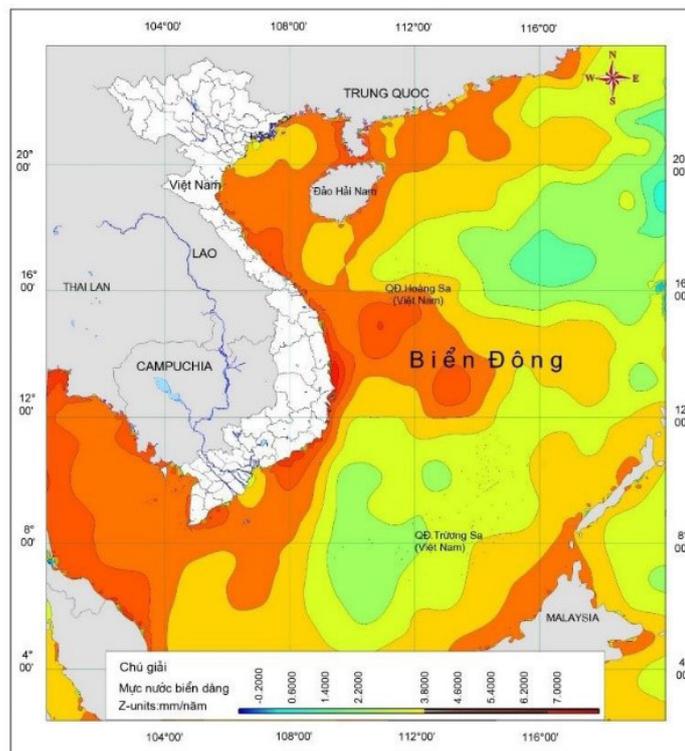
- The mean water level of the whole East Sea increased (4.1 mm/year).
- The water level in the Central part of the East Sea increased the most (6-7.2 mm/year).
- The mean water level along the coast of Viet Nam increased (3.6 mm/year).

Source: (Ministry of Natural Resources and Environment, 2021b)



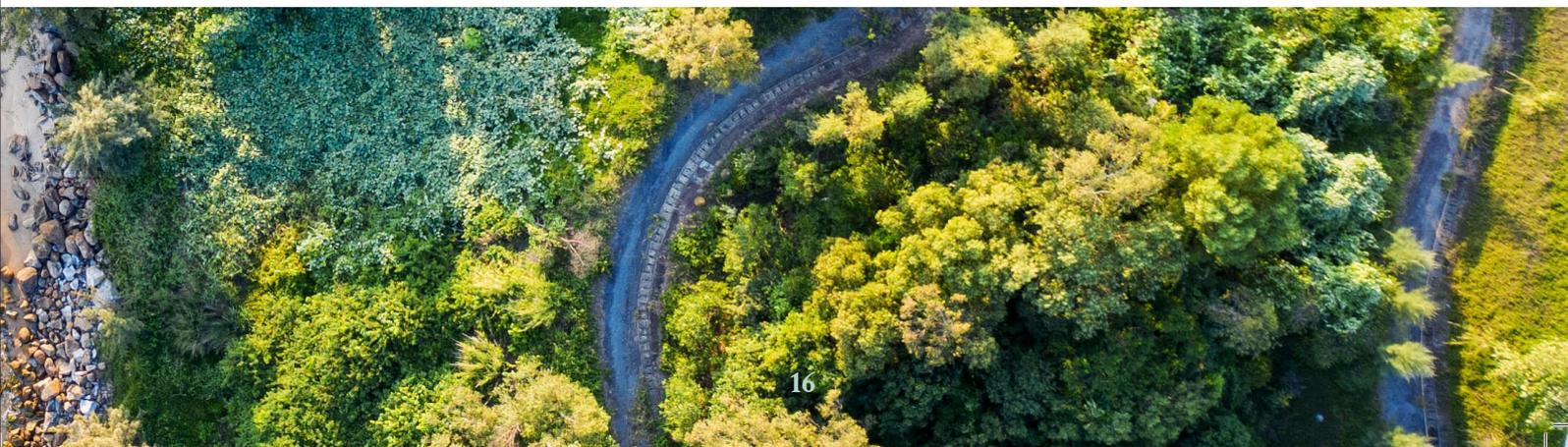
**Figure 2.6.** Trends of sea level change at oceanographic stations (1961-2018)

Source: (Ministry of Natural Resources and Environment, 2021b)



**Figure 2.7.** Trends of sea level change in the East Sea according to satellite data (1993-2018)

Source: (Ministry of Natural Resources and Environment, 2021b)



## 2.2. Forecasted future climate change

### 2.2.1. Climate change scenarios for Viet Nam to the end of the 21st

#### 1) Temperature scenarios

The annual mean temperature in all climate zones increased compared to the base period (1986-2005). According to the RCP4.5 scenario (medium): The annual average temperature nationwide in the middle of the century will increase by 1.2-1.7°C; by the end of the century, it will increase by 1.6-2.4°C. According to the RCP8.5 scenario (high): The annual mean temperature nationwide in the middle of the century will increase by 1.7-2.3°C; by the end of the century, it will increase by 3.2-4.2°C. The temperature in the North increases more than in the South.

Extreme temperatures will increase in all climate zones. By the end of the century, according to the medium scenario, the annual average max temperature will increase by 1.7-2.6°C; the common increase in the North will be 2.0-2.6°C, and 1.7-2.9°C in the South; the annual average min temperature will increase by 1.7-2.1°C. According to the high scenario: the annual average max temperature will increase by 3.2-4.7°C, the highest increase will be in the Northern mountainous provinces, commonly it will increase by 4.0-4.7°C; the average min temperature will increase by 3.3-4.1°C. The annual average min temperature will increase faster than the max temperature.

#### 2) Rainfall scenarios

Annual rainfall will increase in all climate zones. Rainfall in rainy and dry seasons will increase in most of the country. According to the medium scenario: Annual rainfall will increase by 10-15% by the middle of the century and 10-20% by the end of the century. According to the high scenario: annual rainfall will increase by 10-15% by the middle of the 21st century and 10-25% by the end of the century; rainfall may increase by over 40% in a part of the Northeast region.

Extreme rain will increase. According to the medium scenario, by the end of the century, the largest 1-day rainfall will increase by 20-30%, possibly up to 30-40% in most of the North. According to the high scenario, by the end of the century, the largest 1-day rainfall will increase by 25-40%, possibly up to 40-50% in the North.

#### Box 2.3. Summary of climate change scenarios for Viet Nam

- **Temperature:** According to the medium scenario, the annual mean temperature will increase by 1.9-2.4°C in the North and 1.5-1.9°C in the South. According to the high scenario, the increase will be 3.5-4.2°C in the North and 3.0-3.5°C in the South. Extreme temperatures tends to increase obviously.
- **Rainfall:** According to the medium scenario, annual rainfall will increase by 10-20%. According to the high scenario, the largest increase will be over 40% in a part of the Northern region. Extreme rainfall (Rx1 day, Rx5day) will increase nationwide under both scenarios. By the end of the century, extreme rainfall will commonly increase by 20-40% compared to the base period.
- **Monsoon and some extreme phenomena:** The number of strong to very strong storms tends to increase. The summer monsoon will end later with stronger intensity (0.2±0.3 m/s). The number of extreme and damaging cold days in the North and North Central region will decrease. The number of sunny and extreme hot days will increase over most of the country, the highest increase will be in the North Central, South Central and South regions. The number of drought months in the dry season will increase across the country, but decrease in part of the Northwest, Central region and the Southernmost part of the South.

Source: (Ministry of Natural Resources and Environment, 2021b)

### **3) Scenarios for some climate extremes**

- *The number of storms* and tropical depressions will be less variable but more concentrated at the end of the storm season, which is the period when storms are mainly active in the South. Strong to very strong storms tend to happen more.

- *The summer monsoon* will have variability in terms of start time, but will end later; and have a higher intensity than the base period.

- *The number of extreme and damaging cold days* in the Northern mountainous provinces, the Northern Delta, and the North Central region will all decrease.

- *The number of hot days* (max temperature > 35°C) and extreme hot days (max temperature > 37°C) will increase across the country, with the most in the North Central, Northern Delta and Southern regions.

- The number of drought months will increase in the North Central Coast, the Central Highlands, part of the Northern Delta and the South Central Coast but decrease in the North and Central region.

### **4) Scenarios for sea level rise**

According to the medium scenario: By 2050, the sea level is likely to rise by 22 cm (14 cm-30 cm) in the Mong Cai-Hon Dau coastal area; by 24 cm (14 cm-31 cm) in the Spratly Islands area; the mean rise of the whole coastal strip will be 23 cm (13 cm-31 cm). By 2100, sea level rise is likely to be 52 cm (33 cm-75 cm) in the Mong Cai-Hon Dau coastal area, 57 cm (33 cm-83 cm) in the Spratly Islands; the mean rise of the whole coastal strip will be 53 cm (32 cm-76 cm).

According to the high scenario: By 2050, sea level is likely to rise by 26 cm (18 cm-35 cm) in the Mong Cai-Hon Dau coastal area; by 28 cm (20 cm-37 cm) in the Spratly Islands area; the mean rise of the whole coastal strip will be 27 cm (19 cm-36 cm). By 2100, sea level rise is likely to be 72 cm (49 cm-101 cm) in the Mong Cai-Hon Dau coastal area; 77 cm (50 cm-107 cm) in the Spratly Islands area; the mean rise of the whole coastal strip will be 73 cm (49 cm-103 cm).

### **5) Risk of flooding/inundation due to sea level rise**

If the sea level rises by 100 cm, there will be a risk of flooding areas as follows: 47.3% of the Mekong Delta area, in which Ca Mau and Kien Giang are the two provinces at highest risk of flooding (respectively 79.6% and 75.7% of the area); about 13.2% of the Red River Delta area; 1.9% of Quang Ninh province area; 1.5% of area of the Central Coast provinces from Thanh Hoa to Binh Thuan, of which, Thua Thien Hue has the highest risk (5.5% of the area), Binh Thuan is the province with the lowest risk of flooding (0.2% of the area); about 17.2% of Ho Chi Minh City area; 4.8% of Ba Ria-Vung Tau area.

## **2.2.2. Scenarios based on global targets of 1.5°C and 2.0°C**

Climate projections are made to assess the climate in Viet Nam in the context where the whole world joins hands to implement the Paris Agreement to maintain the global temperature increase at below 2.0°C, or strive to keep it below 1.5°C by the end of the century.

### **1) Global temperature increase of 1.5°C**

In the case that the whole world adheres to the best of the Paris Agreement, the global mean temperature increase by the end of the century could be limited to 1.5°C compared to the pre-industrial period. If so, the annual mean temperature in Viet Nam is estimated to increase by 0.9°C-1.2°C, in which the temperature in the North will increase faster than in the South. The annual average max and min temperature will increase by 0.9-1.1°C in the North and 0.8°C-1.0°C in the South. The annual numbers of hot and sunny days could increase by 10-30 days, the number of extreme cold days would decrease, commonly by 10-20 days.

Annual rainfall across Viet Nam would increase by 5-15%, although there will be some areas in the North where rainfall may decrease slightly. The largest 1-day and 5-day rainfalls could increase by 20-60% and 10-60% respectively. Extreme rainfall in the Southern region may increase more than in other areas.

The sea level along the coast of Viet Nam would rise by 13 cm (9 cm-18 cm), the highest rise of 14 cm (9 cm-19 cm) will be in the Paracel Islands and Spratly Islands.

## **2) Global temperature increase of 2,0°C**

If, by the end of the century, the global mean temperature increase could be kept below 2.0°C compared to the pre-industrial period, the annual mean temperature in Viet Nam would increase by 1.3°C-1.9°C, in which the Northern region will increase the most. The average max and min temperature will increase by 1.2-1.9°C and 1.2-1.6°C respectively, the largest increase will be in the North and North Central. The number of hot and sunny days will increase by 20-50 days commonly; the number of extreme cold days will decrease by 5-10 days commonly.

Annual rainfall would increase by 5-15 commonly. The largest 1-day and 5-day rainfalls would increase nationwide, by 20-70% and 30-70% respectively, in which rainfall will increase more in the Southern region.

The sea level throughout the coast of Viet Nam would rise by 23 cm (15 cm-32 cm), with the highest in the Paracel Islands and Spratly Islands, possibly by 24 cm (16 cm-33 cm).

## **2.3. Impacts of CC on Viet Nam**

### **2.3.1. Increasing CC-induced risks**

Viet Nam is identified as one of the countries most affected by CC. Increased exposure to hazards of people and property is the main driver of the increase in long-term economic losses from weather and climate-related disasters (IMHEN and UNDP, 2015).

The extent of vulnerability to CC varies from region to region. The Central Coastal areas and the Mekong Delta have high exposure to the impacts of CC but have moderate sensitivity to CCs. Meanwhile, in the Northern mountainous area, though the exposure is not high, its poverty rate is high, so the sensitivity is high (Gass et al., 2011).

With a coastline of 3,260 km and islands and seas, Viet Nam suffers the most risks and potential impacts related to CC and sea level rise. Risks are higher in deltas and large urban areas, especially coastal cities with high population density, urban/spatial planning not taking into account CC, and high concentration of assets, infrastructure works and populations prone to damages.

The Northern mountainous region and the Central mountainous region are at higher risk of flash floods and landslides. Meanwhile, the Central Coast and South Central Coast, the Northern Delta, the Midlands and the Central Highlands are at higher risk and more vulnerable to drought, water scarcity and increasing desertification (IMHEN and UNDP, 2015). The Mekong Delta is also under impacts of inundation due to sea level rise and land subsidence due to geological subsidence, reduced alluvium to the delta, and over-extraction of groundwater. Over the past 25 years, the area has subsided by an average of 18 cm. The land subsidence rate ranges from 1.1-2.5cm/year, about 10 times faster than the rate of sea level rise (Minderhoud et al., 2017). It is predicted that with the current rate of groundwater extraction, the Mekong Delta's subsidence may reach up to 88 cm by 2050.

The poor, ethnic minorities, people with climate-dependent incomes, the elderly, women, children, and sick people are most vulnerable to CC (McElwee et al., 2010). Ethnic minority women are highly vulnerable to the adverse impacts of CC due to their limited access to education and opportunities to engage in non-farm work (UN Women, 2016).

The fields at high CC-induced risk are agriculture, food security, biodiversity, water resources, public health, housing and technical infrastructure, these sectors/fields are highly exposed to and sensitive to natural disasters and extreme climate events. CC is an existential threat to the goal of hunger eradication, poverty reduction and sustainable development.

An increase in extreme weather events leads to increased risks to vulnerable regions, sectors and groups. In the future, due to the impacts of CC and sea level rise, the potential flooding would lead to the loss of agricultural land; water for agriculture, domestic and industrial purposes would be affected by saline intrusion, seriously affecting local people's lives. (Ministry of Natural Resources and Environment, 2016a).

## **2.3.2. Impacts of climate change on different sectors**

### **1) Impacts on natural resources and environment**

#### **a) Impacts of climate change on water resources**

Water resources suffer the heaviest and most direct impacts of CC, leading to problems in people's livelihood, economy and environment. For example, the recent 2014 El Nino, which was prolonged till 2016, was a strong and record-long El Nino, resulting in drought and water scarcity in the majority of areas of Viet Nam, especially in the South Central, Central Highlands, Southeast and Mekong Delta in the 2015-2016 dry season. It was followed by a drought and salinity intrusion in the 2015-2016 dry season, which was also considered as serious as the one in 2016.

According to CC scenarios, compared to the period 1986-2005, the annual flows on the Red River-Thai Binh River, Ma River, Ca River, Thu Bon River, Ba River, and Mekong River (to Kratie) systems tend to increase by about 4-132%. The flow in flood season will increase by 5-178%. The flows in the dry season tend to increase by about 5-191%. Particularly, the flows in dry season on the Red River-Thai Binh River in the period 2016-2035 tend to decrease slightly by about 0.05% according to the medium scenario (Ministry of Natural Resources and Environment, 2021a).

Droughts may be more frequent and severe in the Central region. Saline intrusion will be especially severe in the Mekong Delta. If the sea level rises by 1 m, about 1.77 million ha (45% of the land area) will be at risk of saline intrusion (Tran Tho Dat, 2013). By the end of the 21st century, with the salinity of 1‰, the saltwater can intrude as far as over 20 km (inland) in Dong Nai, Tien and Hau rivers, approximately 10 km in Thai Binh river (IMHEN and UNDP, 2015).

CC increases and worsens flooding. The highest annual flood peak may increase continuously in most river basins, except for some areas such as the lower basins of Red River-Thai Binh River and Ba River thanks to the regulation of lakes and dams. Flash floods and landslides will also happen more and more fiercely in the Northern mountainous region and the Central Highlands.

CC can reduce the absolute elevation of groundwater levels, reduce the amount of groundwater storage and increase the area of saline groundwater (National Centre for Water Resources Planning and Investigation, 2013a), (National Centre for Water Resources Planning and Investigation, 2013b).

#### **b) Impacts of climate change on land resources**

Changes in weather conditions (temperature, rainfall, extreme climate events, etc.) have resulted in the increasing land areas affected by saline intrusion, drought, desertification, inundation, erosion, washout, landslides—all occurring more frequently.

- *Dry land*: In the South, Central Highlands, and South Central, hot weather and prolonged drought have resulted in increased risk of arid land leading to a decrease in soil quality. The South Central Coast is the driest region in the country. Some places like Ninh Thuan and Binh Thuan often face prolonged drought. Currently, the area of dry land of the region accounts for a significant proportion of agricultural land, it was 1,360,745 ha in 2020, and forecasted to be 1,366,519 ha

in 2030, 1,489,193 ha in 2050. The forest land area of the region predicted to be dry by 2050 is 1,014,962 ha (an increase of 62,689 ha compared to 2030 and 191,551 ha compared to present); the land area for annual and perennial crops predicted to be dry by 2050 is 469,300 ha (an increase of 58,393 ha compared to 2030 and 135,250 ha compared to present) (Mai Hanh Nguyen, 2015).

- *Eroded and washed away soil*: Increased heat risk in the dry season and increased rainfall in the rainy season can cause more erosion. In the Northwest region, the sloping land area accounts for 98%, so its risk of land degradation due to erosion is very high. Every year, during the 6 months of the rainy season, the amount of soil eroded accounts for 75÷100% of the total amount of erosion in the whole year. In the Central region, the rain mostly in September-December is the main cause of erosion and wash away (Mai Hanh Nguyen, 2015).

- *Landslides in riverside and highlands* occur frequently in Viet Nam and the risk is increasing due to CC. CCs cause increased rainfall during the rainy season and higher flood flows. Severe landslides occur in many places along the systems during the rainy and flood season, especially downstream of the Red, Me Kong, Tra Khuc and Ba rivers (Mai Hanh Nguyen, 2015).

- *Flooded land*: Natural disasters, floods and high tides occurring continuously along with sea level rise result in increased inundation. In the Central region, an average of around 120,000 ha of rice and more than 62,000 ha of cash crops are flooded every year. In the South, in the period 2004-2007, the tidal peak level in the Hau River in Can Tho city increases by 4 cm each year, causing frequent flooding in some roads. In Ho Chi Minh City, since 1999, the tide peak has continuously increased, from 1.22 m to 1.55 m (Mai Hanh Nguyen, 2015). Inundation due to sea level rise is one of the main threats to land resources of provinces and cities in the delta and coastal areas of Viet Nam.

### **c) Impacts of climate change on forest resources**

Despite Viet Nam's forest coverage continuing to increase, the quality of natural forests is decreasing (World Bank, 2019a). CC and extreme weather events that occur frequently and irregularly will significantly affect forest resources, causing forest vegetation and forest ecosystem to change both in area and distribution of forest types.

#### **- Impacts on changes in area and distribution of forest types**

*Tropical moist semi-deciduous dense forests*: The current tropical moist semi-deciduous dense forest ecosystem covers an area of about 3,827 million ha (2005), accounting for about 11.4% of the country's total area. With the scenario of a temperature increase by 0.89°C and a rainfall increase by 2.5%, the area of this type of forest will be severely reduced, with the total remaining area is estimated to be only about 1.3 million ha (about 3.89% of the total natural area) by 2050. The distribution of forest types will also change, the area in the North Central region will gradually disappear and its main distribution area will be in the South Central Coast and the Central Highlands (Vu Tan Phuong & Nguyen Viet Xuan, 2008)

*Mangrove and Melaleuca forests*: Mangrove ecosystems are distributed close to the coasts and are heavily influenced by such factors as climate and hydrology (water flow, salinity, etc.) (Vu Tan Phuong & Nguyen Viet Xuan, 2008). CC changes the hydrological, oceanographic and sea wave regimes, which, together with sea level rise, narrow down the area of the mangrove ecosystem. The area of mangroves is shrinking because some plant species cannot adapt to changes in environmental conditions, such as tidal floods, salinity and temperature, in a timely manner. Mangrove forest ecosystems are specifically sensitive to CC impacts. Storms with strong intensity and increased frequency also destroy mangrove forests. Sea level rise worsens the saline intrusion in estuaries and coastal areas, which is the worst threat to the melaleuca forest ecosystem. Water and soil contaminated with higher-than-allowed salinity cause the melaleuca forest plants to die or the forest area to be narrowed. According to the

CC scenario, when the sea level rises by 1 m, it was estimated that about 300 km<sup>2</sup> (about 15.8% of the total mangrove area of Viet Nam) would be affected (ADB, 2013).

### ***- Impacts on the risk of forest fire***

In Viet Nam, there are about 6 million ha of forests prone to forest fire. In the CC context, the temperature is increasing and droughts tend to increase, so the potential risk of forest fire becomes increasingly severe.

In the North Central region, the risk of forest fires will increase in the coming decades. The months at high risk of forest fires are May, June and July. The risk of forest fires in 2020 was higher than in 2000 with an increase of 6-40%; in 2050 it will increase by 16-52% and in 2100 by 51-85%. In the Northwest region, the risk of forest fire increases highly in December, January, February and March, especially December and January. The risk of forest fires in these months in 2020 increased by 5-41%; in 2050 it will increase by 16-35% and in 2100 by 25-113%. In other regions, the risk of forest fires also increases. In the Northeast region, the risk of forest fire increases highly in January, February and March; in the South Central region it is from March to June; in the Central Highlands it is from March to May, in Southeast region and Mekong Delta it is from January to April (Thai Nguyen University of Agriculture and Forestry, 2019).

In the Northwest region, the number of days at high risk of forest fires will increase from 61 days/year in 2000 to 80 days/year in 2090. Also according to this study, in 2090, Son La will be the province at highest risk of forest fires with 101.8 days/year, Hoa Binh will rank second with 77.4 days/year, followed by Dien Bien with 70.7 days/year and Lai Chau at lowest risk with 55.2 days/year (Le Sy Doanh & Be Minh Chau, 2014).

### ***- Impacts on the risk of development and spread of forest pests and diseases***

Higher temperature, high humidity, more frequent rains, strong wind and degraded soil create favourable conditions for pests, insects and diseases to develop and spread into very dangerous diseases/epidemics, affecting the conservation and development of forest ecosystems in Viet Nam. CC provides favourable conditions for pine caterpillars to spread more in the Northeast, Northwest, South Central and Central Highlands regions. The risk of pine caterpillars will increase by about 10% by 2020 compared to 2000, about 13% by 2050 and 31% by 2100 (Nguyen The Nha et al, 2010); the pine top borer is more likely to widespread in the Northeast, Northwest, South Central, Central Highlands, and Southeast regions; bamboo locusts are most likely to cause epidemics in the Southeast and Southwest regions; mosquito bugs are most likely to cause epidemics in the Northern Delta, South Central, and Central Highlands; termites are likely to spread epidemics in most areas (Ministry of Natural Resources and Environment, 2020).

### ***d) Impacts of climate change on island and marine resources***

The marine ecosystem in Viet Nam is being heavily affected by CC, especially the coastal wetlands, typically the mangrove areas in Ca Mau, Ho Chi Minh City, Vung Tau and Nam Dinh. Increased sea water temperature changes the growing season and increases the outbreak of phytoplankton, etc., which changes the environment in a direction that is unfavourable for the growth of seagrass beds. CC increases ocean acidification, and strong storms destroy coral reefs and grasslands, leading to changes in fish species and resources. The mass coral deaths of the past 20 years were due to a number of reasons, including the increased sea temperature.

The islands and groups of islands in Viet Nam have been directly and severely affected by CC and sea level rise which cause inundation in the islands. CC affects biological resources, changing the ecosystems of mangroves, seagrasses and corals on islands nationwide.

### ***e) Impacts of climate change on mineral resources***

Flooding caused by sea level rise can cause soil, rock and ore to be flooded and contaminated with saline and alum, leading to increased production costs. Sea level rise can cause some faults to reactivate, which stimulates the zones to break the water inlets, changing the hydrogeological and engineering geological characteristics of the mine. CC can also facilitate the formation of new ore bodies. Some heavy minerals distributed in solid rocks (precious stones, gold and titanium etc.) easily go into placer. It is possible for some placer deposits and weathered mines to be formed ( Department of Meteorology, Hydrology and CC, 2015).

Coal is the mineral most affected by CC. Coal production and coal mining locations are mostly in high mountains, coastal areas and plains. Some raw materials and production areas are distributed in high terrain areas (mountain slopes, mountains) so they are prone to the impacts of landslides and flash floods.

### ***f) Impacts of climate change on biodiversity***

Viet Nam is one of the 16 countries with the highest levels of biodiversity in the world (ADB, 2013) and is also the second-ranked country in East Asia in terms of the number of threatened species (Rhind, 2012). The area of natural forest with high biodiversity in Viet Nam has decreased significantly. Only about 0.5 million ha of primary forests remain scattered in the Central Highlands, Southeast and North Central regions, and most of the primary mangroves have disappeared. Most of the beautiful birds and large mammals are gone. Many forests have been declining, not only in area, but also in quality of habitat (World Bank and Development Partners, 2011). Out of a total of 310 identified major mammal species, 78 are being threatened (based on the level of national threat), of which 46 are internationally recognised.

CC and sea level rise can change the structure and distribution of biological species and the level of biodiversity of ecosystems in Viet Nam. Increased temperature will change the distribution area and structure of the biome, causing the dispersion of aquatic and marine resources (Ministry of Natural Resources and Environment, 2003). Sea level rise and increased storm intensity will change the composition of sediments, salinity and water pollution, degrade and threaten mangrove forests and the diverse species (Vo Quy, 2009). Rind (2012) predicted that by 2070 tropical plant species in the mountains in Viet Nam will grow at the areas having an altitude higher than the current altitude by about 100 m to 500 m, and about 100 km to 200 km to the North compared to the current location.

The potential for fishing of seafood will also be reduced in the face of temperature increase, sea level rise, ocean warming and ocean acidification. DARA and Climate Vulnerable Forum (2012) estimated that if the temperature increases by 0.5-0.8°C, the damage to fishing activities in Viet Nam (including marine and inland fishing) will be about USD 3.25 billion in 2030 at 2010 comparative prices.

CC and sea level rise have also threatened genetic resources and directly affected livestock production, and some breeds of pigs and chickens have become much fewer such as I pig, Ba Xuyen pig and Ho chicken (Ministry of Natural Resources and Environment, 2013).

## ***2) Impacts of climate change on agriculture and rural development***

### ***a) Crop production***

Increased temperature, prolonged heat, and increased evapotranspiration rate lead to higher need for watering and may increase plant diseases and change the living conditions of organisms, resulting in the disappearance of some species, as well as the emergence of some new strains and pests. Due to the impacts of CC, Viet Nam's rice and maize production by 2030 may decrease by 8.8% and 18.7% respectively, and by 2050 may decrease by 15.06% and 32.9% (Trinh & Lovell, 2016; Mai Van Trinh & Nguyen Hong Son, 2014).

Sea level rise increases the risk of loss or narrowing of agricultural land, and the risk of saline soil, affecting food security. If the sea level rises by 1 m, up to 38.29% of the natural land area and 32.16% of the agricultural land area will be at risk of inundation in the 10 most flooded provinces in the Mekong Delta (Ben Tre, Long An, Tra Vinh, Soc Trang, Vinh Long, Bac Lieu, Tien Giang, Kien Giang and Can Tho) and Ho Chi Minh City. It is estimated that by 2100, the damage caused by the loss of agricultural land in these provinces and Ho Chi Minh City will be 7.6 million tons of rice/year, equivalent to 40.52% of the total rice production of the whole region. According to the scenario for CC and sea level rise, if rice productivity is kept unchanged, Viet Nam will be at risk of losing 21.39% of the country's rice production by 2100 (Trinh et al., 2014).

#### ***b) Livestock***

CC has had impacts on livestock production, including changes in the production and quality of animal feed, and increased disease outbreaks (M. Melissa Rojas-Downing et al., 2017). The impacts of CC on livestock production are said to be negative and different for each type of livestock. The impacts of CC on pig production have been more pronounced than on other livestock (including cattle, poultry and sheep, etc.). The number of heads in pig production is expected to decrease by about 8.2% (Nguyen et al., 2017).

#### ***c) Forestry***

CC and extreme weather events will significantly affect forestry and forest biodiversity, including: (i) Increased risk of forest fire in all ecological regions, especially the Northwest, North Central and Central Highlands. Forests at high risk of fire include pine forests, melaleuca forests, bamboo forests, eucalyptus forests and dipterocarp forests; (ii) Increased risk of landslides and flash floods in mountainous regions such as the Northeast, North Central Coast, and Northwest; risk of coastal erosion, especially in the Mekong Delta; (iii) Impacts on the distribution of sensitive forest biodiversity, in which mangrove biodiversity will be strongly affected by sea level rise; (iv) Increased risk of pests and diseases in forests, especially monoculture forest planting such trees as acacia, eucalyptus and pine; (v) Impacts on productivity and suitability of planted forests; and (vi) Changes in distribution and decrease in biodiversity, especially species with narrow ecological distribution (Vu Tan Phuong & Nguyen Viet Xuan, 2008) (Pham Minh Thoa et al., 2013) (Be Minh Chau et al., 2008); (Nguyen The Nha et al., 2008).

#### ***d) Fishery***

Saline intrusion significantly reduces freshwater aquaculture area and affects ecological environment quality. Biodiversity in estuaries, mangroves of animals and plants will be changed. The annual economic losses (value) of the fishing and aquaculture sectors, according to the CC scenario to 2050 (at 2012 comparative prices, discount rate of 3%/year), are forecasted to be about VND 115 billion and VND 60 billion respectively (Economic University, 2015).

### ***3) Impacts of climate change on the transport sector***

Storms and heavy rains can cause flooding and erosion, damages to roads and embankments/walls (negative/positive slope), damages to electric and communication equipment, and local flooding in the stations/roads; increased temperature causes damage to asphalt pavements and steel structures and signal/communication systems; sea level rise, high tide may cause flooding to coastal roads and coastal stations. Saline intrusion causes structural corrosion, and equipment damage. Northern mountainous region, Central Coast and Central Highlands are at risk of erosion and landslides; Red River Delta, Mekong Delta are at risk of flooding due to sea level rise; Central coastal provinces are at risk of flooding and erosion due to rain and floods.

Strong storms cause damage to structures and equipment in ports and wharves; droughts cause bank erosion on the inland waterway channel; heavy rains cause partial flooding of ports, damages to equipment and goods in ports; sea level rise affects port infrastructure. Storms, tropical depressions,

fog and heavy rains affect aviation operations, disrupt or stop flight operations, and damage aviation infrastructure and equipment. The South Central Coast provinces are significantly affected; lowland and low-lying coastal airports in the Mekong Delta are at risk of inundation.

Extreme weather events often cause serious losses, directly affecting the safety of infrastructure exploitation and the ability to ensure smooth, uninterrupted transportation.

The biggest climate hazards for the transport sector are landslides and flooding. The road sector is identified as suffering the heaviest losses, followed by the railway sector. The inland waterway and maritime industries are moderately affected, while aviation is assessed to be insignificantly affected. Regions significantly affected include Northern Mountainous region, Central Coast, Central Highlands and Mekong Delta.

#### **4) Impacts on urban development and housing**

CC is a major threat to urban infrastructure and quality of life. In the context of CC, urban areas are predicted to be more affected due to the increase in intensity, frequency and severity of natural disasters.

Coastal cities are vulnerable to natural disasters related to storms, floods and sea level rise, which increase risks to urban assets, livelihoods and infrastructure. Urban areas, industrial zones, coastal economic zones and urban areas in the Mekong Delta will be mainly affected by sea level rise. The area from the North to the South Central Coast is affected by tropical depressions and storms, but coastal cities are more seriously affected by storms than other urban areas. Midland and mountainous cities in the North and Central regions are often affected by floods, flash floods and landslides (Central Steering Committee for Natural Disaster Prevention and Control, 2018).

In urban areas, the solid waste treatment system and the urban water supply and drainage system are the most affected. Increased rainfall will cause flooding in storage points, routes of collection, transportation and transition, disrupting the solid waste treatment process at some times. CC also affects water supply sources (surface water, groundwater) and water supply systems, including focal works and water supply networks (Ministry of Construction, 2017).

Water supply systems in urban areas in the Mekong Delta and the Southern key economic region are affected moderately to greatly, depending on their locations and distances to the sea. In addition, the impacts of CC on urban areas (such as droughts and floods) also affect urban water supply systems. Besides, the adaptive capacity of urban water supply systems is mostly medium and low.

CC and urban development are closely related and often interact negatively. Rapid urban development has a strong impact on the nature and increased frequency and severity of natural disasters. The strong development of urban areas, energy use and construction of infrastructure, high-density buildings all turn cities into energy consumers and create many pollutants. When the ground is gradually "concretised," the space is occupied, the water permeability of the urban areas in the event of heavy rain will decrease. The loss of land from water collection to construction puts existing urban areas and newly planned areas into increased likelihood of flooding due to heavy rains.

#### **5) Impacts on tourism**

Tourism is one of the important economic sectors and is really a driving force for socio-economic development, contributing to the changing face of many remote areas where economic development previously encountered many difficulties.

The impacts of CC on tourism can be classified into three groups: (i) impacts on tourism resources; (ii) impacts on tourism infrastructure and facilities; and (iii) impacts on travel and tourism activities.

CC affects natural ecosystems, sustainability, quality of architectural and historical works, monuments, etc., which are the main objects of tourism activities. CC and sea level rise have a great impact on beaches, which are the main resources of sea and island tourism—the most important type of tourism in Viet Nam. The decline or loss of tourism resources will directly affect the quality of existing tourism products or affect the development of new tourism products.

Storms, floods, coastal landslides, flash floods, landslides in mountainous regions and urban flooding have serious impacts on tourism facilities.

Tourism activities depend a lot on weather conditions. Erratic and extreme weather phenomena are increasingly occurring with higher frequency and intensity due to the influence of CC, which has a negative impact on travel and tourism activities.

In recent years, climate change—with the manifestations of sea level rise, extreme weather and unusual natural disasters—has been threatening many relics located in vulnerable areas such as coastal areas, riverside, Central region and Mekong Delta. It is forecasted that in the coming years, climate change will continue to be the biggest threat to the relic system in Viet Nam, of which many heritage sites were recognised by UNESCO as world heritage sites, such as Hoi An and Hue, My Son, etc.

In addition to the above direct impacts, CC also causes indirect impacts on tourism, such as epidemics and increased input costs of tourism-related industries. Negative impacts of CC on economic development affect the income of society and lead to a decrease in tourism spending.

### **6) Impacts on public health**

Many studies around the world show that CC has been adding and will continue to add to the burden of disease and premature death. One of the main reasons is that humans are being directly exposed to the impacts of CC, especially changes in temperature, rainfall, sea level rise and greater frequency and intensity of extreme weather events. In addition, human health is also indirectly affected by CC, such as changes in water reserves and quality, air quality, food hygiene and other changes in ecosystems. CC also affects the technical infrastructure and health system, affecting the capacity of the health system to provide health care services, especially in the event of natural disasters such as droughts, floods and storms.

**a) Impacts on health due to increasing extreme climate events**, including heat waves and severe and damaging cold spells. For heat waves, people face heat stress from working under high temperatures and humidity, or sunstroke, cramps, fainting, heat exhaustion and even heat stroke, which, if not treated promptly, could lead to death. According to statistics, when the mean temperature increases by 1.0°C, the hospitalisation rate increases by 3.4% among children aged 0-2, and by 4.6% among children aged 3-5. The study showed that the rate of hospitalisation in children under 5 due to respiratory infections increased by 3.8% when the mean temperature increased by 1.0°C (Phung et al., 2018).

Severe and damaging cold spells have many bad effects on human health, especially for the elderly and people with low resistance. In Viet Nam in recent years, in some areas, the min temperature has dropped to -4°C, and long-lasting cold spells have been recorded. Extreme cold spells can cause acute risks such as cold hands and feet, hypothermia or increased risk of chronic respiratory and other illnesses. Especially, the severe and damaging cold spells have a clear negative impact on the health of the elderly, children, the poor and those in poor economic conditions.

In addition to the negative impacts of extreme temperatures, natural disasters, such as storms, floods, droughts and saline intrusion also affect human health. In recent years, the increase of strong storms has affected human health, such as deaths, disappearances, injuries and mental health-related problems.

***b) Impacts on human health due to changes in environmental conditions relating to the impacts of CC:*** environmental changes due to CC such as drought, flooding and sea level rise, etc., cause water scarcity, salinisation of agricultural land, pests and diseases, loss of crops and loss of livelihoods, etc. leading to food shortages or food supply disruptions. Lack of food or disrupted food supply lead to malnutrition and insufficient micronutrient intake among pregnant women and children.

Temperature increase presents favourable conditions for many species of organisms, such as flies, cockroaches and food-borne vectors to develop. In addition, disease transmission period could be year-round. An increase in temperature is often associated with an increased risk of food poisoning and gastrointestinal diseases caused by salmonella.

Changes in the rain regime lead to drought and lack of domestic water, making people face diseases related to contaminated water or water shortages, such as renal calculi (kidney stones), dermatitis and red eye, as well as gastrointestinal diseases such as diarrhoea. Inundation leads to skin and digestive diseases.

Adverse weather patterns often increase the formation of certain air pollutants, affecting human health.

Increased winter temperatures, along with a change in rainfall patterns, which causes floods, are favourable conditions for vectors such as flies, mosquitoes, rats, fleas, ticks and rodents to develop both in number and operation area, leading to an increase in diseases such as malaria, dengue fever, Japanese encephalitis and plague. CC is thought to create favourable conditions for vectors to develop, increasing the likelihood of outbreaks and spread of diseases such as influenza A (H1N1), influenza A (H5N1), influenza A (H7N9), diarrhoea, malaria, dengue, yellow fever, typhoid, viral encephalitis, Japanese encephalitis, severe acute respiratory distress syndrome (SARS), plague and zika (Phung, D. et al., 2018)). Outbreaks of diseases can affect the capacity to provide health services for common diseases leading to public health problems.

## ***7) Impacts on trade***

CC and extreme weather events can affect industrial and commercial zones, infrastructure such as roads, electricity and water supplies for businesses and trading. Heat waves will affect workers, reduce productivity and affect commerce. Some commercial and logistics centres located in low-lying areas where there are harbours and other infrastructure are at risk of flooding due to sea level rise. Commercial centres, logistics and infrastructure in highlands often have potential risks of flash floods and landslides.

The impacts of extreme heat waves, extreme rains, storms, floods, landslides, flash floods and droughts will disrupt business operations, reduce labour productivity, disrupt transportation, and stagnate distribution systems, reduce quality of products and services, and damage facilities. They will also cause a shortage of workers, lack of inputs and increased costs. (VCCI & TAF, 2020).

CC affects export fields such as industry and agriculture. Industrial and commercial areas are vulnerable to sea level rise, floods and storms. The crop is mainly grown in lowland coastal areas and plains, which are at risk of sea level rise and saline intrusion. Increasing temperatures, variable rainfall and extreme weather events including storms, floods and droughts can affect all major crops including rice, coffee and fruit trees. This will be exacerbated by damages to trade-related logistics and transport infrastructure (World Bank, 2022).

Viet Nam's trade-related policies have barely mentioned the impacts of CC on the trade sector (King et al., 2020). Viet Nam's trade policy can reduce the impacts of CC by reducing tariffs to improve access to agricultural digital services and technologies to increase the productivity and resilience of plants (World Bank, 2022).

According to a modelling study on the impacts of CC on Viet Nam's international trade position, Viet Nam's relative competitiveness compared to some countries will improve, but will lose its competitiveness against several competitors (AFD, 2021. Chapter 13 in: Espagne E. (ed.)).

## **8) Impacts on energy**

### **a) Impacts on energy demand**

CC has had strong impacts on energy consumption and demand and has directly affected the production of electricity from coal, oil, gas, hydroelectricity and wind energy. CC not only further increases the level of energy dependence, especially for imported energy sources, leading to supply instability but also has a great impact on the safety and stability of energy supply. It also disrupts, stops or even paralyses the energy supply (Pham Khanh Toan et al., 2011).

Increased air temperature leads to increased energy consumption, seen for example in the use of more cooling devices, especially during heat waves. According to the report of the Asian Development Bank (ADB, 2015), electricity demand in the period 2005-2014 increased by an average annual rate of 12.1%. Forecasting results of CC impacts show that by 2030, primary energy demand will increase by about 391.7 thousand TOE, accounting for 0.17% of total primary energy demand in 2030 (Nguyen Minh Bao, 2015). The increase in electricity demand is also due to other reasons such as population growth and socio-economic growth. Increased extraction of groundwater and surface water, and desalination to meet water demand all increase energy consumption.

Regarding the power system, when the air temperature increases, the load of the power system increases, making the power plants, lines and power stations operate with a higher intensity. With the power transmission system, when the ambient temperature increases, it will affect the transmission capacity of the line. For coal, oil, gas, biomass and even nuclear power plants, when the air temperature increases, the water temperature increases, leading to an increase in the circulating water for cooling the condenser, decreasing the turbine efficiency, and resulting in the waste of fuel (Nguyen Minh Bao, 2015).

### **b) Impacts on energy production and supply capacity**

According to CC scenarios, the number of weak and moderate storms shows a decrease while the number of strong to very strong storms shows an increase (Ministry of Natural Resources and Environment, 2021). The offshore energy and marine shipping industries are at risk of being impacted by CC as extreme weather becomes more common. A new report, "Oceanography climate change: the impact of climate change trends on the ocean," says the offshore energy sector—particularly assets like oil rigs and wind power plants—is likely at a higher risk due to worsening extreme weather conditions, including changes in storm patterns. Offshore facilities may not be designed to withstand such environmental challenges. Inclement weather and tropical storms not only cause unforeseen damage but also limit access to sites after incidents, impede maintenance and repair, increase costs and cause difficulties for skilled workers, especially in areas that have not previously been susceptible to such disruptions (IPCC, 2019).

The coal and mineral industry usually have production, business and mining areas concentrated in high mountains, coastal areas and plains; a number of raw materials and production areas are distributed in areas with high terrain (mountain slopes, mountains). So these areas are easily affected by landslides and flash floods due to heavy and day-long rains. Studies show that these impacts, when increased by CC, also contribute to the devastation of mineral deposits, making it difficult to investigate, evaluate, explore and exploit minerals, greatly affecting the process of mine closure and post-mining environmental recovery.

CC, which causes increased rainfall and floods in the rainy season, increases difficulties for production and mining activities, transportation at mineral mines, and damage to people and

businesses. Typically, the historic heavy rain from July 25 to August 5, 2015, affected most units of the coal and mineral industry in Quang Ninh, causing great damage to production and business. Many coal mines have been flooded with rainwater, such as Mong Duong, Quang Hanh, Nam Mau, and Hon Gai. Most of the truck and railway routes transporting coal to port, specialised roads suffered landslides, damages, etc. Many factories and constructions of many mines were filled with mud (Ministry of Industry and Trade, 2018).

CC affects the electricity production process. Changes in rainfall affect the hydrological regime and river flows, leading to changes in the planning and generation output of hydropower plants. Abnormal rainfall and flows also affect the ability of hydroelectric plants to supply and regulate electricity production plans, causing damages to the electricity supply infrastructure, increasing the cost of new investment, renovation, repair and upgrading of equipment, and the electricity distribution network. In contrast, drought reduces power generation time and power generation efficiency (ADB, 2012).

Sea level rise can have negative impacts on power plants, transmission stations, substations, fuel pipeline systems, mines, coal yards and other energy facilities in coastal areas. Sea level rise and changes in wind speed and cloud as well as extreme weather events can affect the output of wind and solar power projects (ADB, 2012). Saline intrusion can corrode materials used in energy production and distribution. In the future, CC is expected to significantly increase risks to energy (Nguyen Duc Huynh & Le Thi Phuong, 2016).

### **9) Impacts on industry**

Industries, especially processing and manufacturing industries will be affected by CC because raw materials for industry, especially food processing, textile and garment industries will be significantly reduced due to lack of supply from raw material zones in the Mekong Delta provinces, which are expected to suffer the heaviest flooding. This will put pressure on the restructuring of industries in terms of industry type, proportion of processing industry and high technology.

Irregular rainstorms and sea level rise will negatively affect the operation and use of the system of electricity transmission and distribution, drilling rigs, oil and gas pipelines to the mainland, oil supply to oil tankers; increase the cost of maintenance and repair of energy facilities; affect the supply and consumption of energy and national energy security. For the ore mining and processing industry, especially in coastal areas, sea level rise poses the risk of ore saline intrusion, affecting ore quality and the production and business activities of enterprises.

According to a study by the Viet Nam Chamber of Commerce and Industry (VCCI), CC has a negative impact on the production and business activities of enterprises. Increased weather extremes and natural disasters will disrupt production and business, reduce labour productivity and revenue, disrupt transportation channels, increase production costs, stagnate distribution networks, reduce quality product quality and cause damage to facilities and human resources, etc. Enterprises in the Central Coast and Mekong Delta are being affected by disaster risks and CC more than other regions. However, CC not only creates challenges but also offers opportunities for restructuring, rearranging production, creating new products and technologies, and building brands for businesses (VCCI & TAF, 2020).

### **2.3.3. Impacts of climate change on different regions**

#### **1) Deltas**

##### **a) Mekong Delta**

The Mekong Delta is considered one of the three large deltas in the world most vulnerable to the sea level rise. The climate factors have changed obviously. In the period 1958-2014, the annual mean temperature increased by 0.67°C. According to the high CC scenario, the temperature by the end of this century will increase by about 3.4°C, with the number of hot days to increase by 40-60 days; rainfall in the rainy season will increase, but in the dry season it will decrease, and the sea level may rise as much as 100 cm which is likely to pose a threat of permanent flooding over approximately 47.3% of the delta area. If the sea level rises by 100 cm, some 10% of the population in the Mekong Delta will be directly affected due to land loss. The rice growing area will therefore shrink significantly. The areas heavily affected by sea level rise include, for example, Tran Van Thoi (Ca Mau), Hong Dan (Bac Lieu), Nga Nam (Soc Trang), Long My (Hau Giang) and Giao Thanh (Kien Giang). Saltwater penetrating into estuaries (causing saline intrusion), together with droughts, has seriously hit the supply of fresh water and reduced the quality of surface and underground water (Ministry of Natural Resources and Environment, 2021a).

Resolution No. 120/NQ-CP of the Government on Sustainable and Climate Resilient Development of the Mekong Delta in Viet Nam was issued and has gained important achievements including the initial completion of the system of mechanisms and policies to promote the development of modern and sustainable agriculture; the development of urban and traffic infrastructure, population stability; linkages among development master plans; the attention to public investment activities that are instructive, promoting and connecting and that help solve urgent problems of people's lives, and the promoted international cooperation that helps attract resources, knowledge and technology to the Mekong Delta.

The Government issued the Decision No. 287/QĐ-TTg approving the Master Plan for the Mekong Delta in the period 2021-2030, with a vision to 2050. The master plan aims to gear the Mekong Delta to sustainable development and green growth in compliance with Resolution No. 120/NQ-CP; focuses on the protection, restoration and development of the socio-cultural foundation and natural ecosystem; puts people at the centre; considers water resources as the key; applies integrated water resources management across the region to ensure the living resources for the environment and people; and transforms to CCA livelihood models in sub-regions. Under the master plan, the development orientation of the region is to strengthen the linkages between localities in the Mekong Delta with Ho Chi Minh City and the Southeast region, to promote trade with countries in the ASEAN, especially countries in the Mekong sub-region; to focus on developing the infrastructure, which is important to the transformation of the development model, with special attention to the infrastructure for transport, energy, clean water supply, irrigation and social infrastructure; to closely link socio-economic development to national defence and security, political stability, and social order and safety; and to focus on ensuring food security, security of water resources, security of borders, waters and islands.

##### **b) Northern Delta**

The severity of natural disasters and impacts of CC on the Northern Delta are similar to those in the Mekong Delta. CC scenarios and results of climate models reflect that the total rainfall during the rainy season in the Northern Delta is expected to increase, leading to a significant rise in the peak flood flow. Increased heavy rains with large amounts of rainfall exceeding the designed capacity have seriously threatened the safety of dams and reservoirs, causing floods in low-lying areas with poor drainage, and accelerating surface erosion (Ministry of Natural Resources and Environment, 2021a).

If the sea level rises by 100 cm, around 240,000 ha of farming land in the Northern Delta is likely to be affected, and rice productivity will decrease by 8%-15% by 2030 and 30% by 2050. Also, there

will be other major threats such as the lack of water for domestic use, saline intrusion and impacted environment for seafood fishing and aquaculture, increase in crop diseases, degradation of land resources and decline in biodiversity and rare genetic sources. In addition, if the sea level rises by 100 cm, approximately 3% of the delta's area will be at risk of flooding, of which 1.4% is for rice cultivation, 0.6% for residential areas, 0.2% for salt production and 0.8% for other uses. Many provinces in the region will suffer severe land loss due to flooding such as Thai Binh (loses 31.2% of its area), Nam Dinh (24%) and Hai Phong city (17.4%) (Ministry of Natural Resources and Environment, 2021a).

## **2) Coastal areas:**

The coastal areas in Viet Nam cover the North, Central and Southeast regions, which are prone to climate-related hazards such as storms and tropical depressions, especially in the Central region, and floods and landslides especially in the North and Central coastal regions. Besides, CC also accelerates soil degradation, causing worse degradation to the soil in the region which is inherently characterised by light composition and poor water-retaining capacity (Ministry of Natural Resources and Environment, 2021a).

CC can lead to significant increases in the salinity area in coastal regions, resulting in rice productivity reduction and other environmental consequences. CC also depletes the biodiversity in coastal areas, changes the ecology of low-lying areas along rivers, in rivers and in estuaries as it causes changes in rainfall, surface and groundwater flows, and changes in some characteristics of water quality and nutrients. Droughts are happening more frequently in coastal provinces, which will aggravate saline intrusion. Especially, the annual rainfall in the South Central Coast is low, so the flow here reduces sharply which facilitates saline intrusion to reach far into the mainland, severely affecting coastal agricultural production and domestic water resources (Ministry of Natural Resources and Environment, 2021a).

Coastal areas are also hard hit by sea level rise. If the sea level rises by 100 cm, many low-lying areas in the Northern coastal plain and Thanh Hoa province are likely to be flooded. When sea level rises by 57 cm on average, about 8% of forest and natural vegetation in coastal areas will be at risk of inundation. The area of mangroves has been most severely reduced in the provinces of Ca Mau, Ba Ria-Vung Tau, Nam Dinh and Ho Chi Minh City (Ministry of Natural Resources and Environment, 2021a).

## **3) Mountainous regions**

The mountainous regions play a vital role in Viet Nam's sustainable development because of their important locations and the fact that they account for three-quarters of the country's area. These regions are diverse in weather conditions and reflect the country's biodiversity. The mountainous regions' economy is being slowly developed, facing barriers of rapid population growth, environmental degradation and poverty (especially in ethnic minority areas) in remote areas. Moreover, Viet Nam's mountainous regions tend to be dependent on external resources while local knowledge is not promoted. Economic, cultural and social differentiation is another reason for the increased vulnerability to CC in the areas (IMHEN and UNDP, 2015).

Rising temperatures in the Northeast, Northwest and North Central regions affect agriculture, biodiversity, energy production and consumption, and public health, putting poor farmers and ethnic minorities at a disadvantage. Flooding in the mountains of the Northwest, Northeast, North Central and Central Highlands affects agriculture, water resources, transportation, people's health and lives, and habitats. The most affected groups are mountainous people, especially the ethnic minorities, the elderly, women and children. Floods and storms also cause serious damage to infrastructure, including rural infrastructure, infrastructure for flood and storm prevention and control, and irrigation works (Ministry of Natural Resources and Environment, 2021a).



Flash floods and landslides are also common in most of mountainous provinces. They are the consequences of heavy rains (caused by storms, cyclones or tropical depressions) combined with steep terrain and weak geological formations. Under the impacts of CC, flash floods tend to be intensified, with greater impacts on the lives of people in mountainous regions, which are prone to flash floods (Ministry of Natural Resources and Environment, 2021a).

#### ***2.3.4. Impacts of climate change on vulnerable people***

##### ***1) Impacts of climate change on women***

Women are more vulnerable to CC than men given their limited opportunity, condition in accessing to education, literacy, income-generating opportunities, land ownership, access to credit, and mental and sexual violence. Women are more dependent on land and ecosystems that are highly exposed to CC.

Natural disasters put women at risk of malnutrition, which may seriously affect maternal health (Few & Tran, 2010). Food unsafety, serious effects on women, pregnant women and women with lactic acidosis who are identified as particularly vulnerable groups. The increase in the frequency of climate and temperature-related diseases poses significant challenges to maternal health (UNFPA, 2021).

Damages to infrastructure and houses, food shortages and loss of livelihoods have increased stress, pressure and anxiety in households, which can lead to violence against women (WHO, 2009).

Forecasts suggest that Viet Nam may face a demographic challenge given its aging population that is rapidly growing (20% of the population will be over 60 years old by 2038 and 25% by the middle of the century). This poses challenges for the health sector, especially to meet the specific needs of elderly women. It also increases the cost of unpaid care work for the elderly (UN Women, 2021), which in turn may hinder women's participation in socio-economic opportunities.

## ***2) Impacts of CC on ethnic minorities***

Ethnic minority groups often live in areas with high exposure to climate risks, especially floods and droughts, in remote areas with little access to basic infrastructure. CC is identified as one of the main causes of poverty among ethnic minorities (World Bank, 2009).

Ethnic minority groups mainly rely on natural resources as their main source of income. However, they have limited access to market and financial services under disaster recovery and adaptation policies. This makes them even poorer with little potential for development.

Ethnic minority groups have traditional knowledge to adapt to natural disasters and extreme climates. In the past, this indigenous knowledge has proven effective in weather prediction or crop selection. However, it has become less reliable and less effective by virtue of CC.

## ***3) Impacts of climate change on children and teenagers***

CC can affect children's cognitive and physical development, education, and access to health care, nutrition and survival.

Extreme weather phenomena have direct effects on the health, survival and well-being of children. The rising temperature, prolonged heat waves, droughts that cause water shortages and poor water quality have a direct link to the rate of water-borne diseases among children (such as dengue, diarrhoea and malaria, etc.).

The impacts of CC on agriculture and fisheries will affect food security, especially of poor and rural households, leading to children's nutrition insecurity. Flooding is a major threat to vietnamese children (UNICEF, 2021), as it can potentially lead to drowning—a cause of death or injuries among children, especially in rural areas. Drought, high temperature and water scarcity increase the risk of dengue and hand, foot and mouth disease (HFMD) in children. Children's education can also be harmed by damage to educational infrastructure. Series of continuous hot days affect children's and teachers' ability to concentrate on studying and teaching. Loss of livelihoods due to storms and floods may also mean dropping out of school for the most vulnerable children who have to assist their families (UNICEF, 2015). Furthermore, children may face increased exposure to post-disaster environmental hazards.

## ***4) Impacts of climate change on the elderly***

Viet Nam is among the countries with the fastest population aging in the world (World Bank, 2021b). Age determines vulnerability to CC (UN Women, 2021). It is forecast that by 2049, 28.6 million people (24.88% of the population) will be 60 or older (UNFPA, 2011). Even if 35% of them will still be working, most are considered 'vulnerable workers' as the rising temperatures or rainfall will result in a 20% reduction in their hourly wages (AFD, 2021). Furthermore, the migration of young couples in pursuit of better economic opportunities often turns into a burden on the elderly as they have to take care of the family and children (World Bank, 2021b).

## ***5) Impacts of climate change on people with disabilities***

CC has a strong impact on people with disabilities, who are highly vulnerable, which impedes their ability to take adaptation actions and participate in planning on adaptation (IPCC, 2022). Generally, people with disabilities have little access to education, stable incomes and ICT technology, while poorer socio-economic conditions lead to higher vulnerability to CC (Gutnik & Roth, 2018). CC can pose high risks to people with disabilities in terms of health problems, economic losses, water shortages and limited access to infrastructure and housing. It is expected to cause an increase in water-borne and vector-borne diseases and mental illnesses. Damages and disruption to health care services (such as vaccination and vector control) may lead to a rise in illnesses and disabilities (CFEDM, 2021).

### 2.3.5. Impacts of climate change on migration

Viet Nam is experiencing rapid urbanisation as migration for economic opportunities to industrial zones near big cities is taking place vigorously. The Mekong Delta has the highest emigration rate in the country (-8.3% in 2019) (GSO, 2020), of which nearly 99% move to the Southeast region. Migrant workers often work in industrial zones, construction and informal sectors. Although their average income is lower than that of non-migrant workers, this income gap is narrowing (GSO & UNFPA, 2016).

The primary reasons for domestic migration in Viet Nam are economic considerations, followed by family and marriage. The impacts of CC and environment on migration are mainly reflected in agriculture. During interviews in Soc Trang and Ben Tre, local authorities and households said that the climate become more unfavourable in the past 5 years, mainly due to saline intrusion, droughts, coastal erosion and extreme rains. Extreme weather has harmed the local economy and livelihoods, resulting in increased migration. Poor adaptability fosters migration decisions. Households that are poor (with little arable land) and vulnerable to climate impacts tend to choose migration as an adaptation solution. The poorer the household, the more they consider migration (IOM & WHO, 2020). An individual's adaptability is largely decided by the region's economic conditions and demographic structure. In An Giang province, the lack of alternative livelihoods other than intensive rice production spurs migration. In Ca Mau, though natural resources are abundant, their exploitation is unsustainable, affecting livelihood stability and hence may aggravate migration in the future (Le, Vo et al., 2020).

### 2.3.6. Losses and damages

#### 1) Estimated past losses and damages

##### a) Economic loss and damage

According to statistics of the Viet Nam Disaster Management Authority (VNDMA), in the period 2011-2020, extreme climate caused severe economic damages, with the total loss estimate of VND 229,958 (equivalent to USD 10 billion, at 2022 exchange rate). In the period 2011-2016, the total damage estimate was at VND 68,230 billion, in the period 2016-2020 it was VND 161,728 billion, nearly 3 times higher than the amount in the previous 5 years. On average, each year extreme climate events cause damage of about VND 23 trillion (equivalent to USD 1 billion/year)<sup>1</sup>.

In agriculture, in the period 2011-2020, 3,354,648 ha of rice and cash crops, 702,821 ha of industrial plants, 382,878 ha of aquatic products were destroyed or damaged, and 10,839,367 cattle and poultry died or were flooded away. Irrigation infrastructure was severely damaged, including 217 km of dykes, 92 km of embankments and coastlines, riverbanks and stream banks being eroded, slid, broken or cracked; 2,390 culverts and 2,305 lakes and dams were broken, eroded/slid, damaged;<sup>2</sup> 140 pumping stations were broken and 1,915 km of canals were eroded and damaged.

Damage to houses and civil works in the period 2011-2020: 3,587,002 houses were affected, of which 44,198 were completely lost, 1,708,826 were broken/damaged and nearly 1,800 were inundated (VNDMA). It was estimated that in 2020, 11.8 million people in Viet Nam were at risk of major floods and inundation, and more than 35% of coastal settlement areas were located on eroded coastlines (World Bank, 2020).

Natural disasters and extreme climate have also caused damage to water and sanitation infrastructure and services. The VNDMA's statistics for 4 years (2012, 2016, 2019, 2020) show that natural disasters resulted in a shortage of clean water among 765,839 households (equivalent to 2.8 million people), and 519,186 ha of polluted residential areas; and about 2 million people suffered from a lack of drinking water (Ministry of Natural Resources and Environment, 2020). For transportation, in

<sup>1</sup> Calculation was based on the disaster-induced loss statistics of VNDMA

<sup>2</sup> According to the statistics of damages caused by natural disasters in the period 2011-2020 of VNDMA

the period 2011-2020 natural disasters caused erosion and damages to 52,905 km of roads; inundation to 31,250 km of roads; damages, collapse and drift-away to 21,253 bridges and culverts, and blockage and jams to 2,850 transport spots.<sup>3</sup> Annual direct damage to public transport infrastructure due to storms and floods is approximately USD 144 million (World Bank, 2020). Furthermore, storms and floods caused about USD 330 million in damage to energy infrastructure annually (World Bank, 2019b). In the period 2011-2020, there were 92,259 electric poles broken or fallen; 5,687 transformer stations damaged or broken; and more than 4 million metres of electric wire broken. Extreme climate also caused 18,932 communication poles to break or fall; 739 station houses damaged; and 1,206,481 metres of wire broken.<sup>4</sup>

Education and health services were also at high risk as 26% of public hospitals and health centres, 11% of schools faced the risk of flooding and inundation from the sea (World Bank, 2019). The statistics of the VNDMA in 2011, 2012, 2018 and 2020 show that 5,929 classrooms and functional houses were destroyed or damaged, and 2,723 school sites were affected.<sup>5</sup>

### ***b) Non-economic losses and damages***

According to the VNDMA's statistics, there were 2,153 deaths, 316 missing persons and 4,117 injuries in the period 2011-2020. In addition, infectious diseases emerged due to contaminated drinking water sources, as well as mental health problems due to psychological trauma and anxiety and stress.

Extreme climate in 2012, 2018 and 2020-2021 destroyed 204,485 ha of forest.<sup>6</sup> In the period 2011-2016, the area of mangroves in the Mekong Delta decreased by nearly 10%, from 194.7 thousand ha in 2011 to 179.3 thousand ha in 2016 (a decrease of about 15.3 thousand ha). In the Mekong Delta, there were 24 locations frequently eroded with a total length of about 147 km, and the erosion rate of 5-45 m/year, annually about 500 ha of land was lost. Biodiversity degradation has become more and more severe, 21% of animals, 6.5% of birds, 19% of reptiles, 24% of amphibians, 38% of fish and 2.5% of vascular plants have been threatened (Thuairé B et al., 2021). In 2018, in the Mekong Delta there were 562 landslide spots, with a length of nearly 800 km, of which 300 to 500 ha of land was lost each year, threatening the lives of nearly 20 million people (Nhan Dan Newspaper, 2019).

## ***2) Trend of future losses and damages***

### ***a) Trends of economic losses and damages***

CC will be one of the factors that diminish Viet Nam's growth in the next 40 years. Without effective adaptation solutions, an increase of 1°C in temperature can cause a loss of about 1.8% of GDP, an increase of 1.5°C in temperature can cause a loss of 4.5% of GDP (AFD, 2021). Without effective adaptation solutions, the loss to economic growth is estimated to be USD 4.3 billion over the next 10 years (World Bank, 2020).

A sea level rise of 30 cm by 2050, and 70 cm by 2100, will affect an additional 4.5 million people in coastal areas; 1.5 million agricultural workers are directly at risk of major flooding and 11.8 million are at risk of major flooding. In addition, every year about 316,000 workers will lose their jobs due to the effects of river floods and coastal inundation (World Bank, 2020). If sea level rise and temperature rise follow the worst scenario, it is estimated that by 2050, in Viet Nam about 3.1 million people will be internally displaced (World Bank, 2021a).

With the high CC scenario, the flood risk level in urban areas is expected to increase by 7%. The loss of houses due to CC-related storms and floods in the Mekong Delta by 2050 is estimated to reach USD 2.1 billion, an increase of 11% compared to the present (German Development Bank [KfW], 2020).

<sup>3</sup> According to the statistics of damages caused by natural disasters in the period 2011-2020 of VNDMA

<sup>4</sup> Calculated based on the statistics of damages caused by natural disasters of VNDMA

<sup>5</sup> According to the statistics of damages caused by natural disasters in the period 2011-2020 of General Statistics Office

<sup>6</sup> Calculated based on the statistics of damages caused by natural disasters of VNDMA

The increased rainfall will put 20% of the total length of the national highway network, about 20% of the total length of the railway network at risk of erosion and inundation (ADB, 2014). It is forecasted that by 2100, if the sea level rises by 100 cm nationwide, about 4% of the railway system, more than 9% of the national highway system and about 12% of the provincial road system will be affected (Ministry of Natural Resources and Environment, 2020). Disruption to railway routes can result in high economic losses of between USD2.3 and USD 2.6 million per day (World Bank, 2019c).

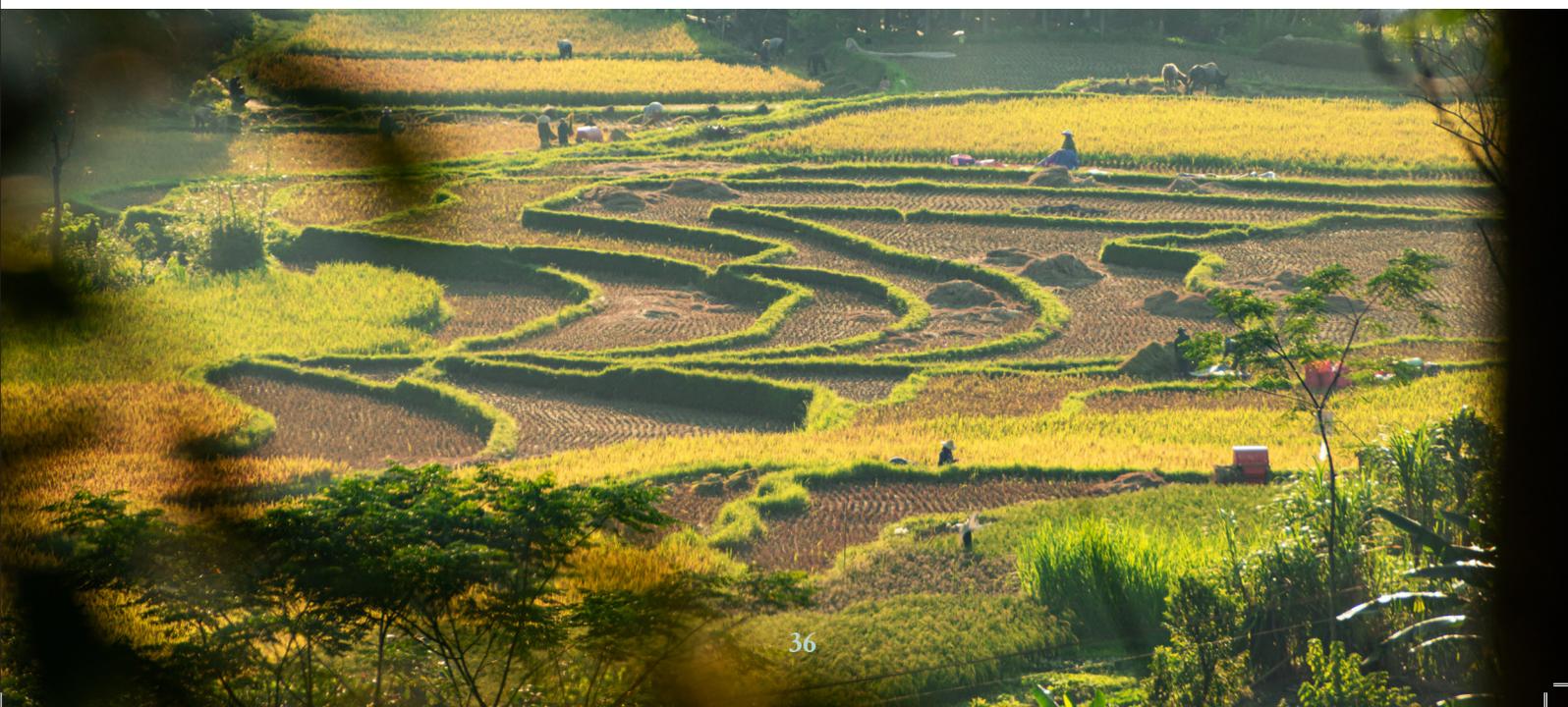
In the period 2020-2100, sea level rise could cause USD 43 billion in damage to the agricultural sector. The Mekong Delta is the region that suffers the most losses, at 52.39%, followed by the Red River Delta, at 31.4% (Ministry of Natural Resources and Environment, 2020). Furthermore, 1.1 million tons of farmed seafood, equivalent to USD 935 million, is at risk of flooding annually (World Bank, 2020).

If the sea level rises by 100 cm, most of the coastal industrial zones will be inundated, the lowest inundation coverage is 10% and highest is about 67%. It is estimated that up to 35% of construction works in coastal areas will be eroded; 42% of coastal hotels are located near landslide areas; and two thirds of the dyke system in Viet Nam, whose length is 2,659 km, does not meet safety standards (World Bank, 2020).

### ***b) Trends of non-economic losses and damages***

It is forecasted that by 2100, if the sea level rises by 100 cm, more than 6% of Viet Nam's land area will be inundated. According to the CC scenario (2020), the Mekong Delta is at highest risk of flooding (47.29% of the area). About 13.20% of the Red River Delta area; 1.53% of the area covering the Central coastal provinces from Thanh Hoa to Binh Thuan are at risk of flooding. According to the Intergovernmental Panel on Climate Change, when the sea level rises by 100 cm, it is estimated that 5.3% of the natural area, 10.9% of the urban area, 7.2% of the agricultural area, and 28.9% of the lowland area in Viet Nam will be affected.

Under the impacts of CC, the climate zone suitable for the distribution of dipterocarp forests accounting for 4.6% in 2020 is expected to decrease to about 1.5% in 2050, and it is forecasted that the dipterocarp forests may no longer exist in the Central Highland by 2100. If the sea level rises by 75-100 cm, then 78 of the 286 'major natural habitats' (equivalent to 27%), 46 protected areas (equivalent to 33%), 9 biodiversity areas of national and international importance (23%) and 23 other biodiversity areas in Viet Nam will be severely impacted (Government of Viet Nam, 2022). Thus, Viet Nam is one of the most vulnerable countries, most heavily affected by climate change. The losses and damages caused by climate change tend to increase, hindering efforts for sustainable development, poverty reduction and socio-economic development.





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## *CHAPTER III.*

# **ACHIEVEMENTS AND GAPS IN CLIMATE CHANGE ADAPTATION**

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## *III. Achievements and gaps in climate change adaptation*

### **3.1. Efforts and achievements in climate change adaptation in Viet Nam**

#### ***3.1.1. Viet Nam's climate change adaptation policies***

Viet Nam has issued and implemented many policies, strategies, programs and plans in response to CC and in fulfilling international commitments, namely:

- The Communist Party of Viet Nam issued Resolution No. 24-NQ/TW of the Central Committee on proactive response to CC and strengthened natural resource management and environmental protection (2013); the Conclusion No. 56-KL/TW on continued implementation of the Resolution of the 7th Central Committee, term 11<sup>th</sup> on proactive response to CC and strengthened natural resource management and environmental protection (2019); Resolution No. 36-NQ/TW dated October 22, 2018 of the 8<sup>th</sup> Conference of the 12<sup>th</sup> Central Committee of the Communist Party of Viet Nam on the Strategy for sustainable development of Viet Nam's marine economy to 2030, with a vision to 2045 (2018).

- The National Assembly promulgated the Land Law (2013); Law on Natural Disaster Prevention and Control (2013); Law on Water Resources (2014); Law on Hydrometeorology (2015); Law on Irrigation (2017); Law on Forestry (2017); Law on Fisheries (2017); Law on Crop Production (2018); Law on Animal Husbandry (2018); Law on Biodiversity (2018); Law on Marine and Island Resources and Environment (2018); Law on Environmental Protection (2020); Law Amending and Supplementing a Number of Articles of the Law on Natural Disaster Prevention and Control and the Law on dykes (2020); and the Resolution No. 134/2016/QH13 adjusting the Land Use Planning up to 2020 and the Final Land Use Plan (2016-2020) at the national level.

- The Government issued Resolution No. 76/NQ-CP on Natural Disaster Prevention and Control (2018); Resolution No. 120/NQ-CP of the Government on Sustainable and Climate Resilient Development of the Mekong Delta in Viet Nam (2017); Resolution No. 06/NQ-CP promulgating the Action Program to continue implementing Resolution No. 24-NQ/TW of the 11th Party Central Committee on proactive response to climate change, strengthened management of natural resources and environmental protection as per the Conclusion No. 56-KL/TW dated August 23, 2019 of the Politburo (2021); Decree No. 119/2016/ND-CP of the Government on a Number of Policies on Management, Protection and Sustainable Development of Coastal Forests in Response to Climate Change; Decree No. 06/2022/ND-CP of the Government on Mitigation of GHG Emissions and Protection of Ozone Layer; Viet Nam's Strategy on Renewable Energy Development to 2030, with a vision to 2050 (2015); National Green Growth Strategy (2021); and the National Strategy on Climate Change to 2050 (2022).

National Target Program to Respond to CC for the period 2011-2015; Program on Science and Technology on Response to CC and Management of Natural Resources and Environment (2016-2020); Support Program to Respond to CC (SP-RCC); Target Program for Climate Change Response

and Green Growth for the period 2016-2020; National Program on Reduction of Greenhouse Gas Emissions through the Mitigation of Deforestation and Forest Degradation, Conservation and Enhancement of Forest Carbon Stocks and Sustainable Management of Forest Resources to 2030; Program on Science and Technology for Disaster Prevention and Environmental Protection (2016-2020); Master Program on Sustainable Climate Resilient Agricultural Development in the Mekong Delta to 2030, with a vision to 2045.

Action Plan to Implement the Paris Agreement (2016); Action Plan on CC Response in Agriculture and Rural Development Sector in the period 2016-2020, with a vision to 2050 (2016); National Action Plan on the Implementation of the 2030 Agenda for Sustainable Development (2017); Viet Nam's Green Growth Urban Development Plan to 2030 (2018); NAP (2020); Scheme on Development of Viet Nam's Cities to Respond to Climate Change by 2020 (2013); Program on Circular Economy Development in Viet Nam (2022); Planning on the National Natural Resources and Environment (NRE) Monitoring Network (2016); National Action Plan on Green Growth in 2021-2030 (2022); Decision of the Prime Minister Promulgating the Master Action Program to Implement the Government's Resolution No. 120/NQ-CP of the Government on Sustainable and Climate Resilient Development of the Mekong Delta in Viet Nam; Decision No. 287/QD-Ttg Approving the Master Plan for the Mekong Delta in the period 2021-2030, with a vision to 2050.

- Ministries, sectors and provinces and cities have issued a number of sectoral and provincial CC-related policies and plans such as Action Plans to respond to CC; Green Growth Action Plans; Action Plan to Implement the Paris Agreement; and the integration of CC into sectoral development strategies, plans and master plans.

### **3.1.2. Viet Nam's climate change adaptation actions**

Viet Nam has been taking a series of CCA programs and projects that bring about specific improvements to the resilience and adaptive capacity of the natural and social systems as follows.

#### **1) Monitor climate, make early warning on natural disasters**

The institutional system, including the promulgation and execution of the Law on Natural Disaster Prevention and Control 2013, the Law on Meteorology and Hydrology 2015 and the sub-law documents, has gradually been completed. Investment plans and projects, as well as systems to monitor CC and sea level rise, have been developed and operated. The hydrometeorological forecasting technologies are developed, gradually catching up with the advanced countries in Southeast Asia, especially in the potential fields of forecasting and warning of storms, hoarfrost, severe cold, damaging cold, floods and heat waves (Ministry of Natural Resources and Environment, 2021a).

The network of hydrometeorological stations included 1,640 gauge stations/points as of April 2020, including 202 meteorological stations; 14 automated radiation stations; 29 agro-climate stations; 1 global climate monitoring station on Pha Din pass; 782 independent automated rain gauges; 404 hydrological stations (of which 162 stations were not included in the Development Planning of the hydrometeorological station network, which were invested to serve the automated hydrological monitoring of the Mekong Delta inland); 27 oceanographic stations; 179 air and water environment monitoring stations/gauges (including 91 salinity gauges); and 27 overhead meteorological and weather radar stations, along with 18 lightning positioning stations (Viet Nam Meteorological and Hydrological Administration, 2020).

The accuracy of Viet Nam's storm forecasts has gradually approached the level of advanced countries in the region and the world. Early storm warnings are made 5 days in advance. Early forecasts and warnings of tropical depressions are made 3 days in advance. Forecasts and warnings of potential hoarfrosts are made 2-3 days in advance with a confidence level of 75%. Warnings of extreme and damaging cold are made 2-3 days in advance with the confidence of 80-90%. River flood warnings in

the Central region and the Central Highlands are made 1-2 days in advance and in the North and the South regions, 3-5 days in advance with a confidence level of 70-80%. Warnings of large-scale heat waves are made 2-3 days in advance with a confidence level of 70%. The number and frequency of broadcasts of warnings and forecasts of storms and tropical depressions has been increased to 4-8 bulletins/day (Ministry of Natural Resources and Environment, 2021a).

The earthquake and tsunami warning system has initially been established. At the Central level, the Institute of Geophysics is responsible for communicating tsunami warnings to relevant agencies and triggering the systems of watchkeeping stations to warn people when a tsunami is likely to occur. At the local level, the Steering Committees for Natural Disaster Prevention & Control of the provinces/cities from Ha Tinh to Ba Ria-Vung Tau are responsible for activating the systems of local watchkeeping stations to guide people to cope with tsunamis, tropical depressions, storms and other types of natural disasters given local situation.

In addition, the maps on disaster warning zones such as flash floods, landslides, floods, etc. were also made. Specifically, by 2019, maps of the current state of landslides at 1:50,000 scale were made for 22 Northern mountainous provinces; and maps of landslide warning zones at 1:50,000 scale for 15 provinces were completed. In some provinces, the survey and mapping of landslide warning zones were carried out to commune level (50 communes in six provinces including Dien Bien, Ha Giang, Lao Cai, Yen Bai, Hoa Binh and Thanh Hoa). Landslide warning bulletins and measures to prevent and minimise damages caused by landslides have been made (Ministry of Natural Resources and Environment, 2021a).

## ***2) Respond to natural disasters, prevent flooding in big cities, and consolidate river and sea dykes and reservoirs' safety***

Some results in proactive disaster response, flooding control in major cities, river and sea dyke reinforcement and consolidation of reservoir safety can be reflected via the promulgation and implementation of development master plans, construction standards in disaster-prone areas, and key and urgent NDPC works that have been consolidated and constructed (Ministry of Natural Resources and Environment, 2021a).

The proactive response to natural disasters and extreme weather events was enhanced. The apparatus for natural disaster prevention, control and mitigation was consolidated at all levels. The motto "4-on-spot" continues to be applied from the central to the local levels. Damages caused by natural disasters in the last decade were significantly smaller than in the previous decade, specifically: (i) The annual average number of deaths and missing persons in this decade was 317 people/year, a decrease of 38% compared to the previous decade (509 people); and material damages in the period 2008-2017 (USD 688 million/year) decreased by 29% compared to the period 1998-2007 (USD 967 million/year). 63/63 provinces have collected fees for the Fund for natural disaster prevention and control. The total fund mobilised was VND 4,919,700 million as of July 2022, of which VND 3,049,428 million were spent.<sup>7</sup>

In implementing the "Program on population resettlement program for areas prone to natural disasters, extremely difficult areas, border areas, islands, free migration, special-use forests for the period 2013-2015 and the orientation to 2020" (Decision No.1776/QD-TTg dated November 21, 2012), in the period 2011-2015, more than 70,000/85,900 households (more than 60% lived in areas prone to natural disasters) were re-arranged for stable settlements. The planning of residential settlements to respond to CC, the system of flood-proof residential areas in the Mekong Delta and the population resettlement program for areas prone to natural disasters, extremely difficult areas, border areas, islands, free migration, and special-use forests have gained great achievements (Ministry of Natural Resources and Environment, 2021a).

At the end of 2015, the consolidation and upgradation of 448.5/816.8 km of sea dykes, 127.6/231.6 km of embankments, 312/590 culverts across dykes were completed from Quang Ninh province to

<sup>7</sup> Reported by the VNDMA

Quang Nam province; and the consolidation and upgradation of 130 km of sea dykes, 11.7 km of embankments, 17 culverts across dykes, and 110 ha of mangroves that protect dykes was completed from Quang Ngai province to Kien Giang province. In addition, provinces also consolidated and upgraded 1,464 km of river dykes; 432 km of embankments; repaired and newly built 440 culverts across dykes, and drilled and concretised to consolidate 500,309 km of dykes (Ministry of Natural Resources and Environment, 2021a).

The flood prevention and reservoir safety protection also generated effective results to assure water security in the context of CC. Multiple projects against flooding caused by high tides and saline intrusion in Ho Chi Minh City and the Mekong Delta took place. During the period 2011-2015, the Ministry of Agriculture and Rural Development invested in repairing and strengthening most of the reservoirs with the capacity of over 10 million m<sup>3</sup> (96/113 reservoirs). The reservoirs with the capacity of 3-10 million m<sup>3</sup> were basically repaired and upgraded. The rest was not many (28/447 reservoirs). But a large number of reservoirs of less than 3 million m<sup>3</sup> need repairing and upgrading (Ministry of Natural Resources and Environment, 2021a).

### **3) Ensure food security**

The rice farming area of 3.8 million ha was maintained and flexibly used. By 2020, in the whole country there was about 07 million ha of rice cultivation<sup>8</sup>; 700-800,000 ha of low-efficient crops were converted to other uses or were used in combination with aquaculture for more efficient economic achievements. Some key activities are as follows:

Shifting crop structure and developing large-scale agricultural production: In 2017, the production value of fruit trees increased by 20% compared to 2012, contributing to the cultivation growth (from 12% to nearly 32%); and the production value of high-value industrial crops increased by nearly 16%, contributing 43% to cultivation growth. The average rice production of the whole country increased from 53.2 quintals/ha in 2010 to 58.1 quintals/ha in 2018. The number of livestock farms increased from 8,796 farms in 2013 to 21,158 farms in 2017. In addition, a disease control system was developed and issued for most crops and livestock suitable for natural and climatic conditions, in which the agencies managing crop production and livestock (including aquaculture) issued guidelines and recommendations on the prevention and control of diseases caused by changes in weather and climate (Ministry of Natural Resources and Environment, 2021a).

Construction of irrigation works to serve the transformation of production structure. This includes restructuring public investment, strong transformation of the investment capital of the specialised rice cultivation to multipurpose irrigation; prioritising the capital for the construction of irrigation works to irrigate crops on dry land and high-value industrial plants, and for aquaculture in Dong Don (Tra Vinh), building infrastructure for shrimp farming in Long Dien Dong-Long Dien Tay communes (Bac Lieu province), and building irrigation system for the aquaculture in Tan Duyet (Ca Mau). The provinces in the Mekong Delta invested in 12 irrigation projects directly serving aquaculture, and 94 other aquaculture infrastructure projects (including the irrigation to serve the aquaculture). Also, there were five irrigation projects serving salt production in the provinces of Bac Lieu, Thanh Hoa, Quang Binh, Ninh Thuan and Soc Trang (Ministry of Natural Resources and Environment, 2021a).

The agricultural insurance policy applicable to crop production, livestock, and aquaculture have facilitated and protected benefits of insured parties and shared agriculture risks. This policy covered 20 provinces by two insurance enterprises (Bao Viet and Bao Minh) and VinaRe Reinsurance Company (in the pilot phase 2011-2013). There were a total of 304,017 farmer households/production organisations buying agricultural insurance. The total insured value of the programme was VND 7,747.9 billion (rice: VND 2,151 billion, livestock: VND 2,713.2 billion, and aquaculture: VND 2,883.7 billion). The total amount of insurance paid was VND 701.8 billion. The insurance claim rate was 178.1%, most of which was payment for aquaculture, at VND 669.5 billion, rice at VND 19 billion and livestock at VND

<sup>8</sup> Calculated on the planted areas (for 1 crop, 2 crops and 3 crops)

13.3 billion (Ministry of Natural Resources and Environment, 2021a). The Government signed Decision No. 13/2022/QĐ-TTg on the execution of the support policy for the agricultural insurance. The insured targets eligible to the agricultural insurance premium support include (1) crops: rice, rubber, pepper, cashew, coffee; (2) livestock: buffalo, cow, pig; and (3) aquaculture: black tiger shrimp (Tôm sú), white leg shrimp (tôm thẻ chân trắng), and pangasius (cá tra).

#### **4) Ensure water security**

Many investment projects to upgrade, modernise and improve effectiveness of irrigation systems have been promoted and implemented across the country, especially some important projects like Cai Lon-Cai Be project and Ninh Quoi ship lock on Quan Lo-Phung Hiep canal in Kien Giang province. The implementation of Circular No. 64/2017/TTB-TNMT dated December 22, 2017 on determining minimum flows in rivers, streams and downstream of reservoirs and dams has contributed to harmonising the benefits and avoiding conflicts in the use of water in river basins, environmental protection and biodiversity (Ministry of Natural Resources and Environment, 2021a). The key components of many irrigation systems were completed, initially proving their efficient water storage for the water supply and flood control, for example: Cua Dat Lake (Thanh Hoa), Do Diem Culvert (Ha Tinh), Ta Trach Lake (Thua Thien Hue), Dinh Binh Lake (Binh Dinh), Ray River Irrigation System (Ba Ria-Vung Tau).

The baseline survey and database systems on water resources were implemented and established. Water resource planning for the period 2021-2030 was approved. By 2018, surveys and evaluation of the surface water sources in the river basins were conducted; list and maps of rivers and streams were developed; minimum flows of 11/13 main streams of major river basins were identified; underground water resources were mapped at the scale of 1:200,000, covering 100% of the country, and at the scale of 1:100,000, covering nearly 30% of the country. The plans for the basins of Bang Giang river-Ky Cung river, Red river-Thai Binh river, and Se San river-Srepok river were included in the Water Resources Planning Task for the period 2021-2030, with a vision to 2050 approved in Decision No. 1748/QĐ-TTg dated December 4, 2019 (Ministry of Natural Resources and Environment, 2021a).

Legal documents were issued, such as Decree No. 54/2015/NĐ-CP dated June 8, 2015, on incentives for water-saving activities, and Decree No. 167/2018/NĐ-CP dated December 26, 2018, on limiting groundwater extraction. Criteria for water-saving products, equipment and technologies are being developed. As of September 2019, in the irrigation sector, there have been 162 technical standards and 04 regulations issued by the Ministry of Agriculture and Rural Development and the Directorate of Water resources for management and application in the stages of investment and construction, management-exploitation-operation. The Irrigation Sector is developing 19 new national standards (TCVN) and reviewing four regulations (QCVN) and 15 national standards (TCVN) (Ministry of Natural Resources and Environment, 2021a).

#### **5) Build effective CCA communities**

Some outstanding activities that brought important results towards the goal of building effective CCA communities were assessed, as follows:

- *Strengthen the community capacity and participation in CC response; pay attention to local response experiences and the roles of authorities at all levels and the grassroots mass organisations:* awareness raising on the community-based disaster risk management was conducted in 1,900/6,000 communes frequently affected by natural disasters. On March 15, 2022, the Government signed Decision No. 342/QĐ-TTg promulgating the National Natural Disaster Prevention and Control Plan to 2025, which enables the provinces to develop local NDPC plans and establish the Steering Committees for NDPC and search and rescue from the provincial to the commune/village levels, with the motto "4 on-spot." This was implemented effectively from the grassroots level (Ministry of Natural Resources and Environment, 2021a).

- *Develop sustainable livelihood in the context of CC:* The provinces have focused on developing and diversifying livelihoods via such actions as transforming crops and livestock structure, changing

production scope and scale, application of technology transfer, etc. Approximately 200,000 ha used for inefficient rice cultivation was converted for more efficient aquaculture, for cultivation of maize, cash crops and feed crops for feeding animals. The most notable examples are in the Mekong Delta and the Red River Delta (Ministry of Natural Resources and Environment, 2021a).

Many typical low-carbon community livelihood models were piloted across the North, Central and South regions, i.e., forest restoration, forest care and protection; low-emission green agriculture; linking cultivation, animal husbandry and eco-tourism; climate-smart villages; community-based climate-resilient eco-villages; low-carbon village communities; closed eco- and integrated production for craft villages, etc. Local knowledge was applied in many regions and provinces, especially in the Northern mountainous region, the Red River Delta and the Mekong Delta to maintain and develop sustainable livelihoods in the context of CC; agricultural cultivation (selection of plant varieties, cultivation techniques, adjustment of seasonal calendars, harvesting and preservation of agricultural products; aquaculture, fishing and livelihood development (combination of aquaculture, cultivation of fruit trees, afforestation and eco-tourism). Some typical low-carbon community livelihood models were piloted and encouraged to be replicated, for example, (i) the model for forest restoration, forest care and protection; (ii) low-emissions green agricultural production model; (iii) integrated model for farming, animal husbandry and eco-tourism; (iv) Climate Smart Village model (CSV); and (v) Low-carbon, highly resilient village community model in rural areas in the Northern Delta, etc. (Ministry of Natural Resources and Environment, 2021a).

*- Improve public health and ensure access to basic healthcare services:* Capacity building for the health system, modernisation of equipment and capacity building for health workers have received attention. Investment and development accounted for about 11% of the budget of the health sector. In 2020, the number of hospital beds per ten thousand people increased to 28 beds/10,000 population and the number of doctors per ten thousand people increased to 9 doctors/10,000 population. The grassroots health care network received more investment and was further developed. Regulations on basic medical service packages provided in commune health stations were promulgated. Almost 100% of people have so far accessed basic health services (Ministry of Natural Resources and Environment, 2021a).

The system of community health care policies was promulgated and applied to a large number of populations, especially the vulnerable groups. Free health insurance cards were granted to poor households, ethnic minorities living in the areas with difficult socio-economic conditions, to children under 6 years old, the elderly over 80 years old and people with disabilities. The Ministry of Health has implemented community health care models, for example, community-based communication models; guiding the construction and use of hygienic latrines in flooded areas and treatment of water sources in flood and disaster seasons (in Cao Lanh city, Dong Thap province); the model of latrines to respond to CC when groundwater levels rise significantly (in two coastal communes in Khanh Hoa province); the model of health organisation to meet the need for health care and protection of people in island districts to adapt to CC (in Bach Long Vi island district); and the model of community-based CCA injury prevention in some affected areas (Ministry of Natural Resources and Environment, 2021a).

Communication on the health care to cope with impacts of CC has also been promoted, for instance, developing and issuing guidelines for health workers and people on health care in hot and cold season and guidance on water treatment. Viet Nam has also made great efforts in preventing diseases in general and CC-related diseases/epidemics in particular (Ministry of Natural Resources and Environment, 2021a).

*Promote the use of local knowledge in CC response, especially developing new low-carbon livelihoods:* The community experience and knowledge were used and applied to improve the effectiveness of CCA, especially at the community level. The knowledge and experience could be manifested through people's understanding of changes in temperature and weather. Knowledge of agricultural production was related to plant varieties selection, seasonal adjustment as well as farming techniques to suit local weather and socio-economic conditions (Ministry of Natural Resources and Environment, 2021a).

## **6) Protect, develop forests sustainably, and conserve biodiversity**

In the period 2011-2019, together with the Law on Forestry (2017), the system of policies and laws on the forestry was further completed. The Agriculture and Rural Development sector deployed the Forest Protection and Development Plan for 2011-2020 (Decision No. 57/QĐ-TTg dated January 9, 2012), the Target Program for Sustainable Forestry Development for 2016 -2020 (Decision No. 886/QĐ-TTg dated June 16, 2017) and the Project on Protection and Development of Coastal Forests to Cope With CC for 2015-2020 (Decision No. 120/QĐ-TTg dated January 22, 2015 and Decision No. 770/QĐ-TTg dated June 23, 2019), and achieved certain important results.

- *Develop forests:* About 1,814,900 ha of forest, including 1,655,100 ha of production forests, 137,700 ha of protection and special-use forests, was planted in the period 2011-2018 nationwide. There were about 16,188.5 ha of coastal forests, of which 12,162 ha was newly planted, as of October 2019. Besides, nationwide, 354 thousand ha was restored per year and 423.7 million trees were planted, on average (Ministry of Natural Resources and Environment, 2021a).

- *Enhance the forest coverage:* The national forest coverage increased from 39.7% (in 2011) to 42.01% (in 2020)<sup>9</sup>, equivalent to 42% of the goal in the 5-year plan in 2016-2020 set by the National Assembly. The area of mangroves has increased, reaching more than 60% of the target of the Project on Protection and Development of Coastal Forests to Cope With CC (Ministry of Natural Resources and Environment, 2021a).

- *Improve forest quality:* Throughout the period 2011-2018, 10.2 million ha of the natural forest area was fundamentally protected; the area of special-use and protection forests increased slightly from 6.65 million ha in 2011 to 6.74 million ha in 2018. The area of mangroves increased from 131.5 thousand ha in 2010 to 149.6 thousand ha in 2018. The area of forest certified with Forest Stewardship Council (FSC) increased from 134,980 ha in 2015 to 245,061 ha in 2018 (Ministry of Natural Resources and Environment, 2021a).

- *Conserve biodiversity, protect and conserve genetic resources and potentially extinct species:* Following the Law on Biodiversity (2017), the Law on Fisheries (2017), the sub-law documents, and together with the implementation of related programs and plans, the biological conservation, protection and conservation of genetic resources and potentially extinct species have achieved outstanding results as follows:

By 2018, 43/63 provinces and cities completely developed Biodiversity Action Plans and 19/63 provinces approved the provincial-level Biodiversity Conservation Plans. The surveys and assessments of the status, distribution and changes of the marine, coastal and island biodiversity are ongoing.

Compared to 2015, there was six more protected areas, equivalent to an increase in protected area of 66,693.67 ha nationwide. Currently, the country has 172 protected areas with a total area of 2,493,843,67 ha, including 10 marine protected areas, with the total of 187,810.93 ha, accounting for 0.11% of all marine area nationwide. In addition, there were many protected areas that meet the required criteria and were recognised internationally. The total number of endangered, precious and rare animal species prioritised for the protection increased from 83 species to 99. Many programs and projects involving the effective conservation of rare and precious wildlife species were implemented; facilities for conserving genetic resources and centres for animal and plant rescue were developed. The tasks of protecting natural wetlands, seagrass beds and coral reefs were actively conducted (Ministry of Natural Resources and Environment, 2021a).

The genetic sources were well preserved. Around 30,000 genetic sources of agricultural crops; more than 2,000 species of forest trees; 730 species of medicinal plants to be conserved; about 70

<sup>9</sup> Decision No. 1558/QĐ-BNN-TCLN dated April 13, 2021, of the Minister of Agriculture and Rural Development announcing the national forest status in 2020

livestock species; 87 varieties of 75 freshwater aquatic species; 12 marine fish genetic sources; 2 crustacean genetic sources, 4 mollusc genetic sources; and about 22,000 microbial species were enlisted and preserved. Based on that, nearly 200 potential ones were selected to be developed into valuable commodity products. The technical processes for replication and production of about 20 genetic resources were studied and successfully developed (Ministry of Natural Resources and Environment, 2021a).

### **3.1.3. Financial mobilisation for climate change adaptation**

The government has promulgated a number of policies to secure public finance for CC response. Viet Nam's public expenditure on CC focuses mostly on CCA and a smaller part on GHG emissions reduction. Official Development Assistance (ODA) also includes financing for CCA. However, ODA loans and non-refundable grants to the Government, seen as part of public expenditure, are used more on GHG emissions mitigation than on CCA (41% on adaptation and 59% mitigation) (CARE and SRD, 2020).

In addition, vietnamese socio-professional and mass organisations, as well as international NGOs, have invested in funding activities to respond to CC, often at the local level. However, many businesses have spent more on GHG emission reduction measures, such as efficient use of energy in buildings and production.

Available data show that the investment capital need for improved resilience and recovery capacity of infrastructures, communities and businesses significantly exceeded the resources for adaptation of the public and private sectors. Compared to other countries, Viet Nam has been suffering great losses to humans and its economy from the impacts of extreme weather events, which increases the need for funding for post-disaster recovery.

In the period 2011-2020, progress was made in Viet Nam in mobilising investments in CC, promoting economic growth while protecting environmental resources. However, financial resources mobilised for CC were low compared to actual needs. Viet Nam needed about USD 55.85 billion to implement the Target Program on Climate Change and Green Growth for the period 2016-2020. The medium-term public investment plan could only provide about USD 24 billion of this, and the rest must be mobilised from the business sector. Narrowing the gap between investment needs and actual financial flows requires improved mechanisms and policies to attract investment from state-owned and private business sector which was assessed to have not developed to its full potential.

#### **1) Public investment**

Expenditures from the State Budget on environmental protection, CC response and sustainable development include: (i) Development investment expenditures including investment in construction of socio-economic infrastructure works, investment and support for businesses and organisations, and expenditure on the implementation of the National Target Program to Respond to Climate Change (investment expenditure); and (ii) Recurrent expenditures including expenditures on activities of agencies and apparatuses working on environmental protection, CC and sustainable development at central and local levels, and expenditures on the implementation of the National Target Program to Respond to Climate Change (recurrent expenditures).

In 2018, the Ministry of Planning and Investment issued the Guidelines for Classification of Public Investments in Climate Change and Green Growth (Decision No. 1085/QD-BKHDT dated July 16, 2018) for ministries, sectors and provinces to refer to and to implement activities on classifying public expenditure on CC response in general and CCA in particular. However, the classification has only been implemented in some ministries and sectors such as MARD thanks to its fairly complete database system on the public investment tasks and projects of the sector and the qualified technical capacity of planning staff. On the other hand, most provinces across the country and a number of relevant ministries and sectors are still

confused in their implementation, and their CCA professional capacity remains limited in classifying and codifying public investment expenditures of projects and tasks other than the programs, schemes and tasks related to CC response (UNDP, CPEIR Project Report, 2020).

#### **a) Investment expenditure**

Analyses of Viet Nam's public investment in CC response were published in 2015 and 2022, for the periods of 2010-2015 and 2016-2020, respectively. The expenditures on CC of five ministries and three provinces during the period 2010-2015 were analysed. Spending on CC was made via funding the activities of the National Target Program to Respond to Climate Change (NTP-RCC) and the Support Program to Respond to Climate Change (SPRCC), with a focus on providing CCA-related infrastructure (MPI, 2015). The analysed database of about 9,000 adaptation projects analysed shows that 20%-50% of adaptation projects were directly related to disaster preparedness, prevention, response and recovery. The focuses of disaster risk mitigation and adaptation project expenditures were on water management, coastal protection, and road and port infrastructure (PeasPros, 2016).

During the period 2016-2021, expenditures related to CC were recorded and analysed in six ministries (MARD, MONRE, MOT, MOIT, MOC, MOST), 28 provinces and one Centrally-run city (Can Tho) (Ministry of Planning and Investment, 2019). The analysis findings show that the total CC-related budgets of the six ministries ranged from VN 8,000 to 13,500 billion in the period 2016-2020, accounting for 26%-38% of the total budgets of these ministries. These were mainly adaptation expenditures and some were on response, with both adaptation and mitigation benefits. A quarter to half of the CC expenditures were from ODA. MARD and MOT spend the majority of their budgets on CC in the period 2016-2020, via investments in irrigation, coastal protection and roads.

The total climate budget of 29 provinces/cities increased from about VND 15,000 billion in 2016 to nearly VND 24,000 billion in 2020. The national allocated budget increased from about VND 11,000 billion to VND 13,000 billion, and ODA increased to about VND 11,000 billion in 2020. The climate budget accounted for 16%-21% of the total budget of 29 provinces/cities. Adaptation expenditures dominated and were in line with policy priorities for public investment, while expenditures on emission mitigation were largely from the private sector. More than half were transport infrastructure, urban infrastructure, irrigation and dyke infrastructure.

#### **b) Recurring expenditure**

*Recurrent expenditure* on CC was clearly reflected in the State budget expenditure on environmental protection. In the period 2011-2020, expenditure on environmental protection increased gradually over the years and increased at both central and local levels. In particular, the task of budget expenditure on environmental protection was focussed at the local level; therefore, the State budget expenditure on environmental protection at the local level accounted for a high proportion (on average in the period 2011-2020, accounting for 85.5% of the total state budget expenditure on the environmental cause). The growth rate of state budget expenditure on the environment in the period 2011-2020 reached 10.2%, higher than the growth rate of general state budget spending in the same period (7.2%). In the period 2013-2020, the total budget expenditure on environmental causes reached nearly VND 129.8 trillion, of which about 11.5% was from the central budget expenditure on environmental causes; and over 88.5% was from the local budget expenditure on environmental causes. In general, state budget recurrent expenditure on environmental protection in the period 2011-2020 was always guaranteed to account for about 1% of total state budget expenditure and increased every year.

#### **c) National Target Programs**

In the period 2010-2015, there were eight out of 16 National Target Programs (NTPs) containing projects directly realising the objectives of the National Strategy on Climate Change and the Green Growth Strategy. In the 2016-2020 period, the number of NTPs decreased from 16 to only two NTPs: (i) NTPs on Sustainable Poverty Reduction (NTP-SPR) and (ii) NTP on New Rural Development (NTP-NRD) (National Assembly, 2015). The two new NTPs contributed to solving national-level problems which

are also highly urgent tasks today, including many local road and water supply projects related to CCA. However, the NTPs in the previous period were not completely removed, but rather reviewed and rearranged rationally into 37 component projects under the 21 NTPs at a more reasonable scale for higher effective implementation. The total approved capital for 21 NTPs was about VND 1.14 million billion (equivalent to USD 51 billion) for the period 2016-2020 nationwide.

Out of a total of 21 target programs, many were directly and indirectly related to CC and green growth, especially there was a separate target program for “CC response and green growth” with total implementation capital of VND 15,866 billion, of which the development investment capital from the central budget was VND 470 billion, non-business capital from the central budget was VND 396 billion, and ODA capital was VND 15,000 billion. The overall objective of the program was to simultaneously implement the National Strategy on Climate Change and the National Green Growth Strategy, to fulfil Viet Nam’s commitment with the international community to protecting the Earth’s climate, creating momentum for further attraction of investment capital support from the international community.

**2) Official Development Assistance (ODA)**

Regarding activities to attract resources for CC, the Ministry of Planning and Investment has also coordinated with other line ministries, the World Bank and donors to evaluate the provision of ODA for CC and green growth; based on that, identified resources needed and priorities in the coming time on the use of ODA capital for CC and green growth.

The 2021 review of international development finance flows into Viet Nam shows a gradual reduction trend in ODA inflows into Viet Nam in recent years (Nguyen Thanh Cai & Nguyen Minh Hai, 2022). Except for 2016, the total ODA flows into Viet Nam decreased from year to year. In the period 2012-2019, the international development finance source for CC into Viet Nam was about USD 2.26 billion per year.

**3) Resources from the business sector**

**a) Green credit**

Green credit in Viet Nam has grown steadily in recent years. Green outstanding loans increased from over VND 85 trillion at 2016 end to over VND 333 trillion at 2020 end, equivalent to an increase of 3.62% in the total outstanding loans of the whole system. Green credit growth rate maintained high during the period 2016-2021. During that period, the average green credit growth rate was 183%/year.

According to statistics of the State Bank of Viet Nam, as of December 31, 2020, outstanding loans to green fields reached VND 333,097.82 billion, accounting for 3.72% of the total outstanding loans of the economy. This is a very modest proportion, indicating that the current limitation is also a great opportunity to promote green credit in the banking sector as well as green growth of the economy.<sup>10</sup> Green credits for CC in Viet Nam are directed towards three main fields of agriculture,

<sup>10</sup> Report on the implementation of the Decision No. 1552/QĐ-NHNN in the period 2015-2020 of the State Bank of Viet Nam



renewable energy and others (including sustainable water and sustainable forestry management), with an annual average total of about USD 12.91 billion during the period 2018-2020. In the coming time, the issuance of the Green Taxonomy providing screening criteria with specified thresholds for different types of projects and economic activities, including CCA activities, is expected to improve the mobilisation of international credits for CCA.

#### ***b) Green bonds***

So far, Viet Nam has issued green bonds worth a total of USD 564 million and there is still more room for the economy to further develop. Out of that USD 564 million, investments in emission mitigation via green bonds and adaptation in Viet Nam are about USD 415.8 million and USD 148.2 million USD respectively.

#### ***c) Foreign direct investment (FDI)***

Viet Nam has been quite successful in attracting FDI. However, the energy consumption coefficient per 1% of the growth rate, despite its reduction from 2.1 in the early years of this millennium to about 1.3 today, remains much higher than the level required for a sustainable economy and environmentally friendly and climate-resilient economic activities.

#### ***d) Public Private Partnership (PPP)***

To date, there have been about 146 major PPP projects with an estimated value of USD 2.71 billion for CC activities implemented in Viet Nam. Among those projects, the values of emission reduction and adaptation projects are USD 2.2 billion and about USD 533.4 million respectively. The majority of investment is made in the field of clean and renewable energy, accounting for 90% of total PPP investment capital in Viet Nam. The balance (USD 270 million) is invested in municipal solid waste management, transportation and drainage management.

## **3.2 Gaps in CCA of Viet Nam**

### ***3.2.1. Gaps in the resilience and adaptability of natural, economic and social systems***

#### ***1) Prevent the decline, degradation, and recovery of natural resources***

A database on water resources has not yet been developed and has not been interconnected with other databases, such as master plans on industrial and agricultural development. Local people and organisations' access to information about water resources remains limited. Cooperation and information sharing on water resources with upstream countries have not yet gained positive results, and the risk of water insecurity still exists. The system of policies and laws on economical, efficient and multipurpose use of water resources has not been synchronised and completed; there remain some issues in the compliance with inter-reservoir operating procedures in river basins, especially the conflict between water release for agricultural and domestic purposes and water storage for electricity production. The research and application of advanced technologies in the sustainable use and management of water resources are still limited; there are not sufficient standards and regulations on water-saving products, equipment and technologies. There is a shortage of human resources for water management, especially at the local level.

Land resources have not been properly and effectively used; alluvial ground along rivers and along the coasts has not been well used for production development and afforestation. Solutions to improve and protect the soil environment, prevent and minimise land degradation due to erosion, drought, and saline intrusion are limited and have been implemented only at model level or at a small scale.

#### ***2) Promote agriculture and food security***

The change in land use from agricultural to non-agricultural purposes continues in many provinces; the policy on land accumulation and development of large fields still faces difficulties. There have been no master plans on shifting of crops and livestock that are linked to the needs of the market; there are few new varieties of climate-resilient plants and animals, and high-quality seeds

could not be proactively provided. A disease control and prevention system for plants and animals has been established but remains incomplete; weather and climate information has not been fully integrated into disease-prediction models for crops and livestock. Agricultural insurance has just been piloted; agricultural insurance premiums remain high, especially with poor farmers.

### ***3) Manage forests and ecosystems***

Forest quality continues to decline, with remaining hot spots related to deforestation, illegal transportation and storage of forest products. The plan on afforestation of coastal mangroves, protection forests and special-use forests faces a lot of difficulties due to lack of financial capital and land funding. The switch in forest land use purpose in some provinces is not in accordance with the approved land use planning, or planning/plans on forest protection and development; land use in agricultural and forestry farms is not effective. The engagement of businesses in forest protection and development to respond to CC has not yet been commensurate with their potential. Equipment and means used in forest protection, fire prevention and fighting are outdated.

Biodiversity continues its declining trend. The expansion of nature protected areas is slow. Typical ecosystems such as coral reefs and seagrass beds are still in danger of degradation due to the direct impacts of socio-economic development activities and CC. Varieties, species and genetic resources continue to decline.

### ***4) Develop climate-resilient infrastructure***

The economic and social infrastructure system has not been developed synchronously; attention has not been paid to the development of climate-resilient multi-purpose, inter-regional works, urban infrastructures, concentrated residential areas, industrial parks, and resettlement areas. Activities to protect and develop island areas to respond to CC, especially sea level rise, have not been fully implemented. The implementation of flooding/inundation prevention programs and projects in urban areas and big cities is slow, flooding is happening frequently in Ho Chi Minh City, Can Tho, Hanoi, etc.

### ***5) Responses to climate change by communities***

The government and public's awareness of responses to CC and natural disasters is not equal; some provinces and cities have neither issued natural disaster prevention and control plans nor developed disaster response plans. There remain many difficulties to the development and diversification of CC-resilient livelihoods in terms of capital and synchronous solutions for replication. A number of livelihood shifting models generated good results but have not been fully and systematically studied and evaluated. There remain obstacles in regulations on planning, accumulation, conversion of land use and expansion of production scale. Many provinces face difficulties in accessing to advanced technology and technology transfer. Indigenous knowledge of CC response has not been comprehensively studied, assessed and developed into guidelines for preservation and development.

### ***6) Strengthen the medical and health care systems***

The public health care system needs strengthening to meet the requirements of proactive and effective response to CC. There has been no monitoring, early warning and forecasting system on health impacts of CC in order to develop and implement timely response measures.

### ***7) Ensure social security and gender equality***

Women play a crucial role in implementing CC-response actions at both local and household levels, while women in many rural areas, poor households and ethnic minority communities are the ones mostly affected by natural disasters and impacts of CC. The social security and gender equality have not received much attention. There have not been many studies and assessments on the impacts of CC on social security and gender equality, and difficulties and challenges faced by women in the CC context. There is a lack of regulations, incentive mechanisms and solutions to raise awareness, role and status of women in the implementation of CC response and disaster prevention and control activities at all levels (Ministry of Natural Resources and Environment, 2021a).

### **3.2.2. Gaps in the capacity to respond to climate extremes and increasing CC-induced natural disasters**

#### **1) Make forecasts and early warnings**

The CC and sea level rise monitoring system established are mainly based on existing hydrometeorological and oceanographic stations, which are not yet connected to the global and regional systems. The system of hydrometeorological and oceanographic monitoring stations has not yet met the information requirements for modernising disaster forecasting and warning. The rate of automated hydrometeorological stations is low (45%), lower than the set target (90%). The network of hydrometeorological and oceanographic monitoring stations is not dense enough, with unreasonable distribution among regions, areas and provinces. The current saline intrusion monitoring network is still sparse and has not met the requirements. There have been no specific regulations and norms applicable to saline intrusion forecasting (Viet Nam Meteorological and Hydrological Administration, 2020). Private sector engagement in the investment into construction of a new hydrometeorological and oceanographic monitoring system has been initially implemented (Ministry of Natural Resources and Environment, 2021a).

The work of forecasting and warning of natural disasters is partially limited, particularly in forecasting and early warning. Meteorological and climate forecasting information has not been really associated with the needs of other sectors and fields such as agriculture, health care, transportation, natural disaster prevention and control, etc. Climate and natural disaster risk forecasting and warning system have not yet met the requirements, especially in case of such natural disasters as flash floods, landslides, thunderstorms, whirlwinds, hail and sea fog (Ministry Natural Resources and Environment, 2021a).

#### **2) Construct and upgrade works serving natural disaster prevention and control**

The investment and construction of key works to respond to natural disasters, especially river dykes, sea dykes, reservoirs, storm sheltering anchorages and evacuation shelters in case of landslides, have not yet met the requirements. At present, there are still 1,500 km of river dykes that have not received upgrading investment, 197 key points of dykes, embankments and culverts that have not been dealt with; 70% of sea dykes that have not yet been upgraded, which could only be able to withstand medium tides and storms of levels 9-10; and 1,150 reservoirs that are being degraded and damaged, of which 350 reservoirs are severely damaged and degraded yet have not yet been invested in or upgraded; over 50% of the sheltering anchorages have not yet been invested in, making 83,850 ships unsheltered in the event of a disaster; and about 1,865 landslide positions with a total length of over 2,350 km, of which 91 are in extreme dangerous condition with a total length of 218 km.

The survey and mapping of the landslide warning zones to the commune level, and the development of a landslide warning map are slowly progressed; Many high-risk provinces and cities have not yet developed any maps or developed maps that are not detailed, resulting in difficulties in the prevention of landslides and the CCA socio-economic development planning.

Damages of the natural disasters remain high, accounting for about 1.5%-2% of GDP/year.

#### **3) Ensure the safety of people's lives and properties in the CC context**

There are difficulties in applying the motto "4-on-spot" in disaster response. On-spot means/equipment in some provinces are not enough and weak, especially specialised means/equipment. The spending of the funds for natural disaster prevention and control is difficult; many expenditures are not suitable with the actual local conditions, especially in the event of a natural disaster. The evacuation and resettlement work in at-risk areas have been slow due to funding constraints. The model of community-based response to CC and natural disaster prevention and control is being applied scattered individually; the development and expansion of climate-resilient livelihood models

face barriers in access to capital and advanced technology transfer. There are limited solutions to improve capacity in CCA, natural disaster prevention, control and mitigation; disaster forecasting and early warning; and replication of appropriate CCA models at community level.

### **3.2.3. Gaps in completing institutions, promoting potentials and resources to effectively adapt to CC**

#### **1) Policies and institutions**

There exist some shortcomings in the development and completion of the system of mechanisms, policies, and legal documents on CC such as:

- Viet Nam's system of policies and legal normative documents is different from international ones, leading to many difficulties in developing, updating and amending documents and implementing them within the country (Ministry of Natural Resources and Environment, 2021a).

- Many legal documents mention CCA, but there is a lack of documents guiding the implementation such as the mechanism for sharing CC information and data; the prioritisation of CCA activities of all sectors; and the integration of gender equality in CCA.

- The system of technical guidances and documents on the management of adaptation activities has not been detailed enough to be applied to each field, and scientific tools for CC forecasting have not yet been mastered. Studies on the use of data from CC scenarios in calculating and designing the works and projects are not sufficient to serve as a basis for developing standards and regulations.

- The focal point staff in charge of CC in some provinces and lines are still small and weak in capacity, leading to confusion and lack of information in solving related issues, especially in emergency situations.

- The institutionalisation of some policies in Resolution No. 24/NQ-TU on proactive response to CC and strengthened natural resource management and environmental protection is slow. The instruction/guidance is not satisfactory, resulting in difficulties in the implementation by provinces as well as in ministries and branches whose technical expertise is not CC.

- Research is needed to provide a scientific basis to support the State management, perfect the system of laws and normative legal documents on CC, natural resources and environment management; propose effective and synchronous management tools to avoid overlap and to support effective implementation; support the implementation of socio-economic development master plans and plans that are integrated and implemented in association with the requirements of CC response and effective management of natural resources and the environment; promote the innovation in the management, approaches to CC response, management and use of natural resources and environmental protection (Ministry of Natural Resources and Environment, 2021a).

#### **2) Capacity**

Currently, human resources with CC expertise in a number of line ministries, especially in provinces, are mainly part-time, rotated from other fields and have professional qualifications that are not really suitable to the needs (Ministry of Natural Resources and Environment, 2021a). Human resources in CCA in various fields are insufficient in both quantity and quality; specialised trainings on CC have not met the actual needs. Trainings to raise awareness and understanding of CC for leaders and staff are still limited; Scientific and technological research on CCA is still widely scattered and lacks focus, so research products of high applicability are not produced and CC information sharing is very limited.

CC awareness of officials and local people is not sufficient given the rapid and increasing changes and impacts of CC. Vision and awareness of CC impacts are often limited to physical impacts such as

impacts on human life, ecosystems and material infrastructure rather than non-physical impacts such as potential impacts on policies, commerce competition, employment, development opportunities, etc. Attention has been paid mostly to construction solutions rather than the promotion of available and feasible solutions such as changing lifestyles, energy production and consumption practices (Ministry of Natural Resources and Environment, 2021a).

### **3) Finance**

Annually, Viet Nam suffers losses due to climate-related hazards, accounting for about 1.5% of annual GDP (Tran Thu et al., 2015). According to a recent macroeconomic model of the costs of CC impacts, annual GDP losses due to extreme climate events are estimated at around 4.5% in the case of 1.5°C global warming scenario compared to pre-industrial times, 6.7% in the case of 2°C and up to 10.8% in the case of 3°C, unless major adaptation actions are taken (AFD, 2021, Chapter 14 in: Espagne et al.). Adaptation costs to prevent these losses are expected to be significantly lower than those losses (World Bank, 2010). To adapt to CC risks, it is necessary to prioritise policy responses and investments in the most vulnerable sectors and locations. These sectors and locations include the agriculture, transport, trade/industry and Mekong Delta (World Bank Group, 2022).

The CC spending is not monitored by current public budgeting and accounting processes, and there is a lack of clarity on different characteristics of different projects, such as adaptation and/or mitigation benefits (United Nations Development Programme, 2022).

The comparison between the expenditure on CCA by the public sector, including ODA, and that by the private sector shows a large funding gap. Expenditures made in the period up to 2020 focused on some necessary infrastructure, but did not include sufficient funding for capacity building at the provincial and lower levels, and very little was allocated to adaptation actions at the community and local levels (AFD, 2021, Chapter 13 in: Espagne E. (ed.) et al.).

According to the 2020 updated NDC, State resources were only enough to meet 30% of adaptation needs. It can be seen that the gap between finance needs for adaptation and actual spending in the period up to 2020 was indeed significant, while the future impacts of CC and finance needs for adaptation are increasing. It is needed to expand the investments in adaptation and risk mitigation in both public and business sectors.

### **4) Science and technology**

Scientific information from research papers and documents has not been widely communicated to relevant agencies. Viet Nam's production technology is pretty backward; at present many enterprises are using machinery and technological lines lagging behind the world average by about 2-3 generations, which consume more energy and resources and generate a lot of waste, causing environmental pollution.

In order to contribute to improving the science and technology potential, in the past period, CC technology transfer has been implemented in a number of key aspects such as energy, industry and waste treatment. Viet Nam promulgated the Law No. 07/2017/QH14 on Technology Transfer, along with many other legal documents such as Decisions and Decrees to encourage and implement the transfer of foreign technology to Viet Nam, or domestic transfer when one of the requirements, including environmental protection, CCA, and mitigation of GHG emissions, is met. However, there have been no appropriate standards and policy frameworks to actively promote technology transfer. The transfer of GHG emission reduction technologies in Viet Nam is carried out mainly through the implementation of projects under the Clean Development Mechanism (CDM), the Joint Crediting Mechanism (JCM), and the Gold Standard (GS) and a number of other international cooperation projects. The implementation results of programs and projects have not been assessed regularly. Technology transfer has not been promoted deeply or on a large scale and has not met the desired requirements (Ministry of Natural Resources and Environment, 2021a).

The program on “Science and technology to serve the national target program to respond to CC” and the program on “Science and technology to respond to CC, manage natural resources and environment in the period 2016-2020” have made great contributions to determining the scientific basis for CC responses nationwide. However, there remains a large gap in important knowledge related to the prioritised research areas identified in Resolution No. 24 of the Party Central Committee on proactive responses to CC and strengthened natural resource management and environmental protection, as well as the National strategy on CC. These gaps include comprehensive, multidisciplinary, multi-sector research projects, or user-oriented research, connection between scientific understandings of CC and response plans, and research projects that can effectively support adaptation and emission reduction while providing more accurate projections in the future (Nguyen Tuan Quang, 2019).

### **5) CCA integration into the system of strategies and master plans**

CC integration into strategies, master plans and plans has received attention of all levels from central to local. However, the specific integration of CCA contents into socio-economic development plans at all levels is still limited and has not yet generated concrete results. Currently, ministries, sectors and provinces are integrating CC (including adaptation) into development plans; however, the integration contents are understood inconsistently and incompletely. Specific analyses of the current gaps in CCA integration at all levels from the central government, ministries/sectors to provinces are presented below.

**\*) Gaps in the integration:** The National Assembly of Viet Nam ratified Resolution No. 142/2016/QH13 on the 5-year Socio-Economic Development Plan for the period 2016-2020. Tasks and solutions of this Plan mention CC, including activities on proactive responses to CC, natural disaster prevention and control, and the strengthened management of natural resources and environmental protection. Resolution No. 142/QH13 assigned the Government to submit to the National Assembly Standing Committee a decision on investments and supports for people to adapt to ecosystem change; immediate investment in a number of projects to promote the effectiveness of drought, saline intrusion and sea level rise prevention in the South Central provinces, the Central Highlands provinces and the Mekong Delta; consolidation of the entire organisational apparatus, forces and operating mechanism with synchronous solutions for forest protection and development, especially coastal protection forests, watershed forests and special-use forests; conservation of nature and biodiversity. However, the contents of adaptation in some fields is still limited health care.

**\*) Gaps in the integration at the ministerial and sectoral levels:** MONRE is tasked to take prime responsibilities for CC-related issues. MONRE has issued development plans for the fields under its management scope, and depending on the typical features of each field, CCA is integrated at different levels.

The Ministry of Agriculture and Rural Development (MARD) issued a Directive on the formulation of the 5-year agricultural and rural development plan for the period 2021-2025 (No. 3110/CT-BNN-KH dated May 8, 2020) which mentions CC issues. However, many CCA-related issues should be integrated, for example, the implementation and replication of models of intercropping which is resilient to climate, drought and saline intrusion; the arrangement of the climate-resilient seasonal and crop structure in accordance with comparative advantages, markets, by region; the development and replication of plant varieties that are resistant to pests and diseases; the deployment and replication of climate-resilient livestock models; and the consolidation of forms of aquaculture that are efficient and climate resilient, etc.

**\*) Gaps in the integration at the local level:** Regarding the integration of CC into local socio-economic development plans, many provinces/cities have so far performed this task. However, their degrees of integration are different:

- Hanoi and Ho Chi Minh City are classified as special-class urban areas of Viet Nam. CC integration into the socio-economic development plans and master plans of the two cities has been well implemented.

- Hai Phong, Da Nang and Can Tho cities are classified as first-class cities. The CC integration into the socio-economic development plans of these cities has also been paid attention to and implemented.

### **6) Coordination among ministries, sectors and provinces in CCA**

Viet Nam has made efforts to develop policies and solutions to implement CCA activities; however, inter-ministerial and inter-sectoral coordination in CCA has not been sharp. In the country's plan and program documents, the roles, responsibilities and coordination among ministries, sectors and provinces have been clearly defined; however, these stakeholders have not collaborated in planning and implementing CC responses in practice. Coordination between the central and local governments is also limited, and coordination between relevant ministries, sectors and provinces, if any, is basically the coordination of the host ministries with provinces who deploy adaptation activities related to that sector (e.g., agriculture, forestry, irrigation, transport, environment, biodiversity, etc.). In fact, there is very little coordination among ministries as well as coordination between ministries, sectors and local authorities in CCA. There is a lack of close and synchronous collaboration among the State management agencies at all levels in the evaluation and replication of the models on a larger scale, over a longer time and in many different regions and provinces.

### **7) Regional linkages/association in CCA**

The analysis and assessment results of CC impacts on all aspects show that the effects of CC in Viet Nam are inter-regional, inter-area and inter-sectoral. Therefore, in the past time, a number of inter-regional programs, projects and solutions in CC response have received attention and been mentioned. In particular, the Mekong Delta is a region assessed to be impacted by CC and these impacts are inter-regional and inter-sectoral (Nguyen Song Tung, 2015).

However, the linkage/collaboration results in key economic regions are still limited, mostly the signing of documents and plans only. There remain many shortcomings in regional development planning, with unsynchronous economic-technical infrastructure, unconnected urbans, ineffective use of natural resources, the low rate of skilled labourers or lack of high-quality labourers, etc.

On the other hand, regional coordination and linkage mechanisms have been promulgated but have not been effective, and conflicts appeared between local interests and the interests of the whole region. There is a lack of legal corridors, appropriate coordination and enforcement mechanisms/sanctions for the regional association (Tan Nguyen, 2022).

The Council of Key Economic Zones has not been provided with a full legal position, has not had sufficient resources to coordinate the overall development of the region, and is not capable of formulating regional orientations, strategies and plans.

The linkage and coordination among provinces are still fragmented and perfunctory, and have not yet created regional synergy; the regional management capacity, mindset and level have not kept pace with development; the regional shared data and information system has not received attention; there is a lack of task assignment among provinces in the region; the linkage among different industries, fields and products is not diverse; the connection of transport infrastructure, seaports, railways and urban areas contains many issues, etc. (Ngo Anh Van, 2022).

The process of regional linkage will lead to an increase in the interdependence of regions. Where the potentials, legal system and experience in operating an environmentally sustainable economy are weak and inadequate, the regional linkage in CC response is difficult.



Socio-economic regions are established mainly based on administrative criteria. The merger of provinces into regions did not consider ecological factors, development advantages, culture, etc. whereas the scale of the region keeps changing continuously. In addition, policies and responsibilities on CC response are often associated with relevant sectors, therefore, CC has not been fully considered by other sectors in the process of development policy-making.

## **8) Social mobilisation in CCA**

### **a) Engagement of young people and women**

Lack of access to further skill development and career opportunities, knowledge barriers, especially for women and young people in vulnerable areas, due to lots of difficulties in local access to CC knowledge, are the major bottlenecks preventing young people and women's greater participation in climate actions.

That Vietnamese youth are not aware of their roles, together with the lack of youth-led social organisations operating in these fields, has limited young people's access to examples of the community's actions.

### **b) Mobilisation of NGOs and social organisations**

Limited access to official data sources, lack of coordination and information sharing between social organisations and government agencies (and even among social organisations themselves) are assessed as barriers for non-governmental organisations (NGOs) and social organisations to participate in CCA activities (Ha et al., 2019).

In addition, there are limits in NGOs and social organisations' access to the state budget and limited government's co-financing for the implementation of long-term projects; limits of district government representatives in adaptation activities; a lack of buy-in of the government with the results of pilot projects conducted by social organisations (SRD and CCWG, 2019).

## **9) International cooperation in CCA**

In order to enhance the effectiveness (as well as to take advantage) of opportunities in fulfilling the commitments on CC response, MONRE, has collaborated with the Ministry of Foreign Affairs (MOFA) to carry out many public communication activities to raise awareness of international treaties on CC. However, understanding of these treaties is very limited, especially in provinces, businesses and communities.

In addition, some contents in the current legal documents do not really support or match the requirements in implementing the CC response goals in international commitments. It becomes even more difficult to comply with commitments, since there is often a lag between the time an international treaty is ratified and the time it is incorporated into national regulations. This could reduce the position and contributions of Viet Nam to, together with the international community, respond to CC and address related issues at regional and international levels (Ministry of Natural Resources and Environment, 2021a).

### 3.3. Lessons learnt from the development of the NAP

From the implementation of CCA activities in the period 2011-2020, some experiences can be drawn as follows:

*1) The attention and commitment of the Communist Party and State, the awareness of management officials, businesses and citizens plays an important role in the implementation of CCA policies and actions. Therefore, it is necessary to closely follow the Party's views and orientations on sustainable development, circular economy development, and proactive response to CC to concretise those views and orientations in the NAP for the period 2021-2030, with a vision to 2050.*

The Party and State have identified CC as one of the severe challenges affecting social stability and sustainable economic development. Together with the Party's attention and commitment, in recent times, a system of legal documents related to CC has been developed and completed, generating a legal corridor for the implementation of CCA actions. Governments at all levels and grassroots mass organisations play an important role in designing and implementing actions on CC response and disaster risk reduction in local areas. Socio-political organisations, international and national NGOs have also made active contributions in supporting the implementation of CC response at all levels. Therefore, in the coming time, it is necessary to engage the maximum participation of relevant stakeholders, especially the non-State sector.

*2) The resource mobilisation from stakeholders is essential to building capacity in CC response. Therefore, it is necessary to identify resources and capacity to mobilise resources to prioritise response activities as well as to engage stakeholders (especially enterprises) in the design and selection of priority programs and actions in the NAP.*

The State budget has not met the increasing requirements to respond to CC. In the period 2011-2020, Viet Nam mobilised resources from various international sources for sustainable development work in general and CC response in particular. However, in the current context where Viet Nam has become a middle-income country, international funding sources tend to decrease, and the nature of cooperation tends to change to a win-win method, then Viet Nam needs to make appropriate adjustments in its resource mobilisation for CC response. Together with further promotion of global, multilateral and bilateral international cooperation to access financial assistance and technology transfer, it is essential to mobilise resources from and engage the business sector, especially private sector.

The State has promulgated a number of mechanisms and policies such as mechanisms to support the development of biomass power projects, pricing policies for solar power and wind power, policies on payment for forest environmental services, etc. These mechanisms and policies have initially generated positive results, especially in the development of renewable energy. In the coming time, it will be necessary to promote the development and implementation of mechanisms for resource mobilisation and the engagement of stakeholders in CCA, including ecosystem-based adaptation (EbA), nature-based solutions (NbS), etc.

*3) Science and technology play a key role in CCA and should be further promoted. Therefore, it is necessary to identify the CCA issues that must be based on science and technology in order to propose adaptation actions and solutions associated with science and technology development in the NAP.*

Science and technology play a crucial role and contribute to improving capacity to adapt to the negative impacts of CC, and at the same time mitigate GHG emissions. Viet Nam has invested in research and application of science and technology in response to CC through key science and technology programs. A number of scientific research findings have been applied in practical production, for example, the climate-resilient plant and animal varieties, in the development of climate-resilient production processes, and in manufacturing some new CCA materials for housing construction and

transport infrastructure. However, the results achieved have not met the requirements of CC response in Viet Nam as well as the science and technology development trend to cope with CC in the world. Most of the researched products are in the form of pilots and experiments, their effectiveness has not been assessed, and they have not been deployed on a larger scale suitable to each ecological region or production field. In future, it is necessary to further promote applied research and transfer of climate-friendly technologies in the production of various industries and fields, both in terms of CCA and GHG emissions reduction. The link between research and application promotion needs to be strengthened.

*4) The overlap between CCA priorities and activities of different industries and fields leads to the dispersion of and reduced efficiency of the use of resources. Therefore, it is necessary to delineate the position of the NAP in the system of strategies, master plans and plans of other sectors and fields in order to identify objectives and specific targets that are institutionally, technically and financially feasible for implementation and contribution to the country's development goals and to proactively adapt to CC.*

Together with the National Strategy on Climate Change and National Action Plan on Climate Change, the State has also issued strategies on sustainable development, environmental protection, green growth, forestry, natural disaster prevention and control, plans to implement the Paris Agreement, National action plan to respond to CC; the NAP on Green Growth, the national action plan on environmental protection, etc. This has led to a situation where resources, including limited financial resources, were scattered and dispersed, resulting in low efficiency, and the principles of prioritisation and a focus on resource use were not guaranteed. In future, it will be necessary to focus on consistent and synchronous coordination among sectors and fields related to CC to ensure the convergence, prioritisation, and effective use of resources. The classification of public investment expenditures and the encoding of budget expenditures for adaptation purposes or partly for CCA are important for monitoring and evaluation activities to be quantified, and for reporting activities to be convenient and consistent.

*5) It is needed to focus and prioritise resources for CCA in a number of highly vulnerable sectors, fields and areas. Therefore, it is necessary to identify priority fields, areas and issues for inclusion in the NAP, and allocate required resources, and implement to create spreading effects, produce persuasive evidence, creating a premise to actively and effectively adapt to CC.*

On one hand, Viet Nam is facing resource constraints, while CC is happening in a complex way with many negative impacts; therefore, it is necessary to prioritise impacted sectors, fields and areas to focus our response efforts. On the other hand, the State budget does not have a separate allocated fund source for overall CC response programs, including CCA activities, but rather, adaptation is often identified as a co-benefit objective in investment projects and tasks. Therefore, it is necessary to clearly determine the feasibility (legal basis, capital, technology) of CCA activities before approving projects having socio-economic development objectives. Priority areas for CCA are different in different sectors and provinces. Therefore, it is necessary to identify using the co-benefit criteria, besides the core CCA benefits, such as natural disaster prevention and control, water resource management, forest protection and development, renewable energy development, gender equality, employment, hunger eradication and poverty reduction, etc. In key locations, it is necessary to prioritise investments in implementing CCA solutions, such as in the Mekong Delta, the Central coastal area, Northern mountainous areas, urbans and key archipelagos and islands.

*6) It is necessary to strengthen monitoring and evaluation of the NAP implementation*

The establishment and implementation of a monitoring and evaluation (M&E) system, part of the NAP, plays an important role in monitoring the implementation of the NAP, in order to make appropriate and timely adjustments, especially for long-term objectives and targets. At the same time, a strong M&E system will contribute to improving the effectiveness and efficiency of the State management of CCA activities.



## *CHAPTER IV.* **NATIONAL ADAPTATION PLAN**

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## ***IV. NAP***

### **4.1. Objectives**

#### ***4.1.1. Overall objective***

Mitigate vulnerability and risks from the negative impacts of CC through strengthening the resilience and adaptive capacity of the natural, economic and social systems; minimise losses and damages caused by increasing natural disasters and climate extremes and sea level rise due to CC; promote the integration of CCA into the strategy and planning systems.

#### ***4.1.2. Specific objectives***

- Strengthen the resilience and adaptive capacity of natural, economic and social systems through investing in adaptation actions, science and technology, capacity building and awareness raising to be ready to adapt to CC;
- Reduce natural disaster risks and minimise damages, be readily prepared to response to increasing CC-induced natural disasters and climate extremes;
- Improve the effectiveness of CCA through intensifying the State management of CC response and promoting the integration of CCA into the strategy and planning systems.

### **4.2. Scope**

- Location: The NAP is implemented throughout the whole mainland and territorial waters of Viet Nam
- Duration: 3 phases: 2021-2025, 2026-2030, and a long-term vision to 2050

## 4.3. Tasks and solutions

### 4.3.1. Enhance resilience and adaptive capacity of natural, economic and social systems, ensure sustainable livelihoods

*Enhance resilience and adaptive capacity of natural, economic and social systems, ensure sustainable livelihoods through investing in adaptation actions to effectively use and prevent the reduction and degradation of water and land resources; develop CCA and climate smart agriculture; protect and develop forests and ecosystems; develop the infrastructure system; strengthen medical and health care systems; ensure social security and gender equality. Specific tasks and solutions include:*

#### **1) Effectively use and prevent the reduction and degradation of water and land resources**

- Make and implement the national master plans on water resources, at national level and in river basins, which identifies areas in need of strict protection. Investigate and assess underground water sources; strictly manage groundwater extraction; prevent degradation, depletion and pollution of water sources. Build a water resource monitoring system, a system of water resource information and database; and enhance the ability to forecast on water resources. Strengthen solutions to manage, regulate, extract and use water resources economically and efficiently; strengthen the surface and underground water storage capacity, focusing on areas at risk of drought, water shortage and adverse impacts of saline intrusion.

- Rationally and efficiently exploit unused land and alluvial land along rivers and coastal areas for further afforestation and green tree plantation in urban areas and industrial zones. Strengthen solutions to renovate and protect the soil environment, especially for degraded agricultural production land; prevent and minimise soil degradation due to erosion, drought, and saline intrusion.

- Prioritise investment in searching, exploration and extraction of water sources to supply water for daily domestic use and production in mountainous areas, ethnic minority areas, border areas, islands, areas with difficult and extremely socio-economic conditions, and areas suffering scarcity of fresh water.

- Encourage organisations and individuals to invest in research on and application of advanced science and technology to manage, protect and develop water sources, extract and use water resources economically and efficiently, treat wastewater up to standards and technical regulations/criteria for reuse, treat saltwater and brackish water into fresh water, collect and use rainwater, artificially replenish underground water, restore polluted, degraded and depleted water sources, prevent, combat and overcome harmful consequences caused by water.

#### **2) Develop climate-resilient and smart agriculture**

- Promote agricultural restructuring, implement CC-resilient and smart agricultural solutions; improve the efficiency of agricultural land use; shift part of the rice-growing area to annual crops or mixed land of rice farming and aquaculture; make use of and promote the advantages of tropical agriculture; develop organic, ecological, environmentally friendly and efficient agriculture based on the natural advantages of each region and market demand; promote regional cooperation and regional linkage and planning on production areas; develop large-scale concentrated commodity agriculture that is modern and applies high technology and scientific advances.

- Arrange cropping structure reasonably; promote intensive farming and intercropping; develop sustainable models of crop production, livestock, aquaculture and fishing that are suitable for drought and salinity conditions; and improve the CC resilience and adaptability of agriculture in each region and area. Shift the structure of crops and livestock, develop new varieties of climate-resilient and smart plants and animals; promote the aquaculture, exploitation, protection and development of aquatic resources of high added value.

### **3) Manage forests and ecosystems**

- Strictly protect existing natural forests; enhance the protection capacity of watershed forests and coastal forests; develop large timber forests and restore forest landscapes; manage forest resources sustainably in association with biodiversity protection and enhancement of ecosystem services; promote community engagement in forest protection, management and development in order to improve livelihoods, income and employment opportunities in forestry; consolidate and complete the system of monitoring and evaluation and emergency response to forest fires.

- Manage ecosystems and biodiversity; strengthen the resilience of natural ecosystems and protect and conserve biodiversity against the impacts of CC and sea level rise.

- Establish and expand the operation of marine conservation zones and nature reserves; develop nature-based, ecosystem-based, and community-based models for CCA; strengthen the participation of local communities in the protection, conservation and management of biodiversity; conduct inventory, assessment and development of the national database on biodiversity.

### **4) Develop CCA infrastructure**

- Make plans; invest in developing the infrastructure of industrial parks, urban and residential areas, coastal and island resettlement areas based on the disaster risk zoning and CC scenarios. Upgrade and renovate the infrastructure of sectors, and also simultaneously implement measures on environmental protection and CCA.

- Build, upgrade and renovate infrastructure in cities, concentrated population areas, industrial parks, coastal and island resettlement areas; develop urban areas, coastal urban areas, marine tourism, eco-tourism centres; apply advanced cooling solutions, new materials and technologies capable of CCA in construction and urban fields.

- Build, upgrade and renovate medical facilities and schools to ensure their resilience to the impacts of CC and natural disasters; ensure accessibility and operation in the events of natural disasters and evacuate in emergency natural disaster situations.

- Construct and complete traffic works in areas at high risk of natural disasters and vulnerable to CC; develop and complete the expressway network and the inter-regional transport system.

- Prioritise the construction and upgrading of water drainage systems to prevent flooding caused by heavy rains, floods, tide surges and storm surges in large cities and coastal cities. Focus on completing freshwater storage works for domestic use and production; build a number of new large multi-purpose reservoirs in drought-stricken and water-scarce areas.

- Strengthen capacity and infrastructure; find solutions to provide clean water for the residents, with attention paid to rural, mountainous and coastal areas, especially areas affected by storms, floods, droughts and saline intrusion.

### **5) Strengthen the medical and health care systems**

- Develop a network of medical and health care to meet the requirements for prevention and control of new CC-induced epidemics and diseases; prioritise vulnerable groups and ethnic minority areas; build and replicate models of the health sector and community health models in order to improve the community's resilience and adaptability; develop a system of monitoring and early warning of impacts of CC on health; strengthen CC communication in the health sector and build the health sector's CCA capacity.

- Develop a system of monitoring and early warning of impacts of CC on health; build and complete the national database on CC and natural disaster prevention and control; improve users' access to and share online data on CC and natural disasters with users.

#### **6) Ensure social security and gender equality**

- Develop sustainable livelihood models, including nature-based, ecosystem-based, and community-based CCA models; focus on training, job change and technology support, access to preferential capital sources and risk insurance services for people in high-risk areas and those vulnerable to the impacts of CC.

- Enhance the participation of women, youth and people in the implementation of policies and activities on natural disaster prevention and control and CCA.

### **4.3.2. Mitigate natural disaster risks, minimise damages caused by increasing natural disasters and climate extremes, contributing to addressing CC-induced losses and damages**

Mitigate natural disaster risks, minimise damages and be ready to respond to increasing CC-induced natural disasters and climate extremes by capacity building in forecasting, early warning of natural disasters and extreme climate and weather conditions; improve natural disaster risk management systems to minimise vulnerability and enhance preparedness to respond to climate extremes; by implementing solutions to minimise losses and damages due to short-term, medium-term and long-term CC-related impacts in the future. Specific tasks and solutions include:

#### **1) Make forecasts and early warnings**

- Enhance investment; upgrade and modernise the national network on CC monitoring, hydrometeorological monitoring; specialised disaster monitoring system, including: storms, tropical depressions, strong sea wind, whirlwinds, lightning, heavy rain, flood, flash floods, and inundation; landslide, land subsidence due to rain, or runoff or drought; water surge/sea level rise, saline intrusion, heatwave, drought, natural forest fire, damaging cold, hail, fog, hoarfrost, earthquake, tsunami and other natural disasters. Socialise a number of activities to monitor climate extremes; give priority to automated rain measurement systems (need to control the process and quality of the installation, and operation of automated rain gauge stations).

- Upgrade and modernise technologies in analysis, forecasting and warning of weather and natural disasters on a par with technologies in developed countries in Asia; apply advanced and modern forecasting technologies; prioritise the development of technology for quantitative rain forecasting, warning of flash floods, landslides, and impact-based forecasting; improve capacity in providing climate services and information for disaster prevention and control.

- Build capacity in disaster information transmission; ensure the complete, accurate and timely transmission of information for effective disaster prevention and control; develop a multi-disaster warning system that can be linked/combined with the national information and communication infrastructure system.

- Improve the disaster risk management system; complete the climate and disaster risk assessment and zoning; perform disaster warning mapping; develop and complete the national database on CC and NDPC; improve the accessibility and sharing of online data on CC and natural disasters with users; strengthen capacity and measures to manage and promote disaster risk reduction, focusing on community-based disaster management solutions; develop nature-based and ecosystem-based natural disaster prevention models that promote local knowledge in disaster prevention.

## ***2) Construct and upgrade works serving natural disaster prevention and control***

- Consolidate, upgrade and complete the system of river dykes, sea dykes, irrigation works and hydropower plants to ensure proactive prevention and control of floods and storms as designed and ensure safety from the increasing impacts of CC; give priority to ensuring the safety of the system of reservoirs, dams, river dykes, sea dykes; construct and upgrade the storm anchorage areas in accordance with the planning, in association with logistics services, fishery information, including island areas.

- Build and strengthen works to prevent and control river bank and coastal erosion in areas where landslides are complicated and seriously threatening dykes, concentrated residential areas and major infrastructures; prioritise the application of soft solutions and nature-based adaptive models in landslide prevention, and in protection of riverbanks and coasts.

- Build capacity in prevention and control of flash flooding, landslides, storm prevention, prevention of heavy floods and extreme floods; prevent and control the harmful effects of drought, strong tides and saline intrusion.

## ***3) Ensure the safety of people's lives and properties, reduce CC-induced losses and damages***

- Make planning; invest, relocate and rearrange residential areas in areas frequently affected by extreme climate, especially in places at high risk of storms, floods and storm surges, erosion of riverbanks, coasts, or at risk of flash floods, landslides, land subsidence, geological hazards; monitor, supervise and warn in areas where relocation could not be conducted to timely evacuate and minimise risks.

- Strengthen measures to ensure safety for citizens, especially vulnerable ones in areas frequently affected by extreme climate and natural disasters; develop and construct disaster-resilient safe houses in association with new rural development work; construct community houses that can be also used as evacuation venues in case of emergent natural disasters to ensure human safety.

- Build capacity of the search and rescue task forces, to ensure security, political and social order and safety in cases of natural disasters.

- Conduct post-disaster recovery and reconstruction programs, with priority given to areas that suffer more damage and to vulnerable people; deploy disaster risk insurance for production and business and immediately prioritise a number of high-risk fields such as crop production, aquaculture and seafood production.

## ***4.3.3. Complete institutions, promote potentials and resources to effectively adapt to CC***

Strengthen the State management of CC, complete policies and systems of strategies and planning related to CC and promote the integration of CCA into the system of strategies and plannings to improve CCA effectiveness; promote CCA activities generating co-benefits, improve public awareness and participation in CCA activities through communication and training on CC; strengthen scientific research and develop technologies; mobilise financial resources for CC and international cooperation on CC. Specific tasks and solutions include:

### ***1) Develop and complete institutions and policies***

- Develop and complete the laws on CC. Review, amend and supplement specialised laws, strategies, master plans and development plans at all levels for the period 2021-2030, with a vision to 2050 to ensure the requirements for CC response and CCA integration.

- Complete regulations on management of CCA activities; develop sets of criteria, tools to assess climate risks, vulnerability, losses and damages due to CC; identify CCA projects and tasks and evaluate the effectiveness of CCA activities; mainstream gender equality; promote the participation of women and young people in CCA programmes and activities.

- Develop and complete an inter-regional and inter-sectoral coordination mechanism in CCA, as well as mechanisms and policies suitable to the objectives of integrating and promoting CCA activities that bring co-benefits together with sustainable socio-economic development, disaster risk reduction and GHG emission reduction.

- Develop mechanisms and policies to promote the development of “green” finance and credit services and the climate risk insurance market; in the short term, deploy CC-induced risk insurance in a number of at-risk fields such as crop production, aquaculture, and seafood production.

- Complete the national M&E system for CCA activities; establish and operate a sectoral and provincial M&E system for CCA activities.

## ***2) Communicate, raise awareness and promote public engagement***

- Diversify communication methods/channels; improve the quality of communication on mass media in order to provide adequate, accurate and timely information on hydro-meteorological forecasts, forecasts and warnings of natural disasters to authorities at all levels, organisations, households and communities.

- Develop and implement a national communication program; organise training courses for authorities at all levels, social organisations and communities to disseminate, raise awareness and update knowledge and information on natural disasters, CC, NDPC and CCA; promote movements, programs and projects of youth and women on NDPC and CCA.

- Preserve and promote traditional culture and local knowledge, with special attention to the role of artisans in CCA; communicate and replicate CCA activities and nature-based, ecosystem-based and community-based CCA models.

## ***3) Develop human resources***

- Develop and conduct trainings, foster trainings and refresh trainings on CCA and disaster risk reduction (DRR), with a focus on technical experts, women, youth and vulnerable groups.

- Develop and implement educational and training programs integrated with CC response and disaster risk management at all educational levels; improve the quality of teaching programs on CC response.

- Enhance research, surveys and statistics; periodically forecast demand and supply capacity of human resources for CCA; disseminate and provide information on the CC-related labour market related to CC.

- Develop a pool of high-quality CCA experts, to meet management requirements and be in line with the roadmap, national regulations and international CC treaties to which Viet Nam is a signatory.

## ***4) Develop science and technology***

- Propose and develop policies to remove barriers for enterprises to invest in research and response to CC and promote research, transfer and application of CCA technology in national corporations and enterprises and communities.

- Promote fundamental research so that Viet Nam has some source technologies in CCA.

- Conduct scientific research; develop and transfer technology, with priority given to high technology, new technology and digital transformation in CCA; study CCA solutions that can generate co-benefits together with GHG emissions reduction and sustainable socio-economic development; study how to address CC-induced losses and damages.

- Actively develop solutions and technologies of Viet Nam for the development of green economy, circular economy, environmental protection and responses to climate-induced challenges.

- Study the scientific basis for the rational use of natural resources; study how to identify the nature, causes and impacts of natural disasters, the nature-human-society interactions, with the CC process in Viet Nam serving as a scientific basis for the proposal and implementation of solutions to limit and respond to CC.

- Promote inter-sectoral research between natural sciences, social sciences, humanities and technology on seas and oceans in order to establish scientific arguments for the formulation of master plans, the planning, and completion of policies on CC response.

- Apply technology and innovation in estimating and forecasting CC impacts on natural and social systems to contribute to transforming challenges into development opportunities; support ministries, sectors and provinces, organisations and individuals to improve their CCA capacity.

- Research, develop, supplement and update standards and technical regulations on planning, designing and construction of works and infrastructure that take into consideration the impacts of CC in the long term.

- Develop and replicate activities and models applying environmentally friendly and CCA technologies.

### **5) Mobilise financial resources for CCA**

- Review, amend and supplement mechanisms and policies to attract investment capital flows and international supports to CCA; develop mechanisms and incentives for the private sector to invest and cooperate in investment to protect themselves against the impacts of CC.

- Encourage and enhance the engagement of businesses and people, especially women, youth and ethnic minorities in investment, research and implementation of CCA activities; mobilise the private sector to invest in implementing CCA activities through forms of cooperation between the State and enterprises, between the State and the private sector, and between domestic and foreign investors.

- Prioritise the allocation of resources and investments from the State budget, or use non-refundable supports, grants, ODA, concessional loans to implement CCA works and projects that co-benefit the socio-economic development and GHG emissions reduction.

- Monitor financial resources and supports for CCA in accordance with Vietnamese law and the requirements of the United Nations Framework Convention on Climate Change (UNFCCC).

- Research and propose the formulation of a Fund for CCA and promote the effectiveness of the Fund for Natural Disaster Prevention and Control.

### **6) Promote international cooperation in CC response**

- Fully fulfil the country's obligations as a signatory of the United Nations Framework Convention on Climate Change, the Paris Agreement on CC and other international treaties to contribute to the global response to CC; periodically develop, update and implement the Nationally Determined Contribution (NDC), Biennial Transparency Report, NAP, National Communications of Viet Nam and other national reports on CC.

- Promote cooperation, research and application of science and technology in implementing solutions to adapt to CC and sea level rise; in forecasting and warning of natural disasters and appropriate response solutions to the transboundary impacts of CC response in the world.

- Support national agencies in capacity building to become recognised organisations to the Green Climate Fund, Adaptation Fund and others.

### **4.3.4. Tasks and solutions for each region**

Due to the unique features of each region, the impacts of CC and CC-induced risks on each region are different. Among the CCA tasks and solutions implemented nationwide, it is necessary to focus on specific CCA tasks and solutions in each region as follows:

#### **1) Northern midland and mountainous region**

- Protect and restore forests and promote afforestation; develop sustainable agriculture, forestry, household economy; protect biodiversity and the ecological environment.

- Shift the structure of crops and livestock; protect crops and livestock by proactively adapting to natural disasters, especially heavy rain, flood, hail, damaging cold, and frost.

- Enhance investments in traffic infrastructure to respond to CC, focusing on linkages within the region and with the Red River Delta and Hanoi capital.

- Protect and effectively use water resources; proactively prevent flash floods, landslides and inundation; ensure the safety of reservoirs, hydroelectric dams and irrigation works.

- Actively relocate residents living in areas at high risk of flash floods and landslides.

#### **2) Red River Delta**

- Develop urban infrastructure and traffic systems; develop a number of modern industrial production and service industries that can adapt to CC and sea level rise.

- Expand and develop high-tech agriculture and clean agriculture that is climate resilient.

- Actively prevent and combat floods and storms; combat and prevent riverbank and coastal erosion; operate the reservoirs safely; ensure the safety of the dyke system; consolidate and complete the sea dyke system, promote the planting of trees to prevent sea waves and coastal protection forests.

- Construct, consolidate and upgrade irrigation systems to ensure drought resistance and serve water supply; construct and complete storm sheltering anchorages; construct and consolidate urban water drainage works, ensure inundation prevention for Hanoi and big urban areas in the region.

### **3) North Central and Central Coast**

- Develop blue economy; restructure agriculture, forestry, aquaculture and seafood production in order to ensure efficiency and CCA, given the typical characteristics of local natural disasters, especially in areas prone to frequent flooding and droughts.

- Develop economic zones and industrial zones; strengthen regional linkages; develop coastal urban systems, marine tourism centres, eco-tourism centres, seaports and seaport services; build and upgrade storm sheltering anchorages which also provide fisheries logistics services.

- Strengthen forest management, protection and development; improve forest quality; preserve natural coastal sand dunes; develop nature-based, ecosystem-based CCA models to contribute to minimising and preventing flash floods, landslides, soil erosion, and ensuring livelihoods and developing tourism.

- Build capacity in preventing, controlling and minimising damages of natural disasters, especially storms, floods and inundation; fight against desertification; make planning on construction of houses and works and evacuation of people to ensure safety before natural disasters; arrange and relocate people in areas at high risk of flash floods and landslides.

- Consolidate and upgrade to ensure the safety of dams, reservoirs, sea dykes, river dykes, irrigation works, and prevent and control of erosion of riverbanks and coasts; effectively operate the reservoirs to ensure the safety of the works and of the downstream areas, and at the same time serve the prevention and control of flood, drought and saline intrusion.

### **4) Central Highlands**

- Focus on developing forestry economy; protect and restore forests; protect the ecological environment; improve the efficiency of industrial and medicinal plant areas; shift crop and livestock structure; apply water-saving irrigation technology.

- Develop transport infrastructure in the context of CC, focusing on connecting the Central Highlands provinces with the Southeast region, the South Central region, with the South of Laos and the North East of Cambodia.

- Construct and upgrade dams and reservoirs; operate reservoirs safely and effectively; make flooding maps for the reservoir downstream areas that correspond to different scenarios of flood release and dam failure.

- Arrange and relocate residents in areas at high risk of flash floods and landslides.

### **5) South East**

- Promote cooperation, develop and build capacity in CCA.

- Build and upgrade transport and urban infrastructure, natural disaster prevention and control works, coastal and riverside works; plant and protect mangrove forests in coastal estuaries; build storm sheltering anchorages which also provide fisheries logistic services.

- Build and upgrade the system of irrigation works; ensure the safe operation of irrigation and hydroelectric reservoirs; supplement and upgrade the anti-flooding system due to heavy rains and strong tides in Ho Chi Minh City; build and upgrade works to prevent drought and saline intrusion.

## 6) Mekong Delta

- Focus on climate-resilient rice, fruit production and aquaculture;<sup>11</sup> develop organic agriculture, highly efficient agriculture that optimises agricultural value; develop seedling technology, processing industry, and preservation of agricultural and aquatic products.

- Develop clusters of agricultural economic sectors linked to urbanised and industrialised areas to create breakthrough development; focus on developing infrastructure which is of great meaning to the transformation of development models, especially transport, energy, clean water supply, irrigation and social infrastructure.<sup>12</sup>

- Shift economic structure suitably to each ecological region; actively “live with floods, droughts and saline intrusion,” make use of advantages for sustainable development.

- Develop an overall strategy for the sustainable protection and use of Mekong River water resources; control groundwater extraction and land subsidence caused by groundwater extraction; build a system of works to store water in the rainy season, regulate the water source for the dry season to minimise the impacts of drought and saline intrusion.

- Build, upgrade and complete the system of sea dykes, dykes, embankments, flood and saline intrusion control works, in-field irrigation systems to serve the shifting and sustainable agricultural development.

- Build and strengthen works to prevent erosion of riverbanks and coasts; ensure safety for residents and infrastructure; develop mangroves and coastal biodiversity while assuring biodiversity and sustainable livelihoods.

- Complete the program to build (safe) residential areas and housing areas in flooded areas; consolidate and upgrade works and evacuate residents in flood and storm prevention and control.

## 4.4. Implementation phases

### 4.4.1. Period 2021-2025

Period 2021-2025 focuses on the following activities: complete CCA mechanisms and policies; prepare the legal grounds and technical conditions to promote the integration of CC into policies and systems of strategies and plannings; implement prioritised CCA tasks and solutions; build capacity in responding to natural disasters, minimising damages caused by natural disasters and erratic changes in climate and weather.

a) Develop and complete the national legal framework on CC; prepare the foundation for the formulation of the Law on Climate Change; review, update and build new socio-economic development master plans and national sectoral master plans in accordance with the provisions of the Planning Law and based on the CC scenarios; promote the integration of CCA into the system of strategies and master plans; develop and implement a monitoring and evaluation system for CCA activities; develop and complete the database on CC and NDPC.

b) Support national agencies in capacity building to become recognised organisations to the Green Climate Fund, Adaptation Fund and others; develop and periodically update the Report on NAP to submit to the United Nations Framework Convention on Climate Change.

<sup>11</sup> Specifically, 3 focuses according to the Decision No. 287/QĐ-TTg approving the Master Planning for Mekong delta in the period 2021-2030, with a vision to 2050

<sup>12</sup> Decision No. 287/QĐ-TTg approving the Master Planning for Mekong delta in the period 2021-2030, with a vision to 2050

c) Deploy and replicate models of climate-resilient intercropping agriculture; improve the efficiency of agricultural land use; arrange suitable seasonal and crop structure; develop and replicate varieties of plant, livestock and climate-resilient crop and livestock models.

d) Effectively use and prevent the decline and degradation of water and land resources; manage ecosystems and biodiversity; strengthen the resilience of natural ecosystems and protect and conserve biodiversity; promote ecosystem-based and community-based CCA activities.

e) Improve capacity for CC monitoring, hydrometeorological monitoring, natural disasters forecasting, warning and information transmission; increase the safety of the system of natural disaster prevention works; timely and effectively implement NDPC solutions related to storms, floods, flash floods, inundation and landslides; control inundation in cities and concentrated residential areas; prevent and control riverbank and coastal erosion, drought and saline intrusion; improve the resilience of the infrastructure; upgrade and renovate traffic works in areas at high risk of natural disasters and vulnerability to CC.

f) Increase resources for CCA through programs and training; implement projects on human resource development; promote gender equality and the role of women and youth in CCA activities; promote scientific research and technology transfer on CCA; attract investment in CCA and strengthen international cooperation.

#### **4.4.2. Period 2026-2030**

Period 2026-2030 focuses on the following activities: further strengthen the State management of CC; collaborate and integrate activities in the implementation of tasks and solutions to build capacity of sectors, aspects and economic sectors, communities and ecosystems to enhance resilience and readiness to adapt to CC; continue to improve the resilience of the infrastructure system, the adaptability of the natural ecosystem and biodiversity; strengthen the recovery capacity of natural ecosystems; protect and conserve biodiversity from the impacts of CC; promote adaptation actions that generate co-benefits in CC-induced risk reduction and economic, social and environmental performance. Monitor and assess the impacts of global CC response activities on Viet Nam; identify solutions to minimise impacts and take advantage of opportunities for socio-economic development.

#### **4.4.3. Vision to 2050**

The period 2030-2050 shall promote the achievements in the period 2021-2030; further strengthen the CCA capacity of citizens, infrastructure and natural systems in order to protect and improve the quality of life; ensure food security, energy security, water security, gender equality, social security and public health; protect natural resources and develop sustainably in the country in the context of CC and assure safety from natural disasters; integrate CCA in all socio-economic activities in order to actively adapt to CC; make use of opportunities from CC for socio-economic development; and make positive contributions to the international community in CC response and protection of the earth's climate system.

### **4.5. Specific tasks**

Specific tasks were determined based on the above tasks and solutions to achieve the specific targets of the NAP. Specific tasks are arranged into groups of adaptation tasks and solutions; At the same time, they are divided by adaptation fields to facilitate organisation, implementation and monitoring and evaluation.

The list of tasks to implement the NAP for the period 2021-2030, with a vision to 2050 is presented in Appendix 1.

## **4.6. Organisation of implementation of the NAP**

### **4.6.1. Ministry of Natural Resources and Environment**

The Ministry of Natural Resources and Environment shall:

- Lead and coordinate with relevant ministries, sectors and People's Committees of provinces and centrally run cities in monitoring and urging the implementation of the NAP; periodically review, summarise, report and propose to the Government and the Prime Minister necessary measures to ensure synchronous and effective implementation of the Plan.

- Lead and coordinate with relevant ministries, sectors and People's Committees of provinces and centrally run cities in organising the monitoring and evaluation of the implementation of the NAP; promptly report and advise the Government and the Prime Minister on solutions to address shortcomings and problems arising during the implementation process at central and local levels, ensure the implementation progress of the NAP as planned, with practical effect.

- Implement the NAP and assigned tasks..

### **4.6.2. Ministry of Planning and Investment**

The Ministry of Planning and Investment shall:

- - Lead and coordinate with relevant agenciesNAPin reviewing and synthesising investment projects into the medium-term public investment plans for different phases based on the proposed project lists of ministries, central and local agencies to submit to competent authorities in accordance with the provisions of the Law on Public Investment and documents guiding the implementation of the Law on Public Investment;

- Collaborate with relevant ministries, sectors and agencies in reviewing socio-economic development master plans and plans to ensure the integration of tasks of the NAP, ensure the synchronization among the master plans and plans; develop mechanisms and policies to support and attract investment for climate change adaptation activities;

- Collaborate with the Ministry of Natural Resources and Environment to monitor and evaluate the implementation of the NAP;

- Implement the NAP and assigned tasks.

### **4.6.3. Ministry of Finance**

The Ministry of Finance shall:

- Lead and coordinate with relevant ministries and agencies in arranging or guiding the allocation of funds for recurrent expenditures to implement the NAP as regulated.

- Lead and coordinate with relevant ministries, sectors and agencies in formulating mechanisms and policies on financial resources mobilisation and management; mechanisms and policies to encourage and enhance the engagement of all economic sectors in the implementation of the NAP.

- Implement the NAP and assigned tasks.

#### **4.6.4. Ministries, ministerial-level agencies, Government agencies, People's Committees of provinces and Centrally run cities**

- Focus resources on implementing the works assigned in the attached list of programs, schemes and projects' tasks, ensuring quality and progress as required.

- Review sectoral, field and local development master plans and plans to ensure that the NAP's activities are integrated as regulated and ensure consistent linkages among these master plans and plans.

- Promote activities on monitoring and awareness-raising communication during the implementation of assigned works.

- Propose to the Government and the Ministry of Natural Resources and Environment measures to optimise the implementation of the NAP and necessary adjustments to the NAP in the following period.

- Conduct monitoring and evaluation of adaptation activities within their respective scope of management. Annually report on the progress of ongoing tasks, results of completed tasks, incomplete tasks compared to the required progress and schedule and reasons/justification, to the Ministry of Natural Resources and Environment before December 25<sup>th</sup> for its summary and report to the Government and Prime Minister.

Based on the approved NAP for the period 2021-2030, with a vision to 2050, ministries, ministerial-level agencies, Government agencies, People's Committees of provinces and Centrally run cities shall develop detailed contents/activities, estimate budget for the implementation of assigned tasks in accordance with current laws, and then submit it to competent authorities for approval – which will be used as a basis for determining and allocating funds in accordance with the Law on State Budget. For those under the regular functions and tasks, ministries, sectors and provinces shall allocate funds for the implementation from their annual assigned budget estimates.

### **4.7. Monitoring and evaluation**

#### **4.7.1. Objectives of monitoring and evaluation**

- Monitor and evaluate the implementation process and results of CCA activities in the NAP, including: monitor, track and evaluate the formulation of normative legal documents, mechanisms and policies; the integration of CCA into master plans and plans; the implementation of adaptation tasks and projects; and activities on increasing resources for adaptation and results.

- Evaluate the effectiveness of implementation of adaptation activities in terms of reduced vulnerability, enhanced resilience, adaptive capacity and reduced losses and damages caused by CC; provide a foundation for the management, coordination and improvement of the effectiveness of adaptation activities and the State management of CC.

- Contribute to raising awareness of CCA through the process of planning and implementation of adaptation activities, monitoring and evaluation of CCA activities.

#### **4.7.2. Subject matters of monitoring and evaluation**

The monitoring work shall focus on the implementation, the results of tasks and adaptive solutions; and the evaluation work shall focus on the extent of achievement of the objectives of

the NAP. The subject matters of monitoring and evaluation are specified into groups of tasks and solutions as follows:

- Group of tasks and solutions to enhance resilience and adaptive capacity of natural, economic and social systems, ensure sustainable livelihoods, including adaptation activities in the fields of: agriculture, forestry and fishery; environment and biodiversity; water resources; transport; construction, urban; industry, commerce and services; health and public health; education, training; labour and society; culture, sport, and tourism.

- Group of tasks and solutions to reduce natural disaster risks, mitigate damages caused by increasing CC-induced natural disasters and extreme climate, including hydro-meteorological monitoring; monitoring of CC, sea level rise and saline intrusion; disaster risk management, forecasting, warning, enhancing the safety of the system of irrigation works, natural disaster prevention works.

- Group of tasks and solutions related to the finalisation of institutions and promotion of potentials and resources to effectively adapt to CC, including:

- + Completion of institutions and policies; formulation and promulgation of strategies, master plans, plans, programs, schemes, projects, national standards and technical regulations, regulations and technical guidelines; preparation of reports on CCA; integration of CCA into strategies, master plans and plans; completion of the organisation, apparatus and human resources to respond to CC.

- + Trainings, communication and awareness raising: professional trainings on CC; CC communication and awareness raising activities.

- + Investment resources for CCA.

- + Science, technology and international cooperation.

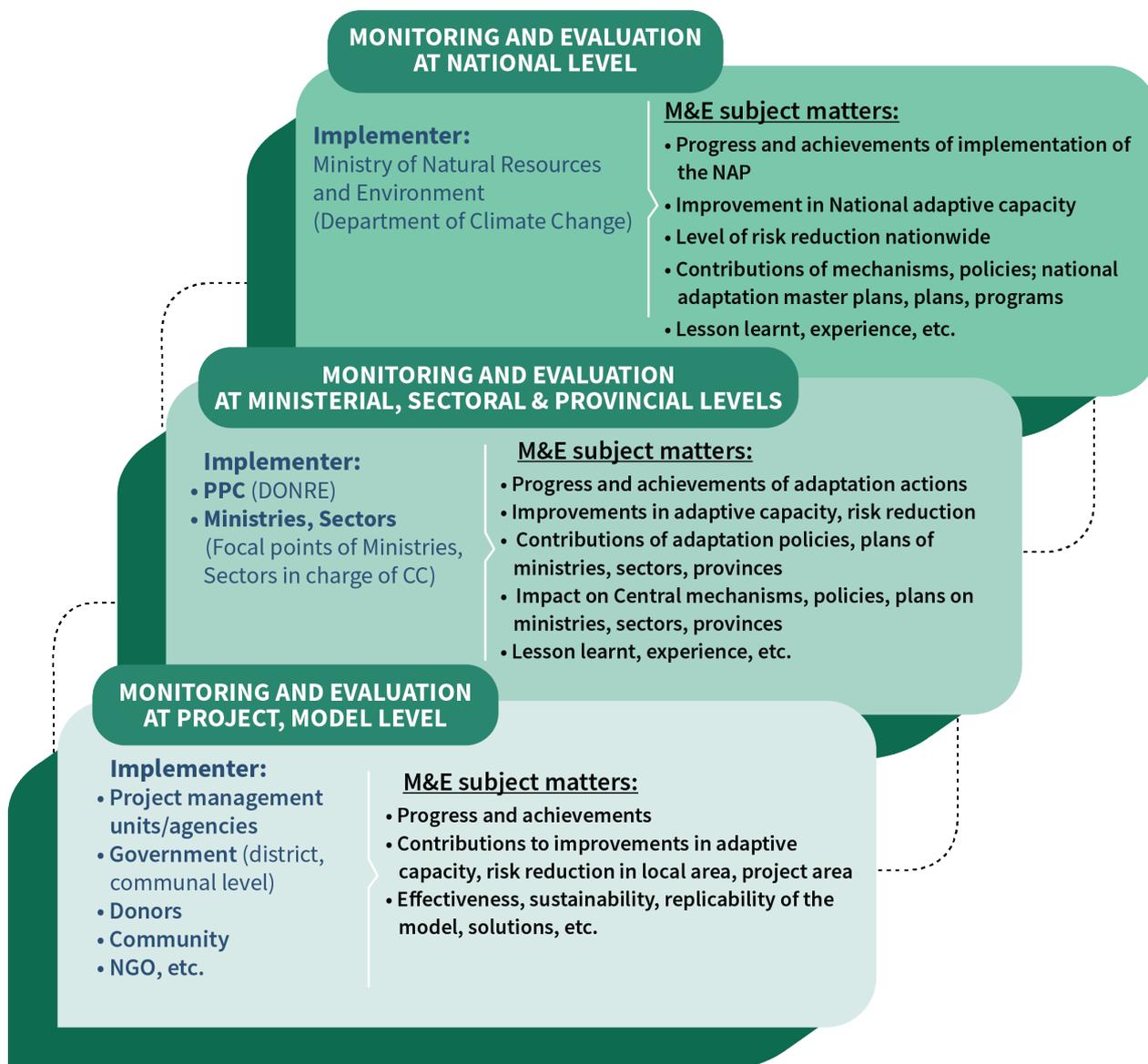


### 4.7.3. Monitoring and evaluation logical framework

In general, the CCA monitoring and evaluation (M&E) framework in this report at all levels can be generalised in Figure 4.1.

The full national adaptation M&E system is an M&E system covering all levels. M&E information and results at lower levels are collected, aggregated, and serve the M&E at higher levels. At the national level, information serving monitoring and evaluation purpose is collected from ministries, sectors and provinces through M&E reports on CCA activities submitted by ministries, sectors and provinces. MONRE synthesises the M&E results of the country's CCA activities; the Department of Climate Change is the agency directly assisting the MONRE in this role. In addition to synthesising M&E information and results from provinces, ministries and sectors, MONRE also synthesises M&E information from plans, programs and projects directly managed, operated and implemented by MONRE.

**Figure 4.1.** M&E Framework and focal points at all levels



At ministerial and sectoral levels, the respective CC focal point of each ministry and sector shall perform monitoring and evaluation of CCA activities within its respective scope of management. The information is synthesised from adaptation areas under the scope of management of each ministry from adaptation programs, plans and projects directly managed by the ministry.

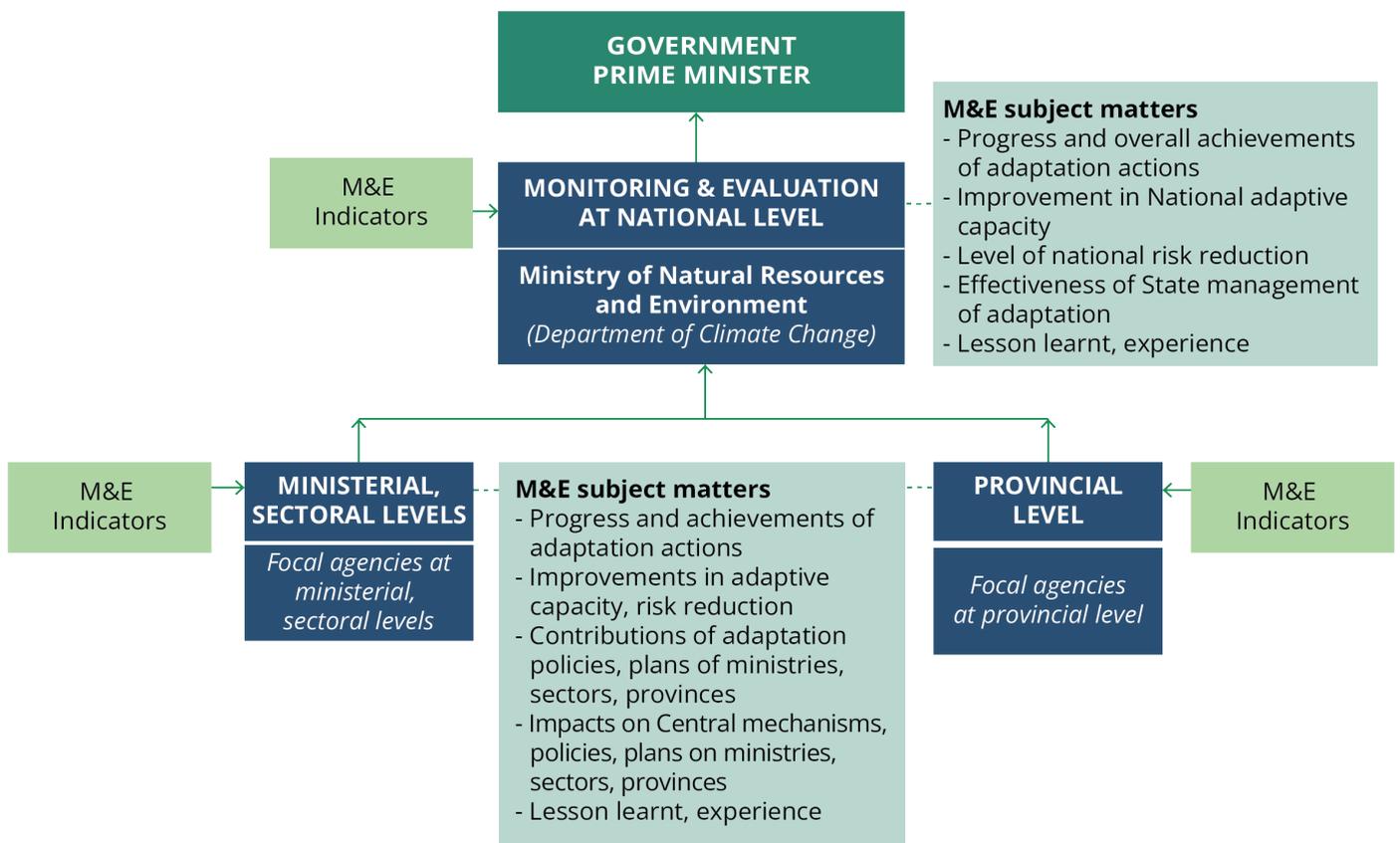
At the provincial level, the Department of Natural Resources and Environment (DONRE), as the focal point on CC, shall synthesise and evaluate CCA activities conducted at the provincial level. The information is synthesised from all districts in the province; from provincial departments and sectors whose works are related to adaptation; from adaptation programs, plans and projects directly managed by the province.

At the adaptation project, model, and activity/community levels, the M&E shall be conducted by the owner/lead agency of the project, model or activity, or by the responsible local government/agency.

Monitoring and evaluation of the NAP means monitoring and evaluation of adaptation activities on a national scale. According to the scope of implementation of the NAP and the aforementioned M&E implementers, the framework of the National M&E System is presented in Figure 4.2.

Users of the M&E system include ministries, ministerial-level agencies, and provincial-level People’s Committees who use the system to monitor and evaluate the results of the implementation of the NAP objectives and tasks, by monitoring and evaluation of CCA activities under their respective scope of management.

**Figure 4.2.** Logical framework of the National M&E System



#### **4.7.4. Set of monitoring and evaluation indicators**

##### **1) M&E indicator development approach**

Indicators were developed based on task groups and specific tasks of the NAP, in line with the M&E framework, following closely the focus of monitoring and evaluation of the implementation process and results, and also applying both M&E directions: top-down and bottom-up (Tran Thuc et al., 2021). The top-down evaluation direction is applied with indicators evaluating the extent and quality of climate risk management processes and actions: it reflects the process of climate risk integration and management in the development process, actions and institutions (evaluate the climate risk management). The bottom-up evaluation direction is applied with indicators evaluating adaptation measures and actions to strengthen resilience, mitigate vulnerability and develop in the context of CC-induced risks (evaluate the results of adaptation and development).

The development of the set of adaptation M&E indicators was done in a step-by-step manner (Tran Thuc et al., 2021), with four (4) fundamental steps as follows:

- i. Step 1 - Assess adaptation context;
- ii. Step 2 - Identify contributions to the adaptation process;
- iii. Step 3 - Develop a results-based M&E framework;
- iv. Step 4 - Identify indicators.

The identification of indicators was carried out using the quality criteria of the SMART rule (Olivier et al., 2012) including:

- Specific (S): Indicators are developed accurately, without ambiguity.
- Measurable (M): Indicators are quantifiable.
- Attainable (A): Indicators should be realistic.
- Relevant (R): Indicators must be valid and describe the correct issue.
- Time-bound (T): There is a clear timeframe.

##### **2) Requirements applicable to the set of M&E indicators**

- The set of indicators need to be established using the results-based analytical approach, while taking into account the context of implementation of national, sectoral and local adaptation activities, ensuring feasibility in the implementation.
- Indicators need to be clear and quantifiable; the information reflected through the indicator should be complete and reliable and capable of being converted into information and knowledge for evaluation.
- It is necessary to have indicators on gender and ethnic minorities in CCA; indicators to evaluate the roles, needs and opportunities of women in CCA; indicators to monitor the buy-in of adaptation results and feedback into policies.
- It is necessary to refer to the existing sets of indicators related to M&E and selectively learn the experience of some countries in similar CCA conditions. It should also be noted that the set of indicators is not immutable, but rather it is a living set that needs to be flexible given the uncertainty of CC.
- In theory, many indicators and detailed indicators will help the M&E work be highly accurate. However, in reality many is not always good, as it also relates to the ability to collect and the availability of information; ability to manage, analyse and synthesise information during M&E process. In the initial stage, only a reasonable amount of indicators should be determined, including the most basic indicators, ensuring a balance between the contents to be monitored and evaluated, and the management capacity (i.e., the ability to collect, synthesise, analyse and

evaluate information). With the implementation of adaptation activities and M&E work, the set of indicators will continue to be supplemented and completed.

### **3) Set of indicators of the National Monitoring & Evaluation System**

Based on the contents of M&E, the set of indicators is divided into 3 groups as follows:

(i) Group of M&E indicators on enhanced resilience and adaptive capacity in the fields of agriculture, forestry and fishery; environment and biodiversity; water resources; transport; construction, urban; industry, commerce and services; health and public health; education, training; labour and society; culture, sport and tourism.

(ii) Group of M&E indicators on disaster risk reduction, CC-induced loss and damage mitigation for following contents: strengthening the system of hydro-meteorological monitoring, monitoring of CC, sea level rise and salinity intrusion; forecasting, warning and disaster risk management.

(iii) Group of indicators related to the completion of institutions, and the promotion of potentials and resources to effectively adapt to CC, including:

+ M&E indicators on the completion of institutions and policies; formulation and promulgation of strategies, master plans, plans, programs, schemes and projects; development of national standards and technical regulations, regulations and technical guidelines on CCA; integration of CCA into strategies, master plans and plans; preparation of CCA reports in compliance with national and international regulations; completion of the organisation, apparatus and human resources to respond to CC.

+ M&E indicators applicable to professional trainings on CC; CC communication and awareness raising activities.

+ M&E indicators on investment resources for CCA.

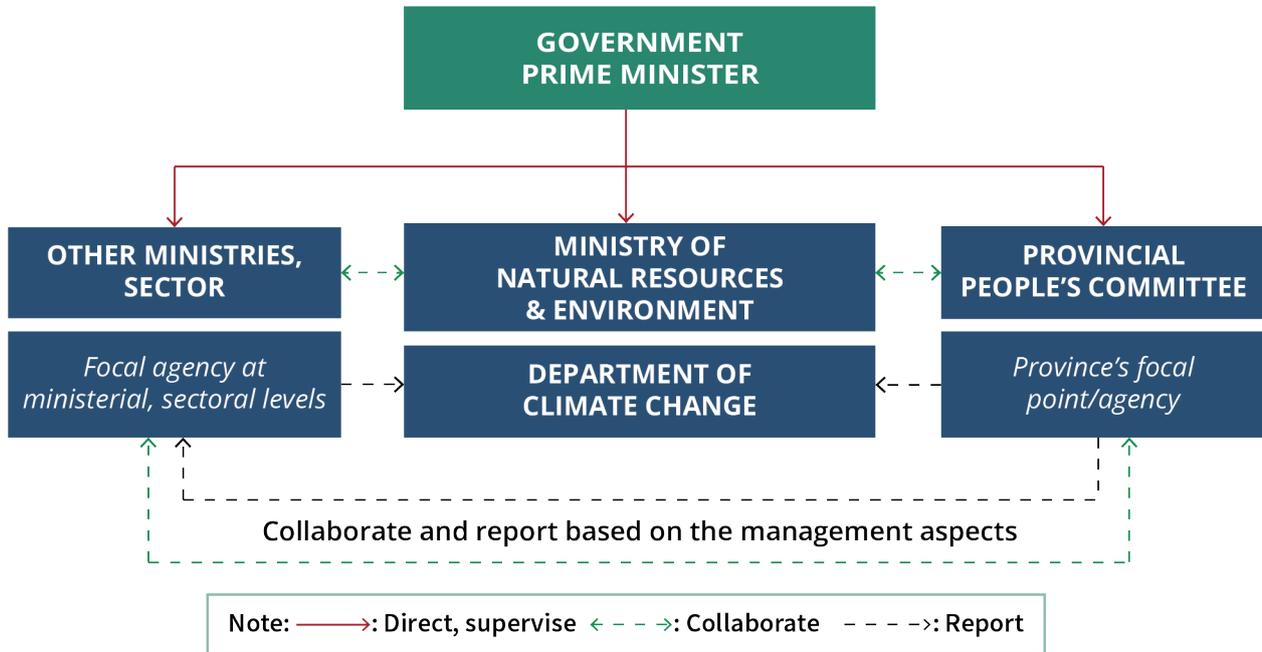
+ M&E indicators on scientific research, application of technology and international cooperation to serve CCA.

The set of national M&E indicators is presented in Appendix 2.

#### 4.7.5. Organisation and responsibilities for monitoring and evaluation

The diagram of M&E organisation, direction and coordination is presented in Figure 4.3.

**Figure 4.3.** Diagram of M&E organisation, direction and coordination



The Ministry of Natural Resources and Environment is the focal agency of the M&E System, and shall: lead and coordinate with ministries, ministerial-level agencies, and provincial-level People's Committees in organising the implementation of the M&E System; organise the M&E of CCA activities within its scope of management; guide ministries, ministerial-level agencies and provincial-level People's Committees in conducting their CCA monitoring and evaluation activities; organise a periodic comprehensive evaluation of the performance of national CCA activities; synthesise and prepare M&E reports on CCA activities to serve the State management of CC and adaptation reports in accordance with the UNFCCC's requirements.

Ministries, ministerial-level agencies and provincial-level People's Committees shall: organise the M&E of CCA activities under their respective scope of management; synthesise and report annual M&E results to the Ministry of Natural Resources and Environment.



## **4.8. Periodical review and update of the NAP**

### ***4.8.1. Review and update of the NAP***

After the first two years of implementation, the NAP will be reviewed and updated for the first time. Three years after that, the second review and update will be conducted, based on the M&E results of the implementation of the NAP in the period 2021-2025.

### ***4.8.2. Review and evaluation of the implementation of the NAP***

The period 2025-2030 will be the phase to complete the NAP's objectives. In the final year, the NAP will be reviewed and evaluated to identify achievements and lessons learnt for the development of the NAP in the next phase. The revision and evaluation of the NAP must be done through extensive consultation with ministries, sectors and provinces.

## **4.9. Financial resources for the NAP implementation**

Resources for the NAP implementation are mobilised from various channels, in compliance with the Law on State Budget, Law on Public Investment, Law on Investment and other relevant legal documents. Some mobilisation channels include the State budget (including Central budget and local budget); international assistance; resources of businesses and public contributions.

### ***4.9.1. State budget for climate change adaptation***

The State annually balances and allocates funds from the Central budget, local budget, international supports and target programs to the CCA implementation, especially to the tasks of institutional completion, CCA and the implementation of urgent investments for CCA purposes.

### ***4.9.2. Funding for scientific research and development of adaptation technology***

The National Science and Technology Program and the National Science and Technology Fund under the Ministry of Science and Technology are the two main sources from the government to fund research on CCA at different scales.

### 4.9.3. Mobilisation from international assistance for CCA

Viet Nam mobilises and calls for international assistance to support the implementation of actions under the NAP.

The Ministry of Foreign Affairs, the Ministry of Natural Resources and Environment, the Ministry of Finance, the Ministry of Planning and Investment, and relevant ministries, sectors and provinces should further mobilise other countries, international organisations and partners to enhance their assistance in CCA in Viet Nam and strengthen in-depth CCA cooperation, especially with countries having established strategic partnership in CC with Viet Nam.

#### *Some examples of the multilateral support channels for CCA actions include:*

*The Global Environment Fund (GEF):* was established in 1991 and serves as an operating entity of the Financial Mechanism under the UNFCCC. Among the supporting contents, CCA is also an area that GEF places great importance. In Viet Nam, in the field of CC, MONRE is the focal point for cooperation with GEF and other related funds. Since 1998, Viet Nam has received 17 projects from GEF for GHG emission reduction and National Communication of Viet Nam with a total funding of USD 50 million. With experience in cooperation with GEF, Viet Nam will continue to cooperate with the Fund in the process of implementing the NAP.

*Adaptation Fund (AF):* operating since 2009, the Adaptation Fund is officially associated with other funds under the UNFCCC. In Viet Nam, the Ministry of Natural Resources and Environment is currently the focal point to work with AF. Given the key nature of the NAP in the field of CCA, Viet Nam can approach the AF Fund during the implementation of the NAP.

*Green Climate Fund (GCF):* The Green Climate Fund was established in 2010 to support projects, programs, policies and other activities on CCA and mitigation for developing countries. To date, Viet Nam has received funding for five projects from GCF. Given the nature of the Fund, Viet Nam can approach GCF during the implementation of the NAP. In Viet Nam, Ministry of Planning and Investment is assigned to be the National Competent Focal Point to work with GCF.

*Loss and Damage Fund:* The Loss and Damage Fund was established under the Decision of the COP 27. The Fund was established and operates on the principles of equity, climate change justice. The aim is to provide financial support to address the “loss and damage” of vulnerable countries, heavily affected by climate change disasters, especially developing countries. Viet Nam is one of the countries that suffers the most risks, losses and damages caused by climate change, so Viet Nam needs the support of access to the Fund to receive support for CC risk and L&D reduction activities.

#### *Other bilateral and multilateral sources of funding:*

Bilateral and multilateral donors, United Nations agencies and non-governmental organisations have also supported many CCA activities in Viet Nam, including:

*Bilateral support,* including direct activities with key Ministries and some provincial agencies. For example, USAID supports strengthening urban and rural resilience to CC and disaster risk reduction. With a total fund of approximately USD 50 million, USAID will assist the Mekong Delta in reducing agricultural methane emissions and building resilience among vulnerable communities. The Project “Climate-Resilient Urban Infrastructure Project in Four North-Central-Coast Provinces in Viet Nam” is implemented with a EUR 5 million grant from the EU and an ODA credit of EUR 123 million from AFD, and the rest of EUR 28 million as counterpart funds from the Government of Viet Nam.

*Multilateral technical assistance*, provided by development banks and United Nations agencies on CC. These technical assistance activities include integration of CCA into sectoral and fields' activities. Recently, ADB, KEXIM, AFD, KfW, JICA and WB have agreed on a list of CCA sustainable development projects in the Mekong Delta expected to be implemented in the period 2021-2025, with committed capital of about USD 2.2 billion.

*Support from NGOs* includes support for CC response activities, especially in provinces; most of the activities usually focus on capacity building. This form of support is one of the few financial channels that the communities can easily approach.

Viet Nam can call for support from these sources during the implementation of the NAP.

#### **4.9.4. Mobilisation from businesses**

The State creates a legal basis to call for and encourage financial institutions, domestic and foreign enterprises to invest in and support the implementation of the NAP in Viet Nam.

Ministries, sectors and provinces, based on their assigned functions and tasks, are responsible for mobilising and managing resources mobilised from the business sector for the implementation of the NAP.

#### **4.9.5. Public mobilisation**

The State creates a legal basis to call for and encourage communities to join hands and support the implementation of the NAP in Viet Nam. This is a suitable solution for CCA measures at the community level.





# *CHAPTER V.* **CHALLENGES AND NEEDS FOR INTERNATIONAL SUPPORT**

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## *V. Challenges and needs for international support*

### **5.1. Challenges in implementing the NAP**

#### ***5.1.1. Difficulties and challenges in implementing the NAP***

CC response and protecting the Earth's climate for current and future generations have become priorities for the cooperation and action of most countries, international organisations and businesses and have become an ideology and lifestyle with widespread diffusion globally, contributing to promoting the CC response in Viet Nam. A proactive response to CC is one of the topics that receives great attention from the entire political system in Viet Nam and international development partners. The Paris Agreement has set out a global goal of adjusting the financial flows for a low-emissions and climate-resilient development roadmap; therefore, international resources to support CC response can be increasingly added. As a responsible and proactive country in realising international commitments on CC and effectively using support resources, Viet Nam has an opportunity to attract international assistance for CC response.

CCA solutions in the NAP are specific actions to realise the CCA commitments in the NDC of Viet Nam as well as to realise the long-term goals in the National Strategy of Viet Nam to 2050. These are both urgent and long-term priorities that have been identified in the strategies, master plans and plans on CCA and NDPC by ministries, sectors and provinces based on the CC scenarios for Viet Nam. Education, people's health care and social assistance have gained remarkable achievements, contributing to raising people's awareness and adaptability to natural disasters and CC. These are very fundamental advantages for the implementation of the NAP of Viet Nam.

However, as a developing country that is heavily impacted by natural disasters and highly vulnerable to CC impacts, the challenges in the implementation of the NAP are not small. Below are some possible challenges in implementing the NAP.

### **1) Overall CC response**

- CC response requires determination and efforts from all countries. Different countries have different natural, political, economic, social, scientific and technological conditions, resulting in different response actions and priorities. Unifying global efforts often takes longer, which may impact negatively on efforts to respond to CC and implement the NAP in Viet Nam.

- *In terms of resources:* The implementation of the NAP requires significant resources in terms of finance, technology and human resources while the vietnamese economy's potential has not yet been able to afford these needs. The cost of implementation of CCA measures is estimated to be around 3-5% of GDP by 2030. Therefore, along with mobilising resources and attracting investment from domestic economic sectors, the international financial and technology supports are crucial to implementing CCA activities.

### **2) CCA tasks**

- The resources needed for NDPC, CCA, sea level rise and urban flooding are very high, but the State budget is limited and needs to be balanced and allocated to various objectives, especially in the context where Viet Nam is still facing a variety of difficulties: the rate of re-impoverishment is likely to increase, especially in case of disasters, and the unemployment rate is likely to increase, especially in rural areas.

- CCA activities often require significant investment and generate little or no direct profits, making it difficult to attract enterprises to participate if there are no other support policies.

- Investments from the State budget are often made based on the priorities of ministries, sectors and provinces, so such investments are not highly inter-sectoral and inter-regional, resulting in inconsistent/unsynchronous CCA activities which could have negative impacts on each other.

- The organisational structure of agencies implementing natural disaster prevention, control and mitigation and CC response has not yet been consistent from the central to local levels.

- In the context of CC, erratic weather, many irregular hydro-meteorological phenomena and extreme weather phenomena lead to difficulties in forecasting and warning; natural disaster prevention and control work focus more on response to events/incidents, while prevention has some limitations; relief work is still overlapping; there is a lack of specialised equipment and professional force to perform the search and rescue work.

- CCA solutions mostly focus on structural solutions. Non-structural solutions, that is, soft solutions such as planning, planting mangroves, planting trees to break waves, urban planning, development of adaptive models etc., have received attention but not enough.

### **3) Completion of institutions, promotion of potentials and resources for effective CC response**

- The awareness and participation of the whole society in CC response is not high, as they assume that this is the task of the State, and the world, rather than the responsibility of each individual and each organisation in the society.

- Although a national M&E system of CCA activities exists, it takes time to consolidate and strengthen staff capacity in order to operate the system smoothly. There is a lack of an M&E system at the sectoral and provincial levels.

- There are no specific mechanisms and policies to engage small and medium enterprises in CCA activities; there are limited opportunities to access preferential credit sources to implement adaptation measures.

- The insurance market has been formed recently but has not really developed, especially disaster and CC insurance due to its high risk.

- Awareness of staff and communities of disaster management and CCA has been strengthened but is still limited.

### **5.1.2. Impacts of the implementation of the NAP**

#### **1. Economic impacts**

- The full implementation of CCA tasks in the NAP will help strengthen the capacity of ministries, sectors, provinces and communities to actively respond to CC and limit CC-induced economic losses (Ministry of Natural Resources and Environment, 2020).

- Effective adaptation solutions will help reduce adverse impacts of CC on economic sectors, limit economic losses through the protection of production facilities, maintain usual production activities, avoid risks from natural disasters and ensure the goals of food security, water security and the well-being of communities (Ministry of Natural Resources and Environment, 2020).

- Forest protection and development and a number of other activities are considered as co-benefit solutions that help enhance GHG absorption and mitigate the impacts of natural disasters and protect production, thereby indirectly stabilising people's lives and production (Ministry of Natural Resources and Environment, 2020).

- The planning, funding and implementation of CCA policies can effectively respond to the increasing risks related to CC. Many programs and policies have helped direct the ministries' focus on CC response. Some CC response programs provide services via State-owned enterprises at the central or provincial level, with either direct payment or in combination with the government budget.

- The economic structure is gradually being transformed, and many industries and products have found their footholds in the international market. Many provinces have actively implemented a number of economic models that are suitable to nature, applying high technology and climate-resilient. Transport infrastructure has received investments, and the transport system is inter-regionally connected; low-emission transport has received attention and investment; the advantages of each region and each area have been promoted, for example waterways in the Mekong Delta and aviation in the Central Highlands and mountainous areas (Government News, 2019).

#### **2. Social impacts**

The full implementation of CCA tasks in the NAP will bring positive social impacts as follows:

- Contribute, together with the international community, to CC response, thereby stabilising and improving the quality of life, security and safety of citizens (Ministry of Natural Resources and Environment, 2020).

- Contribute to improving social justice and addressing gender inequality thanks to a focus on investments in vulnerable areas and communities and attention to vulnerable people (such as children, the elderly, the poor, ethnic minorities women, etc.) and the enhanced gender equality in CC response (Ministry of Natural Resources and Environment, 2020). The implementation of CCA tasks will contribute to reducing adverse impacts on the household economy, increasing incomes and reducing the livelihood difficulties of people, which helps reduce migration rate (IMHEN and UNDP, 2021).

- Contribute to the social order, security, and stability in residential communities as it helps ensure food and water security, and creates a suitable and safe life for residents in all regions and

places, contributing to curbing involuntary migration (Ministry of Natural Resources and Environment, 2020). The implementation of CCA tasks will contribute to increasing access to natural resources in livelihood development as well as education resources (IMHEN and UNDP, 2021).

- Promote the economic, social resources and means available in the community, especially local community knowledge to respond to climate extremes and natural disasters, and to recover after natural disasters (IMHEN and UNDP, 2021).

- Develop a civilised lifestyle, with a sense of readiness to respond, mutually support and cooperate to prevent and overcome difficulties and consequences of CC (Ministry of Natural Resources and Environment, 2020).

### **3. Environmental impacts**

The full implementation of CCA tasks in the NAP will:

- Contribute, together with the international community, to protecting the Earth's climate, reducing CC, and mitigating CC harmful impacts (Ministry of Natural Resources and Environment, 2020).

- Contribute to improving the environment in residential and urban areas; promote the development and protection of ecosystems and vulnerable areas (Ministry of Natural Resources and Environment, 2020).

- Mitigate CC impacts on human habitat, such as reducing air pollution, surface and groundwater pollution; helping agricultural production be safer and industrial production be cleaner; reducing post-disaster transmission of diseases and pollution (Ministry of Natural Resources and Environment, 2020).

- Mitigate CC impacts on ecosystems; maintain and conserve environmental products and services of the ecosystems; and minimise post-disaster environmental disasters (Ministry of Natural Resources and Environment, 2020). The implementation of CCA tasks in the NAP will contribute to promoting the State management of biodiversity conservation, establishing a biodiversity corridor system so that species' distribution can be expanded to areas with more suitable climatic conditions (IMHEN and UNDP, 2021).

### **4. Impacts on integration and promotion of connection approach in development**

- The implementation of CCA tasks in the NAP will promote the integration of CC response in socio-economic development programs and projects. At the same time, due to the interdisciplinary and inter-regional nature of CC response activities, the implementation of CCA tasks in the NAP will promote a connected approach in the socio-economic development of each sector and province in a way that carefully considers the co-benefits and impacts on other sectors and provinces; thereby helping to harmonise the socio-economic development and CC response, improve stability and sustainability, and reduce CC-induced risks for socio-economic development programs, plans and activities (Ministry of Natural Resources and Environment, 2020).

- The integration of the implementation of CCA tasks in the NAP with other socio-economic development programs and plans will create conditions and opportunities to gain a high level of technology and economic efficiency and help make use of opportunities in accessing financial resources, technologies and capacity building (Ministry of Natural Resources and Environment, 2020).

- CC is an intersectoral issue; therefore, it is necessary to integrate the CC response throughout the process of development and implementation of socio-economic development plans; adaptation and GHG reduction measures are considered an integral part of development policies. The integration of CCA contents in the NAP into development policies and strategies will be effective and generate both economic, environmental and CC response benefits.

## **5. The NAP's contribution to Viet Nam's Sustainable Development Goals (VSDGs)**

CC impacts on different sectors and fields; impacts on the socio-economic development and people, especially vulnerable groups, thereby also affecting the country's sustainable development goals (VSDGs) (Huynh Thi Lan Huong et al., 2018).

The NAP details the strategic adaptation commitments in Viet Nam's NDC, in which CC is identified as a tangible threat to the achievement of the VSDGs. The implementation of adaptation actions in the NAP will, therefore, help reduce climate risks and support the implementation and realisation of Viet Nam's Sustainable Development Goals.

In order to provide more inputs for policy-makers in the selection of CCA actions, the analysis and assessment of the contributions of each CCA action to the achievement of the VSDGs is necessary (Huynh Thi Lan Huong et al., 2019).

The NAP's CCA actions will make certain contributions to the achievement of each specific SDG. The summary contributions are analysed and evaluated by considering the contributions of each specific action. The contributions of actions in the NAP to Viet Nam's achievement of 17 SDGs are analysed and presented in Table 5.1.

The analysis results show that the successful implementation of CCA tasks and solutions identified in the NAP will make a positive contribution to the achievement of the VSDGs, in which contributions of actions exist in most fields, for example, Goal 1 "End poverty in all its forms everywhere"; Goal 8 "Ensure sustained, inclusive, and sustainable economic growth, full and productive employment and decent work for all"; and Goal 10 "Reduce social inequalities."

The CCA actions in the NAP are identified to have most contributions to Goal 13 on "Respond in a timely and effective manner to CC and natural disasters" and Goal 11 "Promote sustainable and resilient urban and rural development; ensure safe living and working environments; ensure reasonable distribution of population and work force by region."

The adaptation actions in the NAP make a more modest contribution to Goals 4 "Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all"; Goal 10 "Reduced social inequality"; and Goal 16 "Promoting a peaceful, equitable, and equal society for sustainable development, provide access to justice for all and build effective, accountable, and inclusive institutions at all levels."

**Table 5.1.** Contributions of the National Adaptation Plan to SDGs

Fields in the NAP	Adaptive objectives	Adaptation activities
<b>Goal 1: End poverty in all its forms everywhere</b>		
Natural Resources and Environment	Mitigate the CC impacts, increasing salinity intrusion, increasing intensity and frequency of natural disasters	Strengthen the capacity in CC monitoring, hydrometeorological and natural disaster monitoring and forecasting, proactively respond to CC.  Mitigate the impacts of CC on water resources and land resources.
	Develop ecosystem-based and community-based CCA models	Develop community ecological adaptation models that are ecosystem-based and community-based.
	Enhance the resilience of natural ecosystems	Strengthen the management of ecosystems and biodiversity.  Enhance the resilience of natural ecosystems and biodiversity to the impacts of CC and sea level rise.
Agriculture and Rural Development	Strengthen forest-based community livelihoods	Support and encourage communities to participate in sustainable forestry development.  Develop and improve forest quality through solutions for forest regeneration, forest restoration, forest enrichment, and plant structure shifting.
Labour – Culture – Social affairs	Complete the policy system to limit CC impacts on people's job opportunities.	Develop and integrate CC response and sea level rise in employment policies.
<b>Goal 2: End hunger, ensure food security, improve nutrition and promote sustainable agricultural development</b>		
Agriculture and Rural Development	Reduce the impacts of CC on agriculture	Study, implement and replicate CCA farming models that are suitable for drought and salinity conditions.  Strengthen forms of efficient and climate-resilient fishing and aquaculture forms.  Implement measures to prevent and control diseases; use climate-resilient plant and livestock varieties.

Fields in the NAP	Adaptive objectives	Adaptation activities
Agriculture and Rural Development	Reduce damages caused by CC, sea level rise, and increased intensity of natural disasters	Strengthen structural solutions to cope with increasing drought and saline intrusion.  Continue to invest in building irrigation infrastructure to minimise damages caused by natural disasters.
<b>Goal 3: Ensure healthy lives and promote well-being for all at all ages</b>		
Health care	Develop infrastructure	Develop medical and health care networks.  Develop infrastructure to ensure hygienic conditions and medical work.  Strengthen the monitoring system and early warning of impacts of CC on health.
	Build and replicate the disease surveillance & management model	Build and replicate the disease surveillance & management model; model of environmental sanitation and clean water.
	Complete the policy system	Complete policies, and review and develop health sector plans.
Construction, Agriculture and Rural Development	Build capacity and solutions to provide clean water for the residents.	Develop the water supply infrastructure system, strengthen the capacity and solutions to provide clean water for the residents; pay attention to rural, mountainous and coastal areas, especially areas affected by storms, floods, droughts and saline intrusion.
<b>Goal 4: Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all</b>		
Inter-sector	Promote scientific research, education, training and awareness raising.	Promote scientific research on assessment of CC impacts; mainstream and integrate contents of CC response and NDPC into general education curricula at all educational levels; communicate and train to raise community awareness of CC.

Fields in the NAP	Adaptive objectives	Adaptation activities
<b>Goal 5: Achieve gender equality; empower and create enabling opportunities for women and girls</b>		
Labour – Social Affairs	Complete the policy system to limit CC impacts on people's employment opportunities and gender equality.	Improve women's capacity, develop high-quality female human resources to participate in the CCA process.
<b>Goal 6: Ensure availability and sustainable management of water and sanitation for all</b>		
Natural Resources and Environment	Mitigate the impacts of CC on water resources	Improve the effectiveness of water resource management in the context of CC.
		Strengthen the monitoring and protection of water resources.
		Protect freshwater sources; prevent riverbank and coastal erosion and saline intrusion.
	Increase fresh water storage capacity and improve water use effectiveness.	
	Conserve biodiversity	Strengthen local community's participation in biodiversity monitoring, conservation and management.
<b>Goal 7: Ensure access to sustainable, reliable and affordable energy for all</b>		
Industry and Trade	Increase the efficiency of industrial and commercial production	Develop the processing industry; improve the supply chain of raw materials; diversify sources of supply and substitute alternative sources for climate-sensitive materials.
	Consolidate the industrial infrastructure system, especially the infrastructure system in coastal areas	Upgrade and renovate power plants, power transmission stations, substations and other energy facilities in coastal areas.  Review the planning of industrial zones, upgrade and renovate industrial production facilities in coastal areas.
<b>Goal 8: Ensure sustained, inclusive, and sustainable economic growth, full and productive employment and decent work for all</b>		
Natural Resources and Environment	Develop CCA models,	Develop ecosystem-based and community-based CCA models.
		Build and replicate models of CCA economic zones in coastal areas.

Fields in the NAP	Adaptive objectives	Adaptation activities
Agriculture and Rural Development	Develop CCA production models	Study to change farming methods towards ensuring ecological balance and sustainability, improving soil quality, reducing degraded and poor quality land areas.
		Research, deploy and replicate models of CCA intercropping suitable to drought and salinity conditions.
		Develop and replicate varieties of plants and animals that are resistant to pests and diseases.
		Strengthen forms of CCA fishing and aquaculture with high efficiency.
Tourism, resort	Develop tourism sustainably	Review and adjust planning for tourist areas and resorts based on impact assessments of CC risks and CC scenarios.
Labour – culture – social affairs	Protect the rights of employees	Develop and integrate the response to CC and sea level rise in employment policies.
<b>Goal 9: Build resilient infrastructure; promote inclusive and sustainable industrialisation and foster renovation</b>		
Transport		Upgrade, renovate and build road and waterway traffic works in areas frequently threatened by floods, inundations and sea level rise, especially in the Mekong Delta.
		Upgrade, renovate and build road traffic works resistant to landslides in the Northern mountainous region and the Central Highlands
<b>Goal 10: Reduce social inequalities</b>		
All fields	Complete the policy system to limit the effects of CC on people's employment opportunities and gender equality.	Develop and integrate the response to CC and sea level rise in employment policies.
		Build women's capacity, develop high-quality female human resources to participate in the CCA process.
		Promote production models with the participation of all classes of society.

Fields in the NAP	Adaptive objectives	Adaptation activities
<b>Goal 11: Promote sustainable and resilient urban and rural development; ensure safe living and working environments; ensure reasonable distribution of population and work force by region</b>		
Urban and housing	Build adaptive capacity in the urban and housing	Improve the adaptive capacity of infrastructure systems, industrial parks, and coastal and island resettlement areas.
		Build capacity in combating urban flooding, especially in the Mekong Delta and Southeast region.
	Build adaptive capacity in the Central Coast region	Continue to implement programs to develop and build flood/storm-safe houses in the North Central and South Central regions.
	Apply climate-resilient technology	Promote the application of new technologies, use materials that are sustainable, highly resilient to CC.
Transport	Build adaptive capacity of transport infrastructure system in areas frequently threatened by floods, inundation and sea level rise	Upgrade and renovate traffic works in areas frequently threatened by flood, inundation and sea level rise, especially in the Mekong Delta.
	Improve the landslide resistance capacity of traffic works	Upgrade, renovate and build traffic works resistant to landslides in the Northern mountainous areas and the Central Highlands.
Culture, tourism, resort	Improve resilience of works, tourist sites, cultural heritages and historical sites	Upgrade and maintain infrastructure, works, tourist sites, cultural heritages, historical sites.
<b>Goal 12: Ensure sustainable consumption and production patterns</b>		
Natural Resources and Environment	Develop CCA models	Develop ecosystem-based and community-based CCA models.
		Study to change farming methods towards ensuring ecological balance and sustainability, improving soil quality, reducing degraded and poor-quality land areas.
		Build and replicate models of CCA economic zones in coastal area.

Fields in the NAP	Adaptive objectives	Adaptation activities
Agriculture and Rural Development	Develop CCA production models	Research, deploy and replicate models of CCA intercropping suitable to drought and salinity conditions.
		Develop and replicate varieties of plants and animals that are resistant to pests and diseases.
		Strengthen forms of CCA fishing and aquaculture with high efficiency.
<b>Goal 13: Respond in a timely and effective manner to climate change and natural disasters</b>		
All fields	Strengthen resilience and adaptation to CC-induced risks, strengthen capacity to respond to natural disasters and other natural hazards	Build capacity to monitor, observe and forecast on hydrometeorology and natural disasters.  Enhance the safety of the irrigation system, taking into account the extreme climatic conditions of CC.
	Integrate CC factors into development policies, strategies, master plans and plans	Integrate CC into programs, projects, action plans and development plans of sectors related to CC and NDPC.
	Educate, raise awareness, build capacity and institutions in early warning, CC response and DRR	Raise awareness and build capacity of people and organisations in CCA and DRR.
<b>Goal 14: Conserve and sustainably use the ocean, the sea and marine resources for sustainable development</b>		
Natural Resources and Environment	Complete the database on natural resources, including the marine environment	Strengthen the basic survey; develop a database system on the environment, including the marine environment.
	Strengthen livelihoods in coastal, sea and island areas in CC context	Determine the impacts of CC and sea level rise in coastal areas, seas and islands.
		Deploy CCA economic models in coastal, sea and island areas.
	Enhance the resilience and recovery of coastal areas and coastal protected areas	Make marine and island spatial plannings to serve the management, exploitation, use and protection of sea and island resources by 2050 in the context of CC and sea level rise.
Promote scientific research on seas and islands.		

Fields in the NAP	Adaptive objectives	Adaptation activities
<b>Goal 15: Protect and sustainably develop forests; conserve biodiversity; develop ecosystem services; combat desertification; prevent the degradation of and rehabilitate land resources</b>		
Agriculture and Rural Development, and Natural Resources and Environment	Reduce the risk of CC impacts on forest resources	Strengthen forest management and protection.
		Develop and improve forest quality through solutions for forest regeneration, forest restoration, forest enrichment, and plant structure shifting.
	Strengthen forest-based community livelihoods	Support and encourage communities to participate in sustainable forestry development.
	Complete policies and mechanisms	Complete and supplement mechanisms and policies to support forestry development.
	Enhance the resilience of natural ecosystems	Strengthen the management of ecosystems and biodiversity.
Enhance the resilience of natural ecosystems and biodiversity to the impacts of CC and sea level rise.		
<b>Goal 16: Promoting a peaceful, equitable, and equal society for sustainable development, provide access to justice for all and build effective, accountable, and inclusive institutions at all levels</b>		
All fields	Complete institutions, mechanisms	Review, supplement and complete mechanisms and policies in all sectors and fields in order to attract resources, promote adaptation activities and ensure the participation of all economic sectors and communities.
<b>Goal 17: Strengthen the means of implementation and revitalise the Global Partnership for Sustainable Development</b>		
All fields	Strengthen international cooperation	Strengthen international cooperation in CCA.
Industry and Trade		Promote international trade.
		Promote public-private partnership in investment in CCA.

## 5.2. The need for international assistance for the implementation of the NAP

### 5.2.1. Need for international financial support

According to the data in the technical report of the 2022 Viet Nam's National Determined Contribution The financial need for CCA in 2030 is estimated to exceed 3-5% of GDP in 2020. It is estimated that in the period 2021-2030, about USD 54.99-91.65 billion is needed, at the 2020 net present value and the discount rate of 10% (Table 5.2). If in the period 2021-2030, Viet Nam continues to implement the plan to annually spend 1.5% of GDP on CCA, then on average, it needs to mobilise about USD 2.75-6.42 billion from non-State budget per year, or about USD 27.5-64.16 billion for the period 2021-2030.

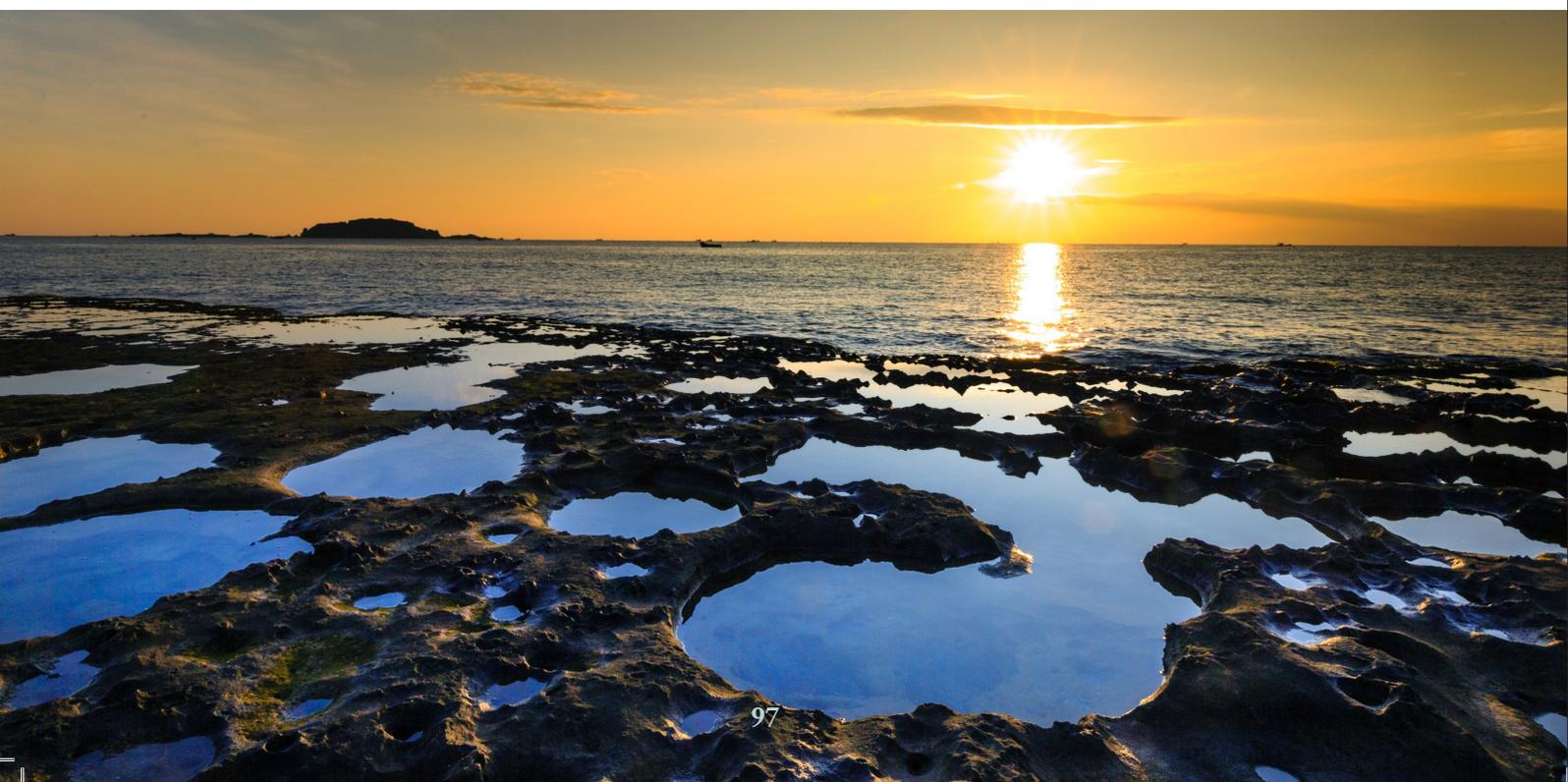
Therefore, along with resource mobilisation and attracting investments from domestic economic sectors, international financial and technological support resources are crucial in GHG emission reduction and in implementing CCA activities.

**Table 5.2.** Estimated financial needs for CCA (2021-2030)

Financial items	Annual average (% GDP)	Accumulated value (billion USD, by NPV)
<b>Total financial need for CCA</b>	<b>3.0-5.0</b>	<b>54.99-91.65</b>
Available finance for CCA	1.5	27.5
Needed finance for CCA	1.5-3.5	27.5-64.16

*Note: NPV is net present value.*

Viet Nam is one of the countries that suffer the most losses and damages from climate change. Therefore, international community support is needed to minimize these damages.



### **5.2.3. The need for international support to build resilience and adaptive capacity**

Some of the priority areas in need of international support are identified as follows:

#### **1) Strengthen policy capacity and human resources for CCA**

**a) Develop policies on CC:** Support the development of the Law on CC and its sub-law documents; formulate mechanisms and policies on climate insurance and risk sharing; formulate mechanisms and policies to integrate CC in the system of strategies and planning; develop national standards and specialised technical guidelines for different fields to enhance the resilience and adaptive capacity of the natural, economic and social systems.

**b) Train staff:** Support to train State managerial staff at all levels in planning, implementing, monitoring and evaluating CCA actions; train highly qualified/senior scientific and technical staff in the field of CC response; train staff in handling CC-induced losses and damages.

#### **2) Enhance resilience and safety given increasing CC-induced natural disasters**

**a) Improve forecasting and early warning capacity:** Forecast and warn on natural disasters and climate extremes; prioritise the development of quantitative rain forecast technologies; make warnings and forecasts on flash floods and landslides; make impact-based forecasts; forecast diseases for plants and animals given CC conditions; monitor, forecast and warn on the CC impacts on health and newly emerged diseases due to impacts of CC

**b) Improve CCA infrastructure:** Plant and protect forests, with priority given to watershed protection forests, mangrove forests and coastal protection forests; conserve biodiversity; conserve ecosystems; give priority to the development of marine and coastal protected areas; improve resilience to natural disasters and impacts of CC in coastal areas; develop nature-based and ecosystem-based CCA models; assure sustainable livelihoods of people; improve resilience to natural disasters and impacts of CC on coastal areas; upgrade and ensure the safety from increasing CC-induced natural disasters of lakes and dykes, as well as the system of river and sea dykes; prevent erosion of riverbanks and coasts; construct and upgrade storm sheltering anchorages; control inundation in big cities, especially Hanoi, Ho Chi Minh City and Can Tho; build storm- and flood-resilient houses for people in high-risk areas; provide further equipment for search and rescue work.

**c) Research on and transfer CCA technology:** Conduct studies to address CC-induced losses and damages; research and transfer advanced technology on CCA; transfer smart agriculture development technology; develop and transfer CC resilient plant and animal varieties; research and transfer technology to prevent coastal and riverbank erosion, technology on economical and efficient use of water, technology to combat degradation and pollution of water sources; research and transfer cooling solutions in urban areas; plan and design CCA-smart cities; prevent and control forest fires.



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**APPENDIX 1. LIST OF TASKS OF THE NAP**

**Objective 1. Strengthen the resilience and adaptive capacity of natural, economic and social systems, assure sustainable livelihoods**

No.	Group of tasks and solutions	Specific tasks	Lead agencies	Outcomes in each phase	
				By 2025	By 2030
<b>1) Effectively use and prevent decline or degradation of water and land resources</b>					
1	Make and implement the national master plans on water resources at national level and in river basins, which identify areas in need of strict protection.	Develop the National Strategy on water resources to 2030, with a vision to 2050.	MONRE	2022: The Strategy is submitted for approval	
		Develop the master plan on water resources for the period 2021-2030, with a vision to 2050.	MONRE	2021-2022: The Master plan is submitted for approval	
		Develop integrated master plans on inter-provincial river basins and inter-provincial water sources.	MONRE	2023: The Master plans are developed/completed and submitted for approval	
2	Investigate and assess underground water sources; strictly manage groundwater extraction; prevent degradation, depletion and pollution of water sources.	Investigate and evaluate underground water sources for the construction of water supply network to adapt to climate change for vulnerable areas (Central Highlands, Mekong Delta, etc.).	MONRE, relevant provinces	2021-2022: The Scheme is approved and implemented	
		Determine areas where underground water extraction is restricted, especially in the Mekong Delta.	PCs of provinces, cities	2025: The task is completed	
		Classify the degree of water scarcity, propose the application of measures of water storage, water saving, restriction of water extraction and use, and prevention of degradation and depletion by each level of water scarcity.	MONRE, PCs of provinces, cities	2021: The Scheme is approved; 2025: Complete, review, evaluate	

No.	Group of tasks and solutions	Specific tasks	Lead agencies	Outcomes in each phase	
				By 2025	By 2030
3	Strengthen solutions to manage, regulate, extract and use water resources.	Complete the national water resource monitoring system.	MONRE	2025: The Scheme is approved and implemented	Complete, review, evaluate
		Review and adjust inter-reservoir operating procedures in river basins.	MONRE, MARD, MOIT	2025: 100% of inter-reservoir operating procedures are issued	
		Establish, carry out and replicate models of water use in an economical and efficient manner.	MARD, MOC, PCs of provinces, cities	2021: The Scheme is approved; 2022-2025: Pilot implementation	Draw lessons learnt, replicate review, evaluate
4	Strengthen the water storage capacity, focusing on areas at risk of drought, water shortage and adverse impacts of saline intrusion.	Investigate, evaluate and develop overall solutions on water storage based on the natural trend of each region, give priorities to areas at risk of drought, water shortage and being affected by saline intrusion.	MONRE	2021: The Scheme is approved; 2022-2025: Implement	Complete, review, evaluate
		Investigate, evaluate and determine solutions on artificial addition of groundwater for the Mekong Delta, South Central and Central Highlands in order to improve the efficiency of sustainable use of underground water resources in the context of climate change.	MONRE, MARD	2022: The Scheme is approved; 2025: Complete, review, evaluate	
5	Rationally and efficiently exploit and strengthen solutions to renovate and protect the soil, minimise soil degradation.	Use the unused land and alluvial land reasonably along rivers and coast for the development of forests and green trees in urban areas and industrial parks.	MONRE, relevant provinces	2023: The Scheme is approved; 2024-2025 Implement	Continue implementing
		Study measures on improvement and protection of degraded agricultural production land; prevent and minimise land degradation caused by erosion, drought, saline intrusion.	MARD, relevant provinces	2023: The Scheme is approved; 2024-2025: Implement	Continue implementing

No.	Group of tasks and solutions	Specific tasks	Lead agencies	Outcomes in each phase	
				By 2025	By 2030
<b>2) Develop climate-resilient and smart agriculture</b>					
1	Promote agricultural restructuring, implement CC-resilient and smart agricultural solutions.	Develop, select and apply climate-smart solutions in the agricultural sector.	MARD	2022-2025: The Scheme is approved, piloted	Replicate and develop. Review the scheme
		Exploit general potentials and promote advantages of irrigation works for multi-purposes and crop and livestock restructuring.		2021: The Scheme is approved 2022-2025: Implement key works	Replicate, complete, review, evaluate
2	Improve the efficiency of agricultural land use, shift part of the rice-growing area to annual crops or mixed land of rice farming and aquaculture; make use of and promote the advantages of tropical agriculture; develop organic, ecological, environmentally friendly and efficient agriculture based on the natural advantages	Evaluate the efficiency of rice land and restructure inefficient rice land to land for fruit trees, vegetables, mixed farming models (rice farming combined with aquaculture, rice, vegetables, fruit trees, animal feed) of high economic efficiency, suitable for each ecological region.	MARD	Evaluation Report is published	
		Restructure crops based on comparative advantages, markets and in a CCA manner in the region (agroforestry, agriculture and fisheries, give priority to large-scale commodity production, chain production, enhance added value).		2021: The Scheme is approved; 2022-2025: Pilot implementation in different regions	Upscale, review, evaluate
		Support the application of agroforestry solutions for the development of fruit trees, in order to improve the livelihoods and CC adaptability of people in the Northwest region of Viet Nam.	MARD	2025: Complete, review, evaluate	
		Apply science and technology, high technology, mechanisation, automation and advanced farming processes,	MARD	2021: The Scheme is approved;	Upscale, review, evaluate

No.	Group of tasks and solutions	Specific tasks	Lead agencies	Outcomes in each phase	
				By 2025	By 2030
	of each region and market demand.	sustainable farming to adapt to climate change in ecological regions. Strengthen activities to control diseases, environmental pollution, improve veterinary services for the CCA and sustainable development of livestock to take advantages of ecological regions.	MARD	2022-2025: Implement  Vet control and services are applied throughout the husbandry process	
3	Promote regional cooperation and regional linkage, planning on production areas, develop large-scale concentrated commodity agriculture that is modern, applies high technology and science advances.	Develop regional linkage in the implementation of adaptation activities for sub-sectors in the agricultural sector.  Develop adaptive and linkage models in livestock production from the improvement of livestock breeds, breeding technology, consumption market (domestic, export-oriented) to waste treatment according to the ecological conditions.	MARD  MARD	2022: Linkage mechanism is issued; 2023-2025: Implement  2021: The Scheme is approved; 2022-2025: Pilot implementation in different regions	Upscale, review, evaluate  Upscale, review, evaluate
4	Arrange cropping structure reasonably, promote intensive farming and intercropping.	Develop chain-based linkage models in aquaculture including the improvement of seed, feed, pond technology, disease control, market development and treatment of pond environment.  Determine CCA seasonal structure.  Replicate methods of intercropping and intensive agriculture of climate smart crops in different regions.	MARD  MARD, provinces  MARD	2021-2025: Prepare technical and management foundation for the development of the Scheme  Crop structures for different agriculture zones are identified  2021: The Scheme is approved;	   Upscale, review, evaluate

No.	Group of tasks and solutions	Specific tasks	Lead agencies	Outcomes in each phase	
				By 2025	By 2030
	Develop sustainable models of crop production, livestock, aquaculture and fishing that are suitable to drought and salinity conditions and improve the CC resilience and adaptability of agriculture in each region and area.	Develop advanced production models (synchronous application of irrigation system, integrated nutrient management, use of disease-free seedlings, varieties in favour of export, intensive agriculture management and environmentally friendly measures of disease prevention).	MARD, provinces	2022-2025: Pilot implementation in different regions	Models are piloted on large scale and evaluated
		Replicate system of rice intensification (SRI); intercropping of maize-bean (IMB), cassava-peanut-bean (ICB); integrated coffee management (ICom); VietGAP (VGP) model of climate-resilient fruit tree intensification.	MARD	2021: The Scheme is approved; 2022-2025: Implement	Upscale, review, evaluate
		Apply and implement integrated farming models (rice-shrimp cultivation, rice-fish cultivation, rice-duck cultivation, rice farming combined with reuse of by-products as fertilizer, energy production) to adapt to climate change on the ecosystem of rice land.	MARD	2021: The Scheme is approved; 2022-2025: Implement	Upscale, review, evaluate
		Replicate livestock models which improve barns and apply climate smart high technology.	MARD	2021: The Scheme is approved; 2022-2025: Pilot implementation in different regions	Upscale, review, evaluate
		Apply interconnected and integrated models along the value chain (high-tech livestock, biosecurity, Integrated Food-Energy Systems (IFES), ecosystem-based adaptation livestock	MARD	2021: The Scheme is approved;	Upscale, review, evaluate

No.	Group of tasks and solutions	Specific tasks	Lead agencies	Outcomes in each phase	
				By 2025	By 2030
		(AEbA), livestock production according to VietGAP, climate-smart agriculture (CSA).		2022-2025: Pilot implementation in different regions	
		Replicate the CCA model of green feed for cattle and other ruminant (GFC) livestock production.	MARD, provinces	Model is applied in different livestock facilities and reviewed, evaluated	
		Shift from scattered and small-scale animal husbandry to concentrated animal husbandry in the farm model; synchronously invest in the animal husbandry system and the environment; apply advanced livestock technology to improve adaptability and added value.	MARD	2021: The Scheme is approved; 2022-2025: Pilot implementation in different regions	Upscale, review, evaluate
		Strengthen the operation of the monitoring and early warning system for CC-induced natural disasters and risks to serve agricultural production.	MARD	2021: The Scheme is approved; 2022-2025: Implement, review, evaluate	
		Strengthen aquatic veterinary services; strictly control, forecast and warn promptly on any epidemic/disease, environment and extreme weather to reduce risks in aquaculture.	MARD	Vet control and services are applied throughout the aquaculture process	
5	Shift the structure of crops and livestock; develop new varieties of climate-resilient and smart plants and animals.	Analyse, select and breed high-quality, high-salinity-resistant, brown planthopper-resistant rice varieties that are suitable for saline soils in coastal plains to adapt to climate change; improve soybean plants to enhance their resilience to climate change using CRISPR/Cas9 gene editing technique; produce raw sugarcane in arid regions of South Central and Central Highlands.	MARD, provinces	New varieties are selected, generated, piloted and evaluated	Upscale, review, evaluate

No.	Group of tasks and solutions	Specific tasks	Lead agencies	Outcomes in each phase	
				By 2025	By 2030
6	Promote aquaculture, as well as the exploitation, protection and development of aquatic resources of high added value.	Evaluate and select silkworm varieties that are thermal-tolerant, contributing to the stable, sustainable and effective development of mulberry cultivation and silkworm rearing.	MARD	New silkworm varieties are selected, piloted and evaluated	
		Replicate the model of local climate-resilient varieties of poultry and waterfowl of high resistance (LCT) that adapt to climate change.	MARD	2021: The Scheme is approved; 2022-2025: Pilot implementation in different regions	Upscale, review, evaluate
		Shift the structures between fishing, aquaculture and protection of aquatic resources; service development for aquaculture.	MARD	2021: The Scheme is approved; 2022-2025: Pilot implementation in different regions	Upscale, review, evaluate
6	Promote aquaculture, as well as the exploitation, protection and development of aquatic resources of high added value.	Replicate climate-resilient multi-species, multi-stage (IAQ) and bio-safety and biosecurity (BSS) mixed aquaculture models.	MARD	The models are applied in husbandry facilities, reviewed and evaluated	
		Replicate the model of shrimp farming under the forest canopy (MSH) to adapt to climate change; model of rice-shrimp (MRS) that adapts to climate change in areas where the irrigation systems are complete.	MARD	The models are applied in husbandry facilities, reviewed and evaluated	
		Restructure ships reasonably based on capacity; renovate fishing technology for high climate-resilience.	MARD	2021: The Scheme is approved;	Upscale, review, evaluate

No.	Group of tasks and solutions	Specific tasks	Lead agencies	Outcomes in each phase	
				By 2025	By 2030
				2022-2025: Pilot implementation in key provinces	
<b>3) Manage forests and ecosystems</b>					
1	Strictly protect existing natural forests; enhance the protection capacity of watershed forests and coastal forests; develop large timber forests and restore forest landscapes.	Develop a national forestry master plan for the period of 2021-2030, with a vision to 2050. Implement afforestation projects, give priority to watershed forests, coastal forests and large timber forests.  Restore and develop watershed protection forests and coastal mangrove forests to protect water sources and prevent riverbank and coastal erosion.	MARD  MARD  MARD in collaboration with MONRE and PCs of provinces, cities	2022: The Master plan is submitted for approval 2021: The Scheme is approved; 2022-2025: Pilot implementation in different regions	Upscale, review, evaluate  Continue implementing; review, evaluate
2	Manage forest resources sustainably in association with biodiversity protection	Implement solutions to combat illegal exploitation; control forest pests and diseases, limit desertification and conserve forest biodiversity.  Develop and implement projects to strengthen forest management and protection and improve forest quality.	MARD  MARD	Solutions are piloted, evaluated and implemented 2021: The Scheme is approved; 2022-2025: Pilot implementation in different regions	Upscale, review, evaluate  Upscale, review, evaluate

No.	Group of tasks and solutions	Specific tasks	Lead agencies	Outcomes in each phase	
				By 2025	By 2030
	and enhancement of ecosystem services.	Research, select, and develop new types of forest trees which are capable of adapting to climate change in ecological regions to reduce the risk of deforestation and forest degradation.	MARD	New plant varieties are selected, piloted and evaluated	Upscale, review, evaluate
3	Promote community engagement in forest protection, management and development in order to improve livelihoods, income and employment opportunities in forestry	Replicate the model of mangrove ecosystem restoration in aquaculture lagoons which are degraded in the direction of forestry and fishery combination and community-based.	MARD	2021: The Scheme is approved; 2022-2025: pilot implementation in different regions	Upscale, review, evaluate
		Support the development of forest-based climate-resilient community livelihood model.	MARD	The model is piloted, implemented and evaluated	Upscale, review, evaluate
		Implement incentive mechanisms of participation in REDD+ in forest and forestland management.	MARD	Incentives are implemented and evaluated	
4	Consolidate and complete the system of monitoring and evaluation, and emergency response to forest fires.	Upgrade and perfect the system of monitoring, evaluation and emergency response to forest fires.	MARD	2025: Complete	
5	Manage ecosystems and biodiversity.	Develop a zoning map of risks caused by climate change on natural ecosystems.	MONRE	2021: The project is approved; 2023: Complete, review, evaluate	

No.	Group of tasks and solutions	Specific tasks	Lead agencies	Outcomes in each phase	
				By 2025	By 2030
		Assess risks and control invasion of alien species under the impact of climate change.	MONRE	2023: The project is approved; 2023-2025: Implement	Continue implementing; review, evaluate
6	Strengthen the resilience of natural ecosystems and protect and conserve biodiversity against the impacts of CC and sea level rise.	Build and develop model of biodiversity conservation in marine areas, high biodiversity areas and CC-vulnerable areas.  Establish rescue areas, off-site conservation, rear and breed threatened species.	MONRE	2022: The project is approved; 2023-2025: Models are implemented	Upscale
		Restore vital natural ecosystems which have been degraded.	MONRE	2023: The project is approved; 2024-2025: Implement	Continue implementing; review, evaluate
7	Establish and expand the operation of marine conservation zones and nature reserves.	Build, expand and improve the quality of nature reserves; give priority to the development of marine, coastal and island protected areas.	MONRE, MARD and provinces	2021: The project is approved; 2022-2025: Implement	Continue implementing; review, evaluate
8	Develop nature-based, ecosystem-based, and community-based models for CCA; strengthen the	Execute the community-based and climate-resilient sustainable conservation of biodiversity and ecosystem services, of which priority is given to conservation of precious genetic resources, endangered species and important ecosystems.	MONRE	2023: The project is approved; 2023-2025: Implement	Continue implementing; review, evaluate

No.	Group of tasks and solutions	Specific tasks	Lead agencies	Outcomes in each phase	
				By 2025	By 2030
	participation of local communities in the protection, conservation and management of biodiversity.	Apply local people's knowledge in conservation and sustainable use of biodiversity, ensure sustainable livelihoods, give priority to vulnerable communities.	MONRE	2024: The project is approved	2025-2030: Implement; review, evaluate
9	Conduct inventory, assessment and development of the national database on biodiversity.	Conduct inventory, assessment and development of the national database on biodiversity.	MONRE	2023: The scheme is approved; 2025: Complete	
<b>4) Develop CCA Infrastructure</b>					
1	Upgrade and renovate the infrastructure of sectors, and also synchronously implement measures on environmental protection and CCA.	Continue the investment in the construction of infrastructure for fishing ports, fishing wharfs, and storm sheltering anchorages in the coastal areas in the Central region and the Southeast region.	MARD	2021: The Scheme is approved; 2022-2025: Pilot implementation in different regions	Upscale, review, evaluate
			MIC, provinces	2022-2025: The scheme is approved, implemented	Continue implementing
			MCST, provinces	2021: The Scheme is approved; 2022-2025: Pilot in different regions	Upscale, review, evaluate

No.	Group of tasks and solutions	Specific tasks	Lead agencies	Outcomes in each phase	
				By 2025	By 2030
		Develop a project of maintenance and conservation of cultural and historical relics in the context of climate change; focus on the maintenance and preservation of cultural relics.	MCST, provinces	2023: The Scheme is approved; 2024-2025: Implement	Upscale, review, evaluate
		Make and implement plans for upgrading and renovation of power plants, power transmission stations, substations, power transmission line systems; fuel pipelines, mines, coalyards and other energy facilities in coastal areas.	MOIT, provinces	2021: The plan is approved; 2022-2025: Pilot in different regions	Upscale, review, evaluate
		Improve raw material supply chain; diversify supply sources; find alternative sources for climate-sensitive materials.	MOIT, provinces	2021: The Scheme is approved; 2022-2025: Implement and review, evaluate	
2	Build, upgrade and renovate infrastructure in urban areas, concentrated population areas, industrial parks, coastal and island resettlement areas; develop urban areas, coastal urban areas, marine tourism and eco-tourism centres; apply advanced cooling solutions, new materials and technologies capable	Build, upgrade and renovate urban and rural infrastructure systems and concentrated population areas based on land use planning, climate change and sea level rise scenarios.	MOC, PCs of provinces, cities	2022-2025: The scheme is approved, implemented	Continue implementing
		Upgrade and renovate the infrastructure of industrial parks, coastal and island resettlement areas based on sea level rise scenarios.	MOC, PCs of provinces, cities	2025: Complete	
		Implement projects to apply advanced refrigeration technologies and solutions; use new, sustainable and highly CC-resistant materials in construction and urban sectors.	MOC, PCs of provinces, cities	Implement	Implement, replicate

No.	Group of tasks and solutions	Specific tasks	Lead agencies	Outcomes in each phase	
				By 2025	By 2030
	of CCA in construction and urban fields.				
3	Build, upgrade and renovate medical facilities and schools to ensure their resilience to the impacts of CC and natural disasters.	Build, upgrade and renovate medical facilities to ensure health care conditions; ensure accessibility, maintain operations in the event of natural disasters and evacuate in case of natural disasters.	MOH, relevant ministries, sectors and provinces	2021: The Scheme is approved; 2022-2025: Pilot implementation in different regions	Upscale, review, evaluate
		Build, upgrade and renovate schools to ensure resilience to the impacts of climate change; ensure safety and less interruption of teaching and learning when natural disasters occur.	MOET and provinces	2021: The Scheme is approved; 2022-2025: Pilot implementation in different regions	Upscale, review, evaluate
4	Renovate and upgrade traffic works in areas at high risk of natural disasters and vulnerable to CC; develop and complete the expressway network and the inter-regional transport system.	Upgrade, renovate and construct road and waterway work in areas which are often threatened by floods and sea level rise, especially in the Mekong Delta.	MOT, PCs of provinces, cities	2021: The Scheme is approved; 2022-2025: Pilot implementation in different regions	Upscale, review, evaluate
		Upgrade, renovate and build road works that are landslide-resistant in the Northern mountainous region and the Central Highlands.	MOT, PCs of provinces, cities	2021: The Scheme is approved; 2022-2025: Pilot implementation in different regions	Upscale, review, evaluate
		Invest in, develop and perfect the expressway network and inter-regional transport system.	MOT	2021-2025: North-South expressway and others and traffic connections	Continue implementing

No.	Group of tasks and solutions	Specific tasks	Lead agencies	Outcomes in each phase	
				By 2025	By 2030
5	Prioritise the construction and upgrading of water drainage systems to prevent flooding caused by heavy rains, floods, tide surges and storm surges in large urban and coastal urban areas.	<p>Implement flood control solutions in large urban areas in provinces and cities.</p> <p>Pilot and invest in technical solutions to adapt to flooding caused by heavy rain, flood tides and sea level rise in the coastal urban areas in Central Viet Nam.</p> <p>Complete flood protection works that are under construction in Ho Chi Minh City; add solutions to gradually form a synchronous and effective flood protection system in the City.</p> <p>Execute flood protection solutions in the core areas in Can Tho City.</p> <p>Execute flood protection solutions in Hanoi City.</p>	<p>PCs of provinces, cities</p> <p>MOC, PCs of provinces, cities in the Central Coast</p> <p>PC of Ho Chi Minh City</p> <p>PC of Can Tho City (Can Tho PPC)</p> <p>PC of Ha Noi City (Ha Noi PPC)</p> <p>MARD, PCs of provinces, cities</p>	<p>connecting the Mekong Delta region</p> <p>2021: The Scheme is approved; 2022-2025: Pilot implementation in key urban areas</p> <p>Implement</p> <p>Complete anti-flood works. Suggest additional solutions</p> <p>Complete anti-flood solutions, review and evaluate</p> <p>Complete anti-flood solutions, review and evaluate</p> <p>2021: The Scheme is approved;</p>	<p>Upscale, review, evaluate</p>
6	Focus on completing freshwater storage works for domestic use and production; newly	Newly build a number of freshwater storage works for daily life and production water supply in the context of climate change; give priority to areas at risk of drought and water scarcity.		Invest based on the roadmap; Complete, review, evaluate	

No.	Group of tasks and solutions	Specific tasks	Lead agencies	Outcomes in each phase	
				By 2025	By 2030
	build a number of large multi-purpose reservoirs in drought and water scarcity-prone areas.	Newly build a number of large, multi-purpose reservoirs for water supply and agricultural production in the context of climate change.	MARD, PCs of provinces, cities	2025: Conduct the construction of urgent works 2021: The Scheme is approved; 2025: Conduct the construction of urgent works	Invest based on the roadmap; Complete, review, evaluate
<b>5) Strengthen the medical and health care systems</b>					
1	Develop a network of medical and health care to meet the requirements for prevention and control of new CC-induced epidemics and diseases; prioritise vulnerable groups and ethnic minority areas.	Develop a medical and health care network; give priority to ethnic minorities and remote and isolated areas to meet the requirements of prevention of epidemics, diseases and new diseases arising from the impacts of climate change.	MOH, relevant ministries, sectors and provinces	2021: The Scheme is approved; 2022-2025: Pilot implementation in different regions	Continue implementing, replicate
2	Invest in technology, equipment to prevent	Invest in technology and equipment for qualified medical and medical facilities to treat climate-sensitive diseases such as: malaria, diarrhoea, respiratory, and cardiovascular issues.	MOH, relevant ministries,	2021: The Scheme is approved;	Upscale, review, evaluate

No.	Group of tasks and solutions	Specific tasks	Lead agencies	Outcomes in each phase	
				By 2025	By 2030
	and treat increasing CC-induced diseases.		sectors and provinces	2022-2025: Pilot implementation in different regions	
3	Build and replicate models of the health sector and community health models in order to improve the community's resilience and adaptability.	Build and replicate models of management and monitoring of epidemic diseases related to weather and climate change.  Build and replicate climate-resilience models of environmental sanitation and clean water for communities and medical facilities.	MOH, relevant ministries, sectors and provinces	2021: The Scheme is approved; 2022-2025: Pilot implementation in different regions	Upscale, review, evaluate
		Build and replicate models of nutrition, food, infectious and non-infectious diseases, and apply environmentally friendly and CCA technologies, renewable technologies, and use clean energy for the community and medical facilities.	MOH, relevant ministries, sectors and provinces	2021: The Scheme is approved; 2022-2025: Pilot implementation in different regions	Upscale, review, evaluate
4	Develop a system of monitoring and early warning of impacts of CC on health.	Invest in and develop a monitoring and early warning system of impacts of climate change on health.	MOH, relevant ministries, sectors and provinces	2021: The Scheme is approved; 2022-2025: Pilot implementation in different regions	Upscale, review, evaluate

No.	Group of tasks and solutions	Specific tasks	Lead agencies	Outcomes in each phase	
				By 2025	By 2030
5	Strengthen capacity, infrastructure, solutions to provide clean water for the residents, with attention paid to rural, mountainous and coastal areas, especially areas affected by storms, floods, droughts, and saline intrusion.	Develop the water supply infrastructure system, strengthen the capacity and solutions of clean water supply for the population, pay attention to rural, mountainous and coastal areas, especially areas affected by storms, floods, droughts, saline intrusion.	MOC, PCs of provinces, cities	Implement	Upscale, review, evaluate
<b>6) Ensure social security and gender equality</b>					
1	Develop sustainable livelihood models, nature-based, ecosystem-based, and community-based CCA models; focus on training, job change and technology support, access to preferential capital sources and risk	Support the development of CCA community livelihood models based on forests and natural ecosystems.	MARD, TNMT, provinces	The model is piloted, implemented and evaluated	Upscale, review, evaluate
		Build and replicate stabilisation models of cultural and spiritual life of local communities during the resettlement under the impacts of climate change in order to protect the grassroots cultural institutions; preserve and promote traditional cultural values and local knowledge in adaptation to climate change.	MCST, provinces	2021: The Scheme is approved; 2022-2025: Pilot in different regions	Upscale, review, evaluate
		Inventory, collect and research local knowledge on climate change adaptation and response; disseminate local	MCST, provinces	2021: The Scheme is approved;	Upscale, review, evaluate

No.	Group of tasks and solutions	Specific tasks	Lead agencies	Outcomes in each phase	
				By 2025	By 2030
	insurance services for people in high-risk areas and those vulnerable to the impacts of CC.	<p>knowledge to the community; pay special attention to the role of artisans and develop CCA community models.</p> <p>Enhance the capacity of local officials to protect and promote intangible cultural values in the face of the impacts of climate change by local knowledge.</p>		<p>2022-2025: Pilot in different regions</p> <p>2021: The Scheme is approved; 2022-2025: Pilot in different regions</p>	Upscale, review, evaluate
2	Enhance the participation of women, youth and people in the implementation of policies and activities on natural disaster prevention and control and CCA.	<p>Develop guidelines for mainstreaming gender equality, enhance the involvement of women and youth in the implementation of policies and participation in programs and activities on natural disaster prevention and control and adaptation to climate change.</p> <p>Develop and train soft skills for female workers and young people involving in new economic sectors in the direction of CCA</p>	<p>MCST, provinces</p> <p>MONRE and MOLISA</p> <p>MOLISA, provinces</p>	<p>2024: Guiding documents are issued</p> <p>2021: The Scheme is approved; 2022-2025: Pilot in different fields</p>	Upscale, review, evaluate

**Objective 2. Mitigate natural disaster risks, minimise damages caused by increasing CC-induced natural disasters and climate extremes**

No.	Group of tasks and solutions	Specific tasks	Lead agencies	Outcomes in each phase	
				By 2025	By 2030
<b>1) Forecast and early warning</b>					
1	Invest in, upgrade and modernise the national network on CC monitoring and hydrometeorological monitoring; specialised natural disaster monitoring system; Socialise a number of activities to monitor climate extremes; give priority to automated rain measurement systems.	Build a climate change and sea level rise monitoring system throughout the mainland and territorial waters of Viet Nam.	MONRE	2021: The Scheme is approved;	Maintain the system's operation
				2022-2025: The Scheme is deployed and completed	
				2022: The Scheme is approved; 2022-2025: Implement	
		Develop dedicated disaster monitoring systems for the prevention and control of storms, floods, flash floods, inundation, landslides, riverbank and coastal erosion; ensure the safe operation of reservoirs, etc.	MARD, provinces	2021-2025: Deploy in high-risk areas	Further replicate
				2025: Complete automated rain monitoring system in the form of socialisation	Continue implementing with other factors
2	Upgrade and modernise technologies in analysis, forecasting and warning of weather and natural	Modernise hydro-meteorological forecasting technology; forecast and make early warnings on natural disasters and extreme weather and climate phenomena; apply advanced and modern forecasting technology; give priority to the development of	MONRE	2021: The project is approved;	Complete, review, evaluate

	disasters on a par with technologies in developed countries in Asia; apply advanced and modern forecasting technologies.	technology of quantitative precipitation estimation, flash flood and landslide warning, and impact-based forecasting.		2022-2025: The project is implemented	
3	Improve capacity in providing climate services and information for disaster prevention and control.	Implement the global framework for climate services in Viet Nam to serve the socio-economic sectors and natural disaster prevention and control.	MONRE	2021: The project is approved; 2022-2025: The project is implemented	Complete, review, evaluate
4	Build capacity in disaster information transmission, ensure the complete, accurate and timely transmission of information for effective disaster prevention and control; develop a multi-disaster warning system that can be linked/combined with the national information and communication infrastructure system.	Invest in expansion of satellite earth stations, mobile communication equipment and monitoring system of fishing vessels with satellite technology; enhance the capacity of transmission of information; ensure complete, accurate and timely transmission and distribution of information of natural disasters to all localities, people across the country and ships operating at sea. Upgrade and effectively operate the multi-disaster warning system, combined with the national information and communication infrastructure.	MIC, MARD, MONRE, The Voice of Viet Nam, Viet Nam Television	2021: The Scheme is approved; 2022-2025: The scheme is implemented	Complete, review, evaluate
5	Improve disaster risk management system,	Review and update the classification of disaster risk levels.	MIC, MARD, MONRE, The Voice of Viet Nam, Viet Nam Television	2022-2025: Implement	Complete, review, evaluate
			MONRE	2022: Approve review, update disaster risk levels	Review and update the

complete the climate and disaster risk assessment and zoning, make disaster warning mapping; develop and complete the national database on CC and NDPC; strengthen capacity and measures to manage and promote disaster risk reduction.	Make disaster risk zoning and risk warning for planning and direction of natural disaster prevention and control, adaptation to climate change.	MONRE	2022: Results of risk zoning and disaster risk warnings are announced	disaster risk classification			
			Develop a database on climate change and a database on natural disaster prevention and control; improve the ability to access and share information online for users.		MONRE, MARD	2025: Complete the database	Update, supplement
			Develop plans of natural disaster prevention and control; determine measures of response to natural disasters and overcoming of natural disaster consequences at all levels.		MARD and provinces	2021 : Plan on natural disaster prevention and control is approved; 2025: Review, evaluate	Upscale, review and evaluate
			Manage community-based disaster risks; apply local people's knowledge to natural disaster prevention and control.		MARD, provinces	2021 : The Scheme is approved; 2025: Pilot investments in a number of key works/projects	Upscale, review and evaluate
			Develop models of adaptation to climate change and natural disaster prevention and control based on nature and ecosystems, contributing to minimise and prevent flash floods, landslides, soil erosion, and protecting biodiversity to ensure livelihoods and tourist development.		MARD and provinces	2021-2025: Develop, pilot models	Upscale, review and evaluate

## 2) Construct and upgrade works serving natural disaster prevention and control

1	Consolidate, upgrade and complete the system of river dykes, sea dykes, irrigation works and hydropower plants; give priority to ensuring the safety of the system of reservoirs, dams, river dykes, sea dykes.	<p>Invest in establishment of a disaster early warning system for reservoirs to take the initiative to respond to climate change.</p> <p>Review and assess the safety of irrigation works, hydropower plants, and natural disaster prevention works.</p> <p>Develop inundation maps and make flood prevention and control plans in downstream areas of key reservoirs in case of emergency water discharge and dam failure.</p> <p>Invest in construction, repair and upgrading to ensure the safety of reservoirs, river dykes, sea dykes and natural disaster prevention works at high risk of vulnerability due to the impacts of climate change.</p> <p>Consolidate and construct key and urgent natural disaster prevention works.</p>	MARD and provinces  MARD, MOIT	<p>2021: The Scheme is approved; 2025: The Scheme is completed</p> <p>2023: Publicise reports, assess the safety level of irrigation, hydropower and NDPC work systems</p>	
		MARD	<p>2021: The Scheme is approved; 2025: Publicise maps and plans for some key reservoirs</p>		
		MARD and provinces	<p>2021: The Scheme is approved; 2022-2025: Pilot investments in a number of key works/projects</p>	Complete, review, evaluate	
		MARD and provinces	<p>2021: The Scheme is approved; 2022-2025: Pilot investments in a</p>	Complete, review, evaluate	

2	Construct and upgrade the storm anchorage areas.	Build and upgrade anchorage areas for ships and boats in storms according to planning, associated with logistics services, fishery information, including islands.	MARD and provinces	2021 : The Scheme is approved; 2022-2025: Pilot investments in a number of key works/projects	Further invest to upscale		
3	Build and strengthen works to prevent and control riverbank and coastal erosion in areas where landslides are complicated.	Investigate, survey, determine causes and propose preventive measures of subsidence and riverbank and coastal erosion in the Mekong Delta.	MONRE	2021 : The Scheme is approved; 2025: Review, evaluate			
		Consolidate and build riverbank and coastal erosion prevention and control works in key and urgent areas; areas of serious and complicated landslides.	MARD and provinces	2021 : The Scheme is approved; 2022-2025: Conduct the construction of urgent works	Invest based on the roadmap; Complete, review, evaluate		
4	Build capacity in prevention and control of flash floods, landslides, storm prevention, prevention of heavy floods and extreme floods; prevent and control the harmful effects of drought,	Establish a monitoring and warning system of flash floods, floods and landslides in high-risk areas.	MONRE, provinces	2021-2025: Pilot implementation	Strengthen and upscale		
		Develop a prevention and control plan on the harmful effects of drought, high tides and saline intrusion.	MARD	2021 : The plan is issued; 2022-2025: Implement	Upscale, review and evaluate		
		Strengthen capacity of prevention from storms, huge floods and extreme floods in river basins nationwide.	MARD and provinces	2021-2022: Formulate and approve schemes;	Upscale, review and evaluate		

	strong tides and saline intrusion.	Review, build and upgrade irrigation works; give priority to works in estuaries and vulnerable areas in order to respond to storms, floods, droughts, sea level rise and saline intrusion.	MARD and provinces	2023-2025: Pilot investments in a number of key works/projects 2021-2022: Formulate and approve schemes; 2023-2025: Conduct the construction of urgent works	Invest based on the roadmap; Complete, review, evaluate
<b>3) Ensure the safety of people's lives and properties, reduce CC-induced losses and damages</b>					
1	Make plans, invest, relocate and rearrange residential areas in areas frequently affected by extreme climate; monitor, supervise and warn in areas where relocation could not be conducted to timely evacuate and minimise risks.	Integrate plans for arrangement, relocation and rearrangement of residential areas in regions which are frequently affected by extreme climates, especially where at high risk of storms, floods, storm surges, and riverbank and coastal erosion or risk of flash floods, landslides, land subsidence, geological hazards in planning of natural disaster prevention and control and irrigation for the period 2021-2030, with a vision to 2050. Implement measures of relocation and evacuation in order to actively prevent, avoid and mitigate natural disasters, especially where at high risk of storms, floods, storm surges and riverbank and coastal erosion or at risk of flash floods, landslides, land subsidence or geological hazards. Invest in, arrange and rearrange residential areas in regions that are frequently affected by storms, storm surges, floods, riverbank and coastal erosion or at risk of flash floods or landslides.	MARD  MARD, provinces  MARD	2022: The Master plan is submitted for approval  Implement  2021-2022: The Scheme is approved; 2023-2025: Pilot implementation in different regions	Continue implementing   Upscale, review, evaluate

		Strengthen measures of natural disaster monitoring, control and warning measures in places where relocation is impossible in order to actively prevent, avoid and mitigate natural disasters, especially where at high risk of storms, floods, storm surges, and riverbank and coastal erosion or risk of flash floods, landslides, land subsidence or geological hazards.	MONRE, MARD, provinces	Implement	Continue implementing
2	Strengthen measures to ensure safety for citizens; develop and construct disaster-resilient safe houses in association with new rural development work; construct community houses that can be also used as evacuation venues in case of emergent natural disasters to ensure human safety.	Build flood/storm-resilient safe houses in the North Central, South Central and South areas of the country.  Pilot and invest in technical solutions to adapt to flooding caused by heavy rain, flood tides and sea level rise in the coastal urban areas in the Central Viet Nam.  Pilot and invest in technical solutions on prevention and control of flash floods and landslides in residential clusters in mountainous areas.  Continue to build the community houses which are also as evacuation places in case of emergency natural disasters to ensure the people's safety.	PCs of provinces, cities  MOC, PCs of provinces, cities  MOC, PCs of provinces, cities	2021 : The Scheme is approved; 2022-2025: Pilot in different regions  2021 : The Scheme is approved; 2022-2025: Pilot in key urbans  Implement	Upscale, review, evaluate  Upscale, review, evaluate  Complete
3	Build capacity of the search and rescue task forces.	Strengthen capacity of search and rescue forces at all levels; ensure security, politics, social order and safety in natural disaster situations.	MARD, provinces	2021 : The Scheme is approved; 2022-2025: Pilot investments in a number of key works/projects	Upscale, review and evaluate

4	<p>Conduct post-disaster recovery and reconstruction programs; deploy disaster risk insurance for production and business and immediately prioritise a number of high-risk fields such as crop production, aquaculture and seafood production.</p>	<p>Implement disaster risk insurance for production and business, give priority to high-risk fields such as cultivation, aquaculture and seafood.</p> <p>Implement programs for post-disaster recovery and reconstruction, give priority to areas that suffer a lot of damage and vulnerable people.</p> <p>Assess losses and damages caused by climate change.</p> <p>Implement solutions on sharing of climate risks, and reduction of losses and damage caused by climate change.</p>	<p>MONRE</p> <p>Ministries and provinces</p> <p>MONRE</p> <p>MONRE</p>	<p>2021: The Scheme is approved; 2022-2025: Pilot implementation</p> <p>Implement frequently</p> <p>2021: The Scheme is approved; 2022-2025: Implement</p> <p>2021: The Scheme is approved; 2022-2025: Implement</p>	<p>Upscale, review and evaluate</p> <p>Implement frequently</p> <p>Upscale, review and evaluate</p> <p>Upscale, review and evaluate</p>
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### Objective 3. Complete institutions, promote potentials and resources to effectively adapt to CC

No	Group of tasks and solutions	Specific tasks	Lead agencies	Outcomes in each phase	
				By 2025	By 2030
<b>1) Develop and complete institutions and policies</b>					
1	Review, amend and supplement specialised laws, strategies, master plans and development plans at all levels for the period 2021-2030, with a vision to 2050 to ensure the requirements for CC response and CCA integration.	Research on the scientific basis, practical implementation, international experience in terms of response to climate change and propose the development of the Law on Climate Change.	MONRE, relevant ministries, sectors and provinces	2025: Submit proposal for development of the Law on Climate Change	Draft the Law on Climate Change after the proposal for development of the Law is approved by the competent authority
		Review, amend and supplement specialised laws and legal documents in order to respond to climate change.	Relevant ministries, sectors	2023-2025: Legal documents are promulgated	
		Review, develop and update sectoral development strategies, national planning, national sectoral planning, regional planning and provincial planning based on the provisions of the Law on Planning and climate change scenario, with focus on to vulnerable areas due to negative impacts of climate change.	Ministries, sectors and provinces	2022-2023: Strategies and master plans are approved	
		Develop a master plan on natural disaster prevention and control and irrigation for the period 2021-2030, with a vision to 2050.	MARD	2022: The Master plan is submitted for approval	
		Review and adjust planning of tourist areas and resorts to adapt to climate change.	MCST, provinces	2023: The master plan is approved	

No	Group of tasks and solutions	Specific tasks	Lead agencies	Outcomes in each phase	
				By 2025	By 2030
		<p>Adjust construction planning of inter-provincial regions, economic zones and high-tech zones to adapt to climate change.</p> <p>Integrate climate change adaptation factors in the formulation, appraisal and approval of coastal urban planning projects approved by the Prime Minister.</p> <p>Develop guidelines for assessment of impacts, vulnerabilities, risks, losses and damages caused by climate change.</p> <p>Develop guidelines for integration of climate change response into the strategy and planning system.</p> <p>Develop guidelines for mainstreaming gender equality, enhance the involvement of women and young people in climate change adaptation programs.</p> <p>Develop sets of criteria for assessment of climate risks of sectors and fields; determine climate change adaptation projects and tasks; assess the effectiveness of climate change adaptation activities.</p> <p>Develop guidelines for vulnerability assessment, cost-benefit analysis, screening and selection of climate change adaptation solutions for agricultural sectors.</p> <p>Complete technical guidance for technical solutions on construction of technical infrastructure works to respond to urban flooding (ground levelling, drainage, regulating reservoir, embankment).</p>	<p>MOC</p> <p>MOC</p> <p>MONRE</p> <p>MONRE</p> <p>MONRE and MOLISA</p> <p>MONRE and relevant ministries, sectors</p> <p>MARD</p> <p>MOC, PCs of provinces, cities</p>	<p>2023: The adjusted master plan is approved</p> <p>The CCA coastal urban plannings are approved</p> <p>2023: Guiding documents are issued</p> <p>2023: Guiding documents are issued</p> <p>2024: Guiding documents are issued</p> <p>2023-2024: The set of criteria was developed and promulgated</p> <p>2022-2023: Guiding documents are issued</p> <p>2022: The technical guidance is promulgated</p>	
2	<p>Complete regulations on management of CCA activities; develop sets of criteria to assess climate risks, identify CCA projects and tasks; evaluate the effectiveness of CCA activities; mainstream gender equality, promote the participation of women and young people in CCA programs and activities.</p>				

No	Group of tasks and solutions	Specific tasks	Lead agencies	Outcomes in each phase			
				By 2025	By 2030		
3	Develop and complete inter-regional and inter-sectoral coordination mechanism in CCA; mechanisms and policies suitable to the objectives of integrating and promoting CCA activities that bring co-benefits together with sustainable socio-economic development, disaster risk reduction and GHG emission reductions.	Develop a set of indicators and guide the integration of climate change adaptation into specific programs, projects and action plans of the agricultural sector.	MARD	2023: The set of indicators and integration guidance are issued			
				Develop an inter-regional and inter-sectoral coordination mechanism in adaptation to climate change.	MPI, MONRE	2023: The coordination mechanism is promulgated	
				Develop a mobilisation mechanism of resources and encourage the participation in investment by all economic sectors for adaptation to climate change.	MPI	2023-2025: Mechanisms and policies are promulgated; and implemented	2030: Continue implementing
				Renovate support mechanisms and policies (in terms of land, finance, technology) for enterprises involving in the development of large-scale adaptation models in the agricultural sector.	MARD, MPI	2022-2025: Mechanisms and policies on business support are promulgated	
		Develop a financial mechanism and policies that support CCA forestry development.	MARD	2022-2023: Mechanisms and policies are promulgated			
		Review and supplement policies of finance and land support to encourage investment sources under the public-private partnership (PPP) for the development of climate-smart agriculture.	MARD	2022-2023 Mechanisms and policies are promulgated			

No	Group of tasks and solutions	Specific tasks	Lead agencies	Outcomes in each phase	
				By 2025	By 2030
		Review and assess industrial, energy and trade mechanisms and policies in the context of international economic integration to adapt to climate change.	MOIT	2022: Evaluation report and proposal are approved	
		Review, amend, build and supplement mechanisms and policies of the health sector on protection of public health in the context of climate change.	MOH, relevant ministries, sectors	2022-2024: Mechanisms and policies are promulgated	
		Improve employment policies to encourage green and sustainable job creation.	MOLISA, provinces	2022-2024 Policies are promulgated	
		Develop policies to promote integration, create green jobs and support job transition; develop sustainable livelihoods for people, especially workers whose purpose of land use has to be changed or affected by impacts of climate change, environmental incidents and disasters.	MOLISA, provinces	2022-2024: Policies are promulgated	
		Develop specific policies to support vulnerable people, mainstreaming gender into the implementation of climate change adaptation activities.	MOLISA, provinces	2022-2024: Policies are promulgated	
4	Develop mechanisms and policies to promote the development of finance and credit services, the climate risk insurance market.	Review, supplement and complete mechanisms and policies to strengthen the insurance system; share climate and disaster risks.  Develop mechanisms and policies on "green" finance and credit to enhance accessibility to capital for investment in disaster recovery and transformation of adaptive production models.	MOF  MOF, State Bank of Viet Nam	2024-2025: Mechanisms and policies are promulgated  2024-2025: Mechanisms and policies are promulgated	

No	Group of tasks and solutions	Specific tasks	Lead agencies	Outcomes in each phase	
				By 2025	By 2030
5	Complete regulations on M&E on CCA results and effectiveness; establish and operate a national, sectoral and provincial M&E system for CCA activities.	Establish and operate a monitoring and evaluation system of climate change adaptation at national level.	MONRE	2021: Establish the system 2022-2025: Operate, improve the system	Further improve the system
		Establish and operate a monitoring and evaluation system of climate change adaptation at sectoral and provincial levels.	Ministries, sectors and provinces	2022-2023: Establish and run the system 2025: Supplement, improve the system	Further improve the system
<b>2) Communicate, raise awareness and promote public engagement</b>					
1	Diversify communication methods/channels; improve the quality of communication on mass media.	Develop and implement a project of diversification of information modes and enhancement of the quality of communication programs on the mass media in order to fully, accurately and promptly transmit information on hydrology forecasting, natural disaster warning, response to climate change for authorities at all levels, organisations and households.	MIC in collaboration with MONRE PCs of provinces, cities	Develop and implement	Continue implementing
2	Develop and implement a national communication program; organise training courses for authorities at all levels, social organisations and communities to disseminate, raise	Develop and implement communication programs on natural disasters, response to climate change, and development of models of adaptation to climate change for local authorities, social organisations and communities.  Develop and implement projects of awareness raising, enhancement of capacity of adaptation to climate change and mitigation of disaster risks for authorities at all levels, social organisations and communities.	MONRE, MOET, MIC, PCs of provinces, cities  MONRE, relevant ministries, sectors and provinces	Develop, Pilot implementation  2021: The Scheme is approved, Implement 2025: Complete, review, evaluate	Continue implementing, replicating  Expand the program for phase 2026-2030

No	Group of tasks and solutions	Specific tasks	Lead agencies	Outcomes in each phase	
				By 2025	By 2030
3	awareness, and update knowledge and information on natural disasters, CC, NDPC and CCA; promote movements, programs, and projects of youth and women on NDPC and CCA.	Organise training courses to improve skills and roles of women and youth in developing and implementing the adaptation to climate change and natural disaster prevention and control.	MOLISA, MONRE, MARD, Women's Union, Central Youth Union, PCs of provinces, cities	Implement	Continue implementing
		Communicate to raise awareness and knowledge on preventive measures and public health protection against the impacts of climate change and extreme weather.	MOH, provinces	2021: Approve and implement scheme	Continue implementing
		Organise movements, programs and projects of women and youth in developing and implementing the adaptation to climate change and natural disaster prevention and control.	MOLISA, MONRE, MARD, Women's Union, Central Youth Union, PCs of provinces, cities	Implement	Continue implementing
3	Preserve and promote traditional culture and local knowledge, with special attention to the role of artisans in CCA; communicate and replicate CCA activities and nature-based, ecosystem-based and community-based CCA models.	Develop and implement training and communication programs on development of models of sustainable forest and forestry development, mangrove ecosystem restoration, community-based livelihood models, and adaptation to climate change based on nature and biodiversity conservation; promote the role of artisans and local knowledge in adaptation to climate change for local authorities, social organisations and communities.	MONRE, MOET, MIC, PCs of provinces, cities	Develop, Pilot implementation	Continue implementing, replicating
		Develop and replicate nature-, ecosystem- and community-based climate change adaptation models.	MONRE, ministries, sectors and provinces	Implement	Continue implementing
		Apply, disseminate and replicate local knowledge in adaptation to climate change.	MONRE, MCST, ministries, sectors and provinces	Implement	Continue implementing

No	Group of tasks and solutions	Specific tasks	Lead agencies	Outcomes in each phase	
				By 2025	By 2030
<b>3) Develop human resources</b>					
1	Develop and conduct trainings, foster trainings and refresh trainings on CCA and disaster risk reduction.	Develop and implement a capacity building project for officers at ministries, branches and localities to ensure the updating and consistency with domestic regulations and international treaties on climate change to which Viet Nam is a member; focus on technical experts.	MONRE, MOFA and other ministries	Develop, pilot implementation	Replicate
2	Develop and implement educational and training programs integrated with CC response and disaster risk management at all educational levels; improve the quality of teaching programs on CC response.	Develop and implement a capacity-building project for political and social organisations in adaptation; focus on women, youth, religious and vulnerable groups at all levels.	MONRE and relevant ministries	Develop and implement the scheme	Continue implementing
		Update, insert and integrate the contents of response to climate change and natural disaster prevention and control into general education curriculum at all levels.	MOET, MONRE, PCs of provinces, cities	Implement	Continue implementing
3	Enhance research, surveys and statistics; periodically forecast demand and supply capacity of human resources for CCA; disseminate and	Improve the quality and capacity of teachers and education officials related to climate change and natural disaster prevention and control.	MOET, MONRE, PCs of provinces, cities	Implement	Continue implementing
		Research, survey, statistical data, periodically forecast demand and possible supply of human resources for adaptation to climate change; disseminate and provide information on the job market related to climate change.	MONRE, relevant ministries, provinces	Implement periodically	Continue implementing

No	Group of tasks and solutions	Specific tasks	Lead agencies	Outcomes in each phase	
				By 2025	By 2030
4	provide information on the CC-related labour market related to CC. Develop a pool of high-quality CCA experts to meet management requirements and be in line with the roadmap, national regulations and international CC treaties to which Viet Nam is a signatory.	Develop and implement projects of development and upgrading of leading research institutions, training high-quality experts on climate change and natural disaster prevention and control and mitigation. Improve the quality and diversify forms of training human resources of expertise in response to climate change in order to meet the requirements of the Paris Agreement and domestic and international regulations.	MONRE, ministries/sectors and PCs of provinces, cities MOET and MONRE, research institutes, universities	Review, develop scheme Review, develop and update the program, implement	Complete and implement the scheme Continue implementing
<b>4) Develop science and technology</b>					
1	Propose and develop policies to remove barriers for enterprises to invest in research and transfer CC response technology.	Review, propose incentive policies to encourage enterprises in investing, studying, transferring technology on CCA.	MOST, MOF	2025: Report on review, propose mechanism/policies	2030: Complete research for the phase 2021-2025
2	Promote fundamental research so that Viet Nam has some source technologies in CCA.	Implement basic research so that Viet Nam has some source technologies in adaptation to climate change.	MOST, MONRE	2025: Complete research for the phase 2021-2025	2030: Complete research for the phase 2026- 2030

No	Group of tasks and solutions	Specific tasks	Lead agencies	Outcomes in each phase	
				By 2025	By 2030
3	Conduct scientific research; develop and transfer technology, with priority given to high technology, new technology, digital transformation in CCA; study CCA solutions that can generate co-benefits together with GHG emission reductions and sustainable socio-economic development.	Implement research, development and effective application of new technologies, innovation and digital transformation in adaptation to climate change.	MOST, MONRE, ministries, sectors and provinces	Implement	Continue implementing
				Study and implement	Continue implementing, replicating
				Publicise the Scenario 2025	Publicise the Scenario 2025
				Implement periodically	Continue implementing
4	Apply technology and innovation in estimating and forecasting CC impacts.	Develop and apply technology and innovation in estimation and forecasting impacts of climate change on natural and social systems to contribute to transforming challenges into development opportunities and support ministries, sectors, localities, organisations and individuals to improve their capacity to adapt to climate change.	MOST, MONRE, ministries, sectors and provinces	Implement	Continue implementing
5	Research, develop, supplement and update standards and technical regulations on planning, designing and construction of works and infrastructure,	Review, develop and complete a system of standards, regulations and technical guidelines on planning and construction of road, railway and waterway transport infrastructure in order to adapt to climate change.	MOT	2022-2024: Standards, regulations and technical guidelines are updated, completed and promulgated	

No	Group of tasks and solutions	Specific tasks	Lead agencies	Outcomes in each phase	
				By 2025	By 2030
	which take into consideration the impacts of CC in the long term.	Review, supplement and develop new regulations and standards on planning, construction of infrastructure works in energy, services and commerce; natural disaster prevention and control works, especially lakes, dams, dikes and embankments, to actively prevent and control floods and storms according to the design level and safety from the increased impacts of climate change.	MOIT, MARD	2021-2024: Regulations and standards are developed, completed and promulgated	
		Review, correct, and develop new construction codes and standards for housing and public works in areas that are frequently affected by natural disasters.	MOC	2021-2024: Regulations and standards are developed, completed and promulgated	
		Review, correct, and develop new construction codes and standards for technical infrastructure of water supply, drainage and solid waste treatment in accordance with the updated scenario of climate change and sea level rise.	MOC	2021-2024: Regulations and standards are issued	
6	Develop and replicate activities and models applying environmentally friendly and CCA technologies.	Develop and replicate application models of environmentally friendly and adaptive technology to serve the national target of response to climate change and suitable to economic regions.	MOST, MONRE, ministries, sectors and provinces	Implement	Continue implementing
<b>5) Mobilise financial resources for CCA</b>					
1	Review, amend and supplement mechanisms and policies to attract	Review, amend and supplement mechanisms and policies to facilitate the investment attraction and international support for adaptation to climate change; develop investment cooperation models in adaptation to climate change,	MOF, MPI, MONRE	2023-2025: Develop and apply	Continue implementing

No	Group of tasks and solutions	Specific tasks	Lead agencies	Outcomes in each phase	
				By 2025	By 2030
	investment capital flows and international supports to CCA.	encourage the private sector to execute the self-protection investment against the impacts of climate change.			
2	Encourage and enhance the engagement of businesses and individuals in investment, research and implementation of CCA activities; mobilise the private sector to invest in implementing CCA activities through forms of cooperation between the State and enterprises, between the State and the private sector, and between domestic and foreign investors.	Develop and apply financial instruments to encourage and enhance the involvement of businesses and people, especially women, youth, and ethnic minorities in investment, research and implementation of adaptation to climate change.	MOF, MPI, and MONRE	2023-2025: Develop and apply	Continue implementing
		Develop and apply financial instruments to mobilise, manage and use financial resources, promote public-private cooperation in order to encourage and enhance the involvement of domestic and foreign enterprises, people to respond to climate change.			
3	Monitor financial resources and supports for CCA in accordance with Vietnamese law and the requirements of the United Nations Framework Convention on Climate Change.	Develop regulations and guidelines for monitoring financial resources to support climate change response in accordance with Vietnamese laws and the requirements of the United Nations Framework Convention on Climate Change.	MOF, MPI, MONRE	2023-2025: Develop and apply	Continue implementing

No	Group of tasks and solutions	Specific tasks	Lead agencies	Outcomes in each phase	
				By 2025	By 2030
4	Research and propose the formulation of a Fund for CCA and promote the effectiveness of the Fund for Natural Disaster Prevention and Control.	<p>Research and propose the establishment of a Fund for Climate Change Adaptation.</p> <p>Review and supplement regulations to effectively promote the Fund for natural disaster prevention and control.</p>	<p>MOF in collaboration with MONRE</p> <p>MOF in collaboration with MARD</p>	<p>2025: Complete the proposal for the establishment of the Fund</p> <p>2023: Complete the review, supplement</p>	
<b>6) Promote international cooperation in CC response</b>					
1	Fully fulfil the country's obligations as a signatory of the United Nations Framework Convention on Climate Change, the Paris Agreement on CC and other international treaties.	<p>Periodically develop a Biennial Transparency Report, NAP, and National Report on Climate Change Adaptation.</p> <p>Periodically develop, update and implement Nationally Determined Contributions, National Notifications and other national reports on climate change.</p>	<p>MONRE, relevant ministries, sectors</p> <p>MONRE, relevant ministries, sectors</p>	<p>Biennial updates</p> <p>Biennial updates</p>	<p>Biennial updates</p> <p>Biennial updates</p>
2	Promote cooperation, research and application of science and technology in implementing solutions to adapt to CC and sea level rise; in forecasting and warning of natural disasters and	<p>Develop and implement cooperation programs and projects with international partners on adaptation to climate change in Viet Nam.</p> <p>Organise and participate in international programs and forums and strengthen cooperation and exchange in research, training and technology transfer to respond to</p>	<p>MONRE, relevant ministries, sectors</p> <p>MONRE, MOET, MOST, MOFA, relevant ministries,</p>	<p>Programs, projects are developed and implemented</p> <p>Implement</p>	<p>Continue developing and implementing programs, projects</p> <p>Continue implementing</p>

No	Group of tasks and solutions	Specific tasks	Lead agencies	Outcomes in each phase	
				By 2025	By 2030
	appropriate response solutions to the transboundary impacts of CC response in the world.	climate change; prevent, mitigate and deal with losses and damage caused by climate change.	PCs of provinces, cities		
		Implement international cooperation activities; share information and data on climate change monitoring, forecasting and warning of natural disasters and appropriate response solutions to impacts of climate change, transboundary impacts of response to climate change in the world.	MONRE, MPS, MOD, MOFA, PCs of provinces, cities	Implement	Continue implementing
3	Support national agencies in capacity building to become recognised organisations to the Green Climate Fund, Adaptation Fund and others.	Develop a monitoring and assessment mechanism of technology transfer to respond to climate change.	MONRE, MARD, MPS, MOD, MOFA	Develop, implement	Continue implementing
		Strengthen the activities of international mobilisation, calling for and attracting investment for response to climate change.	MOFA, MPI, MOF, MONRE	Implement	Continue implementing
		Enhance the support for domestic agencies to build capacity to become recognised organisations for the Green Climate Fund, Adaptation Fund and others.	MOFA, MPI, MOF, MONRE	Implement	Continue implementing

**APPENDIX 2. SET OF MONITORING AND EVALUATION INDICATORS FOR CLIMATE CHANGE ADAPTATION ACTIVITIES – NATIONAL LEVEL**

Updated and supplemented with indicators as per the Decision No. 148/QĐ-TTg

**I. Strengthen the resilience and adaptive capacity of natural, economic and social systems, assure sustainable livelihoods**

No.	M&E subject matters	Monitoring & evaluation indicators	In charge
1	Agriculture, forestry, aquaculture	1.1. Number and varieties of new climate-resilient plants and animals selected for breeding 1.2. Scale of application of new CCA plant and animal varieties 1.3. Number and scale of climate-resilient production and farming models that have been shifted 1.4. Number and scale of technology, useful solutions in production and farming that have been applied 1.5. Number of ships having changes in capacity and appropriate, efficient, and climate-resilient fishing technology 1.6. Areas of special-use, coastal, and watershed protection forests that have been protected, replanted, and restored for CCA. 1.7. Number and scale of advanced hi-technology applied in forecasting, prevention, and control of forest fires	MARD, provinces MARD, provinces MARD, provinces MARD, provinces MARD, provinces MARD, provinces MARD, provinces
2	Environment and biodiversity	2.1. Climate change risk zoning maps for natural ecosystems developed 2.2. Number and scale of protected areas, rescue areas, off-site conservation, and breeding areas of threatened species established 2.3. Number of biodiversity conservation models deployed in areas of high biodiversity and CC vulnerability	MONRE MARD, provinces MONRE, MARD, provinces

No.	M&E subject matters	Monitoring & evaluation indicators	In charge
		2.4. Proportion (%) of the area of degraded critical natural ecosystems restored 2.5. Number and scale of climate change adaptation ecosystem-based models deployed	MONRE, MARD, provinces MONRE, MARD, provinces
3	Water resources	3.1. Number of underground water sources investigated and evaluated to help build a network of CCA water supply points in vulnerable areas 3.2. Number and scale of economical and efficient water extraction and use models deployed 3.3. Number and scale of water storage facilities deployed in the context of water scarcity, drought, and saltwater intrusion increase due to climate change 3.4. Number of water resource monitoring stations (surface water and underground water) built and operated 3.5. Number of inter-reservoir operating procedures in river basins reviewed and adjusted	MONRE, provinces MONRE, MARD, provinces MONRE, MARD, MOIT, provinces MONRE, MARD, MOIT
4	Transportation	4.1. Number of road and waterway transport works/projects built, rehabilitated, and upgraded in areas often threatened by floods, sea level rise, landslides 4.2. Length (km) of roads in areas often threatened by floods, sea level rise, and landslides built, renovated and upgraded	MOT, provinces MOT, provinces
5	Construction, urban facilities	5.1. Number of technical infrastructures for flood prevention and control in urban areas built and upgraded 5.2. Percentage of population in areas frequently affected by storms, storm surges, floods, riverbank and coastal erosion, flash floods, and landslides that have been relocated and arranged for temporary residence 5.3. Number of storm, flood, and sea level rise-resilient houses built	MOC, provinces MOC, provinces MOC, MARD, provinces

No.	M&E subject matters	Monitoring & evaluation indicators	In charge
		5.4. Percentage of people provided with clean and hygienic water; in which percentage of people provided with clean water meets the standards prescribed by MOH.	MOC, provinces
6	Industry, commerce, services	6.1. Number of infrastructures for the energy sector built and upgraded to adapt to climate change 6.2. Number of infrastructures for industrial production built and upgraded to adapt to climate change 6.3. Number of trading and service facilities built and upgraded for climate change adaptation	MOIT, provinces MOIT, provinces MOIT, provinces
7	Medical and public health	7.1. Number of facilities for health care, medical examination and treatment, disease prevention and control in areas at high risk of climate change impacts newly built and upgraded to ensure accessibility and maintain operation in the event of disaster and evacuation in emergency disaster situations 7.2. Number of medical facilities capable of treatment of diseases related to climate change 7.3. Number of warnings on diseases and health risks due to extreme weather and climate 7.4. Percentage of the population who can access medical examination and treatment services	MOH, provinces MOH, provinces MOH, provinces MOH, provinces
8	Education and training	8.1. Number of schools built, upgraded, and renovated to ensure resilience to the impacts of climate change, safety, and less interruption of teaching and learning when natural disasters occur	MOET and provinces
9	Labour and society	9.1. Number of vocational training and livelihood transformation programs for communities and vulnerable groups to the impacts of climate change	MOLISA, provinces

No.	M&E subject matters	Monitoring & evaluation indicators	In charge
		<p>9.2. Percentage of people and women in areas vulnerable to climate change impacts receiving vocational trainings and livelihood transformation</p> <p>9.3. Percentage of people and women in CC vulnerable areas provided with soft skills training on CCA and NDPC</p>	<p>MOLISA, provinces</p> <p>Ministries, sectors and provinces</p>
10	Culture, sport, and tourism	10.1. Number of historical-cultural relics and scenic sites in areas affected by climate change preserved, repaired, and restored	MCST, provinces
		10.2. Number of tourism infrastructures in areas affected by climate change built and upgraded	MCST, provinces
		10.3. Number of sports facilities in areas affected by climate change renovated and upgraded	MCST, provinces
		10.4. Number of models for preservation and promotion of traditional cultural values and local knowledge in CCA built	MCST, provinces

**II. Mitigate natural disaster risks, minimise damages caused by increasing CC-induced natural disasters and climate extremes**

No.	V&E Subject matters	Monitoring & Evaluation indicators	In charge
1	Hydro-meteorological observation; monitoring climate change, sea level rise, and saline intrusion	Monitoring system for climate change and sea level rise built and operated 1.2. Scenario of climate change and sea level rise updated periodically 1.3. National climate assessment report updated periodically 1.4. Number of newly built and upgraded hydrometeorological and saline intrusion monitoring stations	MONRE MONRE MONRE MONRE, provinces
2	Disaster risk management	2.1. Number of hydrometeorological and weather forecasts; forecasts and early warnings of natural disaster and extreme weather and climate phenomena released 2.2. The national database on climate change and disaster prevention built and completed 2.3. Percentage of people living in areas at risk of CC-induced natural disasters having access to forecasting and warning information 2.4. Percentage of households in disaster-prone areas relocated to a safe place 2.5. Number of disaster risk zoning maps developed for the whole country with details to the commune level, especially for high-risk areas 2.6. Number of irrigation, hydropower, and NDPC facilities built and upgraded for safety 2.7. Loss and damage due to climate change periodically recorded and reported 2.8. Number of reservoirs having flood prevention plan for downstream area in case of emergency discharge and dam failure	MONRE, provinces MONRE, MARD MONRE, provinces MARD, provinces MONRE, NNPTNT provinces MARD, MOIT, provinces Ministries, sectors and provinces Ministries, sectors and provinces

No.	M&E Subject matters	Monitoring & Evaluation Indicators	In charge
		2.9. Number of reservoirs having disaster early warning systems to proactively respond to climate change	Ministries, sectors and provinces
		2.10. The search and rescue force's capacity built	MOD, provinces
		2.11. The number and scale of community-based disaster prevention models applied	MARD, provinces

### III. Complete institutions, promote potentials and resources to effectively adapt to CC

#### 3.1. Develop and complete institutions and policies

No.	M&E subject matters	Monitoring & evaluation indicators	In charge
1	Complete institutions and policies	Proposal for development of Law on Climate Change is included in the National Assembly's program on formulation of Laws and Ordinances	MONRE
		1.2. Number of legal documents related to CCA developed and promulgated	Ministries, sectors
		1.3. Number of mechanisms and policies to mobilise resources and encourage the participation of all economic sectors in CCA activities; insurance, and disaster risk sharing	Ministries, sectors
		2.1. Number of strategies related to CCA issued	Ministries, sectors
		2.2. Number of master plans related to CCA developed	Ministries, sectors and provinces
		2.3. Number of plans related to CCA issued	Ministries, sectors and provinces
2	Develop and promulgate strategies, master plans, plans, programs, schemes, projects		

No.	M&E subject matters	Monitoring & evaluation indicators	In charge
		2.4. Number of programs, schemes, and projects on CCA implemented	Ministries, sectors and provinces
3	Develop and promulgate national technical standards, regulations, regulations, and technical guidelines	3.1. Number of national regulations on CCA issued	Ministries, sectors
		3.2. Number of national standards and baseline standards on CCA issued	Ministries, sectors and provinces
		3.3. Number of technical guidelines on CCA issued	Ministries, sectors and provinces
4.	Prepare a report on CCA	4.1. National adaptation report (NAP report)	MONRE
		4.2. National adaptation report is prepared periodically to submit to the Secretariat of the United Nations Framework Convention on Climate Change.	MONRE
		4.3. Report on the response to climate change within the scope and field of management	Ministries, sectors and provinces
5	Integrate CCA into strategies, master plans and plans	5.1. Guidelines for integrating CCA into strategies, master plans, and plans are issued	MONRE
		5.2. Guidelines for assessing impacts, vulnerabilities, risks, losses, and damages due to climate change are issued.	MONRE
		5.3. Assessment of impacts of climate change on sectors and provinces are periodically updated	Ministries, sectors and provinces
6	Conduct monitoring and evaluation	5.4. Percentage of strategies, master plans, and plans that incorporate CCA content	Ministries, sectors and provinces
		6.1. Percentage of ministries, sectors, and provinces that developed and operated a monitoring and evaluation system for CCA	Ministries, sectors and provinces

No.	M&E subject matters	Monitoring & evaluation indicators	In charge
7	Improve the organisation, apparatus and human resources to respond to climate change	7.1. Specialised agencies to respond to climate change strengthened	Ministries, sectors and provinces
		7.2. Number of civil servants, public employees, and workers working in the field of the CC response	Ministries, sectors and provinces

### 3.2. Train, communicate, raise awareness

No.	M&E Subject matters	Monitoring & Evaluation indicators	In charge
1	Provide professional training on climate change	1.1. Number of civil servants, public employees, and workers provided with trainings, foster trainings and professional training on climate change	Ministries, sectors and provinces
		1.2. Percentage of female/ethnic minority civil servants, public employees, and workers provided with professional trainings on climate change	Ministries, sectors and provinces
		1.3. Number of educational and training institutions offering trainings on climate change	Ministries, sectors and provinces
2	Propagate and raise awareness of climate change and NDPC	2.1. Number of programs and communication and awareness raising events on CCA and NDPC conducted	Ministries, sectors and provinces
		2.2. Percentage of people communicated and having improved awareness of CCA and NDPC	Ministries, sectors and provinces
		2.3. Percentage of female/ethnic minority people communicated and having improved awareness of CCA and NDPC	Ministries, sectors and provinces

### 3.3. Investment resources for climate change adaptation

No.	M&E subject matters	Monitoring & evaluation indicators	In charge
1	Investment resources	1.1. State budget 1.2. International funding supports (ODA and non-refundable assistance) 1.3. Private sector	Ministries, sectors and provinces Ministries, sectors and provinces Ministries, sectors and provinces
2	Management and use of investment resources	2.1. Disbursement rate for CCA	Ministries, sectors and provinces

### 3.4. Science, technology, and international cooperation

No.	M&E subject matters	Monitoring & evaluation indicators	In charge
1	Scientific research and technology application	1.1. Number of scientific and technological programs and tasks serving CCA implemented 1.2. Number of technologies applied for CCA activities 1.3. Number of inventions and useful solutions for CCA filed, patented and put into practice	MOST Ministries, sectors and provinces MOST, provinces
2	International cooperation	2.1. Number of international treaties and agreements on climate change engaged 2.2. Number of international cooperation programs and projects on CCA implemented	MONRE Ministries, sectors and provinces

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