

Synthesis report on how developing countries are addressing hazards, focusing on relevant lessons learned and good practices in the context of the recognition of adaptation efforts of developing countries

Recommended action by the Adaptation Committee

The Adaptation Committee (AC), at its 18th meeting, will be invited to take note of this synthesis report which was finalized after the AC's informal stocktake meeting in August and is now in the process of being converted into a user-friendly publication.

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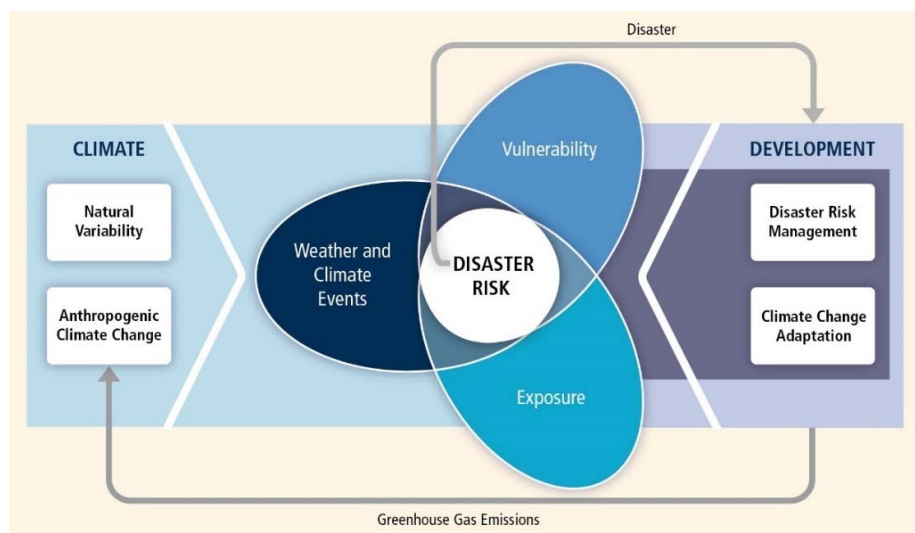
1. Introduction

1. The Conference of the Parties serving as the meeting of the Parties to the Paris Agreement (CMA) requested the secretariat, under the guidance of the Adaptation Committee (AC) and the Least Developed Countries Expert Group (LEG), and in collaboration with relevant stakeholders, to prepare synthesis reports every two years starting in 2020. The synthesis reports, covering specific adaptation themes, are focused on relevant lessons learned and good practices in developing country Parties in the context of the recognition of their adaptation efforts.¹ The CMA also recalled that the global stocktake will review the overall progress made in achieving the global goal on adaptation and acknowledged that adaptation efforts contribute to this objective.²

2. The AC, at its sixteenth meeting, agreed on the theme of “How developing countries are addressing hazards, focusing on relevant lessons learned and good practices” for its first synthesis in the context of the recognition of adaptation efforts of developing countries. It requested the secretariat to develop an initial draft for consideration by the seventeenth meeting of the Adaptation Committee.

3. Mentions of adaptation efforts in IPCC reports have been used to provide this paper with basic conceptual grounding of what adaptation efforts entail. The IPCC Special Report on Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation stated that many climate change adaptation efforts aim to address the implications of potential changes in the frequency, intensity, and duration of weather and climate events that affect the risk of extreme impacts on human society. That risk is determined not only by climate and weather events (the hazards) but also by the exposure and vulnerability to these hazards (Figure 1). Therefore, effective adaptation and disaster risk management strategies and practices also depend on a rigorous understanding of the dimensions of exposure and vulnerability, as well as a proper assessment of changes in those dimensions.³ The IPCC fifth assessment report also highlighted that adaptation responses are underpinned by common enabling factors, including effective institutions and governance, innovation and investments in environmentally sound technologies and infrastructure, and sustainable livelihoods. Hence, this report seeks to explore and address some good practices of adaptation efforts of developing countries in addressing climate hazards that lead to reducing exposure and vulnerability to climate hazards, strengthening resilience and adaptive capacity as well as establishing an enabling environment for adaptation.

Figure 1. The IPCC key concepts involved in disaster risk management and climate change adaptation, and the interaction of these with sustainable development (Source: SREX)



¹ See Decision 11/CMA.1 para 13.

² See Decision 11/CMA.1 para 14.

³ https://www.ipcc.ch/site/assets/uploads/2018/03/SREX-Chap1_FINAL-1.pdf

4. This report considers efforts, within and taken by developing countries, based on a review of National Adaptation Plans (NAPs), Nationally Determined Contributions (NDCs), National Communications, Adaptation communications, and other relevant documents, including reports of the Technical Examination Process on Adaptation (TEP-A), the AC, the LEG, the Executive Committee (ExCom) of the Warsaw International Mechanism (WIM) for loss and damage, and reports prepared under the Nairobi Work Programme. So far, 137 NDCs of developing countries, 154 national communications, 20 NAPs, and 1 adaptation communication submitted to the UNFCCC, have been reviewed (see Figure 2 for the key climate hazards addressed by developing countries). In addition, some examples were derived from other sources to illustrate in more detail the good practices used by developing countries.
5. Following an introduction, the report includes the following sections:
- Section two provides a synthesis of information on adaptation efforts by developing countries designed in response to multiple climate hazards;
 - Section three provides an analysis of impact and response by type of hazards and elaborates on crucial climate hazards faced by developing countries. We considered each hazard's respective impacts, as well as good practices that developing countries follow in responding to it at different scales and areas of response;
 - Section four, informed by previous three sections, provides an overview of overall experience in addressing hazards, including challenges, needs, and lessons learned.
6. Definitions for key concepts, drawn from IPCC glossary of terms⁴, are presented in the box 1 below to assist with common understanding of how the concepts are applied within this paper.

Box 1. Definitions for key concepts

Adaptation options: The array of strategies and measures that are available and appropriate for addressing adaptation. They include a wide range of actions that can be categorized as structural, institutional, ecological or behavioural.

Climate Extreme (extreme weather or climate event): The occurrence of a value of a weather or climate variable above (or below) a threshold value near the upper (or lower) ends of the range of observed values of the variable.

Disaster: Severe alterations in the normal functioning of a community or a society due to hazardous physical events interacting with vulnerable social conditions, leading to widespread adverse human, material, economic or environmental effects that require immediate emergency response to satisfy critical human needs and that may require external support for recovery.

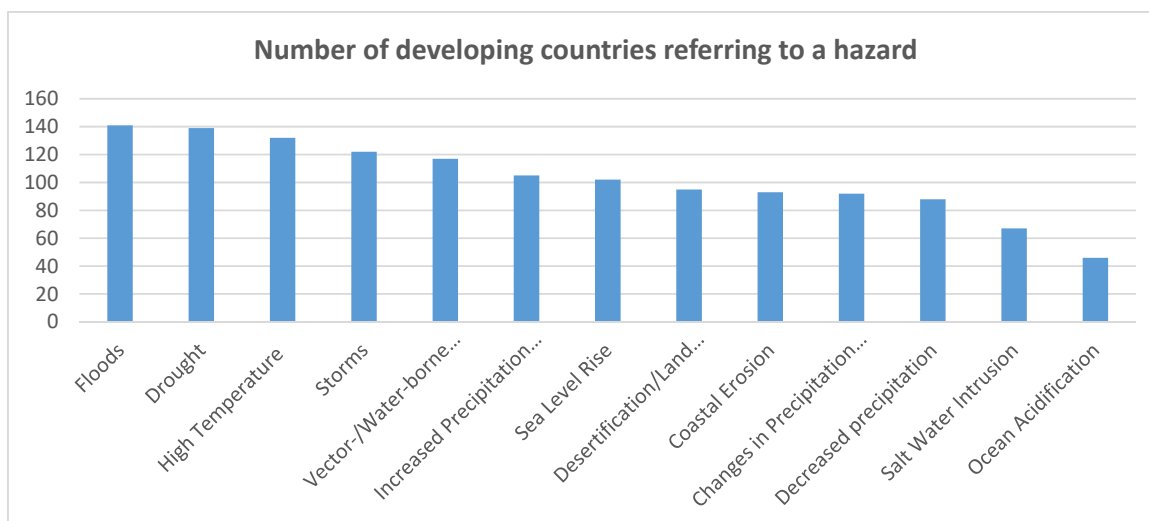
Exposure: The presence of people; livelihoods; species or ecosystems; environmental functions, services, and resources; infrastructure; or economic, social, or cultural assets in places and settings that could be adversely affected.

Hazard: The potential occurrence of a natural or human-induced physical event or trend that may cause loss of life, injury, or other health impacts, as well as damage and loss to property, infrastructure, livelihoods, service provision, ecosystems and environmental resources.

Impacts (consequences, outcomes): The consequences of realized risks on natural and human systems, where risks result from the interactions of climate-related hazards (including extreme weather and climate events), exposure, and vulnerability. Impacts generally refer to effects on lives, livelihoods, health and wellbeing, ecosystems and species, economic, social and cultural assets, services (including ecosystem services), and infrastructure. Impacts may be referred to as consequences or outcomes, and can be adverse or beneficial.

Vulnerability: The propensity or predisposition to be adversely affected.

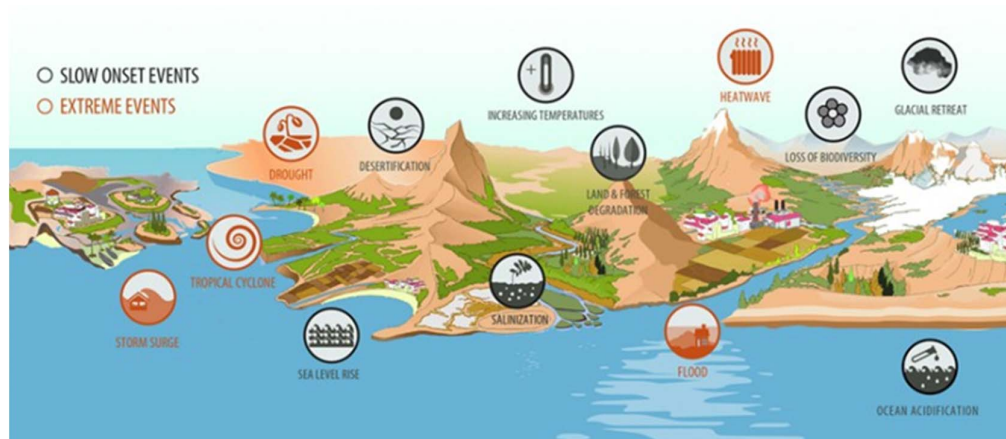
⁴ <https://www.ipcc.ch/report/sr15/glossary/>

Figure 2. Key climate hazards identified by developing countries

2. Adaptation efforts of developing countries to address multiple climate hazards

2.1. Impacts of hazards

7. All developing countries provided a description of key climate hazards faced by the countries. They also highlighted social and economic impacts of those hazards. A majority of Parties referred to multiple hazards, mentioning both extreme events and slow onset ones (see Figure 3). Kiribati, for example, reported on a range of hazards (including sea level rise, ocean acidification, storm, and floods) and estimated that the costs of climate change related risks would be 35 per cent of the country GDP. The estimate included only the potential impacts of climate change on coastal zone (USD 7-13 million per year) and water resources (USD 1-3 million per year).⁵ Colombia reported total losses of USD 6 billion due to extreme events in the period 2010–2011.⁶

Figure 3. Examples of extreme events and slow onset events

Source: Executive Committee of the Warsaw International Mechanism for Loss and Damage

⁵ Kiribati's NDC

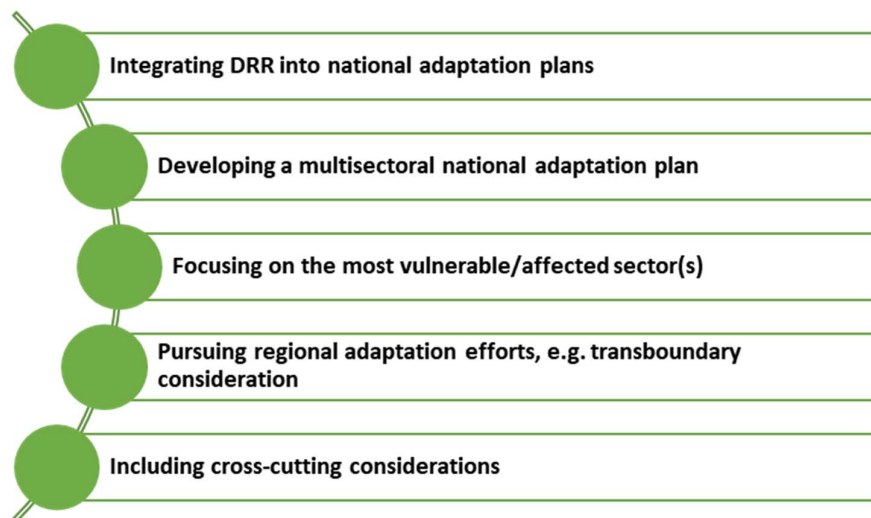
⁶ Colombia's NDC

8. All Developing countries have developed, or indicated their intention to develop, adaptation measures in response to multiple hazards. In their adaptation planning, several countries have given priority to protection of the population, ecosystem and natural resources, as well as key infrastructure, against the risks of extreme events. These include developing hazard maps and models for all potential hazards (including floods, sea level rise, storm surge, and tsunami), improvement of early warning system for climate events, construction of flood and cyclone shelters, construction of inland retention dams, climate resilient infrastructure and housing, and improvement of urban resilience through improvement of drainage system to address urban flooding.^{7,8} Some mentioned priority adaptation needs such as using remote sensing and satellite-based technologies and approaches to improve monitoring and detection of hydrometeorological extreme events.⁹ Planting of mangroves, construction of seawalls, and the relocation of communities to higher grounds were also part of ongoing adaptation initiatives.¹⁰

2.2. Good practices

9. Developing countries' good practices for multiple climate hazards can be categorised mainly into five types of adaptation response (Figure 4). These include (a) integrating disaster risk reduction (DRR) into national adaptation plans, (b) developing a multisectoral national adaptation plan, e.g. through using multiple criteria analysis, (c) focusing on the most vulnerable/affected sectors, (d) pursuing regional adaptation efforts, especially with regard to transboundary consideration, and (e) cross-cutting considerations, for example, some countries have promoted an inclusive process, such as integration of gender consideration as well as inclusion of local communities and indigenous peoples into their practices. Also, some countries have addressed a combination of the approaches.

Figure 4. Good practices in response to multiple climate hazards



2.2.1. Integrating disaster risk reduction (DRR) into national adaptation plans

10. The integration of disaster risk reduction into adaptation responses can optimise efforts to reduce vulnerability and enhance resilience to the impacts of climate hazards. Several Parties adopted a disaster risk reduction approach to multiple climate hazards their countries face, including 11 NAPs¹¹ mentioned integrating DRR into national adaptation plans through aligning their NAPs with international DRR

⁷ Bangladesh's NDC

⁸ Dominican republic's NDC

⁹ Bhutan' NDC

¹⁰ Fiji's NDC

¹¹ Brazil, Burkina Faso, Ethiopia, Guatemala, Fiji, Kenya, Kiribati, St. Lucia, St. Vincent and Grenadines, Sri Lanka, State of Palestine

obligations, especially the Sendai Framework for Disaster Risk Reduction, and/or with existing national frameworks policies and laws (see boxes 2 and 3).

11. adaptation and disaster risk reduction policies with some countries dealing with climate change adaptation and disaster risk reduction as the same issue, and proposed adaptation actions, including development of national databases on climate data and early warning systems, improvement of local capacity and knowledge management, and enhancement of applications of technology.¹² For example, Costa Rica planned to integrate its National Disaster Risk Management Policy within its adaptation plans, including through capacity building for resilience and technology transfer. The country has cited the impact of extreme weather events as one of the main threats to human safety. While the country has improved in the past years its disaster risk management policies, it continues to experience negative consequences caused by extreme weather events, with the public infrastructure being the most affected sector. The country has planned to improve infrastructure resilience by designing a national vulnerability monitoring program for infrastructure during extreme climate events, while recognizing the need to increase the capacity of the National Meteorological Institute to follow-up in real time, strengthen existing early warning systems, promote technology transfer to help adaptation, and to increase country wide research budget on climate change. ¹³Kiribati developed a joint implementation plan on climate change and disaster risk management in 2014 which identifies priority adaptation measures to address current and ongoing climate risks. The implementation cost of the join plan over the period 2013–2023 were estimated to be approximately USD 75 million.¹⁴

12. Another example is Burkina Faso's NAP that contains provisions which address DRR including protection of persons and goods from extreme climate events and natural disasters through:

- a) Taking account of resilience in development projects and programmes;
- b) Formulation of contingency plans at regional and local level and plans to support vulnerable populations;
- c) Providing sustainable financing for disaster and humanitarian crisis prevention and management by formulating and implementing an appropriate financing strategy;
- d) Improving women's skills by disseminating best climate change adaptation practices;
- e) Using social safety nets for vulnerable populations.¹⁵

13. Within the context of disaster risk management, some developing countries developed legal and/or policy framework in response to climate hazards, these include for example:

- a) Jamaica's Climate Change Policy Framework was prepared under a Government-of-Jamaica/EU/UNEP Climate Change Adaptation and Disaster Risk Reduction (CCADRR) Project. Climate-related hazards that have the highest impact on increasing vulnerability in the region include storms, floods and droughts.
- b) The tsunami of Boxing Day 2004 in Indonesia, which caused considerable loss of life and destruction of property and infrastructure, led to the development of the Disaster Management Law of 2007. Also, the Indonesian Act on Meteorology, Climatology and Geophysics was developed in 2009.
- c) In 2017, Lao's Ministry of Planning and Investment, with World Bank support, decreed the inclusion of climate and disaster risk considerations in the public investment review process. A climate change and disaster management law is currently being developed, together with a new five-year National Strategic Disaster Risk Management Plan.¹⁶

¹² Jamaica, Indonesia, India

¹³ Costa Rica's NDC

¹⁴ Kiribati's NDC

¹⁵ Burkina Faso's NAP

¹⁶ Lao's NDC

- d) The Kenya Climate Risk Management Framework (2017) integrated climate change adaptation and disaster risk reduction in the context of sustainable development. The framework serves as a central part of policy and planning at national and county levels in Kenya.¹⁷
- e) The Environment Protection Law No. 42/2014 issued in Kuwait in 2014 includes articles on topics related to climate change adaptation, such as articles 66 and 99 of the law deal with monitoring sea level rise and the marine environment. Article 118 of the law is dedicated to needs for natural disasters (e.g. sand and dust storms and flash floods) emergency and management plans.¹⁸
- f) Draft Disaster Risk Reduction Policy was in place at the time of preparation of the Fiji's NAP. Climate change and disaster risk reduction, with references to the Sendai International Framework for Disaster Risk Reduction, are linked throughout its NAP.¹⁹

Box 2. Joint National Action Plans for adaptation and disaster risk reduction

Three countries in the Asia-Pacific region have completed Joint National Action Plans (JNAPs), which work to combine adaptation with disaster risk reduction. Tonga was the first country in the region to prepare a JNAP and along with the Secretariat of the Pacific Regional Environment Programme has provided guidance to others. As an agricultural nation, and one of the small island developing States, Tonga's JNAP recognizes that the economy is particularly vulnerable to exogenous shocks, including climate- and weather-related hazards, heavy rainfall, droughts, heatwaves and sea level rise. A set of six goals has been developed under the JNAP, in line with Tonga's sustainable development plan, adaptation ambitions and disaster risk reduction efforts; that is, the JNAP cuts across all three global agendas. While countries have varied in their approaches to integrated planning, it has been particularly successful when strong working relationships between government agencies already exist, and key policy documents for climate change and disaster risk reduction are in place. This suggests that countries that have already committed substantial resources to planning are most likely to find success with integrated planning approaches.

Source: <https://unfccc.int/sites/default/files/resource/docs/2017/tp/03.pdf>, Based on an intervention by a representative of the Ministry of Meteorology, Energy, Information, Disaster Management, Environment, Climate Change and Communications of Tonga at the Technical Expert Meeting on 17 May 2017. Audio available at <http://tepa.org/sessions/session-5-naps-framework-creating-links-sdgs-sendai-framework>

Box 3. Kiribati Joint Implementation Plan for climate change and DRR

Climate change adaptation and disaster risk reduction are intertwined in the Kiribati Joint Implementation Plan (KJIP). The main rationale for developing the KJIP for climate change and disaster risk management is to support the implementation of holistic approaches to climate action across sectors and with stronger linkages among climate adaptation planning processes at national, sectoral and island levels.

The KJIP is consistent with three regional climate change and disaster risk reduction frameworks; the Pacific Islands Framework for Action on Climate Change (PIFACC), the Regional Framework for Action on Disaster Risk Management endorsed by the Pacific Leaders in 2005 and the Pacific Islands Meteorological Strategy (PIMS) approved in 2012.

¹⁷ <http://www.lse.ac.uk/GranthamInstitute/wp-content/uploads/2018/10/8737.pdf>

¹⁸ Kuwait's NDC

¹⁹ Fiji's NAP

The KJIP is an integrated plan that prioritizes 104 climate adaptation and disaster risk reduction actions.

Source: Kiribati's NAP, available at <https://www4.unfccc.int/sites/NAPC/Documents/Parties/Kiribati-Joint-Implementation-Plan-for-Climate-Change-and-Disaster-Risk-Management-2019-2028.pdf>

2.2.2. Developing a multisectoral national adaptation plan

14. Several developing countries have undertaken or planned to undertake multisectoral national adaptation response to climate risks (see box 4 for an example). Countries used the NAP process to put in place priority actions to be mainstreamed into development plans of all sectors and identified policy and institutional frameworks to coordinate and enhance mainstreaming.²⁰

15. Argentina in its NDC elaborated on the process of creating a multisectoral national adaptation plan, starting within its national climate change cabinet by first conducting an identification of priorities by all sectors, municipal representatives, and relevant actors of civil society, academia and the private sector. Then the process continued by reviewing the country's current policies and programmes for public and private investment on adaptation with the participation of all relevant actors. After the review, which was said to be iterative and expected to continue in the future, a set of initial needs regarding adaptation were identified. Among the initial needs were the development of structural and non-structural works to prevent floods, widening of the monitoring networks, and strengthening of early warning systems and health climate services.²¹

16. Dominica undertook a national climate change risk assessment to identify priority risks for each sector. It used a multiple criteria analysis, comprising several steps: (1) identification of event/outcome risks based on previously undertaken vulnerability assessments, (2) ranking of the risks based on severity of social/economic/environmental impacts using indicators, (3) probability/frequency analysis on prioritized event/outcome risks that scored the highest in the previous step, (4) verification of the outcomes through stakeholders consultation during a national consultative workshop, and (5) development of a list of national priority risks based on top ranked risks for each sector.²²

Box 4. Algeria's multisectoral adaptation to extreme events through the integration of DRR

Algeria, after the 2001 floods and the 2003 earthquake, has developed a multisectoral approach to protect urban settlements and infrastructure from future losses from hazards. For example, the Ministry of Public Work has developed a database to identify major infrastructure at risk from earthquake, fire and flooding as well as a pilot project to explore flood risk to the infrastructure sector. Algeria's Ministry of Land-Use Planning and Environment collaborated with UNDP Algeria to integrate DRR into urban planning using GIS mapping which led to implementation of risk-sensitive plans across nine provinces.

The Ministry of Education has applied awareness raising measures on DRR, including sensitizing students and teachers to major hazards and integrating natural hazards and preparedness programmes into the school curriculum, as well as leading a series of national campaigns in schools and communities.

Source:

[https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Algeria%20First/Algeria%20-%20INDC%20\(English%20unofficial%20translation\)%20September%2003,2015.pdf](https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Algeria%20First/Algeria%20-%20INDC%20(English%20unofficial%20translation)%20September%2003,2015.pdf)

²⁰ Brazil, Burkina Faso, Ethiopia, Guatemala, Fiji, Kenya, Kiribati, St. Lucia, St. Vincent and Grenadines, Sri Lanka, State of Palestine, Sudan

²¹ Argentina's NDC

²² Dominica's NDC

2.2.3. Focusing on the most vulnerable/affected sectors

17. Some developing countries have undertaken vulnerability assessments to identify and focus adaptation action on the most vulnerable/affected sectors. The most referred to vulnerable sectors by developing countries include water, health and agriculture. For example, Benin took into account climatic projections and the potential impacts of climate hazards, ranging from coastal floods and intrusions of salt-water into groundwater to a decrease in corn yields, and developed key adaptive targets, by 2030, in the water sector. The targets include reducing the vulnerability of natural and human systems to floods and degradation of water quality, promoting water management, enhancing knowledge regarding the climatic system and forecasting of weather conditions.²³ Jordan focused on wide-ranging intervention measures in the health sector to reduce the burden of climate sensitive health disease. Climate sensitive diseases considered in its plan include heat wave-related health impacts, water-, vector-, and food-borne diseases, respiratory and air-borne diseases, and occupational health risks induced by climate change.²⁴ Others such as China included, in their submissions, preparation of contingency plans for public health under the impacts of climate change and improving the capacity of public medical services to adapt to climate change.²⁵

2.2.4. Pursuing regional adaptation efforts, including transboundary consideration

18. Many hazards such as floods, droughts, storms and others do not recognize borders, and their impacts can be far beyond one country. Transboundary cooperation in adaptation to climate change enables countries to address such hazards together and to prevent the possible negative effects of unilateral adaptation measures. Two third of NAPs mentioned some form of transboundary/regional cooperation efforts. The common efforts include; membership in regional climate change frameworks/groups, mobilization of climate finance, generation and sharing of climate scenarios information through climate modelling and forecasting, preparation and implementation of joint adaptation Plans, strategies and projects, promoting exchanges of best practices, and expansion of regional knowledge in addressing common hazards and vulnerabilities.

19. Examples of regional and transboundary initiatives and measures which address hazards include (1) the Dniester river basin, shared by the Republic of Moldova and Ukraine – integration of disaster risk reduction (flood and droughts) into transboundary adaptation strategy and plan followed by joint and coordinated implementation of flood and drought management measures under the bilateral Dniester Commission; (2) the Chu Talas river basin, shared by Kazakhstan and Kyrgyzstan – the issues of droughts and water scarcity was integrated into a draft joint action management plan for the basin and the activities are coordinated by the Chu-Talas Water Management Commission; (3) the Lower Mekong River Basin, shared by Cambodia, Laos, Thailand and Vietnam – integration of disaster risk reduction into transboundary and national adaptation strategies and plans followed by joint and coordinated implementation of concrete measures; (4) the Niger river basin, shared by [Benin](#), [Burkina Faso](#), [Cameroon](#), [Chad](#), [Côte d'Ivoire](#), [Guinea](#), [Mali](#), [Niger](#) and [Nigeria](#) – activities focused on disaster risk reduction are included into the climate investment fund for the Niger basin which receive support from the GCF and other donors; and (5) the Volta river basin, shared by Benin, Burkina Faso, Côte d'Ivoire, Ghana, Mali and Togo, activities implemented by the Volta Basin Authority – a project on flood and drought management is supported by the Adaptation Fund.

20. Climate change adaptation and building resilience were considered a national security issue and a priority for some countries which have been severely affected by extreme climate events,²⁶ with some climate extremes resulting in unprecedented impacts at a regional scale. Some countries collaborated, with a view to reducing regional vulnerability, to implement their priority actions from their adaptation plans. See Box 5 for an example.

²³ Benin's NDC

²⁴ Jordan's NDC

²⁵ China's NDC

²⁶ Costa Rica's NDC

Box 5. Colombia's regional multisectoral approach to climate change adaptation

Impacts of the “La Niña” phenomenon, which took place in 2010–2011 in Colombia, was estimated USD 6 billion. It was reported that over 3.2 million people were affected, 3.5 million hectares flooded, and 845 primary and secondary roads closed, affecting the social and economic life of the country significantly. Taking into account the impacts caused by La Niña phenomena in 2010–2011, the country formulated its NAP in 2011, and has taken actions to implement it through regional (the Caribbean and Andean regions) and sectoral (transport, housing, energy, agriculture and health sectors) adaptation efforts.

To date, Colombian entities have formulated 11 regional adaptation plans, which have prioritized adaptation actions as well as plans for the agricultural sector and the primary road network. The country intended to align its adaptation efforts with other global targets that contribute to increasing resilience, such as those of the Convention on Biological Diversity (CBD), the 2030 Development Agenda, and the UN Convention to Combat Desertification (UNCCD), as well as the Sendai Framework for Disaster Risk Reduction 2015–2030.

Source: Colombia's NDC

2.2.5. Cross-cutting considerations

21. Many Parties underscored the importance of inclusive cross-cutting approaches to adaptation and sustainable development, through including the integration of gender considerations into their adaptation measures. For some countries, **gender is one of the guiding principles in planning for adaptation and sustainable development**. Jordan, in the context of sustainable development-oriented adaptation, addressed integration of gender considerations in climate change policies and strategies in all relevant sectors, such as in its national strategies for poverty eradication and social development. It planned to develop and compile information and methodologies to facilitate the integration of gender considerations in this regard.²⁷ Burkina Faso has dedicated a section of its NAP to address the incorporation of cross-cutting issues, including through “promotion of participatory and gender-sensitive approaches coordinated with sustainable development objectives, policies, plans and programmes”, and the NAP is aligned with its national gender policy.²⁸

22. The consideration of gender issues is imperative in establishing an enabling environment for adaptation. The 2015 LEG paper on strengthening gender consideration in adaptation planning and implementation showed the experiences of Mali, and the important role of existing institutional arrangements in the country in facilitating the integration of gender-related considerations in development planning and adaptation to climate change. Examples include the development of a gender thematic group to facilitate dialogue with the government and society on the issue of gender equality in Mali, the development of a National Gender Policy of Mali for 2009–2018, a national strategy on gender-sensitive planning and budgeting, as well as climate change specific strategies such as Mali's National Climate Change Policy, National Climate Change Strategy and National Climate Action which paved the road to address and integrate gender in Mali's NAP process.²⁹

23. Some countries addressed the **vulnerability of women to climate risk**,³⁰ such as pregnant women being more vulnerable to malaria,³¹ or in terms of addressing vulnerability by identifying measures or options such as **capacity building, empowerment and involvement of women when undertaking adaptation**.³² Examples include:

²⁷ Jordan's NDC

²⁸ Burkina Faso's NAP

²⁹ http://unfccc.int/files/adaptation/application/pdf/21673_unfccc_leg_gender_low_v5.pdf

³⁰ NAPs of Brazil, Cameroon, and Togo

³¹ Togo's NAP

³² NAPs of Sudan, Cameroon, Burkina Faso

- a) Dedicating a NAP section that lays out how gender issues, social and environmental safeguards are enshrined into the NAP;³³
- b) Including a specific provision for gender, vulnerable groups and youth in the measures to address climate change, such as in strengthening the adaptive capacity of women;³⁴
- c) Applying gender-sensitive and racial/ethnic criteria in NAPs to encompass social, cultural and economic dimensions for promoting adaptation.³⁵

24. A few Parties have placed emphasis on a **gender-responsive approach to Disaster Risk Reduction**. For example, many early warning systems do not currently reach women due to cultural norms and lack of women's access to education and information. St. Vincent and the Grenadines referred to a large-scale project on climate resilience that proposes to enhance climate risk management through several strategies, including development and implementation of gender-sensitive disaster risk management initiatives and collaboration with communities at all levels of climate and disaster risk management.³⁶

25. Additionally, some Parties considered **gender through the lens of human rights**, whether by dedicating a section on gender and human rights-based adaptation,³⁷ by setting out expectations for gender and human rights perspectives to be integrated within NAP processes,³⁸ or by aligning adaptation planning with national policies on gender equality.³⁹ Grenada, for example, strongly recommended adoption of gender and human rights approaches within every component of NAP and related processes and made one of its priority actions of the NAP to analyze and report on progress addressing gender through M&E of adaptation.⁴⁰

26. Parties addressed **local communities and indigenous people** in their adaptation planning mainly through two avenues: (1) highlighting the importance of development and implementation of adaptation plans that are location and context-specific, calling for enhanced and active participation of local communities and indigenous people;⁴¹ and/or (2) integration of climate-resilient indigenous knowledge and practices.⁴²

27. Examples of inclusion of local communities and indigenous people in adaptation action include:

- a) Inclusion of context-specific adaptation options such as the empowerment of local communities for more active involvement and ownership in adaptation planning and decision making, protecting their local resources, and providing health insurance for local communities;⁴³
- b) Inclusion of some adaptation options in sectoral NAPs; for example, providing local communities with the tools required for stormwater and wastewater systems;⁴⁴
- c) Enhancing the participation of local communities in monitoring, conservation and management of biodiversity,⁴⁵ such as for the conservation and rehabilitation of sensitive coastal habitats.⁴⁶ In addition to protecting ecosystems affected by climate change-induced hazards and extreme events, experience with ecosystem-based adaptation has provided evidence of increasing local community resilience and adaptive capacity as well as being cost-effective;

³³ Saint Vincent and the Grenadines's NAP

³⁴ Kenya's NAP, Kenya's NDC

³⁵ Brazil's NAP

³⁶ St. Vincent and Grenadines's NAP

³⁷ Fiji's NAP

³⁸ Grenada's NAP

³⁹ Kiribati's NAP

⁴⁰ Grenada's NAP

⁴¹ NAPs of Fiji, Brazil, Sri Lanka, Burkina Faso, and Sudan

⁴² NAPs of India, Sudan, Ethiopia

⁴³ Sudan's NAP

⁴⁴ Burkina Faso's NAP

⁴⁵ Sri Lanka's NAP

⁴⁶ Fiji's NAP

- d) Establishment of a National Policy for Territorial and Environmental Management of Indigenous Lands (PNGATI) for protection, restoration, and sustainable use of natural resources in indigenous lands and territories.⁴⁷

28. With regard to the integration of climate-resilient indigenous knowledge and practices, some examples were provided in the NAPs. For example, Sudan had among its adaptation options the documentation of existing indigenous knowledge as well as merging climate-friendly agriculture technologies with indigenous knowledge and practices to enhance resilience.⁴⁸ Kenya included in its adaptation actions the integration of local/indigenous knowledge into early warning systems as well as promoting indigenous knowledge on crops management.⁴⁹ Finally, Sri Lanka included in its adaptation actions (1) identifying ways to integrate climate resilient indigenous practices of water management into modern practices; (2) launching a partnership programme with academia and undertaking research in order to collect, compile, and analyze traditional local knowledge on climate; and (3) undertaking a study on indigenous weather forecasting knowledge to incorporate it into early warning systems and national climate risk surveillance programme.⁵⁰

Box 6. Application of bamboo poles technology in response to coastal erosion

In Bang Khun Thian, a district of Bangkok, local residents with land next to the sea have been forced to move to higher ground over the past two decades due to coastal erosion at the rate of 20-25 metres annually. Bangkok Metropolitan Administration officials proposed a USD 10.5 million project to build groynes and breakwaters. Local residents argued that groynes would do more harm than good given that they make their living from the coastal ecology and need a solution to restore the coastal ecosystem. Instead they applied indigenous knowledge of using bamboo fences to reduce wave forces and create barriers that trap sediment from the seawater, allowing replanted mangroves behind the fence to grow.

This was a successful bottom up project initiated by local residents which received government financial and technical support. The government is monitoring and promoting this project as an example of ecosystem-based adaptation.

Source: <https://wedocs.unep.org/bitstream/handle/20.500.11822/8114/-Technologies%20for%20Adaptation%20Perspectives%20and%20Practical%20Experiences-20111146.pdf?sequence=3&isAllowed=y>

3. Adaptation efforts of developing countries to address specific climate hazards

29. This section provides examples of good practices from developing countries in response to key climate hazards reported by countries. The main hazards include floods, droughts, sea level rise, and storms (see Figure 1). They result from direct climate change impacts of changes in temperatures and precipitation and, in turn, themselves produce a cascading set of adverse effects such as vector- and water-borne diseases, desertification, coastal erosion, etc. Hence, this section is structured into the four hazards and attempts to present good practices in response to these hazards.

3.1. Floods

3.1.1. Impacts

30. More than 90 per cent of the developing countries addressed floods in their reports (NDCs, NAPs, NCs). Floods were highlighted, in most submissions, as one of the climate-related hazards that have increased and

⁴⁷ Brazil's NAP

⁴⁸ Sudan's NAP

⁴⁹ Kenya's NAP

⁵⁰ Sri Lanka's NAP

will increase countries vulnerability to climate change.⁵¹ Flooding has been reported, by majority, to impact more than one sector, and that the impacts of flooding are not limited to short-term contact with floodwaters. Some addressed the impacts of floods on key economic sectors, while others elaborated on their significant impact on water resources, the health sector and agricultural production. Disruption of services, increases in water and vector borne diseases, and long-term effects to ecosystems, such as destruction of wildlife habitats, were associated with flooding.⁵²

31. A few countries reported specifically on the damages and costs incurred related to flood events. India, while mentioning the total flood prone area in the country being about 45.64 million ha, reported that the country's annual average flood damage during the period 1996–2005 was USD 753.2 million.⁵³

32. Parties have planned or started implementing adaptation actions to enhance resilience, including by developing early warning systems, ramping up disaster preparedness programmes for natural disaster risk reduction, improvement of human settlements, integrated watershed management and climate resilient infrastructure development.⁵⁴ Examples of good practices in responding to floods include, but are not limited to, national plans and strategies, legal and regulatory frameworks and policies, as well as concrete project implementation.

3.1.2. Good practices

33. Majority of developing countries have included in their plans adaptation measures to reduce their vulnerabilities and to enhance their adaptive capacities to the impacts of flooding. Some expressed requiring financial support to implement their adaptation plan. For example, Guyana, while planning to mainstream climate change considerations in all sectors of national development and requiring significant support to implement its plan, specifically identified the agriculture sector to be under threat from flooding. If the country receives its needed support, it will undertake actions in implementation of the climate resilience strategy and action plan. The actions include introduction of new agricultural techniques, development and implementation of early warning systems, enhanced weather forecasting by including microclimate studies and localized forecasting, development and introduction of crop varieties which are flood resistant, developing environmental and climate change awareness programmes at all levels, as well as developing innovative financial risk management and insurance measures.⁵⁵ In addition, planting of traditional tree and root crops is being undertaken to minimize soil erosion by some countries.⁵⁶

34. Antigua and Barbuda reported on the impacts of floods on its health sector, such as increases in vector borne diseases and the spread of water-borne illnesses. Given that climate change projections suggest increased risk of flooding in the country, the country's adaptation response is to protect by 2030 all waterways with a view to reducing the risks of floods and their health impacts in particular. Additionally, some of the country's mitigation responses (e.g. protection of all remaining wetlands and watershed areas as GHG sinks, by 2030) have adaptation co-benefits by enhancing water retention and reducing the risks of flooding and storm surge.⁵⁷ See box 7 for an example of lessons learned from flooding in Cambodia.

Box 7. Lessons learned from flood disasters: a case of Cambodia

Cambodia's heavy rainfall in October 2013 resulted in flash floods, impacting over half a million people and more than half of Cambodia's provinces.

The total cost of flood impacts was USD 356 million, of which USD 153 million accounted for the destruction of physical assets (damage), and 203 million US\$ was the estimated losses in production and economic flows.

⁵¹ Dominica's NDC

⁵² Burkina Faso's NDC

⁵³ India's NDC

⁵⁴ Indonesia's NDC

⁵⁵ Guyana's NDC

⁵⁶ Fiji's NDC

⁵⁷ Antigua and Barbuda's NDC

The country hence developed a number of priority adaptation actions under the Implementation of Climate Change Action Plan for Water Resources and Meteorology (2014-2018). These include strengthening early warning systems and climate information dissemination and developing and rehabilitating the flood protection dykes. Also, the country addresses waterborne and food-borne diseases associated with climate variables under its Implementation of Climate Change Action Plan for Public Health (2014-2018).

Source: Cambodia's NDC.

35. A few Parties included, in their reports and communications, investment cost for flood prevention and management.⁵⁸ For example, Burkina Faso estimated that flood prevention and management of flood waters for its main regional capitals would cost (in constant 2015 USD) 686,000,000 in 2020, 882,000,000 in 2025, and 1,078,000,000 in 2030. The country also estimated investment cost for strengthening of the early warning system for management of extreme climate events to be, in US dollars, 2,286,000 in 2020; 2,667,000 in 2025; and 2,667,000 in 2030.⁵⁹

36. In addition to national adaptation plans, some countries have developed laws and/or policy and legislation frameworks for disaster prevention and risk management, including for climatic risks such as floods. In Algeria, the 2004 Law on the Prevention of Major Risks and the Management of Catastrophes established the legal framework for disaster prevention and risk management. The Law provides guidelines for establishing a general plan of flood prevention which shall contain a national flood risk map, a reference height in the areas at risk under which it is forbidden to be built and thresholds, modalities and procedures of alerts.⁶⁰

37. The National Civil Defence and Protection Policy of Brazil, instituted by Law 12.608, of 10 of April 2012, combines efforts of adaptation and national risk management and disaster warnings, with a focus on increasing adaptive capacity and reducing vulnerability.⁶¹ The law was passed after a series of devastating flooding events during 2008 to 2011. It focused strongly on response towards flooding and landslide events. The law stipulates the maintenance of a national register of areas susceptible to the occurrence of high impact landslides, sudden floods or related geological or hydrological processes. It directs the municipalities to design a master plan comprising of susceptible areas and adopt measures to reduce the risk, among which, the execution of a contingency plan and safety works and, when necessary, the removal of buildings and the resettlement of occupants in a safe place.⁶²

38. One of key climate change related policies of Nigeria is the National Policy on Erosion and Flood Control. The policy serves several functions including responding to national emergencies as they relate to soil erosion and flood control as well as monitoring and evaluation of the implementation of approved Soil Erosion and Flood Control projects nationwide.⁶³

39. Several Parties cited establishment of monitoring and early warning systems of climate events, including for floods. Brazil referred to its National Centre for Monitoring and Early Warning of Natural Disasters that has mapped areas of risk of extreme rainfall events in 800+ municipalities for monitoring purposes and has in place an action plan to respond to such events.^{64,65} India reported that it has currently developed contingency flood management plans in many states based on early warning systems and other weather forecasting systems.⁶⁶ See boxes 8 and 9 for examples of countries' flood management.

⁵⁸ Malaysia's NDC

⁵⁹ Burkina Faso's NAP

⁶⁰ <http://www.lse.ac.uk/GranthamInstitute/wp-content/uploads/2015/05/ALGERIA.pdf>

⁶¹ Brazil's NAP

⁶² https://www.planalto.gov.br/ccivil_03/_ato2011-2014/2012/lei/112608.htm

⁶³ Nigeria's NDC, and <https://www.osgf.gov.ng/offices/ecological-fund/soil-erosion-and-flood-control>

⁶⁴ Brazil's NAP

⁶⁵ Brazil's NDC

⁶⁶ India's NDC

Box 8. Flood management in Bangladesh

Bangladesh has experienced several disasters, in particular flooding. In response to the impacts of climate hazards, the country has implemented projects including construction of flood embankments, coastal polders and cyclone shelters with active participation of communities.

The Government of Bangladesh has also invested over USD 10 billion during the last three decades in order to reduce country's vulnerability and enhance its resilience to the impacts of climate change and natural disasters. Bangladesh has recently established two innovative funds to promote cross sectoral adaptation actions and policies, which are the Bangladesh Climate Change Trust Fund (BCCTF) from the Government's own budget and the Bangladesh Climate Change Resilient Fund (BCCRF) with the support of development partners.

Source:

https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Bangladesh%20First/INDC_2015_of_Bangladesh.pdf

Box 9. 2019 Mozambique flooding

Mozambique experienced heavy flooding in 2019 which was more extreme than the 2000 flooding. The Mozambique National Disaster Management Institute reported that more than 200,000 people were affected and 135 lives were lost, with 150,000 + people being displaced in the province of Gaza. In terms of damage, more than 2,000 homes were destroyed, and damage to infrastructure was estimated USD29 million. In addition, key power lines were damaged which led to a reduction in the power exports to South Africa, from 1,500 to 650 Megawatts.

Half of Mozambique's population is at risk of water-related hazards and the country's GDP growth is impacted negatively due to flooding (approximately USD105 million annually). The country with the assistance of international organizations and funds has taken strong measures to improve its disaster risk management and climate change adaptation. These include the implementation of early warning systems, using remote sensing technique survey for critically affected areas, and rehabilitation of existing ones; enacting the 2014 disaster risk management law; and development of a resettlement strategy for relocating affected families who were not able to return to their homes.

Source: <https://www.gfdrr.org/en/updates-field-responding-floods-mozambique>; <https://reliefweb.int/report/mozambique/protection-cluster-strategy-idai-response-march-september-2019-early-recovery-enpt>

40. There are also some regional projects in response to flood impacts. For example, a community-based flood early warning system is an integrated system of tools and plans to respond to flood emergencies developed by the International Centre for Integrated Mountain Development, and is managed by communities in Afghanistan, India, Nepal, and Pakistan.⁶⁷

3.2. Drought

3.2.1. Impacts

41. 90 per cent of the developing countries which submitted their NDCs, NCs, or NAPs addressed droughts in their submissions. The majority of which reported on the risk and/or impacts of droughts, such as an increase in the frequency and magnitude of droughts and/or the damage caused by droughts. Some included the affected sectors in their reports, ranging from the agriculture sector being the most affected

⁶⁷ <http://servir.icimod.org/science-applications/enhancing-flood-early-warning-systems>

one to social and economic sectors, including health, food, water, infrastructure, and services.^{68,69} A few mentioned adaptation responses to droughts in the form of priorities, plans and proposed actions, and strategies. Bolivia mentioned that it has experienced higher temperatures and lost approximately 50 per cent of the glacier surface during the past 50 years, which has consequently exposed different regions of the country to prolonged dry periods, and that, by 2030, 27 per cent of the country could be affected by persistent drought.⁷⁰ Antigua and Barbuda expressed major concerns about the vulnerability of its water sector to droughts that recur every 5 to 10 years, as well as the significant impacts that these droughts exhibit on the agriculture sector, e.g. a drought in 2010 which resulted in losses to the crop sector totalling USD 1 million.⁷¹

3.2.2. Good practices

42. In developing their climate change adaptation priorities, including for addressing droughts, some countries were guided by their already existing national development programmes and plans to ensure that adaptation measures are mainstreamed into national as well as sectoral planning and strategies, and that the current environmental projects strategically entail adaptation.

43. Some highlighted within their national adaptation plans priority areas such as scaling up climate smart agriculture which includes development of crop varieties with increased productivity under drought stress. Others elaborated on techniques such as low to zero tillage and multi-cropping to increase mulching which reduces evapotranspiration and soil erosion.^{72,73} Guyana has started to introduce new agricultural techniques such as hydroponics and fertigation,⁷⁴ and planned to expand, subject to availability of financial support, the introduction of drought tolerant crop varieties.⁷⁵ A few included, in their plans, adaptation measures such as development of innovative financial risk management and insurance measures, with Antigua and Barbuda anticipating to make an affordable insurance scheme available for farmers by 2030.⁷⁶

44. Several Parties have initiated strategies to adapt to drought episodes, and prioritized development or improvement of early warning systems and weather forecasting (e.g. by including microclimate studies and localized forecasting), climate information dissemination, as well as community-based adaptation actions.^{77,78}

45. With regard to community-based adaptation, Cabo Verde, after experiencing more frequent and severe droughts (e.g. in 2012, drought was experienced by half of country's provinces and negatively affected thousands of hectares of rice growing areas), has prioritized improving the adaptive capacity of communities, especially through increasing the use of mobile pumping stations and permanent stations in responding to mini-droughts. It proposed measures, including disseminating more efficient small-scale irrigation techniques and promoting soil conservation schemes for farmers and rural producers, improving strategies associated with the distribution of agro-climatic zones and the structure of crops, and improving data collection and modelling capacity associated with water and soil management.⁷⁹

46. Additionally, a few countries included in their adaptation plans the efficient management and protection of natural resources⁸⁰ and enhancement of ecosystem resilience against drought.⁸¹

⁶⁸ Djibouti's NDC

⁶⁹ Guinea Bissau's NDC

⁷⁰ Bolivia's NDC

⁷¹ Antigua and Barbuda's NDC

⁷² Botswana's NDC

⁷³ Chad's NDC

⁷⁴ Fertigation is an agricultural practice that uses irrigation water as a transport mechanism for the application of fertilisers to soil and crops (FAO).

⁷⁵ Guyana's NDC

⁷⁶ Antigua and Barbuda's NDC

⁷⁷ Bangladesh's NDC

⁷⁸ Central African Republic's NDC

⁷⁹ Cabo Verde's NDC

⁸⁰ Grenada's NDC

⁸¹ Algeria's NDC

Box 10. Common Programme Framework for Ending Drought Emergencies (EDE) 2012-2022

Kenya's National Climate Change Action Plan (NCCAP 2013-2017) identified drought as the main hazard and prime recurrent natural disaster in Kenya (recent occurrences: 1983/1984, 1991/1992, 1995/1996, 1998/2000, 2004/2005, and 2008/2011).

The EDE Common Programme Framework focuses on the 23 most drought-prone counties in Kenya. Its implementation will be led by the relevant parts of the national and county governments, working in ways that strengthen synergy between sectors and agencies and deepen accountability to drought-affected communities. A multi-sectoral approach to sustainable development is particularly important in the arid and semi-arid lands, owing to a number of distinctive features including remoteness, lack of infrastructure, and perennial drought. The EDE programme has six pillars; peace and security, climate-proofed infrastructure, sustainable livelihoods, disaster risk management, human capital, institutional development and knowledge management.

Examples of ongoing projects/initiatives under the EDE: Kenya integrated climate risk management project; Partners for resilience- Climate Proof Disaster Risk Resilience Programme; Adaptation at scale in semi-arid regions project.

National Drought Management Authority is the secretariat of the Common Programme Framework in Ending Drought Emergencies in Kenya.

Source: Kenya's NAP

47. Some of the projects that countries implemented in response to climate hazards which considered droughts include (a) the introduction of modern sustainable agriculture techniques, (b) strengthening water supplies through EbA, and (c) the use of desalination plants. Examples of each of the abovementioned projects are provided in the following paragraphs.

48. **Introduction of modern sustainable agriculture techniques in Eritrea:** the impacts of climate change are mainly manifested in recurring droughts in Eritrea. It has affected people's livelihoods in large areas of the country, with the majority of affected households being those that are female-headed. Eritrea's agriculture sector is highly vulnerable, and yet over 70 per cent of population depends on agriculture for its livelihoods. Water scarcity, soil nutrient deficiency, and overreliance on traditional farming practices, have resulted in low levels of agricultural production and increases in prices of imported food staples (which more than doubled in price over the past several years). As a result of recurrent droughts, food insecurity is a challenge for the population for most parts of the year. To adapt to climate change, Eritrea has been undertaking efforts to enhance modern sustainable agriculture practices⁸² such as date palm multiplication through tissue culture. A project entitled "Micro-propagation of Date Palm Cultivars using Tissue Culture Techniques" funded by FAO (USD 436,000) was initiated in 2015 (and completed in 2017) to strengthen the tissue culture laboratory at the National Agricultural Research Institute (NARI), which is an agency within the Ministry of Agriculture of Eritrea, and to build the capacities and enhance the skills of date palm farmers and other actors involved in value chain.

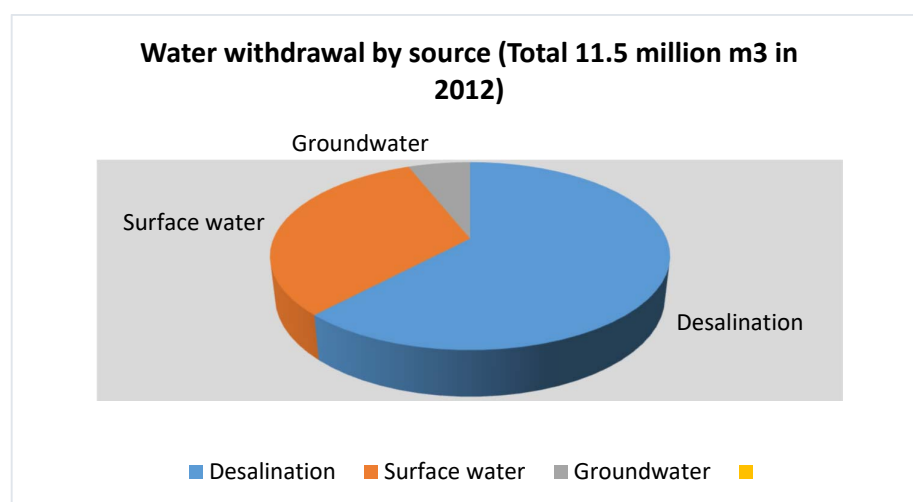
49. **Implementation of priority NAPA actions to strengthen resilience in Djibouti's most vulnerable coastal zones:** this programme was in response to severe water shortages and degraded watersheds as well as prolonged periods of drought affecting the country. The project was implemented by the UN Environment Programme together with the Ministry of Urbanism, Habitat and Environment, and funded by the Least Developed Countries Fund (USD 2.1million) as well as USD 2.4 million of co-finance. The country is classified as 'severely water poor', and climate extreme events were accountable for 50 per cent of human mortalities during the period of 1990 to 2014. The area of intervention includes Khor Angar in the North (pop. 3,500) and Damerjog (pop. 600) in the South. Among the activities of the project was the upgrading of wells, boreholes and pumps to address the impacts of drought. To control water flow and enhancing the

⁸² Eritrea's NDC

water supply, micro-dams were built which improved the community's livelihood by allowing them to grow vegetables for their own-consumption and/or for selling to the market.⁸³

50. **The use of desalination plants in Antigua and Barbuda:** after experiencing several low-rainfall years consecutively, and drought becoming a recurrent feature of Antigua and Barbuda's climate, the country has been using desalination as the primary adaptation solution for enhancing freshwater resources (Figure 5). Adaptation in the water sector is Antigua and Barbuda's national priority, and the country has relied on desalination considerably, with it accounting for 60 per cent of national water supply, and during times of drought accounting for up to 90 per cent of fresh water supply. One of its adaptation goals is to increase desalination capacity in response to freshwater scarcity, by 50 per cent above 2015 levels, from approximately 5.4 million to over 8 million US gallons per day by 2025.⁸⁴ A 2015 report by FAO stated that the country's agricultural and municipal water demands were being met by four desalination plants, two surface water treatment plants, numerous small ponds and five well fields.⁸⁵

Figure 5. The sources of water in Antigua and Barbuda



Source: FAO. 2015. AQUASTAT Country Profile – Antigua and Barbuda.
<http://www.fao.org/3/ca0429en/CA0429EN.pdf>

3.3. Sea level rise

3.3.1. Impacts

51. Two thirds of developing countries' submissions cited sea level rise in different ways. Some reported on observed and projected sea level rise in their countries, as well as the impacts; while, others highlighted the development of maps and models for sea level rise. A majority of Parties affected by sea level rise reported on the impacts mainly within two sectors: the shoreline sector and the infrastructure sector. A diversity of adaptation responses to coastal impacts of sea level rise have been planned or implemented, according to Parties' reports.

3.3.2. Good practices

52. Some Parties proposed **hard measures** such as construction of dykes, coastal embankments, and sea walls for protection of coastal zones against sea level rise and beach erosion.⁸⁶ Djibouti, while emphasizing the importance of safety of its coastal zone for the country development and having considered construction of dykes, mentioned that implementation of such measures is pending funding, and that its

⁸³ Djibouti's NDC ; and
<http://wedocs.unep.org/bitstream/handle/20.500.11822/28425/DjiboutiEba.pdf?sequence=1&isAllowed=y>

⁸⁴ Antigua and Barbuda's NDC

⁸⁵ <http://www.fao.org/3/ca0429en/CA0429EN.pdf>

⁸⁶ Cabo Verde's NDC

initial cost estimate would amount to a total of more than €20 billion.⁸⁷ Benin reported on its key adaptive targets in the shoreline sector, including cleaning up the banks of lakes and lagoons located in the vicinity of the shoreline.⁸⁸ Promoting green infrastructure was included among adaptation measures, especially in the context of co-benefits of adaptation options for other sectors and for mitigation.⁸⁹

53. Parties reported a variety of **soft measures** to respond to sea level rise. These include designing a national vulnerability monitoring program for infrastructure,⁹⁰ developing or improving early warning systems, developing hazard maps and models for sea level rise, creating and refining policies and budgetary systems that can mobilize resources toward climate change and disaster risk management activities, reviewing municipality regulations to facilitate the enforcement of buffer zones for coastal areas and mangrove areas, mainstreaming cost-benefit analysis into the decision making process for enhancing climate resilience and disasters preparedness, revising capital budget appraisal guidelines to incorporate comprehensive hazard, vulnerability and adaptation assessments, and capacity-building for communities whose vulnerability assessments have indicated that relocation is the planned long-term adaptation strategy.⁹¹

54. With regard to updating regulation to support adaptation to sea-level rise, few measures were found in Parties' submission. Bahrain referred to a technical manual, developed at its Ministry of Works Dredging and Land Reclamation, that included recommended land reclamation level of 0.4 meter, take into account the clearance for expected sea level rise of 0.4 meter due to global warming.⁹²

55. Kuwait referring to its Environment Protection Law stated that to adapt to the expected rise in sea level and its impact on the coasts of the country articles (66) and (99) of the Law are dedicated for the marine environment and the need to create a national network for monitoring and regulating the marine environment and conducting studies to monitor sea level rise.⁹³

56. Mangrove restoration and rehabilitation has occurred in a number of locations (e.g., Vietnam, Djibouti, and Brazil) to reduce coastal flooding risks and protect shorelines from storm surge. Restored mangroves have been shown to attenuate wave height and thus reduce wave damage and erosion. They protect aquaculture industry from storm damage and reduce saltwater intrusion (IPCC regional impacts).

57. Some Parties mentioned ecosystem-based adaptation (EbA) for improving protection of coastal zones against sea level rise (see Box 11). For example, mangrove rehabilitation and plantations were among Parties' adaptation measures to respond to sea level rise. Mangroves promote sediment trapping and retention through a variety of mechanisms, so are highly resilient to fluctuations in sea level. Bahrain cited a mangrove transplantation project for planting mangrove seedlings in order to rehabilitate degraded coastal areas, which began in 2013.⁹⁴ Bangladesh, while recognizing mitigation co-benefits of mangrove plantations, reported on approximately 195,000 hectares of mangrove plantations under its adaptation goals.⁹⁵

58. In addition to sea level rise impacts on the shoreline and the infrastructure sectors, some Parties highlighted the impact on the water sector, mainly due to intrusion of sea level rise in groundwater aquifers. In the Caribbean, sea level rise has been observed at between 1.5 and 3 mm per year, which is increasingly putting inland freshwater resources at risk of saline intrusion.⁹⁶ In response to the impact of sea level rise on water resources, Parties emphasized the importance of developing a climate-resilient and integrated water resources strategy in order to sustainably manage its water resources. One Party reported on the establishment of its National Water Resources Council in 2009 to address these challenges.⁹⁷ Some Parties, in response to rising sea level salinization of fresh ground water, have transitioned to use water

⁸⁷ Djibouti's NDC

⁸⁸ Benin's NDC

⁸⁹ State of Palestine's NAP

⁹⁰ Costa Rica's NDC

⁹¹ Fiji's NDC and NAP

⁹² Bahrain's NDC

⁹³ Kuwait's NDC

⁹⁴ Bahrain's NDC

⁹⁵ Bangladesh's NDC

⁹⁶ Antigua and Barbuda's NDC

⁹⁷ Bahrain's NDC

purification measures, including the application of reverse osmosis, which is a process that removes unwanted ions, molecules, and particles from drinking water by forcing water under pressure through a membrane. Bahamas highlighted that its dependence on processed water has increased in order to be able to meet the needs of its tourism- and services-dependent economy.⁹⁸

Box 11. Adaptation measures to reduce vulnerability to sea level rise in Tanzania

The Government of Tanzania implemented two projects, addressed its NAPA priorities, relating to water resources and coastal regions. The two projects entitled “Developing Core Capacity to Address Adaptation to Climate Change in Productive Coastal Zones” and “Implementation of Concrete Adaptation Measures to Reduce Vulnerability of Livelihoods and Economy of Coastal Communities of Tanzania” were supported by the Least Developed Countries Fund (2012-17) and the Adaptation Fund (2012-19) respectively. The two projects were implemented in Dar-es-Salaam and the coastal districts of Pangani, Rufiji, Bagamoyo and Zanzibar facing challenges from sea level rise.

The projects adopted approaches of building and upgrading seawalls, relocating aquifers to protect from rising seas, and restoring mangrove forests that protect communities from floods. The projects were centered on the concept of EbA. Some specific measures are as follows:

- Construction of sea-defence structures such as seawalls, groynes and dykes covering a total area of 2,400 m,
- Restoration of about 1000 ha of mangroves in Rufiji district, and
- Rehabilitation of up to 3000 m² of coral reefs.

Source: <https://www.adaptation-fund.org/project/implementation-of-concrete-adaptation-measures-to-reduce-vulnerability-of-livelihood-and-economy-of-coastal-communities-in-tanzania/>

3.4. Tropical storms

3.4.1. Impacts

59. Storms and hurricanes constitute a prominent threat to approximately 80 per cent of developing country Parties, particularly coastal and small island countries. Several Parties belonging to these categories have uniformly projected threats from increased intensity and frequency of storms and hurricanes in their submissions. Some countries have indicated an increase in variability and unpredictability of storm and hurricane events,⁹⁹ while others have witnessed particular patterns of these extreme events such as storm surges,¹⁰⁰ windstorms¹⁰¹, dust storms¹⁰² and tropical cyclones.¹⁰³

60. Parties from the Small Island Developing States (SIDS) reported specific risks and impacts with known effects of climate change on drivers of hazards, including increased intensity of hurricanes¹⁰⁴ and the Sargassum seaweed phenomenon, amplified by the rise of tropical storm activity.¹⁰⁵ Jamaica reported losses equivalent to 8.0 per cent of its GDP due to hurricanes,¹⁰⁶ while Dominican Republic reported losses and damages equivalent to 1.2 per cent of its GDP and 5.3 per cent of its national budget in 2007 due to tropical storms (Olga and Noel).¹⁰⁷

⁹⁸ Bahamas’s NDC

⁹⁹ Dominica’s NDC

¹⁰⁰ NDCs of Antigua and Barbuda, Bangladesh, and Dominica

¹⁰¹ Bolivia’s NDC

¹⁰² Kuwait’s NDC

¹⁰³ India’s NDC

¹⁰⁴ St. Lucia’s NAP

¹⁰⁵ Grenada’s NDC

¹⁰⁶ Jamaica’s NDC

¹⁰⁷ Dominican Republic’s NDC

61. Several Parties from the least developed countries (LDCs) reported a severe impact of these climate hazards in increasing their socio-economic vulnerabilities, with Bangladesh referring to its rank in the Climate Change Vulnerability Index (CCVI-2011).¹⁰⁸

62. In outlining specific actions oriented towards adaptation to storms and hurricanes, developing countries identified vulnerable sectors to prioritize in their plans and policies. These include agriculture and fisheries, forestry, water, infrastructure, and urban planning. Health is also among the key affected sectors due to storms and hurricanes with some countries highlighting direct and indirect impacts on public health due to increasing incidence of storms and hurricanes, ranging from loss of life and spread of vector- and water-borne diseases.¹⁰⁹ St. Lucia also reported severe impacts on the tourism sector with losses to the tune of USD 6 million 2004.¹¹⁰ A few Parties have also identified education as a vulnerable sector.¹¹¹

3.4.2. Good practices

63. In the context of storms and hurricanes, the integration of climate change policies and strategies with the existing legal and policy framework was highlighted by several Parties. Some countries have specified a sector-specific streamlining of climate actions and strategies. For instance, Kiribati undertook the integration of its climate change policy into developing a new port design and mainstreaming climate action strategies into tourism planning.¹¹² Additionally, countries outlined disaster and resource management measures such as improving policy, legal, regulatory and institutional framework for the water sector to improve storm water drainage and setting up coastal zone management units.¹¹³

64. Priority actions and strategies developed by Parties in their submissions address multiple fronts of the risks posed by storms and hurricanes. Targeting disaster preparedness, some developing countries proposed measures such as cyclone shelters, storm surge protection,¹¹⁴ early warning systems,¹¹⁵ hazard support plans,¹¹⁶ and construction codes for hurricane-resistant infrastructure¹¹⁷ (see box 12). They also highlighted a range of risk assessment and modelling strategies, such as improving technical capacity for spatial data management and risk modelling for storm surges¹¹⁸ and for modelling of coastal inundation impacts.¹¹⁹

65. Some Parties focused on risk reduction and transfer measures, proposing micro-insurance initiatives.¹²⁰ Jamaica indicated emergency relief measures in its adaptation strategies against storms and hurricanes.¹²¹

Box 12. Adaptation to hurricanes in Antigua and Barbuda following Hurricane Irma in 2017

Hurricane Irma caused a great deal of devastation in Barbuda in 2017. The region sustained huge losses to property had to undertake forced evacuation of all 2000 inhabitants of the Caribbean Island to neighbouring Antigua. With the financial assistance to the tune of USD10 million from the Adaptation Fund, the country has been implementing its climate change adaptation project since 2017. The project is designed to help Antigua's most vulnerable communities situated in the coastal McKinnon's watershed to build resilience against flooding, hurricanes and higher temperatures by adopting an integrated approach.

¹⁰⁸ Bangladesh's NDC

¹⁰⁹ Grenada's NAP, Kiribati's NAP

¹¹⁰ St. Lucia's NAP

¹¹¹ NDCs of St. Lucia and Jamaica

¹¹² Kiribati's NAP

¹¹³ Grenada's NDC

¹¹⁴ Lao PDR's NDC

¹¹⁵ Bangladesh's NDC

¹¹⁶ Kiribati's NAP

¹¹⁷ Grenada's NAP

¹¹⁸ Grenada's NAP

¹¹⁹ Kiribati's NAP

¹²⁰ Kiribati's NAP

¹²¹ Jamaica's NDC

Measures include restoring natural drainage canals and climate-proofing vulnerable homes and storm shelters to reduce flooding and disaster risks.

- Restoring natural drainage canals: by cleaning, widening and deepening drainage canals, retention ponds and culverts to natural sizes this measure aims to build capacity to handle extreme rainfall and storms.
- Climate-proofing vulnerable homes: by providing access to an innovative, low-interest revolving loan programme, this measure provides vulnerable households to climate-proof their homes.
- Storm shelters to reduce flooding and disaster risks: by supporting community groups in depressed areas with grants, this measure sought to develop climate-resilient buildings to serve as storm shelters.

The project also enhanced collaboration with other funds such as the Global Environmental Facility's Special Climate Change Fund (SCCF) by undertaking a hydrological study with their support and providing potential to scale it up.

Source: www.adaptation-fund.org.

66. Developing countries also alluded to measures that address the overarching issue of resilience. The measures include the refurbishment of infrastructure and enhancement of ecosystem capacities to absorb climate stresses from storms surges and hurricanes. Kiribati has proposed an urban renewal mission for 500 cities with a focus on ensuring basic infrastructure services such as water supply, sewerage, storm water drains, transport and development of green spaces and parks by adopting climate resilient and energy efficient policies and regulations.¹²² Community management of resources also emerged as a key adaptation strategy in submissions of some Parties.¹²³

4. Overall experience in addressing hazards: challenges, needs, lessons learned

67. This section addresses main challenges and needs identified by developing countries, including economic and financial barrier to implement adaptation actions and the need for development and technology transfer. It also offers insights into overall lessons learned in responding to climate hazards.

4.1. Challenges and needs

68. Several developing countries have developed plans and proposed measures for responding to climate impacts, and estimated the budget required for implementation of such plans, but this implementation is conditional on availability of resources. The majority included information about the funding needs for adaptation. For example, Guinea estimated funding needs for adaptation between USD 670 million and USD 1,700 million.¹²⁴ However, a few Parties in their submissions included quantitative data regarding **adaptation expenditure**. These include the following:

- a) The government of Jordan spent about USD 160,000,000 on adaptation projects and activities in the agriculture and food security sectors in the country from its own resources.¹²⁵
- b) Over the last three decades, the Government of Bangladesh has invested more than USD 10 billion (at constant 2007 prices) to enhance climate resilient and reduce vulnerability to natural disasters.¹²⁶

¹²² India's NDC

¹²³ Kiribati's NAP

¹²⁴ Guinea's NDC

¹²⁵ Jordan's NDC

¹²⁶ Bangladesh' NDC

- c) South Africa has increased its domestic investment to facilitate climate change adaptation from USD 0.29 million to USD 1.4 million from 2011 to 2015. Implementation investment in adaptation programmes increased from USD 0.71 bn to USD 1.88 bn from 2010 to 2015. Support received from international financial instruments: Adaptation Fund: USD 10 Million; UNEP: USD 3.5 Million.¹²⁷

69. In some cases, information regarding domestic adaptation expenditure, which was not reflected in Parties' submissions to the UNFCCC, could be tracked through reports of international organizations or government websites. For example, the People's Survival Fund (PSF) is a special fund in the Philippines National Treasury that will finance climate change adaptation programmes and projects. PHP 1 billion (USD 20 million) is allocated annually to the PSF, which will be sourced from the national budget.¹²⁸ In India, the National Adaptation Fund (NAF) was launched in 2014 to assist the most vulnerable states to adapt to climate change. By late 2016 it had been allocated USD 49 million and is managed by the National Bank for Agriculture and Rural Development.¹²⁹

70. However, it is not possible to track adaptation finance for all countries. There is a growing interest in tracking flows of spending on adaptation, and some countries such as Nepal and the Philippines have developed climate change tagging systems and institutionalized the application of tagging in their budget systems. However, tagging and tracking adaptation expenditures have been reported to be challenging, and not fully capturing the breadth and complexity of adaptation-related activities.¹³⁰ One big challenge is a lack of consensus on what can and cannot be considered an adaptation project. There is a diverse range of adaptation activities and complicated methodologies for assessing them. Additionally, decisions over what exactly constitutes adaptation are not only technical but influenced by various political drivers, vested interests and incentives. A majority of existing systems only track activities that explicitly refer to adaptation. Such systems overlook traditional development activities such as those contributing to building adaptive capacity and which rarely mention adaptation within project documentation.¹³¹

71. With regard to **barriers to the development and transfer of technologies for adaptation**, this part includes information obtained from the fourth synthesis report on technology needs identified by non-Annex I Parties which was prepared by the secretariat in response to an SBI mandate to compile and synthesize information contained in the technology needs assessment (TNA) reports of 53 non-Annex I Parties that participated in phases I and II of the global TNA project, and had submitted finalized TNA reports to the UNEP DTU Partnership by 20 August 2019.

72. Of the 53 countries that participated in the global TNA project, 52 prepared TNA reports on adaptation, with agriculture and water being reported as the highest priority sectors. Most of the technologies prioritized for the agriculture sector were related to sprinkler and drip irrigation systems. Technologies related to crop management, including biotechnologies related to crop improvement, new varieties and drought-resistant, salient-tolerant and short-maturing varieties, were among the most prioritized technologies.

73. All reporting Parties reported economic and financial barrier to the development and transfer of the prioritized technologies, with 87 per cent of the Parties identifying lack of or inadequate access to financial resources as the main barrier. More than 95 per cent of Parties further identified policy, legal and regulatory considerations, institutional and organizational capacity and human skills as barriers. The most common barrier in this category was an insufficient legal and regulatory framework, identified by 88 per cent of Parties.

¹²⁷ South Africa's NDC

¹²⁸ <http://psf.climate.gov.ph/about/>

¹²⁹ <https://www.climatefinance-developmenteffectiveness.org/sites/default/files/IBP-SHORT-FINAL.pdf>

¹³⁰ <https://www.climatefinance-developmenteffectiveness.org/sites/default/files/IBP-SHORT-FINAL.pdf>

¹³¹ <https://www.odi.org/sites/odi.org.uk/files/odi-assets/publications-opinion-files/7821.pdf>

Table 1. Commonly reported barriers to adaptation technology development and transfer by region (Source: Secretariat's fourth synthesis of technology needs identified by Parties not included in Annex I to the Convention)¹³²

Africa	Asia-Pacific	Latin America and the Caribbean
<ul style="list-style-type: none"> • Lack of or inadequate access to financial resources • Poor market infrastructure • Lack of skilled personnel for the installation and operation of climate technologies • Inadequate information • Technical system constraints 	<ul style="list-style-type: none"> • High production costs • Insufficient legal and regulatory framework • Weak connectivity between actors favouring the new technology • Limited institutional capacity • Inadequate information 	<ul style="list-style-type: none"> • Lack of or inadequate access to financial resources • Insufficient legal and regulatory framework • Inadequate staff capacity for preparing projects • Barriers related to traditions and habits • Lack of awareness about issues related to climate change and technological solutions

74. Regarding budget estimates in technology action plans (TAPs), approximately 77 per cent of Parties provided estimates of the budget required for the actions specified in their TAPs. For adaptation, the total cumulative budget requested by Parties for their TAPs was USD 4.4 billion. Four Parties reported budgets over USD 350 million, while several other Parties reported total budgets that did not exceed USD 10 million

4.2. Lessons learned and opportunities

75. The Convention affirms the importance of coordinating climate change response with social and economic development in an integrated manner (UNFCCC, preamble). The Paris Agreement also acknowledges the importance of integrating adaptation into relevant socioeconomic and environmental policies and actions (Paris Agreement, Article 7.5). In this light, adaptation has often been embedded in the development context within NAPAs, national adaptation plans and other national strategies, whether through applying sectoral integration approaches or other dedicated approaches that enhance adaptation planning and implementation, and thereby help attain sustainable development. Reviews of developing country NAPs show that **mainstreaming adaptation** to climate change into development is well established in most NAPs. There is a strong indication that a switch from a traditional approach to development to one that considers climate change is being made. In all the countries reviewed, key climatic hazards and vulnerabilities are identified, and corresponding priority actions to be mainstreamed into each of the sectors of the economy planned. Although different countries are at different stages of setting up policy and institutional frameworks to coordinate and enhance mainstreaming, it is evident from the review that planning, and implementation of climate change adaptation measures precede the NAP process. There is substantial evidence in the NAPs of adaptation policies, projects, programmes, strategies and action plans that were already in place before the NAPs.

76. Submissions by Parties have shown that climate risks and hazards have increased in intensity and frequency, intensifying the impacts of hazards and the cost associated with them. Developing country approaches in response to climate hazards vary, depending partly on how they have been affected by the hazards and their capacity to adapt. Among the **good practices** reported by Parties are: integrating disaster risk reduction into national adaptation plans, undertaking a multisectoral national approach, building on already existing national development programmes, and promoting cross-cutting considerations, e.g. gender and social inclusion processes. In addition, Parties recognised the importance of considering

¹³² UNFCCC, April 2020. The fourth synthesis of technology needs identified by Parties not included in Annex I to the Convention. https://unfccc.int/sites/default/files/resource/sbi2020_inf.01.pdf

adaptation not only as local or national action but also one that goes beyond national boundaries, and hence included in their adaptation efforts actions at the regional level.

77. **Regional adaptation efforts** among developing countries have great potential to accelerate climate change adaptation and to help countries and regions to adapt more effectively and efficiently. Examples have been provided throughout the report, such as on Joint National Action Plans for adaptation and disaster risk reduction in the Asia-Pacific region (Box 1) and joint and coordinated implementation of flood and drought management in several transboundary river basins (para 20). There lie opportunities in further adopting a transboundary view of climate hazards, which will help create positive interdependencies between countries, and enhance mutual learning and technology transfer through regional cooperation.

78. The evidence is growing on the application of **inclusive approaches to adaptation** and sustainable development. Several Parties have included gender consideration into their adaptation responses in the context of gender-based vulnerabilities and/or by taking account of contributions of women in the design, planning, and implementation of adaptation responses. Also, Parties highlighted the importance of development and implementation of adaptation plans that are location and context-specific, emphasising on the enhanced and active participation of local communities and indigenous people and integration of climate-resilient indigenous knowledge and practices.

79. Legal frameworks play an important role in climate change adaptation. As described in previous chapters, some Parties have developed legal and/or policy framework in response to climate hazards. **Legal instruments facilitate adaptation** through including tightening standards of environment conservation (Kuwait's issuance of Environment Protection Law No. 42/2014) and community protection against disaster and government liability for disaster management (Law of the Republic of Indonesia No. 24/2007 Concerning Disaster Management).

80. Opportunities exist to take advantage of the synergies between adaptation to climate change and other international agreements and processes and to maximize the **provision of multiple benefits**. There are commonalities between the goal of adaptation and objectives of other international environmental agenda, including the Convention on Biological Diversity (CBD), the United Nations Convention to Combat Desertification (UNCCD), the work of the Food and Agriculture Organization of the United Nations (FAO), and the 2030 Agenda for Sustainable Development. Such agendas recognise climate change as a major concern and address it in their activities to enhance effective climate actions and to achieve sustainable development. As illustrated in Box 4, Colombia is working towards aligning its adaptation efforts with other global targets that contribute to increasing resilience, such as CBD, UNCCD, the Sendai Framework for Disaster Risk Reduction 2015–2030, and the 2030 Development Agenda.

81. The identification of climate hazards and measurement of their effects are big steps towards developing strategies to address such hazards as part of risk management and financing decisions. Developing country Parties included data regarding the main climate hazards and their impacts. They also reported on their preparedness plans such as establishment of early warning systems and contingency plans such as insurance for farmers. There is potential, perhaps as part of countries' NAPs, to include a further assessment for **optimisation of approaches** in the context of responding to the risks of climate change, and in particular in addressing the balance between investing in pre-emptive measures and contingent measures.

82. Although there has been significant progress in adaptation on the ground, the efforts could not counterbalance the full extent of climate impacts and costs, especially those impacts regarding the loss of human lives and (e.g. Mozambique flooding) and basic supplies such as food and water (e.g. recurring droughts in Eritrea). To reduce vulnerability to current impacts, and to enhance adaptive capacity and resilience to future impacts, more support is required for adaptation action by developing countries, and more effort is needed to improve links between climate change adaptation and poverty reduction.

Document information

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