Climate Diplomacy

REPORT

THE VULNERABLE TWENTY – FROM CLIMATE RISKS TO ADAPTATION

A compendium of climate fragility risks and adaptation finance needs of the V20 countries

Nikolas Scherer and Dennis Tänzler

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Published by
adelphi
Alt-Moabit 91
10559 Berlin, Germany
P + 49 30 89 000 68-0
F + 49 30 89 000 68-10
office@adelphi.de
www.adelphi.de

www.auswaertiges-amt.de

Authors Nikolas Scherer and Dennis Tänzler, adelphi

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LIST OF ABBREVIATIONS

AFDB	African Development Bank Group
CIA	Central Intelligence Agency
ENCC	National Climate Change Strategy of Costa Rica
ENSO	El Niño Southern Oscillation
FFP	Fund for Peace
G20	Group of Twenty
G7	Group of Seven
GCF	Green Climate Fund
GDP	Gross Domestic Product
GFDRR	Global Facility for Disaster Reduction and Recovery
GHG	Greenhouse Gas
GIS	Geological information Systems
I&FF	Investment and Financial Flows
IEA	International Energy Agency
IGC	International Growth Centre
IISD	International Institute for Sustainable Development
IMF	International Monetary Fund
INDC	Intended Nationally Determined Contributions
IWRM	Integrated Water Resource Management
NAP	National Adaptation Plan
NAPA	National Adaptation Programme of Action
NATCOM	National Communication
NCCAP	National Climate Change Action Plan
NCCPF	National Climate Change Policy Framework
ND-GAIN	Notre Dame Global Adaptation Index
NGO	Nongovernmental Organisation
OECD	Organisation for Economic Co-Operation and Development
PIFACC	Pacific Islands Framework for Action on Climate Change
SIDS	Small Island Development State
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
UNICEF	United Nations Children's Fund
US$	United States Dollar
USAID	United States Agency for International Development
V20	Vulnerable Twenty

EXECUTIVE SUMMARY

The so-called Vulnerable Twenty (V20) Group was established in October 2015 with the inaugural meeting of the V20 Ministers of Finance at the Climate Vulnerable Forum in Lima, Peru. The V20 can be considered as an example of the importance of early action in the field of adaptation in order to initiate a transformative change towards resilient societies.

The V20 at risk

The V20 comprises members of quite different sizes, geographic location, economic development, poverty level etc. A number of them even count as fragile states in a "high alert" situation (Afghanistan, Tanzania) and others with "alert" (Bangladesh, Ethiopia, Kenya, Nepal, Rwanda, Timor Leste). Hence, they deserve special attention with respect to vulnerabilities of climate change.

We have also identified environmentally or even climate-induced conflict settings that illustrate the ways in which climate change can be a topic of peace and stability in the V20 countries:

- **Bangladesh: The increase in shrimp farming along the coast** in conjunction with the increasing occurrence of extreme weather events such as cyclones and flooding, shrimp farming has led to increasing salinization of soil and water sources. The destruction of natural ecosystems and decreasing soil fertility due to the shrimp industry has met fierce political opposition.

- **Kenya:** More frequent droughts have exacerbated resource conflicts between Pokomo farmers and Orma herders in the Tana River Delta, Kenya's most important wetland. The Pokomo use the swamp-like river banks to cultivate tropical cash-crops such as rice and mangos, while the Orma traditionally inhabit the hinterlands and only migrate to the Tana River when a lack of water and grazing grounds forces them to. Increasing environmental hardship combined with neglect of local police forces led to clashes between the Pokomo and the Orma in the summer of 2012.

- **Philippines:** Super typhoon Haiyan was one of the strongest tropical cyclones ever recorded. When the cyclone made landfall in the Philippines in 2013, it killed over 6,300 people and left hundreds of thousands without homes or livelihoods. Among the hardest hit were conflict-sensitive areas that had been rendered poor and vulnerable by decades of violent conflict between independent armed groups and the Filipino army. The government response to the disaster was considered by many to be inadequate and led to protests.

Our analysis of five climate-fragility risks further underlines the importance of early action in preventing potential climate-fragility risk from turning into violent conflict:

- **A key hazard is the increase in extreme weather events & disasters:** For 15 out of 20, the increase in extreme weather events poses a key threat to the socio-economic stability/development of these countries. Climate change is likely to intensify natural disasters such as droughts, floods, and tropical storms; it will lead to an increase in human insecurity and contribute to or intensify existing natural hazards. It will also very likely lead to new exposures and more extensive damage and socio-economic impacts.

- **The second** key hazard is **sea-level rise & costal degeneration** (8/20) and associated impacts (e.g. water salination, inundations) together with livelihood insecurity & migration (8/20). For 8/20 countries rising sea-level & costal degeneration as well as **livelihood insecurity & migration** pose a key threat; in some cases, rising sea-level poses an existential threat (Kiribati, Maldives, Tuvalu). The scenarios indicate that climate change will result in greater resource scarcity and aggravate existing grievances (e.g. poverty, health) across the V20. Climate change may lead to changes in relative prosperity and thus deepen existing disparities and intensify rural-urban migration. The impacts of climate change will be particularly pronounced in countries that have already experienced insecurity, lack the capacities and institutions for managing vulnerabilities, and are characterized by rapid population growth (e.g. Afghanistan or Timor-Leste).

Adaptation financing needs of the V-20

Based on the most reliable data that we found on V20 adaptation costs, **we determined that for nearly half of the V20 countries, the annual average adaptation costs up until 2030 sum up to about US$ 15 billion.** There are, in fact, good reasons to believe that the **actual adaptation costs are much higher than indicated in the reports submitted** by the governments to the UNFCCC. INDCs, as the main reference here, and NAPAs consider, for instance, only public sector adaptation costs – costs of adaptation measures planned by public institutions – and ignore private sector adaptation costs incurring to households or companies. These private costs will increase the cost estimates significantly as also outlined by the UNEP Adaptation Finance Gap Report from 2016.

It is also important to point out that this figure does not comprise data for Barbados, Costa Rica, Philippines, St. Lucia and Vietnam as they have not yet outlined the adaptation costs in their INDCs or other governmental documents. It is crucial to underscore that this **estimate is only a very rough indication of the adaptation cost.** As a result, this analysis is faced with very limited empirical information to verify data and claims. Due to the poor state of knowledge on adaptation costs, the number presented here should be seen as a basis for discussion and trigger for future research and is likely an underestimation.

Regardless of the data limitations, there are meaningful implications when we acknowledge the adaptation costs of the most vulnerable countries which seem to offer **a strong rationale for climate finance support:** The Maldives as one of the five V20 small island states candidates has calculated in its recent national communication the total costs for coastal protection, land reclamation and land elevation as an approach to completely prevent the relocation and resettlement of its population: US$ 8.8 billion would be required according to the report submitted by the Government (NATCOM 2016, p.6). This can be a helpful indication on the overall costs indicator of how to support the overall security of a small island state whose integrity as a state is at risk due to climate change. However, this compendium of climate risks and adaptation responses of the V20 indicates that more efforts are needed to promote cost assessments and innovative instruments such as risk insurance.

I. INTRODUCTION

1.1 GUIDING QUESTIONS FOR THIS COMPENDIUM

The Vulnerable Twenty (V20) Group was established in October 2015 at an inaugural meeting of the V20 Ministers of Finance at the Climate Vulnerable Forum in Lima, Peru. It was created to promote the importance of early action to adapt to climate risks and to push for transformative change towards resilient societies. The V20 members represent a broad cross-section of countries in terms of size, geographical location, poverty and economic development. They also include states that international fragility risk indexes categorise as being on "high alert" (Afghanistan, Tanzania) and "alert" (Bangladesh, Ethiopia, Kenya, Nepal, Rwanda, Timor Leste). These countries therefore deserve particular attention when considering the potential impact of climate change risks and how to deal with them.

This report serves as a compendium of the V20's climate risk profiles, adaptation needs and policy approaches, and aims to help readers easily identify what is needed in terms of support for adaptation activities in each country. In this regard, we outline the varying climate risks the V20 countries face, and review the adaptation finance needs these governments have identified in order to offer an initial assessment of the costs required to promote early action. In addition, we provide insights into the potential role of adaptation planning and risk insurance – approaches that are increasingly gaining prominence in discussions surrounding global adaptation governance.

Climate Vulnerable Forum 4th High Level Meeting, at COP22 UN Climate Talks in Morocco.

1.2 CLIMATE RISKS

States and societies are increasingly under pressure by a multitude of shocks and stressors, including population growth, resource constraints and political unrest. Research points out that climate change is a "threat multiplier" that is likely to increase instability.[1] There is little doubt that it will worsen already fragile situations, making it harder to promote peace, adaptation and sustainable development.

Climate impacts are intensifying crises and conflicts around the world. On behalf of the G7 foreign ministries, an international research consortium from Germany, France, Great Britain and the USA, led by the Berlin-based think tank adelphi, analysed what this means for global security and the fragility of states and communities. The findings were published in the report "A New Climate for Peace – Taking Action on Climate and Fragility Risks." One central finding is that there are no "climate wars". Not today and, as far as we know, not tomorrow. Instead of wars directly caused by climate change, we are increasingly being confronted with crises and conflicts that are intensified by climate change.

In particular, states that lack legitimacy and are struggling with weak government institutions will find it difficult to manage the combined and increasing pressure of climate change, population growth, uncontrolled urbanisation, increasing resource consumption, unequal economic development, and environmental degradation. These combined stressors and pressures can lead to political instability and conflicts. The breakdown of states and societies threatens to cause a downward spiral of increasing fragility. Although the exact strength of the current effects of climate change is a hotly debated topic, the following examples give an indication of what the future could look like:

- **Syria:** Between 2006 and 2011 Syria suffered a serious drought destroying many people's livelihood, especially in rural areas: Almost 75 percent of Syria's farmers lost their harvest. Many fled to the cities and the government failed to respond to the resulting humanitarian crisis. Pressures bubbled over as a result of the influence of the Arab Spring, combined with grievances towards the authoritarian regime that had built up over the years.

- **Thailand:** Heavy monsoon rains in 2011 led to flooding in 26 provinces, which affected two million people. The political landscape was already fragile after violent protests between 2008 and 2010. Many considered the government's attempts at managing the disaster to be misguided and inequitable. Hundreds of people protested the unfair distribution of aid supplies and the protests continued until a military coup occurred in 2013.

[1] Rüttinger, Lukas; Gerald Stang, Dan Smith, Dennis Tänzler, Janani Vivekananda et al. 2015: A New Climate for Peace – Taking Action on Climate and Fragility Risks. Executive Summary. Berlin/London/ Washington/Paris: adelphi, International Alert, The Wilson Center, EUISS.

Women sell vegetables on the road from Raqqa to Palmyra, Syria. The droughts from 2006 and 2011 heavily impacted agricultural yields.

At the foundation of these and many similar examples are seven compound risks. These risks have been expounded on in detail in the report and are meant to bring future crises into sharper focus for foreign policy makers. So what are these climate risks?

1. **Local resource competition:** As climate change constrains access to natural resources in some regions, competition to secure them will increase. This competition can produce new tensions, increase fragility, and even escalate into conflict, particularly if resource management institutions and processes to resolve disputes are illegitimate or weak. Conflicts can take the form of clashes within communities or wider quarrels between user groups, and can even contribute to large-scale violence.

2. **Livelihood insecurity and migration:** For people dependent on natural resources for their livelihoods, climate changes could increase unemployment, influence their migration patterns, or push them to seek alternative sources of support. Each of these options could increase fragility by increasing pressures, such as high rates of unemployment among young men, migration to resource-stressed areas, and competition over resources. It could also make joining armed groups and criminal gangs more attractive.

3. **Extreme weather events and disasters:** Extreme weather events and disasters can compound pre-existing grievances, stressing already stretched governance systems; decrease economic opportunities and available resources; and increase displacement. In fragile and conflict-affected situations, disasters can undermine the resilience of at-risk communities, increasing the severity of the impact. The unwillingness and inability of governments to prevent or manage disasters can increase fragility significantly by undermining the legitimacy of governments. However, if managed well, such crises can also provide opportunities to build resilience and peace.

4. **Volatile food prices and provision:** Climate changes interact with other drivers of food price volatility, such as high energy prices and population growth, to increase the risk of price inflation. Sudden price spikes spur protests, rioting, democratic breakdown, and civil conflict, especially in urban centres. The risk of large-scale violence increases during political transitions or against a backdrop of long-term oppressive regimes.

5. **Sea-level rise and coastal degradation:** Rising seas, storm surges, and increased salinization of coastal areas will decrease economic and agricultural viability, leading to increased fragility and migration. Rising seas will also submerge markers of sovereignty and economic exclusivity zones, which may lead to disputes and conflicts between states. Areas threatened with submergence will experience social and psychological disruption, migration, and fragility.

6. **Transboundary water management:** *As demand grows and supply decreases, the stakes for growing populations and economies will also increase. Existing transboundary governance mechanisms might not be able to manage disputes. Countries might decide to unilaterally change water flows. The development of water infrastructure in transboundary river basins could be especially conflictual, as new dams can change the power balance in a basin.*

7. **Unintended effects of climate policies:** *Climate adaptation and mitigation policies can have unintended negative effects that increase livelihood insecurity, resource conflicts, and food price volatility. These unintended effects could increase fragility risks, if climate policies are not carefully designed to take into account their broader impacts and the possibility of contributing to conflict in certain settings.*

These seven risk factors interact in complex ways and extend across borders. For the purpose of this report we focus on the first five risks due to the fact that 6 and 7 are addressing different risks levels (transboundary as well as indirect impacts of policy response measures).

	**Local resource competition:** As the pressure on natural resources increases, competition can lead to instability and even violent conflict in the absence of effective dispute resolution.
	**Livelihood insecurity and migration:** Climate change will increase the human insecurity of people who depend on natural resources for their livelihoods, wich could push them to migrate or turn to more informal or illegal sources of income.
	**Extreme weather events and disasters** will exacerbate fragility challenges and can increase people's vulnerability and grievances, especially in conflict-affected situations.
	**Volatile food prices and provision:** Climate change is highly likely to disrupt food production in many regions, increasing prices and market volatility, and heightening the risk of protests, rioting, and civil conflict.
	**Sea-level rise and coastal degradation:** Rising sea levels will threaten the viability of low-lying areas even before they are submerged, leading to social disruption, displacement, and migration, while disagreements over maritime boundaries and ocean resources may increase.

In 2017, Ethiopia faced the worst drought in decades. Two successive rainy seasons had failed, leaving up to ten million people in need of aid.

1.3 METHODOLOGY

Fragility and conflict are always the result of a complex interaction between multiple political, economic, social, historical and cultural factors. Climate and environment conditions are all but one factor. Now climate change is predicted to lead to systemic changes in climatic or environmental conditions. It may even change the entire geophysical characteristics of a country: for example, fertile grounds may turn into deserts. This change may alter the fragility or conflict context. Droughts may reduce yields. The impacts will therefore be felt in particular by people who depend on rain-fed agriculture – but only if there are no political measures in place to support food-insecure groups.

Pinning down the relationship between climate change and conflict is a difficult and ultimately a speculative undertaking. Too many factors interact. And, yet, we know that climate change acts as a stressor that will create new winners and losers. Climate change impacts on agriculture, water, health and infrastructure, amongst others. These impacts will influence socio-economic development. The pressure on the socio-economic context can be addressed via an adequate adaptation plan equipped with sufficient financial resources. Adaptation measures comprise technical solutions (e.g. installation of irrigation systems), financial and social protection measures (e.g. safety net to address food shortages) and many other solutions. There is in fact no agreement on what counts as an adaptation measure.

Typhoon Ketsana (Ondoy) dropped 455 mm of rain on Metro Manila in a span of one day on 26 September 2009. A month's worth of rainfall in a single day washed away homes and flooded large areas.

In this report we seek to identify the greatest climate change risks that may jeopardize the relative stability of V20 countries. We created 20 climate risk profiles with analysis showing how climate change affects the **(1)** climatic and environmental conditions and the **(2)** socio-economic developments of the countries under given circumstances. In addition, we sought to take stock **(3)** if adaptation measures have been planned, if so, which measures, and the funding required to address climate risks. Given the recent prominence of insurance solutions with regard to addressing climate risk, we paid particular attention to the pros and cons of "climate risk insurances".

To create the climate risk profiles, we used official country sources whenever possible. Alternatively, we turned to information provided by authoritative sources, such as UNEP and the World Bank. Our analysis was guided by the five compound risks explained above.

II. CLIMATE RISK PROFILES

2.1 AFGHANISTAN

KEY CLIMATE RISKS

LOCAL RESOURCE COMPETITION

LIVELIHOOD INSECURITY AND MIGRATION

ADAPTATION FINANCING REQUIREMENTS

US$ 10.785 billion
over a period of ten years (2015 - 2025)

2.1.1 MAJOR CLIMATE AND ENVIRONMENT RISKS

Recent climate projections indicate that Afghanistan will face significant temperature increases over the course of this century. Models predict that temperatures will rise between 3°C and 7°C by 2100, compared to the 1986 to 2006 baseline period – an increase that is considerably higher than global mean projections (GoAF, 2015, p.3). The strong increase in temperature is forecasted to lead to **scarcer water resources and desertification** in the country's arid and semi-arid land areas. As mountains are major sources of water, accelerated glacier melt will reduce water supplies and change the seasonality of lows in river basins supplied by snow and ice (GoAF, 2013, p.viii). Moreover, it is predicted that Afghanistan will face more frequent and intense **extreme weather events** such as heatwaves, flash floods and droughts. According to various indices, Afghanistan is already one of the countries mostly affected by extreme weather events (Germanwatch, 2016; ND-GAIN, 2015).

2.1.2 MAJOR SOCIO-ECONOMIC RISKS

Warmer and drier conditions will have substantial economic and socio-economic consequences that increase the country's fragility. The country is highly dependent on the agricultural sector, which in 2013 provided direct or indirect employment to around 85 % of the population and accounted for about a third of the country's GDP (GoAF, 2013, p.vi). Most of the arable land is rain-fed. Its productivity thus depends to a large extent on the availability of sufficient natural water resources. Predicted erratic rainfall, reduced river flows, soil loss, reductions in gazing land, and a shorter cultivation season will severely impact the productivity of the agricultural sector. Without significant improvements in irrigation systems and water

and land management, agricultural productivity will drop dramatically. This will **threaten the livelihoods** of large parts of the population and **lead to food insecurity.** People dependent on the agricultural sector will be forced to relocate and seek alternative sources of income. Greater flows of people to more fertile areas could create new social tensions, and trigger and **exacerbate social conflicts about land and resources.** In recent decades, Afghanistan has had repeated disputes over access to transboundary water resources with neighbouring Iran and Pakistan. Reduced livelihood opportunities could drive farmers to cultivate the less water-intense crop of opium and thus into the arms of narco-traffickers or other armed insurgent groups to secure an income and basic food supply. In 2015 armed groups attacked food aid vehicles from the World Food Programme, which led to the temporary suspension of food distribution (Nett et al. 2015, p.34). Reduced livelihoods may therefore exacerbate current insecurity.

The negative impacts on the agricultural sector will therefore disproportionally affect the poorest segments of society, particularly women and children. Afghanistan is already one of the poorest countries in the world, with around 36 % of the population living in extreme poverty (GoAF, 2013, p.vi). Climate-induced environmental changes risk increasing poverty and hunger yet further, with **famines, reduced food consumption, malnutrition** and a high dependency on food aid as possible consequences (GoAF, 2013, p.viii). This further exacerbates the country's overall fragility.

Afghanistan is already widely considered a **'failed state'** and is plagued by an alarming set of problems, including poor governance, inadequate state capacities, corruption, nepotism and cronyism, social erosion and a lack of infrastructure. Demographic changes will place additional pressure on the country. If the population continues to growth at current rates, it will increase from 26 million to 39 million by 2030 (GoAF, 2013, p.ix). This population growth will intensify the need for resources, including energy, in a situation where resources are declining.

2.1.3 ADAPTATION POLICY CONTEXT

Despite the problems it faces as an LDC member country, Afghanistan prepared a National Adaptation Programme (NAPA). It identified 51 different short-term measures in seven different sectors as potential adaptation projects. Of these, 11 were prioritized for immediate implementation and largely revolve around improving land and water management, such as the prevention and/or reduction of land degradation, rehabilitation of partly degraded land and the reclamation of desertified land (GoAF, 2013, p.ix). Together with the international community, Afghanistan initiated a number of programmes and projects. In 2015, Afghanistan presented **a National Adaption Plan (NAP).** The country estimates the **total costs** for immediate adaptation to be **US$ 10.785** billion over **a period of ten years** (GoAF, 2015, p.5). They include measures to strengthen watershed management, the restoration and development of irrigation systems, and efforts to promote the regeneration of degraded forests and rangeland. All measures rely heavily on technology transfers and capacity building.

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2.2 BANGLADESH

KEY CLIMATE RISKS

- EXTREME WEATHER EVENTS AND DISASTERS
- SEA-LEVEL RISE AND COASTAL DEGRADATION

ADAPTATION FINANCING REQUIREMENTS

US$ 40 billion over a period of 15 years

2.2.1 MAJOR CLIMATE AND ENVIRONMENT RISKS

Bangladesh is particularly prone to **tropical cyclones, floods and droughts.** Due to its specific low-lying, sub-tropical location, the impacts of climate change will be more intense and damaging than in many other countries. About 60 % of the country is less than five meters above sea level, the country is also characterised by large numbers of river basins. It is predicted that climate change will lead to more extreme weather events, in particular an increase in tropical cyclones and floods. Studies also show that cyclones may penetrate further inland. Enhanced wind velocity and rainfall will lead to increasing **storm surges** and **coastal flooding,** while increased precipitation during the monsoon season, as well as the predicted **sea-level rise,** will present further challenges for the country. Sea-level rise will lead to coastal erosion and the **salinization** of soils and aquifers (GoBD, 2012, p.113-126). The climate-related increase in temperature is likely to accelerate snow melt in the upper Himalayas. This, in turn, is likely to affect the river systems and generate additional volumes of water (GoBD, 2013, p.126). It is predicted that the typical droughts during the dry season will be prolonged. The impacts of climate change are already materializing.

2.2.2 MAJOR SOCIO-ECONOMIC RISKS

It is above all the increase in extreme weather events that poses a **direct threat to people's lives, livelihoods, health and communities.** In the absence of appropriate measures, it will lead to greater numbers of deaths and substantial damage to infrastructure (e.g. public and private assets such as residential housing). Moreover, it will challenge the integrity of ecosystems. Flash floods, for instance, can have severe impacts on river morphology (changing channel topography, sedimentation) and vegetation. Floods damage crops, even prohibit future crop growth, leading to reductions in agricultural yields, and can also negatively affect livestock. Storm surges and sea-level rise will lead to the salinization of cultivable land in coastal areas and render them unfit for future agricultural production. Climate

change also poses a threat to public health. The increase in floods is reported to facilitate the diffusion of waterborne diseases such as diarrhoea, cholera or dysentery, in particular to low income regions, and expand malaria-affected areas (GoBD 2012, p.152-154). Overall, climate change will put **particular pressure on the poor rural population.** Inundations, riverbank erosions, and salinization of soil may **push thousands of Bangladeshi to seek new housing and alternative sources of income.** There has been a strong trend towards **urbanization** in recent years and this is further exacerbated by population growth. Cities such as Dhaka are extremely densely populated (about 23,000 people per square metre, according to the World Population Review) and infrastructure and housing development have not been able to keep pace with this influx of people. This creates its own problems. Migrants often find themselves in **highly precarious working and living conditions.** Roughly 30 % of the population of Dhaka lives in shanty towns or slums. The weak urban infrastructure is severely challenged by **increasing pressure on the provision of water, electricity, sanitation, and policing** (GoBD, 2012, p.166).

2.2.3 ADAPTATION POLICY CONTEXT

Natural disasters are common in Bangladesh. Accordingly, the country has **planned and partly implemented a number of adaptation measures** to address vulnerabilities. These measures have been outlined in the country's NAPA and NAP, among others (GoBD, 2009, p.42). Key adaptation measures include structural measures, such as the construction of embankments, polders and dykes to prevent flooding, saline water intrusion, and over-topping by storm surges in the coastal areas (GoBD, 2012, p.132-33), as well as efforts to manage water-regarding surface flows, inundation, groundwater use, drought and various types of waterlogging, and capacity building. Significant resources will be needed to implement the planned adaptation measures. According to our own and most other calculations, Bangladesh requires around **US$ 40 billion between 2015 and 2030 to implement key adaptation measures** (GoBD, 2015, p.13-14).

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2.3 BARBADOS

KEY CLIMATE RISKS

EXTREME WEATHER EVENTS AND DISASTERS

SEA-LEVEL RISE AND COASTAL DEGRADATION

ADAPTATION FINANCING REQUIREMENTS

As yet unspecified

2.3.1 MAJOR CLIMATE AND ENVIRONMENT RISKS

Barbados is a small island development state (SIDS) with the Caribbean Sea to the west and the Atlantic Ocean to the east. The country's climate is tropical, with a dry and a rainy season. Climate change is predicted to contribute to a temperature rise of up to 1.2°C and a decrease in annual rainfall (World Bank, 2017). This will lead to overall drier conditions and environmental degradation. The geography of Barbados exposes the country to seasonal hurricanes and associated floods. As climate change is predicted to **increase the frequency and intensity of extreme weather events** in the Atlantic Basin, these represent the key threats for Barbados. As a small island, Barbados is also highly exposed to both sea-level rise and the increase in sea surface temperatures, as well as compounded consequences such as coastal erosion and flooding, saltwater intrusion and inundations, and coral reef degradation (GoBB 2015, p.1; USAID 2013, p.1-2; CaribSave 2012, p.2).

2.3.2 MAJOR SOCIO-ECONOMIC RISKS

The increase in **hurricanes** poses first of all a direct **threat to lives and livelihoods.** It may challenge the island's fairly high level of development. Barbados is a largely service-based economy, and is the wealthiest and most developed country in the Eastern Caribbean. The tourism and finance sectors account for about 75% of GDP (CIA Factbook 2017). Large parts of the island's population (about 25%, according to the CIA Factbook 2017) and infrastructure are concentrated within two kilometres of the coastline (about 32%, according to CaribSave 2012). They are therefore highly exposed to the adverse impacts of hurricanes, such as storm surges, coastal erosion and flooding. The observable **sea-level rise** and the loss of shorelines due to coral reef degradation could further exacerbate these negative impacts. Without protective measures, beaches, hotels and other key infrastructure related to the country's social and economic wellbeing might simply disappear, threatening the livelihoods of large parts of the population, including farmers, fishermen and vendors (GoBB 2015, p.3).

The **increase in temperature and decrease in rainfall,** along with greater saltwater intrusion due to sea-level rise and growing demands from tourists, might also reduce **water availability.** Water scarcity is already a pressing issue in Barbados, and the country ranks 15th in the world on the Water Scarcity Index (World Bank 2017). Water shortages may negatively affect agricultural production as well as households. Barbadians, particular in poorer rural areas, already have to cope with a low or non-existent water supply (Barbados Advocate 2017).

2.3.3 ADAPTATION POLICY CONTEXT

Barbados has adopted a variety of strategies, programmes and measures, and is collaborating in a number of regional intergovernmental networks to cope with the negative effects of climate change. The country has drafted a National Climate Change Policy Framework (NCCPF), which ensures that both adaptation and mitigation efforts are in line with the Barbados Sustainable Development Policy (GoBB 2004). Planned key measures largely revolve around disaster risk, coastal zone and freshwater management; such as infrastructural developments (including beach stabilization), rigorous implementation of building codes, improved freshwater storage, and the increase in desalination production, as well as the generation of information and studies on the precise impact of climate change (World Bank 2017). Barbados is a member of the Caribbean Catastrophe Risk Insurance Facility (CCRIF) and purchased insurance coverage to finance disaster-related expenses.

No official data has been released about adaptation financing needs. A report on the economics of climate change adaptation is in preparation for the second national communication.

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2.4 BHUTAN

KEY CLIMATE RISKS

- EXTREME WEATHER EVENTS AND DISASTERS
- LIVELIHOOD INSECURITY AND MIGRATION

ADAPTATION FINANCING REQUIREMENTS

US$ 6.4 million
according to NAPA (2006)

2.4.1 MAJOR CLIMATE AND ENVIRONMENT RISKS

The Kingdom of Bhutan is a small landlocked country in the eastern Himalayas that is characterized by mountainous terrain reaching altitudes of over 7,000 metres above sea level (GoBT, 2015, p.1). Bhutan is increasing **threatened by climate hazards and extreme events such as flash floods, glacial lake outburst floods,** windstorms, forest fires and landslides (GoBT, 2015, p.5). In addition, the eastern Himalayas have been identified as an international global hotspot for biodiversity conservation. Bhutan aims to play a major role in protecting some of the world's most endangered species such as elephants, tigers, snow leopards and golden langurs (GoBT, 2006, p.1). However, biodiversity is at risk due to climate change impacts. For example, more intense droughts may combine with increased lightning risks to trigger forest fires. Furthermore, temperature rises could lead to the increased spread of vector-borne diseases among wildlife (GoBT, 2006, p.8).

2.4.2 MAJOR SOCIO-ECONOMIC RISKS

Bhutan's economy is threatened by climate change due to its high dependence on agriculture and the significant role of hydropower in economic development (GoBT, 2015, p.5). The population growth rate of 2.5-3% is among the highest in the world and the kingdom's population is expected to double in the next 23 years (GoBT, 2006, p.1). As the dominant sector in Bhutan, **agriculture provides a livelihood, income and employment to 79% of the population.** The majority of farmers are subsistence farmers, and the country's main export earnings are from hydropower generation (GoBT, 2006, p.1). Dry land crops are entirely dependent on rainfall, making the agriculture sector even more vulnerable to climate risks (GoBT, 2006, p.2). **The most vulnerable group is the farming community** as agricultural activities are highly susceptible to unpredictable and increased variability in the timing of the monsoons. The country's **main cash crops are all highly sensitive to water and temperature variations.** Furthermore, dry land crops such as wheat, buckwheat, maize and barley are the most important food source for farmers – both for them and their families and for livestock.

Another major concern is that glacial lake outburst floods could have a **potentially devastating impact on infrastructure.** Flash floods and landslides and the heavy siltation of rivers will damage infrastructure essential to hydropower systems, such as generation plants as well as transmission and distribution infrastructure. There will also be negative effects on the country's main export products, as well as industrial facilities and human settlements. The loss of life from frequent flash floods, glacial lake outburst floods, and landslides will **pose major risks to human security.** These risks could also be heightened by the spread of vector-borne tropical diseases, such as malaria and dengue fever, to higher altitudes due to the warming climate.

2.4.3 ADAPTATION POLICY CONTEXT

Bhutan has identified a number of priorities in the field of adaptation (GoBT, 2015, p.5-7). They include measures **to address water and food security, and to improve disaster management capacities.** In the water sector, the kingdom aims to increase resilience to the impacts of climate change on water security using Integrated Water Resource Management (IWRM) approaches like climate-proofing water distribution systems. In the field of agriculture, the objectives outlined in the Intended Nationally Determined Contribution (INDC) are developing and introducing climate resilient crop varieties and conservation of plant genetic resources, and combined capacities to develop and implement emergency responses to agricultural pest and disease outbreaks or epidemics. Climate risk insurances for crop and livestock are also highlighted as potential tools. In the field of **disaster prevention and management,** continual assessment of potentially dangerous glacial lakes and improving the early warning system for outbreak floods is a key priority – together with the development of monitoring, assessment and warning systems for flash flood and landslide hazards and risks. In its 2006 National Adaptation Programme of Action (NAPA) Bhutan stated that it would cost US$ 6,440,231 to implement nine priority adaptation measures.

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2.5 COSTA RICA

KEY CLIMATE RISKS

EXTREME WEATHER EVENTS AND DISASTERS

SEA-LEVEL RISE AND COASTAL DEGRADATION

ADAPTATION FINANCING REQUIREMENTS

Total investment and financial flows of US$ 3,408.25 billion (in constant 2005 US$) according to UNDP. Over US$ 7 billion by 2030 (since 2006) and almost US$ 30 billion by 2050 (GoCR, 2015, p.15)

2.5.1 MAJOR CLIMATE AND ENVIRONMENT RISKS

Costa Rica is bordered by both the Caribbean Sea in the north-east and the North Pacific Ocean in the southwest. Two climatic regimes dominate the country's climate. **The most frequent and extreme weather phenomena and events are tropical depressions, tropical storms, hurricanes, low pressure systems, troughs and cold fronts,** all of which have the potential to cause intense flooding (GoCR, 2014, p. 23). The country also faces climate variability due to the El Niño Southern Oscillation (ENSO). It is likely climate change will alter the Pacific slope and lead to central regions experiencing dry to extremely dry conditions. There is a greater likelihood of more extreme rainfall in the Caribbean (GoCR, 2014, p.23). Due to climate variabilities, there are multiple phenomena that may increase or decrease in frequency or intensity, eliciting simultaneous changes in extreme drought and extreme rain (GoCR, 2015, p.15).

2.5.2 MAJOR SOCIO-ECONOMIC RISKS

Costa Rica has identified its **most vulnerable sectors as those related to water supply and the agriculture sector** (GoCR, 2015, p. 15). As **the impact of hydrological events increases, so too will economic losses.** The cost of only direct loss and damage was estimated at around US$ 1.13 billion for the period 2005 to 2011. The biggest impact has been on road infrastructure, followed by power distribution networks, agriculture and housing – four vital activities for the country's development. Further, 77.9% of Costa Rica's population and 80.1% of the country's GDP is in areas at high risk or multiple hazards (GFDRR, 2011, p.6). Research indicates that by 2030 losses will amount to over US$ 7 billion for the period since 2006, and could reach almost US$ 30 billion by 2050 with a likely greater impact on vulnerable groups like women, children and people in extreme poverty (GoCR, 2015, p.15). A further major impact of climate change is the possible rise in sea levels of up to one metre by 2100 (GFDRR, 2011, p.6).

2.5.3 ADAPTATION POLICY CONTEXT

Costa Rica has a long track record in environmental and climate policy. The National Climate Change Strategy (ENCC) and its Plan of Action, as well as advances in the Framework Law on Climate Change, are initiatives that have been promoted to fulfil the objectives in this area. The ENCC **prioritizes action on mitigation, adaptation, metrics, technology, education and finance,** all with the common goal of integrating climate change policy into policies ensuring the long-term competitiveness of the country and the strategy of sustainable development (GoCR, 2014, p. 24). Despite its high exposure to extreme weather events, Costa Rica has built an efficient disaster response system and has managed to limit vulnerabilities through the effective enforcement of building codes, environmental standards, and land-use planning. Costa Rica has also made substantial progress in strengthening its institutional and legal frameworks and mainstreaming disaster risk management in its national development programme (GFDRR, 2011, p.8). **Seven priority areas for adaptation to climate change have been identified:** water, energy, infrastructure, health, fisheries and coastal areas, biodiversity and agriculture (GoCR, 2014, p. 27). However, the main initiatives in adaptation are related to networks observing and monitoring climate change (GoCR, 2014, p. 28). Costa Rica's Intended Nationally Determined Contribution (INDC) foresees targeted adaptation action for the period 2016 to 2030 (GoCR, 2015, p. 16-18). Measures include the development of a National Adaptation Plan by 2018 and improvements to community-based adaptation, with the Adaptation Fund providing resources and technical assistance to over 30 community-based adaptation projects. Also important are commitments regarding the planning and management of territory adaptation – by 2020, every city and every coastline county in the country should accordingly have a land-use plan that considers vulnerabilities to climate change and measures for increasing adaptation and mitigation.

To date, the government has not directly announced adaptation financing requirements. However, economic losses without adaptation will amount to over US$ 7 billion by 2030 (since 2006) and almost US$ 30 billion by 2050 (GoCR, 2015, p.15). According to a UNDP study, the main adaptation measures for the water and biodiversity sectors in Costa Rica require total investment and financial flows (I&FF) of US$ 3.41 billion (in constant 2005 US$). The water sector will require US$ 2.05 billion and the biodiversity sector US$ 1.35 billion (UNDP, 2010).

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2.6 ETHIOPIA

KEY CLIMATE RISKS

EXTREME WEATHER EVENTS AND DISASTERS

VOLATILE FOOD PRICES AND PROVISION

ADAPTATION FINANCING REQUIREMENTS

Not specified (US$ 150 billion over a period of 15 years for mitigation and adaptation)

2.6.1 MAJOR CLIMATE AND ENVIRONMENT RISKS

Recent climate projections indicate that Ethiopia will face **more frequent and intense droughts and floods.** However, the predicted increase will vary from region to region. Ethiopia is characterized by highly diverse climatic and ecological settings, with desert-like conditions in the north-east, east and south-east lowlands, and humid rainforest in the south and southwest. Accordingly, water resources are very unevenly distributed, both spatially and temporally. Climate change will therefore most likely contribute to severe droughts in northern and central Ethiopia and 'heavy' rainfall events during the bimodal rainfall seasons in some southern parts. It is also important to note that "[m]uch of the water flows across Ethiopia's borders, being carried away by the transboundary rivers to neighbouring countries in northern and eastern Africa" (GoET, 2015, p.xvi).

2.6.2 MAJOR SOCIO-ECONOMIC RISKS

The increase in extreme weather events poses first of all a **direct threat to people's lives and livelihoods.** It will lead to greater loss of life and substantial damage to infrastructure. Moreover, changing temperature and rainfall patterns will have substantial environmental consequences, including land degradation due to desertification and soil erosion and loss of biodiversity, including wildlife (GoET, 2015, p.208). The increase in human insecurity results primarily from Ethiopia's extreme dependence on rain-fed agriculture, and is exacerbated by other factors, such as the country's inadequate infrastructure, poor agricultural and livestock practices, poor governance, low levels of economic development and high population growth (GoET, 2015, p.xxvi). The agricultural sector contributes around 40-50 % to total GDP (GoET, 2015, p.xvi) and employs about 80-85 % of the population. A key problem is that the cultivated land is largely rain-fed. Irrigated land makes up only 1 % of the total cultivated land. It is reported that in the drought-prone highlands, land productivity and thus **crop yield is expected to decline** substantially (GoET, 2015, p.193). The expected decline in agricultural productivity could lead to **food insecurity,** not to say famines – in

particular if the population continues to grow at the current rate. High dependency on international food aid, malnutrition and reduced food consumption are all potential consequences. The reduced viability of agricultural activities could **push people to move and/or seek alternative means of income.** It could also increase competition over scare fertile lands and water resources. Although conflicts are by no means inevitable, 'water-stress', food crises, **sinking living standards,** and the search for fertile land and/or alternative sources of income might overburden existing capacities in Ethiopia and lead to **clashes and political instability.** In addition, it is predicted that climate change might facilitate the outbreak of diseases associated with floods, such as malaria, dengue fever and waterborne diseases like cholera and dysentery, and respiratory diseases associated with droughts among the vulnerable (GoET, 2015, p.xxvii).

2.6.3 ADAPTATION POLICY CONTEXT

Ethiopia has already put in place a number of strategies, programmes and policies to adapt to climate change, as reflected, for instance, in the NAPA, the Water Sector Strategy and the Climate Resilient Green Economy Strategy (GoET, 2015, p.210). Given the importance of water stress, improvements in **water management** are key to address climate change. Restoration of floodplains, sound land-use planning, protection of watersheds, more efficient water usage, awareness raising, development of an irrigation system, diversification of crops and agroforestry, as well as economic diversification, are among the key measures to adapt to climate change (GoET, 2015, p.196-197).In their INDC, Ethiopia has considered the adoption of climate risk insurances for the agricultural sector. Ethiopia has not published official figures on its climate change adaptation financing needs. Yet, in the INDC it states it would require about US$ 150 billion by 2030 to realize its overarching Climate-Resilient Green Economy Strategy, which bundles both mitigation and adaptation measures (GoET, 2017, p.9).

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2.7 GHANA

KEY CLIMATE RISKS

VOLATILE FOOD PRICES AND PROVISION

LIVELIHOOD INSECURITY AND MIGRATION

ADAPTATION FINANCING REQUIREMENTS

US$ 12.8 billion

2.7.1 MAJOR CLIMATE AND ENVIRONMENT RISKS

Climate change projections indicate that **temperatures will rise and rainfall levels will fall** (and become increasingly erratic) in all areas of the country. While this contributes to **desertification** and **soil erosion** in a more general sense, the extent and severity of these changing weather patterns will vary across the country. Some forecasts predict an **increase in extreme weather events,** namely **droughts, floods and heatwaves** in some designated zones. Moreover, it is reported that the projected **sea-level rise** will contribute to **coastal erosion** and challenge the marine ecosystem (GoGH, 2015b, p.121; GoGH, 2015a, p.13).

2.7.2 MAJOR SOCIO-ECONOMIC RISKS

The risks for Ghana result primarily from the country's dependence on its natural resource base. The country's climate-sensitive natural resources are major sources of income and energy. Although Ghana is a service-led economy, rain-fed agriculture still contributes about 19 % of GDP. It is estimated that 50-70 % of the population is employed in the agricultural sector (CIA Factbook 2017; UNDP/UNEP, 2015, p.6). Agricultural productivity is largely managed by small-scale landowners living in rural areas. As agricultural production is rain-fed – irrigation systems are de facto absent – any change in temperature and precipitation will have serious impacts on yields. Soil degradation, droughts and floods will all affect crop production. The decline in yields and gazing land may seriously **challenge the livelihoods** of large parts of the population and increase extreme poverty. This especially applies to the more northern regions, which are poorer and more susceptible to droughts and floods (CIA Factbook, 2017), as well as to savannahs (UNDP/UNEP, 2015, p.13). **Displacement and migration** could be coping strategies. In the 1970s and 1980s, severe droughts and an economic downturn led substantial numbers of Ghanaians to emigrate to neighbouring Cote d'Ivoire and Nigeria (CIA Factbook, 2017). Declines in income from agriculture also increase pressure on rural-urban migration. In recent years, there has been substantial migration from the comparatively dry areas in the north to the wetter and urban areas in the south (UNDP/UNEP, 2015, p. 11).

However, Ghana's **rapid urbanization** comes with its own problems. According to the African Development Bank, "there are signs that Ghana's cities are facing considerable challenges with land use, infrastructure and services provision (particularly with regard to housing, sanitation and transportation), and the absence of gainful and productive employment opportunities, especially for the youth" (AFDB, 2017). Poor sanitation and urban flooding could also create serious **public health problems** and lead to an increase in incidences of malaria and cholera (UNDP/UNEP, 2015, p.11). As a low to middle income country, Ghana's capacities to provide social and healthcare provisions are limited.

Moreover Ghana's energy supply is highly dependent on water. About 70 % of electricity generation is based on hydropower and thus highly vulnerable to precipitation changes and water stress (UNDP/UNEP, 2015, p.11). In recent decades, one of the greatest problems facing the country has been an unreliable and inadequate supply of electricity. This has been an obstacle for the country's economic growth (USAID, 2015). Resource scarcity, coupled with an annual population growth rate continuously above 2 %, may pose a significant challenge to the stability of the country.

2.7.3 ADAPTATION POLICY CONTEXT

Ghana has identified a number of adaptation measures to address the adverse impacts of climate change (GoGH, 2015a, p.16). Key measures include the use of 'climate-smart' technologies and practices to increase livestock and fisheries productivity, the promotion of post-harvest storage innovations to ensure food security, land-use reforms, infrastructural development in urban areas (e.g. housing, transportation and waste management), and the development of a health information system. Ghana has stated it requires about **US$ 12.8 billion** for the period 2020-2030. It intends to finance US$ 4.2 billion (about 34 %) from its own budget and mobilize the remaining US$ 8.3 from among the international community (GoGH, 2015a, p.9).

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2.8 KENYA

KEY CLIMATE RISKS

LIVELIHOOD INSECURITY AND MIGRATION

VOLATILE FOOD PRICES AND PROVISION

ADAPTATION FINANCING REQUIREMENTS

US$ 38 billion over a period of 15 years (2015-2030)

2.8.1 MAJOR CLIMATE AND ENVIRONMENT RISKS

Recent climate projections indicate that Kenya will face **more intense droughts,** due to projected temperature increases that will affect evaporation and to a lesser extent precipitation. Some models also predict more erratic and heavy rainfall (e.g. flash floods), there is however considerable disagreement over the extent of the changes. In general, Kenya will see a trend towards warmer and drier conditions. This will put substantial pressure on Kenya's natural resource base (e.g. forests, dryland), leading to **desertification** of the country's arid and semi-arid land areas and threatening its wildlife (GoKE, 2015a).

2.8.2 MAJOR SOCIO-ECONOMIC RISKS

The warmer and drier conditions will have substantial economic and socio-economic consequences. Above all, more pronounced droughts and environmental degradation (e.g. erosion of soil and gazing land) pose a **direct threat to people's lives and livelihoods.** The rain-fed agricultural sector is currently the country's primary source of employment and income, contributing about 25% of GDP (CIA World Factbook, 2017). Desertification processes will put extreme pressure on the already water-scarce country and render large areas of land inadequate for agro-pastoral production. In the absence of adaptation measures, a substantial decline in agricultural output and thus in food production is likely. This not only places the livelihoods of small-scale subsistence farmers at risk but could also lead to widespread **food insecurity,** if not large-scale famines. **Health problems** and the spread of diseases associated with a lack of freshwater and malnutrition are also potential second-order issues (GoKE, 2015a, p.22).

The decline in fertile land might trigger disputes over scarce resources and **intensify current rural-to-urban migration** trends (GoKE, 2015b, p.10). Currently, about 67% of the population lives in rural areas (GoKE, 2015b, p.2). Yet, over the last two decades there has been a significant migration to urban centres. The urban population increased from 5.4 million in 1999 to 12.2 million in 2009, and is projected to have

reached 17 million in 2017 (GoKE, 2015b, p.2). This is driving the growth of overcrowded, unsanitary slums that lack basic services, such as Kibera in Nairobi. Kenya's vulnerability to climate change will be particularly pronounced not only because of its (already) scarce water resources but also because of its tremendous population growth. Since 2009 Kenya's population has grown from 37.7 million to around 48 million (World Population Review, 2017), which is putting additional pressure on water resources. Despite sustained economic growth of 5-6 % over the past decade (The World Bank 2017), large parts of the population (about 46 %) live in extreme poverty on less than US$ 1 per day (UNICEF, 2017). Social inequality, insecure land ownership, and poor governance further challenge the country's overall adaptive capacity.

2.8.3 ADAPTATION POLICY CONTEXT

Kenya has developed a National Adaption Plan (NAP) that prioritizes a number of actions to address the adverse impacts of climate change between 2015 and 2030. The NAP's risk and vulnerability assessments take a sectoral approach and list a number of short, medium and long-term measures. Key measures include the fast-track implementation of the Ending Drought Emergencies Common Programme Framework, education, training and awareness-raising on the impacts of climate change, the climate proofing of infrastructure, and land reforms. For the agricultural sector, Kenya is planning measures including the promotion of indigenous knowledge on crops, increasing awareness on climate change impacts on the agriculture value chain, promoting new food habits, encouraging the uptake of index-based weather insurance, and the development of drought-tolerant crops (GoKE, 2016, p.37). The NAP details the cost of the various adaptation measures. The total costs of implementing the NAP up to 2030 are approximately US$ 38 billion (GoKE, 2016, p.43). ARC is also a member of African Risk Capacity and purchased insurance coverage against drought.

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2.9 KIRIBATI

KEY CLIMATE RISKS

SEA-LEVEL RISE AND COASTAL DEGRADATION

LIVELIHOOD INSECURITY AND MIGRATION

ADAPTATION FINANCING REQUIREMENTS

US$ 75 million over the time period 2013-2013 (GoKI, 2015, p.25)

2.9.1 MAJOR CLIMATE AND ENVIRONMENT RISKS

Kiribati consists of 33 low-lying atolls and reef islands dispersed over a surface area of 3.5 million km². Many islands are located no more than two metres above sea level and are only a few hundred metres wide (GoKI, 2015, p.4). The islands are subject to periodic storm surges and coastal floods. The greatest threat posed by climate change is **sea-level rise,** which is also reported to **increase the impact of storm surges and coastal flooding** (GoKI, 2015, p.5). Climate models indicate that by 2050, 18-80 % of Buariki, North Tarawa, and up to 50 % of Bikenibeu, South Tarawa could be inundated (GoKI, 2015, p.4). In 1999 two small uninhabited Kiribati islands, Tebua Tarawa and Abanuea, disappeared underwater (GoKI, 2015, p.12). Although Kiribati currently has a low exposure to tropical cyclones, there is a risk that they might occur more frequently in future (GoKI, 2015, p.5). Kiribati is also highly vulnerable to the consequences of ocean acidification, which occurs when atmospheric greenhouse gas are absorbed into the oceans. As the ocean acidifies, it becomes harder for marine life to form skeletons. By consequence, Kiribati's coral reefs are projected to progressively decline. This degeneration will in turn exacerbate the impact of storm floods, due to the loss of natural protection in coastal zones (GoKI, 2015, p.16).

2.9.2 MAJOR SOCIO-ECONOMIC RISKS

Incremental sea-level rise **threatens the very existence of Kiribati.** Due to the islands' small size, their entire population and infrastructure is concentrated on the coasts. Inundations may become a frequent event. As reported to the UN, the "low-lying places along the atolls have already experienced coastal inundation from unexpected extreme high tides" (GoKI, 2015, p.14). Moreover, saltwater intrusion into groundwater aquifers has made arable land increasingly infertile and contaminated freshwater. This **undermines food and water security.** Ocean acidification and the associated loss of biodiversity will affect fishermen, household (and tax) income, and food security. The projected scarcity of freshwater and food is reported to facilitate the spread of water, vector and food-borne diseases, and may impact the

health of humans as well as livestock (GoKI, 2015, p.16). Rapid population growth also poses additional challenges for the supply of food and freshwater. Only very recently, Kiribati procured higher lying land from the Fiji Islands – primarily to ensure food security, but also to accommodate its population in the future.

Due to rising levels and increasing food insecurity, **large parts of the population will be forced to move and emigrate.** Half of the population already lives on Tarawa, the capital island. More and more people are moving into towns and urban centres. Rapid population growth and urbanization come with particular social, economic and environmental problems (Noble et al, 2011; Kehew et al., 2015). Due to the limited resource base and governance capacity, it will be particularly challenging to deliver adequate public services. Urban centres, such as Tarawa, might also act as springboards for international migration. Although international migration has been fairly low so far, internal migration to overpopulated cities is not a lasting solution to climate change. In fact, in the long term international migration might be the only real coping strategy.

2.9.3 ADAPTATION POLICY CONTEXT

Climate change adaptation has a prominent role in public policymaking. Kiribati has adopted a number of measures and policies to address the adverse impacts of climate change. Kiribati's National Adaptation Program of Action (2007) set out a three year plan for urgent and immediate action in critical sectors (water, coastal zone management, agriculture, coastal infrastructure). The subsequent National Framework for Climate Change and Climate Change Adaptation (2013) established a comprehensive framework to address climate change risks. In 2014, Kiribati committed to the Pacific Islands Framework for Action on Climate Change (PIFACC) and developed the Kiribati Joint Implementation Plan on Climate Change and Disaster Risk Management (2013-2023). Key strategies in this living document revolve around strengthening water and food security, as well as delivering health services, infrastructural developments, increasing the efficacy and effectiveness of early warning systems, awareness raising and capacity building. Kiribati claims it requires approximately **US$75 million** (GoKI, 2015, p.25) to implement this plan. Kiribati is a member of the Pacific Catastrophe Risk Assessment and Financing Initiative (PCRAFI) and has purchased insurance coverage to finance disaster-related expenses.

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2.10 MADAGASCAR

KEY CLIMATE RISKS

- EXTREME WEATHER EVENTS AND DISASTERS
- VOLATILE FOOD PRICES AND PROVISION

ADAPTATION FINANCING REQUIREMENTS

US$ 28 billion (2015-2030)

2.10.1 MAJOR CLIMATE AND ENVIRONMENT RISKS

Madagascar, the world's fourth largest island, has a tropical climate and two distinct seasons: a dry and a rainy season. Climate projections indicate that Madagascar will face a substantial **increase in temperatures** (2.5-3°C by 2100), in particular in the southern and inland parts of the island, as well as more erratic rainfall. While rainfall during the dry season is forecasted to decrease, in particular in inland areas, rainfall is predicted to increase during the rainy season (GoMG, 2015, p.6; USAID, 2016, p.1). This will lead to **more frequent and intense extreme weather events,** in particular **droughts** and **floods,** in some areas. Moreover, due to its geographical location, Madagascar is highly exposed to **tropical cyclones** and associated rainfall. Climate projections indicate that the intensity of tropical cyclones in the Indian Ocean will increase. The pathways of tropical cyclones that make landfall are also predicted to shift gradually northwards.

2.10.2 MAJOR SOCIO-ECONOMIC RISKS

Increases in temperature and reduced rainfall will have a negative impact on water availability, especially in the east and south where water shortages are already common. As "[r]ivers and rainfall are the primary sources for agricultural production, household consumption and energy generation" (USAID, 2016, p.2), reduced water availability will have severe socio-economic consequences. Climate sensitive agriculture, including fishing and forestry, forms the backbone of Madagascar's economy, accounting for over 26 % of GDP and employing more than 80 % of its labour force (CIA Factbook, 2017). Climate change is likely to exacerbate existing problems in the agricultural sector such as limited productivity, low yields and low technical capacity (USAID, 2016, 3). Increasing temperatures and rainfall variability will impact the quality and quantity of rain-fed crops (such as rice and maize) and thus food production and food prices. Climate change is likely to contribute to **livelihood insecurity** and **food insecurity,** which may lead to greater poverty, malnutrition and famines. Madagascar is already one of Africa's poorest countries, with 81 % of

the population living on less than US$ 1.25 per day. About 25 % of the rural population is categorized as food insecure (USAID, 2016, p.1). Madagascar's population grew from about 4 million in 1950 to 25 million in 2017 (World Population Review 2017), and this steady and rapid population growth of over 2 % per annum will continue to increase demand and therefore likely exacerbate problems. Madagascar is comprised of 18 ethnic groups, with persistent class tension between them (CIA Factbook, 2017). Growing demand and competition for resources could lead to conflicts on land-use and thus to **social upheaval and conflict.** Madagascar has already seen some violent unrest, as a result of land acquisition and clearing of forests by a mining company that threatened the livelihoods of subsistence farmers and coastal communities reliant on fishing (ECC Factbook).

Moreover, more intense tropical cyclones and resulting floods pose a direct and indirect threat to lives, as well as destroying vegetation, (water-related) infrastructure, inland soil and coastline erosion. Furthermore, increased temperatures and flooding, along with high levels of poverty, population growth, urbanization, poor water and food quality will also facilitate the transmission of water and vector-borne diseases such as malaria and diarrhoea. Malaria is already one of the main causes of death in the country (USAID, 2016, p.4). Climate change is likely to have a multiplier effect on existing **health problems.**

2.10.3 ADAPTATION POLICY CONTEXT

Due to a lack of development and government stability, Madagascar has adopted relatively few measures to cope with climate change. Indeed, climate change has only become a major issue in recent years. The Politique Nationale de Lutte contre le Changement Climatique was adopted in 2010 and defines key targets. Madagascar is currently working to finalize and implement the National Adaptation Plan. Key measures revolve around infrastructural developments in order to increase resilience towards and develop early warning systems for droughts, floods, and cyclones, the promotion of climate-smart agriculture and improved farming practices, and the development of guidelines for water-sanitation hygiene (GoMG, 2015, p.7). Madagascar has stated it requires about US$ 28 billion to finance the adaptation measures it has planned for the time period 2015-2030 (GoMG, 2015, p.8).

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2.11 MALDIVES

KEY CLIMATE RISKS

- SEA-LEVEL RISE AND COASTAL DEGRADATION
- LIVELIHOOD INSECURITY AND MIGRATION

ADAPTATION FINANCING REQUIREMENTS

US$ 108 million (GoMV, 2008)

2.11.1 MAJOR CLIMATE AND ENVIRONMENT RISKS

Located in the Indian Ocean, the Maldives is an archipelago of 1,192 small and low-lying coral atolls. The coral reef ecosystem is the seventh largest in the world, covering an area of approximately 4,513 km² (GoMV, 2016, p.2). Over 80 % of the islands are less than one metre above sea level. Due to their geographical and low-lying location, the islands are highly exposed to the impacts of extreme weather events such as tropical thunderstorms, cyclones, earthquakes and tsunamis from the Indian Ocean, and in particular the associated sea swells, storm surges, coastal floods and inundations. Climate change models indicate that these disaster-related extreme **flooding events are likely to increase in the future** (GoMV, 2016, p.3). As one of the lowest-lying countries in the world, the Maldives are gravely threatened by **sea-level rise** and associated impacts such as land loss, coastal erosion, tidal inundations and groundwater salination. Available records for the capital Malé indicate significant sea-level rise of around 5.2mm per year over the past decade. This has increased vulnerability to coastal hazards during extreme events and threatens the islands' very existence. An increase of just one metre would cause the Maldives' entire land area to disappear under water. In addition, the observed and projected **increase in sea surface temperature and ocean acidification** is reported to substantially degrade reef structures, leading to the **loss in marine biodiversity** and natural coastal protection, thus further exacerbating the impacts of a changing climate (GoMV, 2016, p.5).

2.11.2 MAJOR SOCIO-ECONOMIC RISKS

The increase in extreme flood events (such as extreme rainfall, storm surges or inundations) compounded by incremental sea-level rise and environmental degradation (such as the loss of marine biodiversity) poses a **direct threat to lives and livelihoods** and, in the long run, **threatens the very existence of the Maldives.** As a country with limited resources, the Maldivian economy is driven by tourism, which accounts for about 28 % of GDP (GoMV, 2016, p.21). The tourism industry depends almost entirely on the country's

pristine natural environment, in particular its rich marine biodiversity. Increasing floods, as well as incremental environmental degradation such as coastal or beach erosion, coral bleaching and loss of marine life will severely challenge the natural resource base of the tourism sector. The local fishery will also be adversely affected. Even though its contribution to GDP is marginal, fish are still a key source of income and food for resident Maldivians. Marine products, especially tuna, account for around 90% of export earnings (GoMV, 2016, p.25). Fish are also a key component of local food security, especially due to the limited amount of cultivable land. Losses in marine biodiversity **not only reduce food availability** but exacerbate the country's high dependency on food imports. Changing precipitation patterns (in particular in drier northern and central regions) and groundwater salination due to sea-level rise also threaten the islands' scarce freshwater resources and might lead to water insecurity.

Furthermore, land loss and fewer economic opportunities might increase the pressure to **migrate** to urban centres and create **very densely populated areas** that come with their own **social problems.** The Maldives is the eleventh most densely populated country in the world, with about 1,102 people per square kilometre (World Population Review, 2017), and Malé is already over-crowded, counting around 133,000 residents for every 5.3 square kilometres. Further migration compounded with population growth puts additional pressure on local housing markets and urban infrastructure.

2.11.3 ADAPTATION POLICY CONTEXT

The Maldives completed a NAPA in 2007. Based on a review of key vulnerabilities, it identified 12 priority adaptation projects. The majority of the proposed measures focus on risk reduction in coastal zones, but also include other actions in the areas of health, tourism, water, agriculture, nature and fishing, such as improved food and freshwater storage, awareness building measures, and the establishment of an insurance mechanism (GoMV, 2015, p.8-10). To realize the 12 adaptation projects outlined, the Maldives estimated it would require about US$ 108 million in funding (GoMV, 2008, p.47-78).

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2.12 NEPAL

KEY CLIMATE RISKS

- EXTREME WEATHER EVENTS AND DISASTERS
- LIVELIHOOD INSECURITY AND MIGRATION

ADAPTATION FINANCING REQUIREMENTS

US$ 350 million for NAPA implementation (GoNP, 2010, p.29-31).

2.12.1 MAJOR CLIMATE AND ENVIRONMENT RISKS

Nepal is a mountainous, land-locked country situated in the central Himalayas. It has five physiographic regions (GoNP, 2010, p.1) and a wide range of climatic conditions, varying from tropical in the south to Alpine or Arctic in the north due to their topographic extremes (GoNP, 2014; p.XV). **Nepal is one of the most vulnerable countries to climate change, water-induced disasters and hydro-meteorological extreme events,** such as droughts, storms, floods, inundation, landslides, debris flow, soil erosion and avalanches. According to the 2010 National Adaptation Programme of Action (NAPA), out of Nepal's 75 districts, 29 are highly vulnerable to natural hazards such as landslides, 22 to drought, 12 to glacial lake outbreak floods, and nine to flooding (GoNP, 2016, p.1). There have already been changes in mean precipitation: from 1975 to 2005, mean rainfall significantly decreased by an average of 3.7 mm (-3.2 %) per month per decade. Climate change has increased rainfall variability by 1-10 % in winter in eastern Nepal, while in summer there has been increase of 15-20 % across the country (GoNP, 2010, p.8-9). The **climate change effects on glaciers** have been profound. In Nepal's Himalaya, between 1977 and 2010 the total estimated ice reserve decreased by 29 percent (129 km^3), the number of glacier lakes increased by 11 percent and glaciers receded on an average by 38 km^2 per year. **Climate change has had visible and pronounced impacts on snows and glaciers** that are likely to increase glacial lake outburst floods (GoNP, 2016, p.1).

2.12.2 MAJOR SOCIO-ECONOMIC RISKS

Nepal has already suffered significantly as a result of **more frequent extreme weather events** such as landslides, floods and droughts, experiencing large losses of human life as well as high social and economic costs (GoNP, 2016, p.1). It remains one of the least developed countries in the world, despite making significant progress in reducing poverty. The percentage of the population living below the poverty line dropped from 42 % in 1995/96 to 31 % in 2003/04 to 25.4 % in 2008/09 (GoNP, 2014; p.XV). The population

is **predominantly rural and over 85% is engaged in agriculture,** predominantly subsistence farming. **Increasing urbanization has led to the growth of new settlements even in highly vulnerable flood plains**, landslide prone areas and along river banks. Only about 56 % of households in Nepal have access to electricity (GoNP, 2014, p.XV).

There are six major areas that are impacted by climate change (NAPA, 2010, p.11) – among them **agriculture and food security, water scarcity and climate induced disasters.** The agricultural sector is the second largest contributor (33 %) to GDP after services (39 %) (NAPA, 2010, p.2), and provides the basis for the livelihood of almost 80 % of the population, **employing about 66 % of the country's labour force.** Agricultural land covers about 21 % of the country's territory, second only to forest in terms of land use, but only 59 % of that land (1.766 million ha) is irrigable (GoNP, 2014, p.XV). Data revealed that from 2004 to 2014 some 20,945 hectares of land, owned by 4.7 percent of households, became uncultivable due to **climate-induced disasters.** Only one third of total cultivable land has access to assured irrigation facilities, with the majority highly dependent on rainfall (GoNP, 2010, p.24). Hence, climate change is affecting the direct costs of crop production, livestock production, and natural hazard risks (GoNP, 2010, p.12). The main risk driver, **climate-induced disasters,** comprises various types of hydro-meteorological disasters. In total, 20 glacial lakes are at risk of bursting (GoNP, 2010, p.12).

2.12.3 ADAPTATION POLICY CONTEXT

Nepal prepared its **National Adaptation Programme of Actions (NAPA) on climate change** in September 2010 to address its most urgent and immediate adaptation needs. According to the government, effective implementation of NAPA priorities would provide multiple opportunities to help climate vulnerable communities and ecosystems to cope with the adverse impacts of climate change, and improve livelihoods by addressing the most urgent and immediate adaptation needs (GoNP, 2016, p.5). To address the risks related to agriculture and food security, the adaptation measures in the NAPA are part of a larger framework for sustainable agricultural land use. This includes the development of new crop varieties, the adoption of organic farming techniques and practices to reduce chemical fertilizer use, community-based water management, and farmer cooperatives for the implementation of adaptation measures (GoNP, 2010, p.24-25). With respect to climate-induced disasters, a broad spectrum of activities has been proposed, including improving institutional guidance through capacity building, better land-use regulation, awareness raising programmes, building construction codes, development of early warning systems, use of geological information systems (GIS), and provision of insurance. In the agricultural sector, measures aim for example to promote rainwater harvesting, soil moisture retention, flood mitigation and bamboo planting (GoNP, 2010, p.25-26). The costs of the nine priority projects outlined in the NAPA amount to USD 350 million (GoNP, 2010, p.29-31).

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2.13 PHILIPPINES

KEY CLIMATE RISKS

- EXTREME WEATHER EVENTS AND DISASTERS
- SEA-LEVEL RISE AND COASTAL DEGRADATION

ADAPTATION FINANCING REQUIREMENTS

As yet unspecified

2.13.1 MAJOR CLIMATE AND ENVIRONMENT RISKS

The Philippines is considered to be among the world's most disaster-prone countries. **Tropical typhoons and floods** are major climate-related events that pose significant risks for a country that has one of the world's longest coastlines. The Philippines is also particularly vulnerable **to sea level rise and storm surges** as about 60 % of its municipalities and ten of its largest cities are located along the coast (USAID, 2012). With a view to future trends, heavy rainfall associated with typhoons and other weather systems may become more frequent and intense under a changing climate. This could **exacerbate flooding in existing flood-prone areas and increase landslide and mudslide risks,** as well as introduce flood risks into new areas. Severe droughts are associated with the increased climate variability that may be caused by changes in the El Niño Southern Oscillation (ENSO).

2.13.2 MAJOR SOCIO-ECONOMIC RISKS

An intensification of ENSO due to climate change could have **profound implications for agricultural production and thus food security and pricing.** The country is already witnessing longer drought episodes, with attendant crop damage and often sharp declines in GDP (GFDRR 2011). The increase in such extreme events poses first of all a **direct threat to people's lives, livelihoods, health and communities. Droughts, landslides, and mudslides are all regularly occurring hazards.** As a result, the Global Climate Risk Index (Germanwatch, 2016) cites the Philippines as **the country affected the fifth most by extreme weather events** from 1996 to 2015. During that period 283 such events accounted for one death per 100,000 inhabitants, indicating that a significant increase in damaging extreme events occurred in recent decades. In the absence of appropriate measures, such events will lead to an **increase in the number of deaths and substantial infrastructural damage.** The Philippines' most important economic sectors are agriculture and industry, with agriculture contributing 14 % of GDP and employing over a third of the population (GFDRR, 2011). In addition, there has been a strong trend towards **urbanization** in recent

decades. The Philippines is the fastest urbanizing country in East Asia, with over 65% of residents living in urban areas (World Bank, 2017). However, urban infrastructure is often inadequate, meaning the cities could come under increasing strain due to **increasing pressure on the provision of water, electricity, sanitation and policing.**

2.13.3 ADAPTATION POLICY CONTEXT

For the Philippines, natural disasters are not a new phenomenon. In recent decades disaster risk management capacities have been established. In addition, the Philippines has started with **adaptation planning activities.** These measures were outlined, for example, in the National Climate Change Action Plan (NCCAP) in 2011, with an outline of short, medium and long term actions in the seven areas of **food security, water security, ecological and environmental stability, human security,** climate smart industries and services, sustainable energy, and knowledge and capacity development. Significant resources will be needed to implement planned adaptation measures. The Philippines' INDC (RoPH, 2015) also outlined priority measures that required international implementation support. Among them was a call for assistance in strengthening the institutions and systems responsible for downscaling climate change models, climate scenario-building, climate monitoring and observation, as well as the roll-out of a science-based climate/disaster risk and vulnerability assessment process as the basis for mainstreaming climate and disaster risks reduction in development plans, programmes and projects. More broadly, the government has emphasised the importance of enhancing the climate and disaster-resilience of key sectors such as agriculture, water, and health. To implement the adaptation activities outlined in the NCCAP, the Philippines allocated a budget of US$ 157,412,848 in 2016 (Lapiz, 2017). There is no reference in the INDC as to what resources and how much financing would be required to implement all the country's adaptation priorities. Only in September 2017 did the Philippine governement purchase insurance coverage to finance disaster-related losses to national government assets.

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2.14 RWANDA

KEY CLIMATE RISKS

EXTREME WEATHER EVENTS AND DISASTERS

LIVELIHOOD INSECURITY AND MIGRATION

ADAPTATION FINANCING REQUIREMENTS

Not specified (estimates US$ 50-600 million/year by 2030)

2.14.1 MAJOR CLIMATE AND ENVIRONMENT RISKS

Climate projections indicate that landlocked Rwanda will face an **increase in the number of extreme weather events,** in particular **floods, landslides** and **droughts.** This is linked to a significant increase in temperature. Since 1970, Rwanda has experienced a temperature rise of 1.4°C and can expect an increase of up to 2.0°C by 2030 – a value above the projected global average. Climate models also predict an increase in rainfall volumes that will lead to more frequent floods and landslides. These extreme weather events will be unevenly distributed, both spatially and temporally. The mountainous areas in northern and western regions are expected to experience more floods and landslides, while the flat eastern parts will suffer more droughts. The increase in floods, landslides and droughts will likely result in **land degradation,** such as **soil erosion** and **fertility decline** (GoRW, 2015, p.2-3).

2.14.2 MAJOR SOCIO-ECONOMIC RISKS

Increasing average temperatures, changes in precipitation, and water shortages will have substantial economic and socio-economic consequences. The adverse impacts result primarily from Rwanda's strong reliance on rain-fed agriculture for both rural livelihoods and exports (tea and coffee). The agricultural sector accounts for about 39 % of GDP, 80 % of employment, 63 % of foreign exchange earnings, and 90 % of the country's food needs (World Bank, 2013). It has been a major driver of economic growth and poverty reduction. Problematically, about 90 % of crops are cultivated on flood and landslide-prone slopes (INDC, 2015, p.5). The increase in floods and droughts contributes to soil erosion, reduced fertile land, crop losses and infrastructure damage. This might lead to a **decline in agricultural production,** which could **hamper economic development and even challenge livelihoods.** A poor or volatile food supply might contribute to future **food insecurity and land disputes.** Even today, food production often cannot keep pace with demand (CIA World Factbook, 2017) and current population growth may further exacerbate the situation. Rwanda has not only the highest population density in Africa (GoRW, 2015, p.2) but has seen its

population grow from about 20 % from 10 million in 2010 to around 12 million in 2017 (World Population Review 2017). By 2050, it is expected to grow to about 20 million. This demographic development puts pressure on the agricultural sector, increasing demand for land, water, food and energy resources. At present, around 97 % of households rely on wood-burning stoves for cooking (GoRW, 2015, p.7). Given that the country has historically experienced ethnic conflicts, there is a risk that increasing resource and land scarcity will lead to renewed tensions. Declining land resources could also amplify the recent urbanization trend (6.4 % between 2010 and 2015, according to the CIA Factbook 2017). Cities risk not developing infrastructure and housing quickly enough to accommodate these increasing numbers of urban migrants, and may therefore see the growth of slums and their associated health and social problems. In addition, rising temperatures and changing rainfall patterns in northern and western regions might increase the occurrence and facilitate the distribution of diseases such as **malaria** (USAID, 2012), leading to major **public health** impacts.

2.14.3 ADAPTATION POLICY CONTEXT

Rwanda has identified a number of sector-specific adaptation measures to address the adverse impacts of climate change. They are outlined in the country's comprehensive Green Growth and Climate Resilient Strategy, which was adopted in 2011. Key measures include the promotion of recovery and reuse of both organic waste and wastewater "in order to restore and maintain soil fertility" (GoRW, 2015, p.4), crop and export diversification, installation of land protection measures and "progressive terraces" (GoRW, 2015, p.5), development of a water irrigation system, land reforms, and the establishment of an early warning system to improve disaster preparedness (GoRW, 2015, p.6-13). Unfortunately, no official estimates exist for the country's adaptation financing needs. A comprehensive study from 2009 concludes that Rwanda requires US$ 50 to 300 million per year to address climate change in the medium term (2030); if social protection measures are included, financing needs are estimated to be around US$ 600 million per year (SEI, 2009, p.iv).

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2.15 SAINT LUCIA

KEY CLIMATE RISKS

- EXTREME WEATHER EVENTS AND DISASTERS
- VOLATILE FOOD PRICES AND PROVISION

ADAPTATION FINANCING REQUIREMENTS

As yet unspecified

2.15.1 MAJOR CLIMATE AND ENVIRONMENT RISKS

Saint Lucia is a small island developing state (SIDS) situated in the eastern Caribbean Sea adjacent to the Atlantic Ocean. The country's climate is tropical, with a dry and a rainy season. Global climate models indicate that it will experience a slight increase in temperature (1.2-1.4°C) and increases in annual rainfall with greater inter-annual rainfall variability (World Bank, 2017). Overall, warmer and drier conditions and heavier and more erratic rainfall are most likely, although models also include substantial uncertainty. St Lucia is highly exposed to seasonal tropical storms such as **hurricanes** from the Atlantic Basin. These cause both direct coastal damage and indirect impacts through **floods and landslides.** Climate models indicate **an increase in the severity of these extreme weather events** due to changing sea surface temperatures. Ocean acidification is forecasted to adversely affect coral reef building and may exacerbate tropical-storm related damage to reefs (GoLC , 2012).

2.15.2 MAJOR SOCIO-ECONOMIC RISKS

Above all, the increase in **hurricanes** poses a direct **threat to lives and livelihoods.** St Lucia is highly dependent on the tourism sector, which is very vulnerable to climate related impacts. The tourism industry accounts for about 65 % of GDP and is Saint Lucia's main source of jobs and income (CIA World Factbook, 2017). Around 55 % of the population and a large proportion of infrastructure can be found along the coastline (GoLC , 2012, p.3). The island's vulnerability to storms, high winds, floods and landslides has been exacerbated by the absence of approved building codes and standards, poor land-use planning, uncontrolled human settlements in disaster-prone areas such as low-lying coastal or hillside areas, deforestation, inadequate stormwater drainage systems and inappropriate garbage disposal that blocks drains. Moreover, factors such as coral bleaching and physical damage from anchors

have reduced the protection provided by the coral reefs near the coastline (GoLC , 2012, p.128). Overall, more frequent and intense hurricanes, as well as their secondary effects like floods and landslides, increase the country's physical, social, economic and environmental vulnerability.

The various problems generated by shifting weather patterns and extreme weather events present a significant threat to the island's agricultural sector. This contributes a substantial albeit declining proportion of foreign export earnings and employs about 22 % of the country's labour force. The impact of increasing temperatures, erratic rainfall, storms, floods and landslides affects soil productivity and therefore the quantity and quality of crops. Declining agricultural production translates into decreasing wages and potentially lower food availability, leading to higher food prices and food insecurity among poorer, rural segments of the population (GoLC , 2012, p.133). Given the country's existing social disparities, social tensions may rise as a consequence. Overall, climate change poses a considerable threat to the country's social and economic development. It could lead to substantial disruption to St Lucia's economic and social base, and create widespread **livelihood insecurity.**

2.15.3 ADAPTATION POLICY CONTEXT

St Lucia has adopted a relatively high number of strategies, programmes and measures, and collaborates in regional intergovernmental networks to address climate change. For example, in 2003 it adopted its first National Climate Change Policy and Adaptation Plan, wich was updated in 2015. The plan identifies key vulnerabilities and guides adaptation measures. Planned or implemented key measures involve infrastructural developments, improvements in land-use planning, development and enforcement of building codes to withstand natural hazards, promotion of soil conservation measures, and the introduction of heat-resistant crops (World Bank, 2017). St Lucia is a member of the Caribbean Catastrophe Risk Insurance Facility (CCRIF) and purchased insurance coverage to finance disaster-related expenses.

St Lucia has not yet published data on its adaptation financing needs.

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2.16 TANZANIA

KEY CLIMATE RISKS

LOCAL RESOURCE COMPETITION

VOLATILE FOOD PRICES AND PROVISION

ADAPTATION FINANCING REQUIREMENTS

US$ 7.625 billion for the time period 2015-2030 (GoTZ, 2015)

2.16.1 MAJOR CLIMATE AND ENVIRONMENT RISKS

Climate projections for Tanzania indicate a substantial increase in average temperature (1-2°C by 2050 and up to 4°C by 2100) and changes in seasonal rainfall. While the rainfall seasons are forecasted to become shorter, the overall amount of rainfall is predicted to increase (GoTZ, 2014, p.60-67). That implies that Tanzania is expected to face **more frequent and intense extreme weather events,** namely **droughts, floods and heatwaves.** Tanzania has already experienced recurrent droughts and floods over the past 40 years (GoTZ, 2015, p.3). However, it is important to note that these changes in weather patterns and extreme weather events will vary in their timing and between regions, as they are usually associated with particular climatic or topographic zones. Climate change will also have substantial impacts on ecosystems, leading to the desertification of semi-arid regions and degradation of wildlife habitats.

2.16.2 MAJOR SOCIO-ECONOMIC RISKS

Changing weather patterns and more frequent extreme weather events will have major effects on agricultural production. The agricultural sector is the backbone of Tanzania's economy, accounting for 24 % of GDP and about 74 % of employment (GoTZ, 2014, p.18; data from 2013). Changing weather patterns will affect the quantity and quality of certain crops and shift the usual start of the farming season (GoTZ, 2014, p.19). The agricultural sector mainly consists of small-scale farmers and is largely rain-fed. The erosion of arable and gazing land due to reduced water availability, frequent flooding, and poor agricultural infrastructure will make it harder for farmers und herders to maintain the same level of overall agricultural production. A decline in agro-pastoral production could lead to **food insecurity** and substantial income reductions, while also increasing **livelihood insecurity** and heightening the risk of extreme poverty. At almost 3 % per annum, **population growth** in Tanzania has also been consistently high, leading the population to increase from 12 million in 1967 to around 45 million in 2012, and likely about 56 million in 2017 (World Population Review, 2017). This will put huge additional pressure on increasingly scarce fertile

land, and the growing competition for this land and other resources could even lead to social conflict. In the past, the limited availability of cultivable and gazing land has often triggered **land-use conflicts between farmers and herders** (GoTZ, 2014, p.21). **Displacement and internal migration** are also potential consequences of conflict, as well as food and livelihood insecurity. The urbanization rate in Tanzania has been high, at around 5% per annum, particularly in the areas of Dar es Salaam, Rukwa and Arusha (IGC, 2014). Rural flight and increasingly overcrowded cities will bring their own social problems.

Changing weather patterns, reduced water availability and quality, heavy rainfalls and floods, and malnutrition will cause outbreaks of diseases such as malaria, cholera and dengue fever to become more widespread and prolonged. Greater prevalence of these diseases, and the heightened potential for large-scale epidemics, will negatively impact **public health** and place existing healthcare services under strain (GoTZ, 2014, p.17). The capital Dar es Salaam has already experienced an outbreak of diarrhoea, pneumonia and dengue fever in February 2014 (GoTZ, 2014, p.81). Weak institutional capacity and low awareness of climate change impacts pose additional challenges (GoTZ, 2014, p.86).

2.16.3 ADAPTATION POLICY CONTEXT

Tanzania has adopted and implemented a number of strategies, policies, programmes and projects to address the adverse effects of climate change. The National Climate Change Strategy (2012) and the Zanzibar Climate Change Strategy (2014) comprise both comprehensive mitigation and adaptation measures (GoTZ, 2015, p.1). The measures planned or implemented have been sector-based. Key measures include improvements to ensure the supply and more efficient use of water (e.g. construction of storage reservoirs and irrigation systems, use of water-saving technologies), measures for enhancing crop-productivity, the provision of health education (e.g. awareness-raising on cholera), and infrastructural developments (GoTZ, 2014, p.68-138). Tanzania has considered the adoption of climate risk insurances for its INDC. Tanzania has stated it requires around US$ 150 million as "start-up financing needs to enhance adaptive capacity" (GoTZ, 2015, p.2), about US$ 500 million per year up to 2020 and about US$ 1 billion from 2030 onwards (GoTZ, 2015, p.2).

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2.17 TIMOR-LESTE

KEY CLIMATE RISKS

LOCAL RESOURCE COMPETITION

VOLATILE FOOD PRICES AND PROVISION

ADAPTATION FINANCING REQUIREMENTS

US$ 21.3 billion (GoTL, 2010)

2.17.1 MAJOR CLIMATE AND ENVIRONMENT RISKS

The climate of Timor-Leste is characterized by the West Pacific monsoon and thus by a dry and a wet season. Climate change projections indicate an average temperature increase of around 1.5°C by 2050, without significant variability across the dry and wet seasons. However, **heatwaves** are forecasted to become more intense and prolonged (GoTL, 2014, p.23-26). While the annual volume of rainfall is expected to remain relatively stable, climate projections indicate that extreme rainfall events, and thus the occurrence of **floods and landslides,** is expected to **increase in intensity but decline in frequency.** Given its geographical location, Timor-Leste is exposed to seasonal **tropical cyclones** (GoTL, 2014, p.26).

2.17.2 MAJOR SOCIO-ECONOMIC RISKS

Timor-Leste is one of the world's newest countries, as it gained independence only in 1999 after 450 years of Portuguese colonization and 24 years of Indonesian occupation. It is also one of the poorest and most fragile countries in Asia. The declaration of independence in 1999 led to mass violence and the destruction of most of the country's infrastructure. Despite subsequent interventions to stabilize the country, the potential for conflict remains high, as evidenced by Timor-Leste's consistently high ranking on the Fragile States Index (FFP, 2017). About 41 % of the population lives in extreme poverty on less than US$ 0.88 per day, and a high proportion is unemployed (GoTL, 2014, p.iii). The country therefore faces major challenges due to the post-conflict situation, underdeveloped or destroyed infrastructure, a large dependency on aid funds and oil for state revenues, extreme poverty and a high unemployment rate (USAID, 2013, p.5). Beyond the agricultural sector, economic activities are fairly limited. Around 80 % of the population depends on (subsistence) agriculture, fishery or forestry for income. Inadequate infrastructure and agricultural practices contribute to low yields and high levels of food insecurity (USAID, 2013, p.6).

As weather patterns shift, the growing intensity of heatwaves, floods and associated landslides, and tropical cyclones will **exacerbate existing livelihood and food insecurity.** They will also amplify **environmental degradation,** loss of agricultural land and reductions in soil fertility. Water supply, and particularly water scarcity during the dry season, will likely be the most important environmental constraint on agricultural output. Rapid population growth and rising demand for resources will further challenge agricultural production and therefore food security. Given the fragile political situation, more **intense competition for resources** could escalate into **violent conflicts.**

Increased cyclone intensity could also lead to greater **losses of life and infrastructure.** Rising temperatures and growing rainfall variability, leading to more frequent floods, will likely cause **more frequent and widespread outbreaks of pests, crop diseases, and vector-borne diseases** such as malaria.

2.17.3 ADAPTATION POLICY CONTEXT

In its 2010 National Adaptation Plan for Action (NAPA) Timor-Leste proposed nine programmes that each identify a number of key adaptation measures. These include improvements to water management, including developing and using rainfall harvesting, and protecting and rehabilitating rainfall catchment areas; measures to enhance agricultural productivity; and the development of an emergency preparedness plan for waterborne and vector-borne disease. Adaptation costs have been estimated at US$ 21.3 million (GoTL, 2010, p.83-108). International support is needed to implement these measures, and the main obstacles remain the lack of funds and institutional capacities (GoTL, 2016, p.22).

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2.18 TUVALU

KEY CLIMATE RISKS

SEA-LEVEL RISE AND COASTAL DEGRADATION

EXTREME WEATHER EVENTS AND DISASTERS

ADAPTATION FINANCING REQUIREMENTS

US$ 8.6 million (GoT, 2007);
US$ 67.6 million (GCF, 2016)

2.18.1 MAJOR CLIMATE AND ENVIRONMENT RISKS

Tuvalu consists of five coral atolls and three table limestone reef islands (GoTV, 2007, p.13), which are all over three metres above sea level (GoTV, 2015, p.4-5; 30). The country is one the smallest in the world, with a total land area of only 27 square kilometres. The greatest threat posed by climate change is **sea-level rise** and associated impacts such as coastal **erosion and flooding, inundations and groundwater salination.** Coastal flooding and inundations are already evident on all of Tuvalu's islands (GoTV, 2007, p.24). Due to its geographical location, Tuvalu is also highly exposed to seasonal **tropical cyclones,** while climate models predict that these extreme weather events will become **more frequent and intense** in future. Rising sea surface temperatures and ongoing ocean acidification will adversely affect coral reef building and marine life. Sea surface temperatures around Tuvalu are already about 29°C, which is at the upper end of the spectrum of what most coral species and marine life can withstand. Future increases would also affect the coral fish populations and lead to **biodiversity loss** (GoTV, 2007, p.29).

2.18.2 MAJOR SOCIO-ECONOMIC RISKS

Sea-level rise poses an **existential threat to Tuvalu.** There is a significant chance that large areas of the country will disappear underwater in future. Tuvalu's land area has already decreased (GoTV, 2007, p.32), and king tides in February 2004 and 2006 flooded homes and about 40 % of the airstrip (GoTV, 2007, p.31). Moreover, the impact of storm surges has been exacerbated by rising sea-levels in combination with more intense tropical storms and coral bleaching. This intensifies coastal erosion and flooding, and can lead to **internal displacement and external migration.** An estimated 45 % of the total population was internally displaced after tropical cyclone Pam hit Tuvalu in March 2015 (GCF, 2017). Internal displacement may trigger social conflicts. The loss of land has already triggered some land boundary disputes between families (GoTV, 2007, p.29).

Water security will be undermined by rising water salinity, coupled with the predicted increases in temperature and more erratic rainfall patterns. As there are no streams or rivers on the islands, Tuvalu already largely depends on stored rainfall for drinking water. The saltwater intrusion associated with sea-level rise will also contaminate groundwater. Moreover, it could dramatically reduce the productivity of the few fertile soils that allow for the cultivation of coconuts, breadfruit and local vegetables (GoTV, 2007, p.32). This **undermines livelihoods and food security** on the island – an issue further exacerbated by the adverse impacts on the fish population caused by increases in sea surface temperatures and ocean acidification. The islands and lagoons are crucial sources of both subsistence and commercial fishing (GoTV, 2007, p.30). Tuvalu receives substantial licenses fees from foreign fishing fleets for the use of its exclusive economic zones. Rising seawater temperatures challenge coral fish stocks and affect the migration patterns of ocean fish, undermining subsistence and commercial fishing.

More frequent and intense tropical cyclones pose a direct threat to lives and livelihoods. In March 2015, Tuvalu's livelihood and economic assets were devastated by tropical cyclone Pam. According to government sources, total loss and damages amounted to approximately US$ 10.34 million, equivalent to 26.9 % of GDP (GCF, 2016, p.11.

2.18.3 ADAPTATION POLICY CONTEXT

Tuvalu has enacted a number of climate change programmes, projects and activities. The country first outlined its strategy and adaptation measures in its 2007 National Adaptation Programme of Action (NAPA). They were subsequently updated in the National Strategic Action Plan in 2011, which identified 16 adaptation projects in the areas of coastal zones and resources, water resources, human health, fisheries, agriculture and natural disasters. Key measures focus largely on short-term training and awareness raising, as well as vulnerability assessment. Based on the priorities identified in 2007, Tuvalu has stated it requires about US$ 8.6 million for climate change adaptation (GoTV, 2007, p.38). At present, there is limited information about the extent to which measures have been implemented. It is also questionable whether these measures and funds would be adequate, even if fully realised. The Green Climate Fund (GCF) has reported that the recovery and disaster reduction measures in response to cyclone Pam will have a total cost of around US$ 67.64 million (GCF, 2016, p.3). This may indicate that adaptation financing needs are in fact much greater than the government has reported. In any case Tuvalu is a member of the Pacific Catastrophe Risk Assessment and Financing Initiative (PCRAFI) and purchased insurance coverage to finance disaster-related expenses.

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2.19 VANUATU

KEY CLIMATE RISKS

- EXTREME WEATHER EVENTS AND DISASTERS
- VOLATILE FOOD PRICES AND PROVISION

ADAPTATION FINANCING REQUIREMENTS

US$ 9.5 million per year (GoVU, 2015)

2.19.1 MAJOR CLIMATE AND ENVIRONMENT RISKS

Vanuatu has 80 islands, of which the two largest islands, Espiritu Santo and Malekula, make up almost 50 % of the total land mass (GoVU, 2007, p.10). Vanuatu's climate varies from tropical to sub-tropical, and is characterized by a cooler wet and a hotter dry season (GoVU, 2014, p.4). Due to its geographical location on the Pacific 'Ring of Fire' Vanuatu is highly exposed to seasonal tropical cyclones, as well as volcanic eruptions and earthquakes, and their associated impacts such as floods, storm surges, tsunamis and landslides. Climate change models indicate that the region can expect a temperature increase of between 1.4 to 3.1°C by 2060, along with greater rainfall variability. This will increase the likelihood of **droughts and intense rainfall** (World Bank, 2017). Due to the more frequent occurrence of El Niño weather patterns, models indicate that **tropical cyclones** will become more frequent and intense. **Sea-level rise,** the **increase in sea surface temperature** and the ongoing **acidification of the ocean** will reportedly lead to environmental degradation (such as coastal erosion or coral bleaching) and negatively affect marine life (GoVU, 2014, p.61-62). Overall, Vanuatu is vulnerable to a number of climate and geological hazards, and the adverse effects of climate change will likely exacerbate their impact.

2.19.2 MAJOR SOCIO-ECONOMIC RISKS

Climate change is expected to negatively affect the economic sectors that underpin Vanuatu's development. The economy is based primarily on (tourism-related) services and small-scale agriculture, and thus on the country's natural resource base. The service sector accounts for about 61 % of GDP and is the country's main source of income. The agriculture sector provides a living for around 80 % of the population and contributes about 10 % to GDP (GoVU, 2014, p.5).

Changes in weather patterns, including the increase in extreme weather events (in particular tropical cyclones and associated floods), present significant challenges for the country's natural resource base,

as well as posing a direct **threat to lives and livelihoods.** Most tourism-related infrastructure is located on or close to the coastline, and is thus highly vulnerable to the impacts of cyclones and storm surges. Coastal erosion, including beach erosion and coral reef degeneration, will weaken natural barriers and therefore exacerbate the impact of these extreme weather events. Climate change therefore poses a significant threat to the infrastructure and resources underpinning Vanuatu's tourism-based economy (GoVU, 2014, p.7).

Moreover, higher temperatures combined with more erratic and heavy rainfall will adversely affect **water availability and quality,** with negative consequences for agricultural production and other sectors. The increase in droughts, flash floods and tropical cyclones will also reduce agricultural productivity by intensifying soil erosion and could lead to outbreaks of pests and diseases. Declining agricultural yields particularly threaten the livelihoods of small-scale farmers (GoVU, 2014, p.7) and could heighten **food insecurity** and associated problems. Furthermore, projected rises in sea surface temperatures, combined with increased ocean acidification, will negatively impact marine ecosystems and lead to declines in fish and seafood stocks (UNDP, 2017).

2.19.3 ADAPTATION POLICY CONTEXT

In its National Adaptation Programmes of Action (NAPA), Vanuatu identified a number of immediate and long-term adaptation measures for its most vulnerable sectors. Key measures include the diversification of crops, expansion of rainwater storage capacity through rainwater harvesting, infrastructural development, and the development of relocation plans for vulnerable communities. Vanuatu is a member of the Pacific Catastrophe Risk Assessment and Financing Initiative (PCRAFI) and purchased insurance coverage to finance disaster-related expenses. In the report outlining its Intended Nationally Determined Contribution (INDC), Vanuatu stated the annual cost of adapting to climate change to be around 1.5 % of the country's GDP. This equates to about US$ 9.5 million per year (GoVU, 2015, p.6).

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2.20 VIETNAM

KEY CLIMATE RISKS

- EXTREME WEATHER EVENTS AND DISASTERS
- SEA-LEVEL RISE AND COASTAL DEGRADATION

ADAPTATION FINANCING REQUIREMENTS

Estimated to exceed 3-5% of GDP by 2030 (GoVN, 2015, p.9)

2.20.1 MAJOR CLIMATE AND ENVIRONMENT RISKS

Vietnam is among the countries that will be most severely affected by climate change and related disasters. The government has emphasised that the **Mekong Delta is one of the world's deltas most susceptible and vulnerable to sea-level rise.** Over the past 50 years, the average temperature in Vietnam has increased by approximately 0.5°C and the **sea level has risen by about 20 centimetres** (GoVN, 2015, p.1). Extreme climate events have increased both in frequency and intensity. Climate change has also made hazards, particularly storms, floods and droughts, more intense. According to Vietnam's climate change reference scenario (2012), by 2100 the annual average temperature in Vietnam is expected to increase by 2-3°C, precipitation will increase in the rainy season and decrease in the dry season, and the sea level will rise between 78 and 100 centimetres (GoVN, 2015, p.7). Vietnam's **long coastline, geographical location,** and diverse topography and climates combine to make it one of the most hazard-prone countries of the Asia-Pacific region, with storms and flooding particularly responsible for economic and human losses. Vietnam is also highly at risk with regard to **tropical cyclones and floods, which are likely to become more frequent and intense in the future.**

2.20.2 MAJOR SOCIO-ECONOMIC RISKS

The Global Climate Risk Index (Germanwatch, 2016) cites Vietnam as being the country sixth-most affected by extreme weather events from 1994 to 2016. A high proportion of the country's population and economic assets (including irrigated agriculture) are located in coastal lowlands and deltas. Storms resulted in nearly **US$ 4.5 billion in damage in Vietnam over the past century** and, given population growth in exposed areas, as well as the continued development of infrastructure assets, the damage potential of typhoons is rising. The increase in extreme weather events poses first of all a **direct threat to people's lives, livelihoods, health and communities.** In the absence of appropriate measures, it will lead to an increase in the number of deaths and to substantial infrastructural damage (e.g. public and private

assets such as residential housing). Moreover, climate change will challenge the integrity of ecosystems. Storm surges and sea-level rise will result in saltwater intrusion onto cultivable land in coastal areas. **Floods are likely to have significant negative impacts on rice cultivation, with reductions in agricultural yields posing a major risk to food security.** Significant impacts are also likely for the two most important rice-growing areas, the deltas of the Mekong and Red River. Though the relative contributions of agriculture, forestry and fishing to GDP have been declining over the last decade, they still are of **key relevance for economic development and employ almost half the country's labour force** (World Bank, 2011).

2.20.3 ADAPTATION POLICY CONTEXT

Vietnam already has a well-established disaster risk management system. In addition, Vietnam has been engaged in **adaptation planning activities** to address medium to long-term vulnerabilities. These measures have been outlined in the country's INDC up to 2020 and to 2030 (GoVN, 2015, p.7-11). Key adaptation measures include structural measures to **protect against river floods, storm surges, saline water intrusion, and drought.** These are likely to exceed the country's existing capacities. The increasing impact of climate change on residential areas, economic zones and ecosystems will lead to unavoidable losses. Significant resources will be needed to implement planned adaptation measures. According to the government forecasts outlined in the INDC, the cost of adaptation is estimated to **exceed 3-5% of GDP by 2030** (GoVN, 2015, p.9).

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III. CLIMATE RISKS AND FINANCING NEEDS OF THE V20

Workers from the Public Utilities Board putting pressure onto water pipes to ensure they are not moved or damaged during high tides, Ambo village, Kiribati, February 2013.

3.1 CLIMATE RISKS OF THE V20

A cross-country analysis reveals that three climate risks stand out: Extreme weather events & disasters; sea-level rise & costal degeneration; and livelihood insecurity & migration. These risks may jeopardize the socio-economic development and relative stability of the V20. The following figure illustrates for which country extreme weather events & disasters, sea-level rise & costal degeneration and livelihood insecurity & migration present key risks:

MAIN CLIMATE RISK

EXTREME WEATHER EVENTS AND DISASTERS

BANGLADESH


BARBADOS


BHUTAN


COSTA RICA


ETHIOPIA


MADAGASCAR


NEPAL


PHILIPPINES


RWANDA


SAINT LUCIA


TANZANIA


TIMOR-LESTE


TUVALU


VANUATU


VIETNAM


MAIN CLIMATE RISK

SEA-LEVEL RISE AND COASTAL DEGRADATION

BANGLADESH


BARBADOS


COSTA RICA

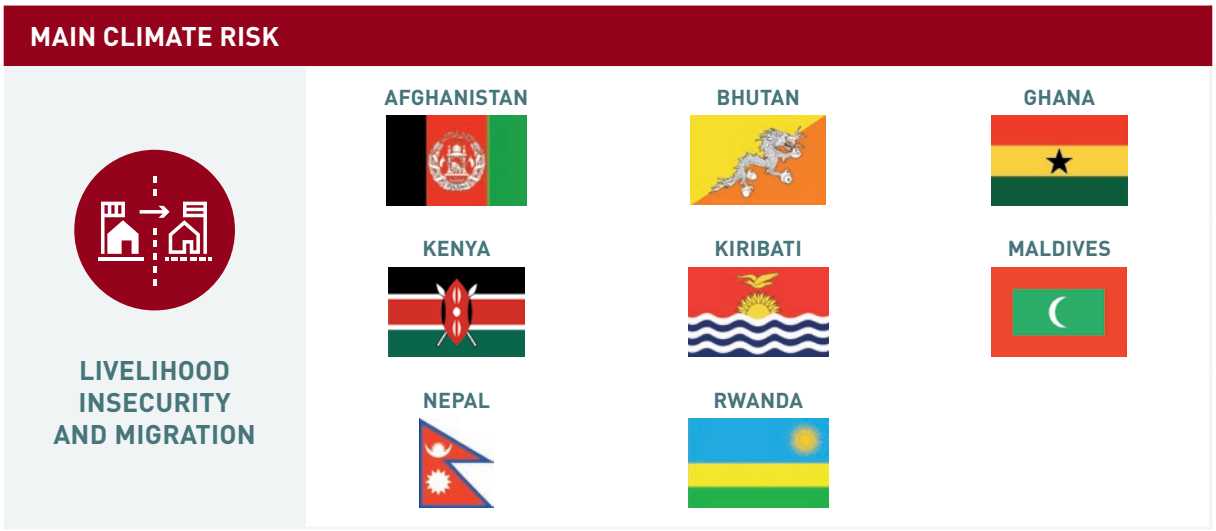

KIRIBATI


MALDIVES


PHILIPPINES


TUVALU


VIETNAM

The most important risk to stability is extreme weather events & disasters. For 15 out of 20 countries the increase in extreme weather events and disasters poses a key threat. In the absence of appropriate resources, capacities and policies, more frequent and intense extreme weather events (such as droughts, floods, and tropical storms) are likely to exacerbate the V20's vulnerability and fragility.

Why is this the case? The V20 are basically natural-resource based economies. The large parts of their GDP derive from natural resources (agriculture) and/or related services (e.g. tourism). In Ethiopia and Rwanda, for instance, the agricultural sectors accounts for about 40 % of GPD and employs about 80 % of the population. The shifting weather patterns and increasing extreme weather events affect the availability, access and distribution of natural resources. It may lead to greater resource scarcity or an abundance of a specific resource. Over the long term, these climate-induced changes may jeopardize the 'business model' of the V20. There is a risk that this may lead to heightened grievances and thus political instability.

The second most important risk is sea-level rise & costal degeneration together with livelihood insecurity & migration. For 8 out 20 countries, rising sea-level & costal degeneration and associated impacts (e.g. water salination, inundations), as well as livelihood insecurity & migration pose a key threat. In some cases, rising sea-level poses an existential threat (Kiribati, Maldives, Tuvalu).

The scenario analysis indicates that climate change may lead to changes in relative prosperity and thus deepen existing disparities. Livelihood insecurity may intensify the already fairly high urbanization trend. The impacts of climate change will be particular pronounced in countries that already experience insecurity, lack the capacities and institutions for managing vulnerabilities, and are characterized by rapid population growth such as in, for instance, Afghanistan or Timor-Leste.

3.1.1 CLIMATE CHANGE AS "THREAT MULTIPLIER"

If we take more recent political tensions into consideration, climate change has the potential to exacerbate or even trigger new conflicts:[2]

- **Afghanistan:** Disputes over access to land are already a common cause of conflict in the country. According to a UNEP report from 2009, entrenched inter-ethnic conflict between the settled Hazara and the nomadic Kuchi in the central highlands were fuelled by an overlap of legal rights held by the Kuchi and historical rights held by the Hazara (UNEP 2009). Both groups are dependent on high-altitude grazing land to support livestock, and compete for access to this land, increasingly resorting to violence to restrict the access of the other resource-user group. Climate change has the potential to exacerbate such land-use conflicts.

- **Bangladesh:** Bangladesh experienced a boom in shrimp farming during the 1980s due to growing international demand. **The increase in shrimp farming along the coast** in conjunction with a higher occurrence of extreme weather events such as cyclones and flooding shrimp farming led to increasing salinization of soil and water sources in the late 1980s. The destruction of natural ecosystems and decreasing soil fertility due to the shrimp industry has met fierce political opposition. Since the shrimp cultivation boom in the 1980s, numerous protests and anti-shrimp movements have developed. Protests occurred again in 2010 which resulted in violent clashes between rice and shrimp farmers.

- **Ethiopia:** With large-scale land acquisitions by foreign and domestic investors intensifying due to high demand for biofuels in developed countries, local populations are being forced to leave their land and give up access to essential environmental resources and unique livelihoods – frequently without proper warning or adequate compensation from the state. These displacements have led to strained relations with public authorities and in some cases even to violent clashes between local communities and state security forces. In the Gambella region, for instance, some 70,000 indigenous people were displaced and forced to abandon their traditional lifestyle in 2011, according to Human Rights Watch (HRW 2012).

- **Kenya:** More frequent droughts have exacerbated resource conflicts between Pokomo farmers and Orma herders in the Tana River Delta, Kenya's most important wetland. The Pokomo use the swamp-like river banks to cultivate tropical cash-crops such as rice and mangos, while the Orma traditionally inhabit the hinterlands and only migrate to the Tana River when lack of water and grazing grounds force them to. Increasing environmental hardship combined with neglect of local police forces led to clashes between the Pokomo and the Orma in the summer of 2012.

- **Kiribati:** In 2016 Kiribati bought about 6,000 acres of land from the Fiji islands to ensure food security and relocate a part of its population. The 'migration with dignity' policy is part of Kiribati's long-term nationwide relocation strategy. According to the government website, it contains two components: "Firstly, opportunities must be created to enable the migration of those who wish to do so now and in the coming years. This will assist in establishing expatriate communities of I-Kiribati, who will be able to absorb and support greater numbers of migrants in the longer term. It will also benefit those who remain by lifting the levels of remittances. Secondly, the levels of qualifications able to be obtained in Kiribati will be raised to those available in countries such as Australia and New Zealand. This will make qualified I-Kiribati more attractive as migrants, but will also improve the standards of services available locally." (Government of Kiribati 2016).

[2] All cases are based on the ECC Factbook Platform https://factbook.ecc-platform.org/

- **Philippines:** Super typhoon Haiyan was one of the strongest tropical cyclones ever recorded. When it made landfall in the Philippines in 2013, it killed over 6,300 people and left hundreds of thousands without homes or livelihoods. Among the hardest hit were conflict-sensitive areas that had been rendered poor and vulnerable by decades of violent conflict between independent armed groups and the Filipino army. The government response to the disaster was considered by many to be inadequate. As it lacked both necessary funds and disaster response mechanisms, many were still without jobs, homes and basic sanitation months afterwards. Angry at the slow pace of reconstruction, citizens organised protests accusing the government of corruption and demanding greater transparency and accountability by government officials during the reconstruction process in order to prevent fraud.

3.2 ADAPTATION FINANCING REQUIREMENTS OF THE V20

Estimating adaptation costs is challenging. Available estimates vary strongly according to the approach, method and available data. As the V20 reflect a data poor environment, this study had to turn to a pragmatic and **a very stylized characterization of adaptation costs.** To calculate adaptation costs, we turned to the official figures given by the countries themselves and added them up ('bottom-up'-approach). We extrapolated the adaptation costs out of the adaptation costs as outlined in the Intended Nationally Determined Contributions (INDCs) submitted to the UNFCCC wherever possible.

INDCs were developed in the context of the Paris Agreement and outline intended mitigation and adaption measures for the post-2015 period. Most INDCs were submitted in 2015. Indicated finance figures are thus fairly recent. INDC adaptation measures are typically outlined for a 10 or 15 year time period. The envisioned beginning, however, varies from country to country. Some outlined measures for the time period between 2015-2015, others for the time period between 2020-2030. In one case (Kiribati) costs were indicated for the period 2013-2023. Based on the data available, we created an average annual cost value by dividing total adaptation costs by the envisioned time period, ignoring the precise time scale or sequence of intended measures.

If no INDCs were published, we reviewed the National Adaptation Plans of Action (NAPAs) or comparable public sources (e.g. National Adaptation Plans, National Communications). NAPAs were sponsored by the Least-Developed Country Fund and identify a number of priority adaptation measures. NAPAs were published mostly between 2007 and 2010. The figures given are thus fairly old and likely reflect an underestimation, given newer assessment methodologies (cf. UNEP 2016). However, to secure consistency we did not consider these figures in our calculation. For some countries, namely Barbados, Costa Rica, Philippines, St. Lucia and Vietnam, no data was available.

We summarized adaptation cost estimates for nine V20 countries and arrived at **total estimate of about US$ 15 billion/year.** The number indicates annual adaption costs for the time period 2015 up to 2030.

Table 1: Annual average adaptation costs up to 2030 (own calculation, based on available INDC reports)

COUNTRY	ANNUAL AVERAGE COST (in billion US$)
Afghanistan	1.785
Bangladesh	2.667
Ethiopia**	5
Ghana	0.83
Kenya*	2.714
Kiribati	0.0075
Madagascar	1.914
Tanzania*	0.13
Vanuatu***	0.0095
All Countries	**15.057**

The total adaptation costs add up to about US$ 200 billion.

Table 2: Total adaptation costs up to 2030 (own calculation, based on available INDC reports)

COUNTRY	TOTAL ADAPTATION COSTS (in billion US$)
Afghanistan	10.785
Bangladesh	40
Barbados	n/a
Bhutan*	(0.006)
Costa Rica	n/a
Ethiopia**	75
Ghana	8.3
Kenya*	38
Kiribati	0.075
Madagascar	28.713
Maldives*	(8.8)
Nepal*	(0.35)
Philippines	n/a
Rwanda*	(0.05-0.3)
Saint Lucia	n/a
Tanzania	0.65
Timor-Leste	0.021
Tuvalu*	(0.007)
Vanuatu***	0.095
Vietnam	n/a
All Countries	**201.734**

Notes:
* Data derived from NAPAs, NDCs or NATCOMs
** Ethiopia requires US$ 150 billion for mitigation and adaptation. Figure assumes 50:50 share between mitigation and adaptation
*** Vanuatu estimates adaptation costs at 9.5 million/year. Figure extrapolates costs for a ten year time period

The Kiribati Adaptation Program promotes coastal management protection measures such as mangrove re-plantation and protection of public infrastructure, strengthening laws to reduce coastal erosion, and population settlement planning to reduce personal risks.

It is important to underscore that this **estimate is only a very rough indication of the adaptation cost** and is likely an underestimation. Estimates are only as good as their sources and INDCs and NAPAs require some caution in this regard. They vary tremendously in scope and depth. These reports often focus on only a very narrow set of measures and ignore others (e.g. administrative costs of building planning capacity). One reason is that no common definition of an adaption measure exists. Moreover, it is not clear how governments calculated these cost estimations. These omissions and the lack of a common estimation method lead unavoidably to an upward or downward bias in the adaptation cost estimate.

There are, in fact, **good reasons to believe that the actual adaptation costs are much higher** than indicated in the reports submitted to the UNFCCC. INDCs and NAPAs consider, for instance, only public sector adaptation costs – costs of adaptation measures planned by public institutions – and ignore private sector adaptation costs incurring in households or businesses. Including these private costs will increase the cost estimates significantly (UNEP 2016, p. 5).[3] It also is important to point out that the figure does not indicate data for Barbados, Costa Rica, Philippines, St. Lucia and Vietnam.

As outlined above, the problem that this analysis is confronted with is that there is simply not enough empirical information to verify data and claims. Due to the poor state of knowledge, the number presented here is not robust but indicative at best. It should be seen as a basis for political discussion and should serve as a trigger for future research. In light of serious methodological problems and data gaps, comprehensive studies and data-sets are of utmost importance in order to achieve a more precise indication of adaptation costs.

[3] UNEP.2016. Adaptation Finance Gap Report. Retrieved from http://www.unepdtu.org/-/media/Sites/Uneprisoe/News%20Item%20(pdfs)/UNEP-GAP-report-2016_web-6_6_2016.ashx?la=da

IV. CONFRONTING CLIMATE RISKS

The most sustainable way to reduce climate change risks is to lower GHG emissions and mitigate climate change. However, to address the risks identified for the V20 countries in this report, measures to support adaptation are just as important. Adaptation helps countries to anticipate the adverse effects of climate change and to take action to prevent, minimize, and respond to its potential impacts. When combined with comprehensive disaster risk management, it has the potential to avoid triggering or exacerbating future climate-related risks that may even threaten peace and stability.

4.1 ADAPTATION POLICY TO ADDRESS CLIMATE RISKS

Strengthening countries' capacities to engage in climate change adaptation is key. Many face significant barriers to assessing their adaptation needs and acquiring the relevant tools, which impedes efforts to improve adaptation capacity. The international climate policy process (UNFCCC and partners) has sought to address these gaps by establishing an international adaptation architecture and emphasizing the need to integrate adaptation into development planning.

Given the compound climate-related risks affecting the V20, single-sector interventions will not suffice to minimise or prevent the impacts of climate change, which may even lead to the destabilisation of states. Of course, policies to address risks like water scarcity or food shortages are needed, but they alone will not reduce exisiting or future fragility risks. Integrating policy responses for adaptation can result in significant co-benefits for policy fields and goals. For instance, experts have shown that efforts to adapt to climate change can contribute to building peace by improving cooperation, equity, and fairness.[4] There are various critical stages when integration is necessary and these can be summarised in line with the different parts of the planning process.

4.1.1 INTEGRATED ADAPTATION PLANNING

Integrating knowledge from across adaptation, development and other sectors, including peacebuilding, and making such analysis available to decision-makers is arguably the most important step towards confronting climate risks for the V20. Starting with existing gaps in risk assessments, most policy deliberations on adaptation take place in separate political arenas, with minimal exchange between the respective fields. There are various guidelines and handbooks that provide best practices for analysing vulnerability and risk. However, there is less of a focus on standardizing assessment approaches so as to provide a sound basis for policies at all levels. Vulnerability and risks assessments should cover a broad range of sectors and topics (e.g., water, agriculture, fisheries, and ecosystems) as well as different spatial levels and time horizons.

Climate-resilient communities are more likely to be able to cope with internal and external shocks. At the same time, a country's ability to deal with enviromental hazards is greatly compromised, as long as the fragile or conflict-affected situation persists. This is still the case for some of the V20 countries. The international climate change regime provides extensive support and guidance on adaptation frameworks for developing countries. However, there is no specific guidance for adaptation planning in fragile situations where linkages to long-term peacebuilding and development strategies are required.[5] Another

[4] See Bob, Urmilla und Salomé Bronkhorst (eds.) 2014: Conflict-sensitive adaptation to climate change in Africa. Berlin: Berliner Wissenschaftsverlag.

[5] See Tänzler, Dennis and Nikolas Scherer (forthcoming): Guidelines for conflict-sensitive adaptation to climate change. Berlin/Dessau: German Environment Agency.

crucial barrier to effective adaptation planning and action is a lack of coordination, including a lack of inter-ministerial coordination in the affected countries, and a lack of robust cost-benefit assessments. Assessing the economic, environmental and social benefits of adaptation action (and costs of inaction) provides important information for the rest of the planning process. Such assessments inform planners within government about when and where to act, as well as on how to prioritize and allocate scarce financial and technological resources.

Tuvalu 2015. As part of UNDPs NAPA project this Tatao tree seedling was planted together with 270 others on the coast of Vanuatu.

4.1.2 THE RELEVANCE OF IMPROVED ADAPTATION PLANNING FOR THE V20

The National Adaptation Plan Process (NAP) can be seen as an important stepping stone on the way to addressing the abovementioned challenges. Established in 2010 as part of the Cancun Adaptation Framework, the NAP process seeks to reduce the vulnerability of developing countries, especially the LDCs and the most vulnerable groups. It identifies medium and long-term adaptation needs and strategies, including an assessment of potential co-benefits in other sectors. The UNFCCC guidelines to support the process also call for integrating adaptation into national and subnational development planning. A collection of best practices for adaptation planning published by the UNFCCC in 2014 sheds some light on promising approaches for tackling water scarcity, food insecurity, and human mobility. With regard to the latter, the International Organization for Migration (IOM), together with other organisations, provided an overview of tools and methods for adaptation planning processes that address human settlements.

This overview has shown that the V20 countries vary significantly with respect to the progress they have made to establish viable NAP processes, including the compilation of cost-benefit assessments. The V20 and their international partners joining forces to invest in stronger support structures to address gaps and shortcomings in this regard would be an important step forwards. The country profiles above identify

some entry points for action, especially for the LDCs among the V20 that have gained some experience with the NAPAs and are already in the process of implementing the first projects in the adaptation priority lists. The same holds true for the broad experience some of the countries have gained in the area of disaster risk management, and in the following we turn our attention to this field and the potential contribution climate risk insurances can play in this context.

4.2 CLIMATE RISK INSURANCES AS PART OF A COMPREHENSIVE DRM STRATEGY

Disasters caused by natural hazards and exacerbated by climate change represent one of the biggest threats to sustainable development and human safety today. In the context of a comprehensive Disaster Risk Management (DRM) strategy, governments can take **precautionary measures** to protect inhabitants and **reactive measures** to limit the impact as far as possible.

Precautionary measures refer to actions taken well in advance of extreme weather events. The goal here is to prevent a disaster from happening in the first place. Overall, if extreme weather events turn into a disaster is not a natural process but related to human activities. These **disaster risk reduction measures** address underlying vulnerabilities. They include technical solutions (e.g. coastal shore protection), natural or ecosystem-based measures (e.g. reforestation of mangrove forests, protection or promotion of wetlands), regulatory measures (e.g. improved construction standards, designation of 'high risk' zones) and knowledge tools (e.g. disaster education).

Reactive measures can be understood as actions that are taken immediately before, during and after the disaster. These **disaster response measures** refer to essential services to stabilize the condition of the affected population and infrastructure, preventing further loss of life, and act as the basis for future recovery. Measures include public information campaigns (e.g. provision of early warning systems), law and order measures (e.g. implementation of contingency or evacuation plans), humanitarian assistance (e.g. provision of food, shelter, health care), financial assistance, (e.g., climate risk insurance, cash transfer and voucher programs to support disaster-affected communities).

In principle, disaster risk reduction measures are always preferable versus disaster response measures. Disaster risk reduction measures address underlying vulnerabilities, that is, the drivers of disaster. Disaster response measures, by contrast, 'only' help to cope with the disaster. Investing in disaster risk reduction is also more cost-effective. However, in practice the boundaries between disaster risk reduction and disaster response measures are not as clear-cut. Ideally, these measures are integrated into a comprehensive institutional framework, that is, a comprehensive DRM strategy.

4.2.1 CLIMATE RISK INSURANCE

One instrument that has recently gained increasing popularity as risk management approach is climate risk insurance. On reason is that climate risk insurance functions somewhat as disaster risk reduction and disaster response instruments.[6] On a more general level climate risk insurance is a financial instrument that supports governments or individuals in responding to natural disasters. In exchange for an annual premium, insurance policyholders receive a payout in the case of a **major** catastrophe. But they also receive other benefits: insurers also help (potentially) affected states and societies to anticipate and act on climate hazards through early warnings and action.

[6] See Nikolas Scherer. 2017. Insuring Against Climate Change: The Global Career of Regional Index Insurance Instruments. PhD Thesis submitted to the Hertie School of Governance: Berlin.

Training women farmers on climate-smart innovations in Nyando Kenya.

Climate risk insurance can be distinguished into direct or indirect climate risk insurance. The direct-indirect distinction refers to the buyer of the insurance contract. In direct schemes it is an individual who buys insurance coverage, in indirect schemes it is the state itself that buys insurance protection:

- **Direct climate risk insurance** (micro-insurance schemes): Policyholders are individuals, such as farmers. These policies are often sold at the local level through microfinance institutions, farmers' cooperatives, banks, NGOs and local insurance companies.

- **Indirect climate risk insurance** (macro-insurance schemes): Policyholders are governments. These policies are often sold at the regional level through regional risk pools (CCRIF, ARC, PCRAFI). Payouts can be used to finance disaster response program. Individuals can be beneficiaries of these programs.

Most climate risk insurance is index-based. That means, the payout is **not** informed by ex-post loss assessments as in "traditional" indemnity-based insurance schemes. Instead, a payout depends on the performance of an index or model. The performance of this index or model is based on specific meteorological variables (such as the wind-speed or the amount of rain during a certain time period) derived from weather stations and satellites and functions as a proxy for the actual loss. If the index falls above or below a pre-specified threshold a payout is due – irrespective of whether the model's estimation was accurate or not.

This has certain advantages and disadvantages: On the positive side, index-based insurance allows for quicker payout and reduces operational costs, which translates into lower premiums. Why? The insurance company does not have to send a loss adjuster to check and verify claims. On the negative side, the payout may not match the actual losses on the ground. Why? As highlighted above, the insurance pays out on the basis of a model. If the model or underlying data is inaccurate it may come to a situation where the payout does not match the situation on the ground.

4.2.2 THE POTENTIAL RELEVANCE FOR THE V20

As outlined in this report, seven V20 countries purchased indirect climate risk insurance coverage (as of April 2018). Since November 2017 the **InsuResilience Global Partnership on Risk Financing and Insurance Solutions** has facilitated the expansion of climate risk insurance across the V20. This development can be helpful for the following reasons:

- **Climate risk insurance quickly provides countries with needed-cash in case of a major disaster.** For example, countries from the Caribbean or the Pacific receive a payout from CCRIF and PCRAFI within 14 days of a disaster. African countries may receive a payout even **before** the disaster strikes. The African Risk Capacity (ARC) pays out on the basis of a drought forecasts.

- **Climate risk insurance empowers countries to act faster. They make countries less dependent on the volatilities of international aid.** Low income countries often lack the financial resources to budget appropriately for disasters. As a consequence, funds for rebuilding and other efforts to lessen the impact of these disasters are largely mobilised on an ad-hoc basis by re-allocating budgets. In some cases, countries are totally dependent on the generosity of the international community. This search for funding in the aftermath of a disaster often places additional strain on administrative forces and leads to subsequent delays in public relief and recovery efforts. Meanwhile, lives are lost, infrastructure remains unrepaired, and development gains are reversed.[7] Climate risk insurance helps to address these problems. Through purchasing insurance, a country buys "a right" to get access to finance. These payouts support countries in financing early emergency and relief measures such as the clearance of debris, the provision of shelter, cash transfers, and food assistance.

Yet, despite these positive aspects, climate risk insurance has certain limitations:

- **Climate risk insurance provides states only with a very basic protection.** The payouts are, in fact, very limited as payouts are typically capped at a certain level. So far, the largest payout involved around US$ 26 million. Given the massive post-disaster bill after a large disaster, such an amount arguably reflects a drop in the ocean. In other words: Climate risk insurance is not designed to finance the large-scale recovery processes. Instead, it is designed to finance immediate disaster response measures. Full catastrophe insurance that covers all disaster-related costs would make climate risk insurance prohibitively expensive. It would translate into exorbitant annual premiums. Hence, it is important to keep in mind the limited role climate insurance can play in addressing disasters.

- **A good payout is of limited use without a good plan for its usage.** The problem is that not all climate risk insurance is linked to such disbursement plans. In contrast to ARC, CCRIF and PCRAFI do not demand that countries set out guiding principles or rules for how the payout will be used. These risk pools embrace a laissez-faire philosophy. While this may have its merits, international experience from the fields of disaster management indicates that it is not so much finance per se but early, quick and coordinated action that saves lives and livelihoods. This requires ex-ante planning. The post-disaster process is usually too politicized, leading to delays and poor decisions. In other words, a disbursement plan stating who will do what when and how with an insurance payout is of crucial importance to ensure effective disaster response measures. Ideally, this disbursement plan is embedded in comprehensive DRM strategy.

[7] See Nikolas Scherer. 2017. How to Advance Regional Climate Risk Insurances. Berlin: adelphi.

V. CONCLUSIONS

The V20 members represent a broad cross-section of countries in terms of size, geographical location, poverty and economic development. They also include states that international fragility risk indexes categorise as being on "high alert" (Afghanistan, Tanzania) and "alert" (Bangladesh, Ethiopia, Kenya, Nepal, Rwanda, Timor Leste). These countries therefore deserve particular attention when considering the potential impact of climate change risks and how to deal with them.

A cross-country analysis of the main climate risks V20 countries are facing reveals that three climate risks stand out: extreme weather events and disasters, sea-level rise and costal degradation, and livelihood insecurity and migration. These risks may jeopardize the socio-economic development and relative stability of the V20.

This compendium does not claim to be a comprehensive risk analysis for all V20 countries; rather it offers some guidance as to how the key climate risks identified by each country in their main climate policies can also play a role in potentially endangering peace and stability.

Based on the most reliable data available on V20 adaptation costs, we estimate that for almost half of the V20 countries, the annual average adaptation costs up until 2030 add up to around US$ 15 billion. However, actual adaptation costs are like to be much higher than indicated in the reports submitted by the governments to the UNFCCC.

At the same time, the overview of the V20 countries' ongoing adaptation governance efforts reveals that areas like adaptation planning, cost-benefit assessments for climate change adaptation and the use of innovative instruments such as risk insurance deserve more attention by the V20 and international partners alike.

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