Analysis 86

STUDY

Limiting Global Warming to 1.5°C

The Climate Risks and Irreversible Losses We Must Avoid

World Council of Churches
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Content

Preface

Dear Readers,

The recent Special Report on Global Warming of 1.5°C by the Intergovernmental Panel on Climate Change (IPCC) confirms what many of our partner organizations and members in the Global South have been saying all along: climate change, its related hazards including extreme weather events and slow onset events pose a major threat to the existence of the poor and vulnerable communities. Every tenth of a degree Celsius temperature rise matters to them and has profound impact on their lives and livelihoods.

This publication highlights the importance of limiting global warming at 1.5°C degrees instead of 2°C degrees. It outlines that the world cannot afford to lose time, but rather pursue all sustainable and human rights-based efforts to stay at 1.5°C degree. In addition, this publication highlights the day to day challenges and vulnerabilities that communities and partners in the Global South face in the wake of climate change.

As the world's top climate change scientists issue another wake-up call in the IPCC Special Report Global Warming of 1.5°C, we reiterate our call for fast and coordinated action to combat climate change and its impacts.

As faith-based organizations we are very concerned that marginalized, vulnerable, and poor people are affected by climate change impacts that are increasingly exposing them to emergencies and humanitarian crises. If we fail to address climate change and to increase the efforts to protect the affected communities now, we will bear the incalculable risks to future generations. In other words, if we significantly increase our ambition and efforts towards the protection of the poorest and most vulnerable to climate change, we will be taking steps towards ensuring that the rest of the world and the future generations are protected.

The publication discusses the various vulnerability aspects of climate change and the significant differences between 1.5°C and 2°C of global warming, and the resultant impacts on sustainable development as elaborated in the Agenda 2030 and the Sustainable Development Goals (SDGs).

The conclusion is that every tenth of a degree matters. With recommendations presented in this publication, we hope to give guidance to policy makers to ensure that no one will be left behind in the climate crises. The publication concludes with the urgency for ambitious climate action, without which the situation will only deteriorate.

Limiting global warming to 1.5°C is a humanitarian and ethical imperative, and we affirm that financially, technologically and politically sound solutions are possible.

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Executive Summary

The world is at crossroads. Awareness is growing rapidly that overshooting the aspirational goal of the Paris Agreement (PA) to limit global warming to 1.5°C would severely jeopardise the achievement of the SDGs, making the poor poorer, and causing increasing inequalities, conflicts and humanitarian catastrophes.

Climate action and sustainable development are inseparable. The IPCC Special Report **Global Warming of 1.5°C** (SR15) was the first to systematically examine the links between different scenarios of global warming and sustainable development. It was the first to identify climate risks that can only be avoided by ambitious climate action, and the tremendous socio-economic opportunities – or co-benefits of sustainable development – that can be realised by taking ambitious climate action. The IPCC also discusses possible trade-offs between mitigation and adaptation on the one hand, and SDGs on the other. Minimising these trade-offs requires knowledge gaps to be closed, particularly with regard to the footprint associated with land-use change caused by following 1.5°C-consistent pathways. Finally, in the report the IPCC stresses the importance of design triple-win solutions based on mitigation, adaptation and sustainable development.

Our report summarises the main facts and trends identified by the IPCC's special report and other leading scientific literature. We focus on showing the key risks and the possible differences between a 1.5°C and a 2°C world. Moreover, we show where these differences would be felt the most, and how they may have an impact on the achievement of the SDGs and human rights, and translate into humanitarian challenges and concerns for justice. We identify Small Island Developing States (SIDS), Least Developed Countries (LDCs), South Asia, Southern Africa, the Horn of Africa, the Mediterranean, the Middle East, Central America and Northeast Brazil as hot spots. Agriculture, water, health, (coastal) communities and cities, and tropical marine (coral) ecosystems are the areas most at risk if average global temperatures rise above 1.5°C.

We tell the stories of vulnerable communities in the low-lying island state of Tuvalu and drought-prone Ethiopia, and describe what they do and what they need if they are not to be left behind.

We discuss policy options for 1.5°C-consistent pathways in the context of sustainable development, cover mitigation and transformational adaptation, and address climate-induced loss and damage and humanitarian responses. We compare these benchmarks with the policies promoted by the Climate Vulnerable Forum (CVF) and the German government and consider the CVF's vision as the most mature political pledge for climate and sustainable development action in the context of limiting warming to 1.5°C. In contrast, the policies drawn up by the German government are at a crossroads: although they are currently lacking, by implementing the ten measures that we propose, the government still has the ability to ensure its policy conforms to 1.5°C-consistent pathways.

Placing the world on a 1.5°C pathway is possible. If it is done the right way, such a world would be characterised by sustainable and equitable societies that operate within planetary boundaries.

Nevertheless, this would require precaution and multilateral cooperation, the closure of knowledge gaps and building in-country capacities, equities and climate justice, the triple win of mitigation, adaptation and sustainable development, de-coupling economic growth from GHG (greenhouse gas) emissions, wide-ranging and fast emissions reductions, minimising the land-use footprint of climate-related action, shifting investments, transformational adaptation, and fair climate risk financing and transfer.

Introduction

Despite the commonly agreed goal of the Paris Agreement to keep global warming at 1.5°C, the world is still 'off-track'. If the current annual level of emissions is not cut down fast and steeply, the remaining carbon budget (i.e. the level of carbon dioxide emissions that can still be emitted without causing the climate to pass this temperature goal) will have already been used up by 2030. The Global Warming of 1.5°C Special Report, which is published by the IPCC, therefore, is very clear about the scientifically proven fact that governments from across the world must significantly increase their level of ambition with regard to the Nationally Determined Contributions (NDCs) now. This is the only way of preventing the 1.5°C climate threshold from being passed well before mid-century.

It is important to understand that even a 1.5°C world comes with high risks and severe losses for people and nature, as the IPCC SR15 shows. But a temperature increase that goes beyond this threshold would unjustifiably increase the risk of huge and partly irreversible impacts. These include a potential climate catastrophe for the world's coral reefs which are home to at least a quarter of the world's maritime biodiversity. The IPCC argues that these species would very likely be doomed to extinction in a 2°C world. This could endanger the livelihoods of hundreds of thousands of people living along tropical coastlines (such as people whose lives depend on fishing), and communities living on atolls would be less protected against sea surges once the coral reefs have been wiped out. However, humanity will suffer many more severe consequences from heatwaves and erratic rainfall to storms, floods and droughts, but also to sea level rise and biodiversity loss. This would put large populations, particularly in SIDS and the LDCs, at risk of being left behind in terms of development, and make it far less likely that the SDGs could be reached.

This is not the future that we want. Therefore, we call on all countries, especially on the countries that are largely responsible for past, current and future emissions, to fulfil their responsibilities and ratchet up their NDCs now, while providing support to poor and vulnerable states that are overly burdened by the problems caused by climate change.

Based on the evidence provided by the IPCC SR15, and the body of current scientific knowledge and evidence, we view 1.5°C-coherent emission pathways for all countries as imperative to justice, humanitarianism and sustainable development.

Fortunately, the future is still unwritten, and we can stop temperatures rising above 1.5°C, increase resilience, achieve the SDGs, and the goals of the Sendai Framework for Disaster Risk Reduction (SFDRR). The world can become a better, more equal place with fewer conflicts. However, if this is to happen, countries and non-state actors must prepare their NDCs and climate action plans, and this includes adaptation and disaster risk reduction planning, using scientific knowledge. Moreover, they need to fully recognise the precautionary principle, and remain driven by ethics and empathy. Only then, will it be possible to develop a more enabling environment for transformational, pro-active and ambitious climate and sustainable development policies that foster transformational economic and behavioural change, solidarity and justice.

The main achievement of the IPCC Special Report Global Warming of 1.5°C lies in the fact that it provides a scientific knowledge base that can be used by all state and non-state actors to better understand the possible consequences and risks of a 1.5°C global warming scenario compared to a 2°C scenario for eco-systems, sustainable development, the fulfilment of human rights, and the protection of vulnerable populations against climate-induced economic and non-economic loss and damage. In addition, increased awareness of climate risks should provide guidance with which to foster climate action aimed at closing the large emission gap and avoid overshooting the 1.5°C temperature goal. On the other hand, a solid knowledge base should also contribute towards strengthening climate resilience by ensuring that measures are taken that help close the protection gap.

Our report contributes to raising awareness and encouraging climate action by

- Providing compiled, up-to-date scientific research about the challenges that a global temperature increase of 1.5°C or above poses for sustainable development and the fulfilment of the human rights of vulnerable communities in climate change hot spots.
- Creating a more comprehensive and empathic understanding of the humanitarian and development-related challenges of a 1.5°C temperature increase compared to those of a 2°C scenario in terms of increasing climate variability and environmental stress, triggering conflicts, and causing poverty, marginalisation and forced migration. This is done using Talanoa-inspired

The arid Sahel region is affected by extreme weather caused by climate change. To minimise risks and more losses due to climate change, global warming has to be limited at 1.5°C.

storytelling from Tuvalu in the South Pacific and the African Sahel zone.

- Showing how sea level rise and storm surges in one region (Tuvalu), and drought and the acceleration of irregular weather patterns in other regions (Ethiopia) are already affecting people on the frontlines of climate change, how they are attempting to deal with the future humanitarian and development-related risks associated with a 1.5°C and 2°C scenario, and which action should be taken.
- Discussing current climate, humanitarian and development policy responses and proposals of selected policy actors in view of the challenges described; successful resilience building requires much more than just technical solutions but ensuring that fundamental attributes of a system are adapted in response to climate change and its effects. This includes addressing the root causes of vulnerability, in other words, social exclusion, inequality, gender discrimination, injustice, a lack of relevant capacities, and participation.
- Providing policy recommendations that are particularly focused on industrialised countries, and the EU and Germany in particular.

This report was written between June and October 2018 by a collective of climate experts and development practitioners from Africa, Europe and Oceania. It takes stock of available scientific literature, including the IPCC Special Report Global Warming of 1.5°C, and practical experience from the ground. It relates scientific facts and experiences to the challenges, goals and principles of humanitarianism, human rights and sustainable development and do so in a clear and understandable manner. The aim is to document the lessons that need to be learned for climate action and development planning at the international, national and local level.

Our report starts with a global overview that mainly takes stock of findings from the IPCC Special Report **Global Warming of 1.5°C**. The second chapter further elaborates the specific challenges facing the African drought corridor south of the Sahara, and of the low-lying small island developing state of Tuvalu in the South Pacific. The third chapter discusses the resulting policy challenges and ways in which the wide climate protection gap could be closed before comparing the 1.5°C and 2°C scenarios. It concludes with a set of policy recommendations.

Part 1

A comparison of the projected climate change and hazards associated with a 1.5°C or 2°C scenario.

This chapter briefly presents key findings from the IPCC's special report **Global Warming of 1.5°C** and other scientific studies that the IPCC either refers to or that were made available in 2018, thus too late to be considered by the IPCC. Although there are many knowledge gaps and difficulties in comparing the impacts of 1.5°C and 2°C scenario, preliminary findings demonstrate the urgency of employing the precautionary principle and thereby scaling up the mitigation and adaptation measures drawn up as part of the current NDCs. This is essential to minimise the adverse impacts on SDGs, and to limit displacement and conflicts over scarce resources such as food and water.

Heat and heatwaves

Maximum temperatures are increasing faster than mean temperatures. Since the 1970s, accelerating temperature anomalies with more warm extremes have been identified throughout the world. In other words, the world is seeing more and more increasingly hotter days that last for longer periods of time. This highly significant statistical trend is projected to become much durable with 1.5°C temperature increase, and massively so in a 2°C scenario. Moreover, overshooting the 2°C threshold would be extremely dangerous. The highest absolute increase in maximum temperatures is projected for regions with stronger soil-moisture-temperature coupling, such as **Central and Eastern North America, Central and Southern Europe,** the **Mediterranean, Western and Central Asia** and **Southern Africa**. When 1.5°C and 2°C scenarios are compared, **Central America, Venezuela, Madagascar, South Asia, Indonesia** and **Papua New Guinea** are projected to see the highest incremental increase in the number of hot days.

In a 1.5°C scenario, vulnerable and disadvantaged populations living in **megacities** are predicted to be particularly at risk from deadly heatwaves: these populations are expected to a see a substantial increase in the frequency of heatwaves compared to present-day levels. Moreover, twice as many megacities as today are expected to be affected by this problem, which means an additional 350 million inhabitants could be exposed to heat stress. A 2°C temperature rise is linked to even stronger effects, with 15 % to 20 % increased heatwave-related mortality than at 1.5°C in Europe, and cities like **Karachi/Pakistan** and **Kolkata/India** suffering annually from deadly heatwaves similar in scale to that of 2015 (IPCC 2018a, Chapter 3.3).

Drought and dryness

Dry spells with critical levels of water scarcity have also increased over the last few decades, but these have been more widely dispersed than temperature increases. Currently, the trend is particularly detectable in the Mediterranean region. Drought is projected to accelerate with any additional temperature increased, particularly in regions that are already affected by drought. Limiting global warming to 1.5°C is likely to significantly reduce the probability of extreme droughts compared to a 2°C scenario. The regions with the strongest increased risk of drought are the **Mediterranean** and **North Africa,** the **Middle East, North-eastern Brazil,** and **Southern Africa**. Extreme water scarcity – as experienced in Southern Africa in 2018 – conflicts over water, and massive losses to agriculture and livestock could become the norm. This situation would also cause food insecurity as a regular impact, not merely be limited to these regions. Alongside marginalised rural populations, people depending on forests for their livelihoods would also be particularly affected, since forests will certainly also suffer from the lack of water (IPCC 2018a, Chapter 3.3.4).

Precipitation

Over the last few decades, precipitation anomalies have been subject to great regional and even sub-regional variations. Future trends in precipitation, therefore, are harder to predict using climate models. **Heavy rainfall events** are clearly rising in high latitudes, particularly Northern Europe, and this is especially the case in winter. Trends in other regions are less clear. Nevertheless, there seems to be a general tendency towards wet regions becoming wetter and drier regions drier. Climate modelling suggests that higher altitudes (e.g. the **Tibetan Plateau**), **East Asia** (China and Japan) and **South Asia** will also see a significant increase in heavy rainfall in a 1.5°C (or higher) scenario, with South Asia facing the largest difference between a 1.5°C and 2°C temperature increase.

People living close to rivers in Shyamnagar area, Bangladesh, experience climate change already massively. Fields and fresh water pools are flooded regularly.

As rain-fed agriculture is the predominant agricultural system in most parts of Africa and Asia, the predicted acceleration in the **irregularity of rainfall,** as for instance in monsoon regions, is particularly worrying. It would also lead to an increasingly unpredictable shift in the seasons, and make it more difficult to know when to start planting seasonal crops (IPCC 2018a, Chapter 3.3.3; Schleussner et al. 2017).

Fluvial flooding

More heavy rainfall implies greater risks of flooding at the regional and local level. Adapting land-use and river morphology can also contribute to river flooding (due to faster runoff). A temperature increase of 1.5°C or above is predicted to increase the **frequency of floods** in **Southeast Asia, India** and **East Africa**. A high increase in the frequency and magnitude of flooding, which significantly exceeds present-day flood risks, is predicted for the Ganges-Brahmaputra-Meghna basin in **Bangladesh**. Most of **Southern Europe** also constitutes a further hot spot for increased river flooding. Ultimately, flood risks are projected to become much stronger in any scenario that overshoots the 1.5°C threshold (IPCC 2018a, Chapter 3.3.5).

Tropical storms and cyclones

Over the last few decades, very intense cyclones (category 4 or higher) have increased in number, while the overall number of tropical storms seems to be decreasing globally. This trend of fewer **but more intense tropical storms and cyclones** is predicted to continue in a 1.5°C scenario. There is uncertainty about the differences compared to a 2°C scenario, but any differences seem to be relatively small (IPCC 2018a, Chapter 3.3.6). However, another significant trend over the past few decades, and which is expected to continue with higher levels of global warming, is the poleward migration of tropical cyclones. Thus, tropical cyclone exposure is expected to slightly decrease in the **Philippines, Vietnam** and **southern China,** but to increase in **Japan, Korea** and **eastern China** (Lucas et al. 2014).

Sea level rise

Since the early 20th century, sea levels have risen on average by 20 cm globally, but with regional variations, and extremes being associated with storm surges. The main drivers are thermal water expansion due to higher ocean temperatures, and the melting of glaciers and ice sheets.

There is a lot of uncertainty regarding future sea level rise, as, for instance, the risks associated with an eventual collapse of parts of the Antarctic ice sheet are difficult to calculate. As such, the total additional average **sea level rise** by the end of this century as compared with the baseline year 2000 could vary between 26 cm and more than one meter. Only minimal differences in sea level rise were identified for a 1.5°C and a 2°C scenario by mid-century, but are still projected to increase by 10 cm by 2100, and to continue to increase over the next century and the distant future (IPCC 2018a, Chapter 3.3.9). In the year 2150, approximately five million fewer people would be directly affected by flooding due to sea level rise in a 1.5°C scenario (as compared to a 2°C scenario), including 40,000 people living in SIDS (Rasmussen et al. 2017).

Coastlines and islands are affected differently by sea level rise due to the regional changes in the Earth's gravitational field, to ocean streams caused by regional differences in (geological) tectonic plate movements, with some places seeing almost 10 times faster sea level rise than others (IPCC 2018a, Chapter 3.4.4).

The district Legambo in Ethiopia is suffering from soil erosion due to unregular rain patterns.

As the **frequency of storm surges** is associated with sea level rise, it will also increase: in a 2°C scenario, some places will face at least a quadrupling of the type of floods that currently occur every 100 years, whereas limiting global warming to 1.5°C could mean that these events 'merely' double in frequency (Kopp et al. 2014).

Oceans

Since 1950, the upper layer of the oceans has been **warming** at a rate of between 0.05°C and 0.1°C per decade; sea ice has been retreating rapidly, and oceans, as the largest natural carbon dioxide sinks, have become more **acid**, due to the huge deposits of anthropogenic CO2. These significant changes to the physical and chemical characteristics of the ocean, which are projected to accelerate with each additional level of global warming, will potentially have a huge impact on marine ecosystems; in general, these are highly complex, and barely understood. The biogeographical ranges of many species are expected to move poleward, whereas the biodiversity of tropical oceans, particularly in coastal areas, is expected to decrease. **Coral reefs,** which are home to at least 25% of all marine species, have already faced mass-mortality events, and are projected to suffer from mass extinction. In a world that is just 1.5°C warmer, between 70% and 95% of all coral reefs are projected to die; a 2°C scenario would almost lead to the total extinction of these species (99%), and with them, thousands of others that use corals at least once in their lifecycle (IPCC 2018a, Chapter 3.4.4). This catastrophe will be worsened by the negative impact that multiple climate-induced changes will have on seaweed and seagrasses. This will disrupt ocean food webs and cause a projected decline in **fish stocks** of 3% per 1°C temperature increase. Clearly, this comes with high risks for our own food security as three billion people – including a disproportionally high proportion of poor people – depend on fish for 20% of their protein intake, as well as for the livelihoods of hundreds of thousands of people in the coastal areas of tropical countries who rely on fishing for their livelihoods (IPCC 2018a, Chapter 3.4.5 and Chapter 3.4.6).

Biomes, forests and peatlands

Latitudinal and elevational shifts of **biomes** are predicted to lead to loss in biodiversity. Limiting global warming to 1.5°C could reduce biome shift significantly compared to a 2°C world, especially in the **Arctic, Tibet,** the **Himalayas, South Africa** and **Australia** (IPCC 2018a, Chapter 3.4.3.1).

Higher temperatures, increasing dry spells, forest fires, storms and pests negatively affect **forests** leading to a reduction in their capacity to act as carbon sinks. While there is still high uncertainty regarding the future development of terrestrial carbon sinks under different scenarios, there is increasing evidence that the **Amazon rainforest** and forests in **Central America** will come close to their climate threshold if warming exceeds 1.5°C or 2°C (IPCC 2018a, Chapter 3.4.3.5).

Peatlands cover only 3% of the land surface but hold one-third of the world's soil-based carbon. In the **Congo** and **Amazon** basins peatlands store an equivalent level of carbon to forests. Peatlands are particularly vulnerable to lower levels of precipitation and land-use changes, which are also projected to accelerate with additional levels of warming (IPCC 2018a, Chapter 3.4.3.5).

Permafrost and glaciers

The **High Arctic** has been the hot spot of global warming during recent decades, and the above-average warming that has been recorded there is going to continue. High mountain areas such as in **Northern Europe,** the **Himalayas**, or the **Southern Andes** are also suffering massively from glacier melting and a reduction of **near-surface permafrost,** which leads to more rock falls and landslides. The permafrost is expected to thaw less in a 1.5°C scenario compared to 2°C, leading to significantly lower ecological and socio-economic risks. Reduced **glacier and snow melt** would also improve water availability (IPCC 2018a, Chapter 3.4.3.5).

Freshwater

Water security is being increasingly threatened due to substantial population growth, increasing living standards, agricultural and industrial activities, and, of course, climate change. 3.8 billion people, which is more than half of the world's population, suffer from water scarcity. Exposure to water scarcity is projected to increase with further warming above present-day levels, but could affect between 184 and 270 million fewer people at 1.5°C compared to a 2°C world. SIDS, particularly in the **Caribbean**, would face 25% less water stress at 1.5°C. **Southern Africa** and the **Mediterranean** are other hot spots of increasing water stress, which would also be extremely affected in a 2°C scenario (IPCC 2018a, Chapter 3.4.2).

Agriculture

Food production systems are highly dependent on many interacting impact factors, with climate change being one of them. In view of this complexity, it is difficult to quantify the impact of climate change on food production. However, changes in climate parameters have already negatively affected crop suitability and crop yield in many areas, particularly in subtropical and tropical developing countries. In terms of the main staple foods, maize and wheat yield has yet to be affected as negatively as rice and soybean. Altogether, climate change is responsible for more than 60% of yield variability in the main global breadbaskets, with tropical agriculture being more vulnerable to higher temperatures. A 1.5°C scenario is projected to reduce the present Sub-Saharan maize cropping areas by 40%, and impact negatively on the suitability of the western Sahel and southern Africa for sorghum. However, risks of tropical crop yield decline would by significantly higher in a 2°C scenario, affecting **South** and **Southeast Asia, Central** and Southern America, and **West, East** and **Southern Africa**. A 2°C warming by 2040 could reduce per capita crop production in Southeast Asia, for instance, by one third, which would pose a massive risk to **food security** (IPCC 2018a, Chapter 3.4.6.1 and Cross-Chapter Box 6).

Livestock in developing countries is affected negatively by climate change: heat stress, lack of water, more diseases, and less available forage and feed have already had a negative impact on livestock quality and quantity, and are projected to do so at increasing rates with higher levels of warming (IPCC 2018a, Chapter 3.4.6.2).

Fisheries and aquaculture provide 88.6 and 59.8 million tons of fish and seafood respectively annually, and therefore contributes to human protein intake; these stocks face increasing risk due to higher temperatures and acidification, storms and sea level rise. These factors are projected to provide a moderate risk in a 1.5°C scenario, but a high risk at 2°C. **Tropical small-scale fisheries** that provide food for millions of coastal peoples will be disproportionally affected, as today's climate is already linked to moderate climate change-induced risks, and the risk is expected to reach very high levels in a 1.5°C scenario. Moreover, although fish catch in mid and high latitudes could moderately increase, global fish catch is expected to decrease by three million metric tons per year if temperatures increase by 1.5°C (IPCC 2018a, Chapter 3.4.6.3).

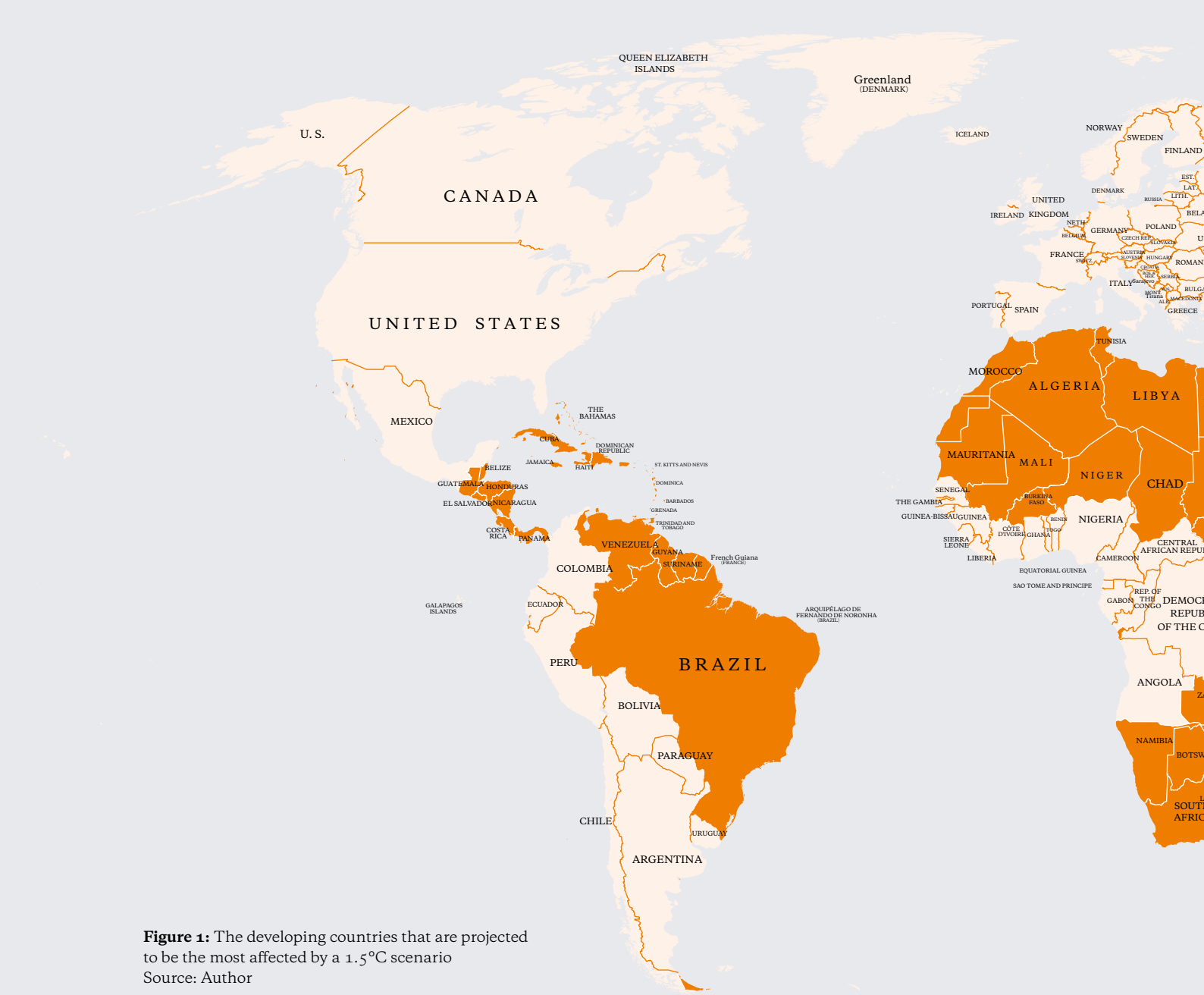

Figure 1: The developing countries that are projected to be the most affected by a 1.5°C scenario
Source: Author

Human Health

Vulnerable people (e.g. children, pregnant women, elderly people and malnourished people) are disproportionally affected by health problems caused by climate change, and this trend will accelerate in the future. **Heat waves** will cause higher mortality rates, and **vector-born tropical diseases** like malaria, dengue, chikungunya, Zika virus, yellow fever and West Nile virus are projected to spread further, both in terms of altitude and latitude. However, a 1.5°C temperature increase would cause lower temperature-related mortality rates and less temperature-driven latitudinal and elevational migration of tropical diseases compared to a 2°C scenario (IPCC 2018a, Chapter 3.4.7).

Global multi-sector risks

The IPCC SR15 provides strong arguments why 1.5°C should be taken very seriously as a climate threshold or as a tipping point that could result in abrupt climate change. Moreover, it could cause irreversible climate change: a 1.5°C temperature rise is very likely to be the tipping point for the decimation – if not global extinction – of corals, and thus a tremendous trigger for huge **marine biodiversity loss**.

Furthermore, the world might be approaching a climate crossroads that would have a huge impact on the entire Earth system: according to a study by Steffen et al. (2018), any further level of temperature increase bears the risk of crossing a climate threshold that could prevent stabilisation of the climate (even if future anthropogenic GHG emissions were to be reduced to zero). Moreover, it could cause continuous warming and place the planet on a **'hothouse Earth'** pathway resulting in self-enforcing geophysical feedback loops and, therefore, much higher temperatures for millennia. This would cause serious disruptions to global ecosystems, societies and economies.

An example of a self-enforcing feedback mechanism is the blockade of changing weather conditions for weeks or months that could occur due to a persistent atmospheric circulation called a high amplitude planetary

wave. Effectively, this wave blocks the usual planetary circulation in the mid- and high troposphere of the middle and sub-polar latitudes of the northern hemisphere, and may have caused the long dry spell and heat waves that occurred in summer 2018 in parts of Europe, Russia and the US (Coumou et al. 2018). This new phenomenon seems to result from the massive warming in the Arctic, and, if the temperatures keep rising, it may become a new climate norm in the future.

Hot-spots of climate change in developing countries

According to the IPCC's 1.5°C special report, **Africa** and **Asia** are projected to face between 85 and 95% of the global risk exposure and account for between 91 and 98% of the globally exposed population, with approximately half located in **South Asia** (IPCC 2018a, Chapter 3.4.11). Hot spots of climate change in developing countries in either a 1.5°C or 2°C scenario are projected to include **South Asia** (especially India, Pakistan and Bangladesh), **Sub-Saharan Africa** (particularly southern Africa, the Sahel and East Africa), the **Mediterranean** region (particularly Northern Africa and the Levant), the **Arab Peninsula, Central America, northeastern Brazil,** and **SIDS**.

Thus, the regions most affected by climate change are already hot spots of hunger and poverty, include most LDCs, the majority of the extreme poor, and hundreds of millions of people who already go hungry every day. As such, even a 1.5°C scenario will put a huge extra burden on governments in these regions and make it far more difficult to achieve the SDGs; if the forecasts of the IPCC are correct, a 2°C scenario would very likely result in at least tens of millions of people being left behind (IPCC 2018a, Chapter 3 and Chapter 5). This will not only lead to human rights violations, humanitarian disasters and conflicts, but also to far greater needs for development assistance and humanitarian aid. Therefore, we must implement the precautionary principle and do everything

possible to prevent average global temperatures from rising more than 1.5°C above current averages, and to prepare as much as we can in order to understand, minimise and address the adverse and (even in a 1.5°C scenario, the) unavoidable impacts of climate change on sustainable development. What these and other vulnerable countries have in common, and this also applies to other LDCs and lower middle-income countries in **Africa, Asia,** and the entire **SIDS** group, is that a majority of their poor rural populations are highly dependent on natural resources, agriculture, fisheries, forests, and traditional knowledge for their livelihoods. If we are to minimise the negative impacts of a 1.5°C world on the achievement of the SDGs, massive investment is desperately needed in building the resilience of these groups and to avoid that the negative effects that land-use changes could have on these people in the context of GHG mitigation.

Small Island Developing States are the countries most endangered by climate change; in some cases, such as with Tuvalu, their very existence as nation states is even under threat (see Part 2 of this report).

In a 1.5°C world, the SIDS are projected to suffer from multiple climate risks with very severe impacts that will be extremely hard to deal with, given a high climate risk exposure and high socio-economic vulnerability. If the 1.5°C mark is permanently overshot, and the world see a 2°C or even higher average temperature increase, many of these risks, such as sea level rise, storm surges and the total extinction of corals, could become unmanageable, at least for the low-lying island states such as **Kiribati**, the **Maldives**, the **Marshall Islands** and **Tuvalu**, as well as numerous atolls belonging to other countries. The main projected impacts and risks can be summarised as follows (see also IPCC 2018a, Chapter 3 and Box 3.5):

- Ocean warming and **coral bleaching**, leading to a loss of marine ecosystems (particularly coral reefs), increased coastal erosion, and severe damage to fish stocks and coastal livelihoods, particularly in the tropics. 1.5°C is considered a tipping point for the survival of coral reefs, and the people whose livelihoods depend upon them.
- **Sea level rise** (which will be highest in the low- and mid-latitude **Pacific Ocean** and **Indian Ocean**), more intense **cyclones**, and higher **storm surges** are projected to damage ecosystems, coastal settlements and coastal infrastructure. In Pacific island states, 57% of all buildings are located less than 500m from the shore.
- Changing **rainfall** patterns, more frequent **droughts** (in particular in the **Caribbean**), and more extreme **El Niño** (see Glossary) events (projected to double in terms of strengths, threatening **Pacific** and **Caribbean SIDS**) will not only severely increase the risk of coastal flooding, but also lead to freshwater stress and damage agriculture. These risks are significantly lower at 1.5°C.
- **Saltwater intrusion** is projected to further deepen freshwater scarcity in low-lying island states. This will also harm agriculture and ecosystems on land, including ecosystem services.

This cascade of events will mean that SIDS are likely to undergo very difficult times, and this may be accompanied by economic instability and social unrest. A 1.5°C scenario would not prevent additional loss and damage from happening, but it would significantly reduce at least some of the risks, including the risk of coastal flooding by between 20% and 80% (Rasmussen et al. 2017).

South Asia and **Southeast Asia** are projected to be especially affected by more **erratic rainfall** and **river flooding, cyclones** along the coasts, dryness and **drought** in the north, and heat waves that will be particularly hit the megacities. Impacts will be higher beyond 1.5°C, with a specific risk of a stronger reduction in growth in terms of GDP per capita above 1.5°C (Petris et al. 2017) and increasing economic losses at an above-1.5°C pathway starting in the 2040s (Hsiang et al. 2017). For most of the regions affected, river flooding is projected to be between 50% and 70% lower at 1.5°C compared to a 2°C scenario, but still at least 10% higher than current levels.

North eastern parts of **Brazil, Central America** and **Mexico** are also projected to benefit disproportionally from ensuring that average temperature increases do not surpass the 1.5°C mark: further global warming would lead to increasing losses to per capita growth (Petris et al. 2017), mainly due to the impacts of heat, drought and heavy rainfall, which would lead to declining crop yields, particularly for wheat and maize (Sultan and Gaetani 2016).

Similar risks, but with worse effects, are projected to occur in the **Mediterranean, Southern** and **East Africa**, and especially the **Sahel** region, where agriculture is projected to suffer the most, particularly due to **drought**, dryness and **heat**: However, a 1.5°C scenario is associated with significantly lower risks of food shortage and malnutrition than a 2°C scenario (ibid.). Globally, 114 million people are projected to be exposed to extreme droughts in a 1.5°C world, whereas this figure would increase to 190

million in a 2°C world (Arnell et al. 2018). Water scarcity, which is already a huge problem, is projected to increase alongside additional warming, and this will likely lead to more **conflicts over water resources,** particularly in the **Middle East,** the **Mediterranean** including the **Jordan** basin and **Syria,** the **Horn of Africa, South Sudan, coastal Madagascar, Mozambique, northern Nigeria, southern Mali, Sierra Leone, Guinea, Uganda** and **Kenya** (Schleussner et al. 2016).

Leave no one behind – Possible impacts on the achievement of selected SDGs

The 17 Sustainable Development Goals are an integral part of the Agenda 2030, which was adopted in 2015 by the community of states. The title of the Agenda 2030, **Transforming our World,** is an expression of the truly transformational character of sustainable development, as referred to in the Agenda 2030.

Due to the fact that not all SDGs are climate-sensitive to the same extent, and, therefore, that IPCC SR 15 does not explicitly refer to all of them, our analysis focuses only on selected issues. It is important to note, however, that there is a specific climate-related SDG on 'Climate action' (SDG 13), which commits states to 'take urgent action to combat climate change and its impacts'.

It includes three overarching targets:

- Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries (13.1).
- Integrate climate change measures into national policies, strategies and planning (13.2).
- Improve education, awareness-raising and human and institutional capacities on climate-change mitigation, adaptation, impact reduction and early warning (13.3).

The SDG 4 'Quality education' is another SDG, whose implementation may serve as an important trigger for enhanced climate action, despite the fact that it is not particularly focused on climate change. It commits states to 'ensure inclusive and equitable quality education and promote lifelong learning opportunities for all'.

The potential implications of different levels of global warming on the achievement of the SDGs remained a blind spot for a long time. It is only recently that this important question has started to move more to the forefront of scientific and political discourse, a situation that has been triggered in particular by the IPCC Special Report Global Warming of 1.5°C. The report even contains a chapter dedicated to this issue (see IPCC 2018a, Chapter 5). But even though awareness about how climate action and sustainable development are interlinked has started to increase, the remaining gaps are still huge and need to be addressed with urgency. The following overview aims to briefly introduce the main impacts of climate (in)action on selected SDGs. The information it includes is taken from the IPCC's special report (IPCC 2018a, chapters 3 to 5) and other primary literature.

SDG 1: No poverty

Very little literature is available about the impact on poverty that could be avoided in a 1.5°C versus a 2°C scenario. It is very important that this gap in the research is closed. Bottom-up approaches that start with household-level data and then overlay future demographic and socio-economic trajectories with climate change scenarios are discussed by the IPCC as a promising methodological approach. According to the IPCC's special report,

Poor households are suffering especially from climate change effects such as droughts because they have less capacities to adapt.

All over the world, fetching water is mostly done by women. Climate change can intensify gender inequalities as in future it will be harder to find access to fresh water sources.

findings that relate emission scenarios (RCPs) to **'Shared Socio-Economic Pathways'** (SSP) (see box below) indicate that a 1.5°C scenario could place up to 122 million additional people in poverty by 2030 – mainly due to impacts on health and rising food prices (IPCC 2018a, Chapter 5.2.1). However, these results, which stem from the 'inequality scenario' (SSP4), can be considered a business-as-usual scenario.

Subsequently, the IPCC is highly confident that without the concerted action of all countries, under consideration of equity and fairness, and including aspects such as redistributive measures, it will be exceedingly difficult to eradicate poverty. Moreover, limiting global warming to 1.5°C instead of 2°C will create **important co-benefits** for poor people and have less of an impact on attempts to achieve SDG1.

SDG 2: Zero hunger

Food security will be increasingly endangered in line with rising global temperatures. **Price fluctuations**, will hit poorer consumers hard, and undermine food security. Today, 60% of the variability faced by the global breadbasket is caused by climate change (Ray et al. 2015). A further 1°C of warming would lead to declining crop yields of cereals in the tropics, with wheat being affected the most and rice the least. More extreme weather events, drought, flood, more irregular patterns of rainfalls and the partial shift of the seasons, particularly leading to early springs (resulting in leaves to unfold or plants to flower too early, and, therefore, increased risk of frost damage) all pose challenges to agriculture, and these issues are projected to be much worse in a 2°C compared to a 1.5°C scenario.

The massive damage to tropical corals will put t**ropical small-scale fisheries** at highest risk. About 500 million people's livelihoods on the coasts of tropical developing countries are projected to be negatively affected by coral bleaching. Importantly, many of them are strongly dependent on this eco-system, and without sufficient access to land, will have no alternative opportunities, and this may lead to large movements of migrants, as for example in coastal Bangladesh (IPCC 2018a, Chapter 5.2.).

There is a high level of confidence that stabilising global warming at 1.5°C would limit the mortality of coral reefs and safeguard many threatened livelihoods that have some albeit limited potential for adaption. Food and

water security would be much less under threat in **Central America** than would be the case in scenarios with higher levels of warming. There is limited evidence, but a high level of agreement, that the 1.5°C climate threshold would save more than 40 million people from hunger compared to a 2°C scenario (IPCC 2018a, Chapter 5.2.).

Agriculture and fisheries must implement climate adaption measures in order to improve food security. However, land-use, forestry and agriculture are also important sectors for 1.5°C-consistent decarbonisation pathways. Most pathways foresee massive levels of **afforestation**, more agricultural land being used for **biofuel production,** or a combination of the both. In either case, this will increase the pressure on fertile land. Combined with the pressure on agricultural land caused by climate change (such as salinization, drying and flooding), this may mean that less (but more intensively used) land will be available for agriculture in the future. The same applies to pasture land, which will lead to less livestock produce. This could lead to rising conflicts over land, and **trade-offs** between climate action and food security (IPCC 2018a, Chapter 4).

SDG 3: Health and well-being

Vulnerable and disadvantaged people are disproportionally affected by health problems caused by climate change, and this trend will further accelerate. **Heat waves** will cause higher mortality rates, **vector-born tropical diseases** like malaria, dengue, chikungunya, Zika virus, yellow fever or West Nile virus are projected to spread further, in altitude as in latitude, even reaching temperate climate zones. By 2030, compared to the period ranging from 1961 to 1990, climate change could be responsible for an additional 38,000 annual deaths due to heat exposure among elderly people by 2030, as well as 48,000 deaths due to diarrhoea; 60,000 due to malaria; and 95,000 due to childhood undernutrition (WHO 2014). Global warming of 2°C poses greater risks to health than 1.5°C. However, it is difficult to quantify the differences due to the complexity of the issues.

SDG 5: Gender equality

Gender inequality continues to persist worldwide, depriving women and girls of their basic rights and opportunities. Unfortunately, the IPCC Special Report **Global Warming of 1.5°C** falls short of analysing the **gender-specific risks** associated with a 1.5°C average temperature rise and of overshooting this aspirational goal. In view of women's disproportionally high level of climate vulnerability, which is mainly caused by discrimination and the high dependency of female livelihoods on eco-systems and agriculture in rural Africa, Asia and Latin America, it is extremely likely that women will be much more negatively affected by overshooting 1.5°C than men. This would seriously undermine SDG 5 and perpetuate gender discrimination and equality and is another huge injustice associated with climate change. As such, it is essential that IPCC breaks its silent on this issue and prioritises overcoming the **blind spot** of the IPCC's 1.5°C special report in terms of gender.

SDG 6: Clean water and sanitation

Water availability is projected to increasingly shrink and represent a major climate-induced risk for people in dry and drought-prone areas. Today, 40% of the world's population is affected by water scarcity and more than 40 countries experience water stress. Universal access to safe and affordable drinking water by 2030 will largely depend on limiting the impact of global warming – not just investing in adequate infrastructure. In a 1.5°C scenario, between 184 and 270 million fewer people would suffer from **water scarcity**, compared to a 2°C scenario. Access to **sanitation** will also be endangered by water scarcity, and increasing coastal and river flooding. Flooding risks are expected to rise by 73% in a 1.5°C scenario, and up to 98% in a 2°C scenario. Without keeping global warming to a maximum of 1.5°C, combined with massive investment in flood protection, it is very unlikely that SDG 6 will be achieved (IPCC 2018a, Chapter 5.2.3).

SDG 7: Affordable and clean energy

Overall, massive **reductions in the cost** of solar power and other renewable energies, combined with the increased urgency to abandon fossil fuels, is very likely to **boost access to clean and affordable energies** in developing countries. Apart from these co-benefits, trade-offs are also partly possible. Increased **water scarcity** in many regions will have a negative impact on **hydro energy**, as for instance in eastern Africa (Arent et al. 2014). This may lead to increasing energy costs, and, hence, less access to energy for poorer people in affected regions. These risks would be significantly lower at 1.5°C.

SDG 8 Decent work and economic growth

More extreme climate-related conditions, and the partial deterioration of livelihoods **worsen working conditions**,

as for example in the increasingly hostile environments on outer atolls of low-lying SIDS, or in the Sahel. This will force people to migrate to cities, where it will be very difficult for unskilled labourers to find decent work. Increasing **heat stress** is projected to reduce the productivity of people working outdoors and in industries located in heat-stressed megacities. Negative effects of climate change on GDP growth rates are also likely to occur. Developing countries are projected to face the most statistically significant **reductions in GDP per capita growth**, due to their higher levels of vulnerability. This is the case for most African countries (where West African countries would benefit the most from a stabilising global warming at around 1.5°C), Southeast Asia, India, Brazil and Mexico (Petris et al. 2017). The **economic losses** associated with climate change by 2040 are the same in a business-as-usual scenario (BAU) as they are in a 1.5°C-coherent pathway. However, beyond 2040, the 1.5°C pathway leads to a lower level of loss and damage, and the advantages of this pathway continue to increase every year after this point (Hsiang et al. 2017).

SDG 9: Industry, innovation and infrastructure

Climate change has significant effects on industry, innovation and infrastructure – and vice versa. However, these links are not covered by the IPCC SR15 in a similarly condensed way as with regard to some other SDGs. Doing so in a future report would be very important in order to comprehensively address both risks and opportunities. Our report at least briefly covers these aspects in Part 3.

Vunisavisavi Village, Fiji, is in a relocation process due to sea level rise.

SDG 10: Reduced inequalities

Despite the difficulties to quantify precisely the effects of climate change on inequality at different levels of warming (mainly because of the fact that stressors leading to inequality do not usually operate individually but are interrelated), the IPCC concludes that climate risks disproportionally and more directly affect poor and vulnerable people. Moreover, risk exposure will increase further, particularly in areas with high levels of poverty and inequality. Importantly, these risks are significantly higher at 2°C compared to 1.5°C (IPCC 2018a, Chapter 5.2).

SDG 11: Sustainable cities and communities

Each level of additional warming will **increase the costs incurred by communities and cities** to remain or become sustainable. Coastal cities and settlements and infrastructure along flood-prone rivers will come under massive additional stress, particularly if the 1.5°C climate threshold is overshot: Bangladesh alone could face incremental flood protection costs against river flooding and storm surges of USD 2.6 billion initially, and USD 54 million in recurrent annual costs (Dasgupta et al. 2010).

The projected increase in heatwaves and its accelerated levels beyond 1.5°C will become a huge burden for megacities, with a massive need for additional measures in urban development to reduce the formation of heat islands, which is difficult and costly to implement in existing buildings.

Remote and vulnerable communities in increasingly harsher climates such as in the Sahel, on outer atolls, or along flood-prone rivers and coastlines will bear the highest risk of becoming **overburdened by the need for adaptation**, and being left behind with little chance of maintaining the sustainability of their communities. If these people are to be protected, it is essential than the 1.5°C threshold is not overshot.

SDG 12: Responsible consumption and production

1.5°C- and even 2°C-consistent emission reduction pathways imply very fast and wide-ranging economic transitions. Thus, to succeed they largely rely on responsible consumption and production (SDG 12) and enabling behavioural and social change, and an ethical value base. However, there is more than one possible socio-economic pathway. Food habits (meat), consumption, land-use

Shared Socio-Economic Pathways (SSPs)

Shared Socio-Economic Pathways are a set of narratives of societal futures augmented by quantitative projections of socio-economic determinants such as population, GDP (Gross Domestic Product), and urbanisation. Socio-economic driving forces consistent with any of the SSPs can be combined with a set of climate policy assumptions that together would lead to emissions and concentration outcomes consistent with Representative Concentration Pathways (emission scenarios). This is at the core of the scenario framework for climate change research that aims to facilitate the establishment of scenarios that integrate emissions and development pathways.

Source: IPCC 2018a, Cross-Chapter Box 1: Scenarios and Pathways

For further information see:
https://unfccc.int/sites/default/files/part1_iiasa_rogelj_ssp_poster.pdf

SSP 1 — Sustainability Pathway Scenario: Characterised by rapid technological innovation, high environmental awareness, low energy demand, low population growth, medium to high economic growth and deepened international cooperation
SSP 2 — 'Middle of the road'-Pathway Scenario
SSP 3 — Fragmentation Pathway Scenario: Characterised by slow technological innovation, reduced international trade, very high population growth, slow economic growth and fragmented international cooperation
SSP 4 — Inequality Pathway Scenario: Characterised by slow technological innovation, high inequality, very high population growth and slow economic growth
SSP 5 — Conventional Development Pathway Scenario: Characterised by rapid innovation regarding fossil fuel-based technologies, high energy demand, low population growth and high economic growth.

Source: Calvin n.d.

changes, technical innovation, and many other factors shape these pathways, alongside the choice of mitigation strategy. In terms of Shared Socio-Economic Pathways (SSP), the **sustainability pathway scenario (SSP1)** (O'Neill et al. 2014; Rogelj et al. 2017; see Glossary) has been found to be the **scenario that is most likely to prevent temperatures from exceeding 1.5°C**. It assumes low levels of population growth, a high rate of per capita growth, great technical progress, low demands for energy and food, and an environmentally-based approach. The fragmented world pathway scenario (SSP3), in contrast, might be the most likely one, assuming that the world falls back into blocks, with high levels of population growth accompanied with low economic growth, very little innovation and a strong focus on national food and energy security. But this socio-economic scenario is predicted to lead to a 3°C world.

SDG 14: Life below water

Continued global warming is projected to lead to increased marine biodiversity in high latitudes, but extinction of species in tropical marine habitats. As stated above, coral reefs are among the most vulnerable eco-systems, and will face high risk even at a 1.5°C level of global warming.

Ocean acidification will vary with latitude and be at its highest where temperatures are lowest or where CO2-rich water is brought to the ocean surface. This is a very concerning trend, leading to **coral bleaching** and is assumed to have lots of other impacts on the oceans, fish stocks, and marine life – these impacts are still not fully understood. **Ocean acidification** is projected to be significantly lower in a 1.5°C scenario compared to a 2°C world. Be this as it may, the process may already be irreversible, but it could certainly be slowed down.

SDG 15: Life on land

Temperature increases will lead to a latitudinal and altitudinal **biome shift** (see Glossary). This is projected to be 25% lower at 1.5°C compared to 2°C (Warszawski et al. 2013). In some areas, such as South Africa, Australia and the Himalayas, at 1.5°C scenario could almost prevent biome shift from occurring in these regions.

Water management in the dry highlands of Ethiopia helps to adapt to climate change.

Tropical forests and peatlands are among the land-based ecosystems most at risk in a warming world. Both store the majority of the world's carbon stocks in biomass and soils and their further degradation would accelerate global warming. Apart from ecosystems, many – endemic – species are at risk of extinction, and this risk disproportionally increases with any further warming.

SDG 16: Peace and justice and strong institutions

Many studies indicate a linkage between climate stress (e.g. drought) and **conflict**. For populations that are particularly dependent on agriculture, livestock, forests or fisheries, and, thus, highly vulnerable to the impact of climate change, the risk of conflict is projected to increase in a 1.5°C scenario, and even more at 2°C warming (Schleussner et al. 2016). Increasing water scarcity, in particular in the Middle East, may also lead to more conflicts. **Displacement** caused by climate stressors such as drought, flood, or sea level rise, is a huge injustice. If compensation is not provided for the loss and damage caused, the lack of preparedness of state authorities for relocations, and the rejection of displaced people by potential host communities or states will further increase these injustices and is likely to lead to social unrest.

Institutions that are already weak today, such as in countries known as failing states, could be further undermined in projected hot spots of climate change due to accelerating climate induced challenges and loss and damage. Low-lying SIDS, such as Tuvalu, are attempting to survive a situation without precedence. These countries are facing fundamental threats due to rising sea levels, storm surges and the depletion of freshwater resources.

All these risks are significantly lower at 1.5°C, meaning that a 2°C world would be a much less peaceful world, with more conflicts and injustice, particularly in countries that are particularly vulnerable to the impact of climate change.

SDG 17: Partnership for the goals

A successful agenda for climate action and sustainable development requires **more cooperation** between governments, international institutions, civil society and the private sector. Moreover, it needs to build on a **shared vision** and **strong support** for the Paris Agreement and the SDGs. Apart from fulfilling the **climate finance- and development assistance commitments**, which have yet

to be met, a massive overall shift of public and private investments from brown/unsustainable to green/sustainable is needed, going far beyond what is included in the NDCs. For the years ranging from 2018 to 2050, the IPCC estimates that in order for temperatures to remain at 1.5°C, between USD 0.3 and 1.3 trillion is needed per year in Asia, between USD 0.3 and 0.8 trillion per year in OECD countries, between USD 0.08 and 0.5 trillion per year in the Middle East and Africa, between USD 0.07 and 0.2 trillion per year in Latin America, and between USD 0.05 and 0.2 trillion per year in Eastern Europe and the former Soviet Union (IPCC 2018a, Chapter 2.5.1). Not a single country will be able to make these investments on its own. Without global cooperation and a spirit of common trust, partnership and solidarity, the 1.5°C threshold is very likely to be overshot.

In conclusion, ensuring that average temperatures do not rise above 1.5°C and achieving the SDGs largely depends on each other. It is unlikely that either target will be achieved without the other. Thus, mitigation, adaptation and sustainable development should mobilise as much as possible co-benefits as a 'triple win'. However, there are also potential trade-offs, which, instead of

SDG	Negative impacts of 1.5°C on the possibility of achieving an SDG	Negative impacts of 2°C on the possibility of achieving an SDG	Links between a 1.5°C pathway and the SDGs
1 — No poverty	*high*	*very high*	*co-beneficial*
2 — Zero hunger	*high*	*very high*	*co-benefits and trade-offs*
3 — Health and well-being	*high*	*very high*	*highly co-beneficial*
5 — Gender equality	*uncertain*	*uncertain*	*uncertain*
6 — Clean water	*high*	*very high*	*highly co-beneficial*
7 — Clean energy	*moderate*	*moderate*	*highly co-beneficial*
8 — Decent work	*moderate*	*high*	*co-benefits and trade-offs*
10 — Reduced inequalities	*uncertain*	*uncertain*	*uncertain*
11 — Sustainable cities and communities	*moderate*	*high*	*highly co-beneficial*
12 — Responsible consumption and production	*low*	*moderate*	*highly co-beneficial*
14 — Life below water	*very high*	*extremely high*	*highly co-beneficial*
15 — Life on land	*moderate*	*high*	*co-beneficial*
16 — Peace and justice	*moderate*	*high*	*highly co-beneficial*
17 — Partnership	*uncertain*	*uncertain*	*highly co-beneficial*

Figure 2: The links between the SDGs and different global warming scenarios
Source: Authors' analysis of the main findings set out in the IPCC's 1.5°C special report

The right to water and sanitation is a human right. But overshooting the 1.5°C will threaten the human rights.

being neglected, need to be analysed seriously and addressed. Placing 1.5°C pathways in a context of justice and sustainable development requires co-benefits to be maximised and trade-offs to be minimised. Land-use changes, the elimination of poverty, decent work, and food security are elements of sustainable development that may benefit from decarbonisation, but which could also be threatened by fast and wide-ranging mitigation strategies, depending on the conditions and profile of each case (Clarke et al. 2014).

The possible impacts of climate change on the fulfilment of human rights

The IPCC Special Report **Global Warming of 1.5°C** and current scientific literature clearly demonstrate that overshooting the 1.5°C climate threshold will massively threaten the fundamental economic, social and cultural human rights of populations that are already deprived with regard to their rights to life, health, and an adequate standard of living. It is, therefore, unfortunate that these linkages, unlike those to the SDGs, are **not addressed explicitly in the IPCC's SR15:** The only reference made to human rights can be found in Chapter 5.5.3 (IPCC 2018a), where human rights are very briefly mentioned as core elements of justice. This shortcoming is highly regrettable and falls short of the **human rights provisions in the Paris Agreement** – in the preamble, the parties agreed to fully respect human rights as part of any actions they implement in the interests of climate mitigation or adaptation. Specific reference is made to the right to development of people who temporarily or permanently count among the most vulnerable, and, thus, are **most in need of protection**. This includes **indigenous people, local communities, children, people with disabilities and migrants** (for a more detailed discussion of the significance of the preamble in terms of human rights see Brot fuer die Welt/ACT Alliance 2016a).

Human rights are legally anchored in international human rights law such as the Universal Declaration of Human Rights, the International Covenant on Economic, Social and Cultural Rights and the International Covenant on Civil and Political Human Rights. Thus, human rights always correspond to state obligations to invest the maximum amount of resources to respect, protect and fulfil individual rights, including through international cooperation and support. In 2014, the Office of the United Nations High Commissioner for Human Rights compiled a report on human rights and climate change that demonstrated how climate change is threatening human rights, and that states were not meeting their obligations to avoid this from happening (for more details see Brot fuer die Welt/ACT Alliance/Germanwatch 2016b). However, this call remained largely unheard, and little has been done so far to include human rights impact assessments in adaptation or mitigation plans, policies and programmes. The same must be said with a view to the work of the IPCC, and climate change-related scientific research in general.

Bread for the World (Brot fuer die Welt) and ACT Alliance have presented a number of proposals on how climate adaptation and mitigation can be better aligned with countries' human rights obligations (ibid.). These proposals remain valid in view of the latest findings on 1.5°C warming and should be integrated into 1.5°C-consistent adaptation and sustainable development

pathways. With a view to the potentially huge impacts of mitigation on land-use changes (particularly regarding afforestation and biofuel production) they should also be applied to mitigation.

The following graph provides an overview of climate risks, which are also highlighted in the new IPCC special report, human rights standards, and the state obligations that can be derived from them.

In addition to **human right standards**, international human rights law covers **'human rights principles'**, which oblige countries to ensure due process. The following table shows how human rights principles can be operationalised as part of 1.5°C-consistent adaptation, mitigation and sustainable development pathways. Human rights risk and impact assessments would constitute appropriate human rights instruments.

Areas of climate risks and vulnerabilities	Human rights threatened by climate change	States' corresponding human rights obligations
Human security	The human right to life Universal Declaration of Human Rights, Article 3	To take appropriate steps to safeguard the lives of people within a state's jurisdiction
Food security	The human right to adequate food Universal Declaration of Human Rights (UDHR), Article 25	To respect, protect, and fulfil (facilitate and provide) people's access to adequate food and use of resources and means of ensuring livelihoods, including food security
Freshwater resources	The human right to water Resolution 64/292, UN General Assembly, 2010	To ensure everyone has access to a sufficient amount of safe drinking water, personal sanitation, water to wash clothes, prepare food, and for personal and household hygiene
Human health	The human right to health International Covenant on Economic, Social and Cultural Human Rights, Article 12	To ensure access to (i) health facilities, goods and services on a non-discriminatory basis, especially for vulnerable or marginalised groups; (ii) essential drugs; equitable distribution of all health facilities, goods and services
Low lying and coastal areas	The human right to adequate housing Universal Declaration of Human Rights, Article 25(1) The human right to self-determination International Covenant on Civil and Political Rights, Article 1	To take specific, deliberate and targeted steps to fulfil the right to adequate housing. Each country should guarantee at least minimum essential levels are in accordance with this right. For instance, they should ensure that significant numbers of people are not deprived of basic shelter and housing. To take positive action to facilitate the realisation of and respect for the right of peoples to self-determination within the state's own jurisdiction and beyond
Livelihoods and poverty	Particular protection of vulnerable groups Conventions (i) on the right of the child, (ii) on the elimination of all forms of discrimination against women, (iii) others 'While [the human rights] implications affect individuals and communities around the world, the adverse effects of climate change will be felt most acutely by those segments of the population that are already in vulnerable situations, owing to factors such as geography, poverty, gender, age, indigenous or minority status and disability' (Human Rights Council Resolution 26/L.33, 2014)	To pay specific attention to the impact on vulnerable groups

Figure 3: Climate risks, human rights standards and states' corresponding obligations
Source: Brot fuer die Welt/ACT Alliance/Germanwatch 2016b

Vunidogoloa in Fiji was the first village which had to relocate because of climate change. In 2014, it moved two kilometres inland.

Key principles	Criteria	Possible indicators
Participation	Active, free, meaningful, effective and informed participation by multiple stakeholders in all phases	Processes, plans and documents that are properly communicated in local languages; multiple stake-holders including representatives of most vulnerable populations consulted during all phases
Empowerment	Adequate resources are made available for raising awareness, developing human capacities, natural capital and infrastructure, and protection of those most at risk	Comprehensive awareness raising program in place; plans specify ratio or percentage of funding for each category of expenditure, community institutions are strengthened
Non-discrimination	No discrimination, e.g. due to ethnicity, colour, gender, language, religion, political or other opinion, national or social origin, property, birth or other status	Non-discrimination policies in place and applied; grievance mechanisms in place; outcome indicators disaggregated by population groups
Transparency	Plans, policies and budgets, including roles, responsibilities and procedures are communicated adequately	Due diligence and information disclosure applied; full and free access to information
Accountability	All relevant governmental authorities and other actors involved have defined responsibilities; transparent budgets are allocated; policy projects have clearly defined objectives, timelines and indicators of outcomes with specific reference to vulnerable groups	Regulatory frameworks and policies in place and rule of law applied; indicator-based periodic review of progress achieved with particular reference to the most vulnerable groups; NGOs participate in monitoring processes

Figure 4: Human rights principles for 1.5°C-consistent pathways in the context of sustainable development
Source: Brot fuer die Welt/ACT Alliance/Germanwatch 2016b

Possible humanitarian challenges

Although losses of lives and to livelihoods caused by non-climate-related natural disasters have remained stable over the past three decades, climate change has led to a dramatic increase in climate-related disasters. According to the experts, the estimated global risk **protection gap** due to extreme weather events amounts to **USD 1.7 trillion** (Business Green 2017), making disaster risk reduction a top priority in the fight against climate change.

Climate-related disaster risks are projected to further increase in a 1.5°C world, and even more so at higher levels of warming: hurricanes, for instance, are expected to significantly increase in magnitude, with more category 4 and 5 hurricanes occurring, although the overall number of hurricanes may decrease slightly (Holland and Bruyere 2014).

These and other trends are particularly relevant to the **Sendai Framework for Disaster Risk Reduction (SFDRR)**, an international treaty that was drawn up in March 2015 in Sendai/Japan, as the successor of the Hyogo Framework for Action. The SFDRR has prioritised the need to (i) better understand disaster risks, (ii) to strengthen disaster risk governance and management, (iii) to invest in disaster risk reduction for resilience, and (iv) to enhance disaster preparedness, including to 'build back better'. The seven associated targets (see Figure 5) will have to be achieved by 2030 in order to minimise the risk of disaster. Climate risks, as the table indicates, are better manageable, and disaster risk reduction will thereby be less expansive at 1.5°C as compared with 2°C warming.

Displacement and mass migration could become **the biggest humanitarian challenge under worsening climate change conditions**, especially in regions where livelihoods are massively impacted and where people have very little other option with which to make a living (Islam/Shamsuddoha 2017). For many regions, a correlation exists between increasing climate anomalies and accelerated migration rates; this is the case with South Africa, Syria, Mali and Senegal. Extreme weather events often result in massive temporary migration and forced displacement, as was the case during the floods in Pakistan (2015, 2017 and 2018) and Bangladesh (2017 and 2018). Altogether, more than 90% of global displacement during 2011 and 2015 was caused by climate disasters, with 60,000 people being at least temporarily displaced every day (IDMC 2015).

SFDRR target by 2030	Negative impact of 1.5°C on achieving the targets	Negative impacts of 2°C on achieving the targets	The links between a 1.5°C pathway and the SFDRR
Substantially reduce global mortality from disasters by 2030	*high*	*very high*	*highly co-beneficial*
Substantially reduce the number of affected people g lobally by 2030	*high*	*very high*	*highly co-beneficial*
Reduce direct disaster-related economic loss in relation to global GDP	*high*	*very high*	*co-beneficial*
Substantially reduce disaster-related damage to critical infrastructure and the disruption of basic services	*high*	*very high*	*co-beneficial*
Substantially increase the number of countries with national and local disaster risk reduction strategies	*uncertain*	*uncertain*	*uncertain*
Substantially enhance international cooperation with developing countries by providing adequate and sustainable support	*uncertain*	*uncertain*	*uncertain*
Substantially increase the availability of and people's access to multi-hazard early warning systems and disaster risk information and assessments	*uncertain*	*uncertain*	*uncertain*

Figure 5: The links between the targets of the Sendai Framework for Disaster Risk Reduction and different levels of global warming
Source: Author's own assessment of the main findings of the IPCC's 1.5°C special report

Equity and climate justice in the context of a 1.5°C world

Poor people will experience climate change severely, and climate change will exacerbate poverty (O'Neill 2017). Future impacts and risks will emerge along the axes of **gender, age, ethnicity, class, indigeneity and (dis)ability** (IPCC 2018a, Chapter 5.2) and thus will further **sharpen and deepen inequalitie**s. Warming of 1.5°C will put **unequally increasing risks** on hundreds of millions of people, most of them poor, and not significantly causing GHG emissions – even more so at 2°C. Without ambitious climate action in terms of both mitigation and adaptation, the **human security** of these people will be threatened, probably leading to conflict, mass migration and humanitarian disasters on an immense scale (Adger et al. 2014).

The IPCC's Special Report **Global Warming of 1.5°C** concludes that a higher number of potentially adverse impacts can be avoided when global warming is limited to **1.5°C** rather than 2°C, and that **poor and vulnerable people would particularly benefit** from this situation. It also states with high confidence that **without consideration of equity and fairness**, and concerted efforts from all countries, as well as individuals, communities, and organisations, the **dual goal of limiting global warming and achieving the SDGs is unlikely to be met**. It calls on countries, institutions and communities to commit to a higher level of equity and fairness, because otherwise people will be left behind (IPCC 2018a, Chapter 5, Executive Summary). Equity, procedural and distributive justice, as well as fairness towards the least privileged are considered to be core elements of 1.5°C-consistent climate resilient development pathways (ibid.).

Reference to justice in an abstract sense, as in the IPCC's special report, the Paris Agreement (in the preamble) and the SDGs (with its paradigmatic slogan of leaving no one behind), would hardly be contested by anybody. However, the **concept of justice** – or climate justice (see Glossary) and equity – becomes more contested once the discourse moves to the concrete level. Does climate justice mean structural (avoidance of structural discrimination, e.g. by showing responsibility towards rights of future generations), distributive (cost-benefit sharing) or procedural (inclusiveness, participation) justice? Often, such claims are also politically misused due to national or personal interests. This leads to the questions of who are the rights holders, who are the claim addressees, what are corresponding entitlements and through which instruments of justice could they be achieved? Furthermore, climate justice has different dimensions: **justice to the climate vulnerable** (e.g. small islanders), **justice to those workers** and communities who will lose their jobs and livelihoods due to fast, steep decarbonisation (e.g. coal miners), **justice to future generations** (e.g. not depriving them of their opportunities and well-being), or **justice to nature** (e.g. biodiversity loss of corals). These and other **climate justice concerns** need to be addressed in a balanced way to make transformational change and 1.5°C-consistent pathways successful. Therefore, justice and equity play a major role in the concept of Shared Socio-Economic Pathways as related to emission reduction scenarios (see above). The IPCC rightly argues throughout its entire report that **justice, equity and fairness are necessary enablers for the triple win of mitigation, adaptation and sustainable development**, and the Paris Agreement mentions equity five times. However, there could be conflicts between claims for justice (such as due to different notions of justice between small islanders fighting for their survival and coal miners fighting for their jobs). Finding fair solutions between conflicting claims for justice is a key challenge in achieving a **just transition**, and essential in gaining the necessary political and societal support for 1.5°C-consistent sustainable development pathways (FES/Brot fuer die Welt 2017a). Varying national circumstances mean that different solutions will be required in different countries. What they have to have in common to succeed, however, is a clear commitment to fairness, equity and structural, distributive and procedural justice. The same is true for the level of international cooperation: without a **common spirit of solidarity**, willingness to cooperate and readiness to provide massive support to the poor and vulnerable, and common climate action duly based on the **principle of equity across regions and generations**, it will be impossible to keep global warming under 1.5°C.

Part 2

Talanoa: climate change impacts, future challenges and possible solutions for the communities most vulnerable to climate change

The story of Ethiopia. A drought-prone Least Developed Country on the Horn of Africa

Contribution to the Talanoa Dialogue by Sophie Gebreyes, national representative of the Lutheran World Federation in Ethiopia

Ethiopia, a LDC, is particularly vulnerable to climate change because of its high economic dependence on natural resources and the limited adaptive capacity to climate variability and extreme weather events.

Agricultural livelihoods at high drought risk: food insecurity and water crisis

The detrimental effects of climate change are already evident, mainly in form of more frequent and more intense droughts, rainfall irregularities and heat. High exposure to these climate hazards in combination with low adaptive capacity will have severe repercussions for health, livelihoods, food production and water availability, but also on ecosystems and the overall human security of populations at risk, due to more conflicts over resources such as water and land. Poor people are disproportionally affected in Ethiopia, one of the most-at-risk countries and yet among the least responsible in terms of historic emissions.

Rainfall in Ethiopia is increasingly unpredictable, with rain falling heavily in short stretches of time across different regions. Rivers and aquifers are erratically distributed. Droughts degrade grazing lands and weaken livestock while floods spread diseases and decimate herds. Most Ethiopians are subsistence pastoralists and farmers, relying on small livestock herds and fragmented land plots. When rains fail to appear, crops are lost, and scarce reserves are depleted, and households switch to coping strategies such as selling assets and migrating to seek work or food aid.

Climate change affects different regions in different ways. The eastern part of Ethiopia including the cereal-growing northern highlands and the arid, semi-arid, and dry lowlands in the southern drought belt are most vulnerable to climate change. These regions are often classified as 'stressed', 'at crisis' or 'in emergency' under the Integrated Food Security Phase Classification of the World Food Programme. The droughts in 2015/16 and 2017 alone affected close to a total of 18.5 million people who then needed assistance, and over 3 million livestock perished.

The impact of climate change poses immense challenges to Ethiopia's economic and social development as Ethiopia's economy is heavily dependent on rain-fed agriculture and other climate-sensitive activities. More than 70% of Ethiopia's population is still employed in the agricultural sector, contributing 36% of GDP. Therefore, any adverse impact on agriculture significantly affects the Ethiopian economy.

Water scarcity is one of the main impacts of climate change and agriculture consumes up to 93% of all surface water and groundwater. Increasing variability in timing and spatial distribution of rain, in combination with extreme climate events, have pushed Ethiopia into conditions of extreme water scarcity and chronic food insecurity.

While Ethiopia has relatively abundant water resources, it is considered 'water stressed' by the United Nations due to climate change and rapid population

Water scarcity is one of the main impacts of climate change.

growth (USAID 2018a), meaning that the availability of water is less than 1700 m3 per person per year (Open Education 2018). Additional levels of global warming could further reduce the amount of accessible water to less than 1000 m3 per person per year, so that Ethiopia would then fall into the 'water scarce' category.

Water scarcity exposes women and girls to multiple gender-based risks. During droughts, rural people – particularly women and children – may have to walk for up to six hours to fetch water from unprotected water sources such as ponds, exposing them to sexual and gender-based violence. In drought-stricken rural areas, a higher priority is given to the collection of water than to any other activity, which can cause girls to drop out of school because their labour is needed for water collection.

Water stress also increases the risk of water-washed diseases, which occur as a result of poor personal hygiene and inadequate washing. With climate change the frequency of waterborne and other diseases caused by an inadequate supply of safe drinking water, low sanitation

Risks and Impacts	Driver	Co-stressor
Droughts Reduced yields and/or crop failure Increased evapotranspiration and water stress Biodiversity loss and land degradation Food insecurity Increased incidence of pests and diseases Increased livestock mortality	El Niño/La Niña Erratic, unpredictable rain patterns Dependence on rain-fed agriculture	Rapid population growth Land tenure system Lack of early warning systems
River flooding	Heavy rainfall	Land degradation Soil erosion
Water scarcity Drying of wetlands and freshwater sources	Erratic, unpredictable rainfall	Poor water management
Ecosystem degradation and deforestation	Erratic rainfall Drought and heat	Rapid population growth Environmental pollution Depletion of natural resources Fuelwood and charcoal production
Loss of biodiversity	Mono-cropping Land degradation	Loss of indigenous knowledge Rapid population growth and growing demand for agricultural land
Spread of diseases Changing ranges of vector-borne diseases Increased risk from waterborne diseases	Drought Floods	Insufficient sanitation
Economic losses, particularly in agriculture	All the afore-mentioned drivers/ impacts	
Non-economic loss of land, culture Traditional knowledge and social cohesion	All the afore mentioned drivers/ impacts	

Figure 5: Linkages between climate risks, adaptation and the SDGs in a 1.5/2°C scenario for Ethiopia
Source: Author 2018

coverage and poor hygiene practices will further increase (ibid.). During the droughts in 2015/16 and 2017, outbreaks of acute watery diarrhoea were registered in many parts of the country. Furthermore, Ethiopia is a country located in the African Malaria Belt stretching westward from the western half of Ethiopia to the west coast of Africa. Nevertheless, malaria cases in the highlands of Ethiopia were unknown in the past. However, with the rise in night-time temperatures in the highlands creating favourable conditions for mosquitos to breed and survive, malaria cases are no longer uncommon at these altitudes (ibid.).

With 15.2 million children aged under five, 38% of whom are stunting and 24% are underweight, chronic malnutrition among children aged five or under is another widespread problem in Ethiopia (USAID 2018b), and one which could become more prevalent if climate change leads to regular food shortages, caused by more frequent and intense droughts. Staple food crops such as teff (an annual grass, native to Ethiopia that is raised

Difference between a 1.5°C and a 2°C scenario	Measures	SDG affected
High at 1.5°C Very High at 2°C	Improved soil and water management Rainwater harvesting Drip irrigation Reforestation Land reform Investment in early warning Improved focus on animal health and VET extension services	Zero hunger (SDG 2) No poverty (SDG 1) Life on land (SDG 15) Good health and well-being (SDG 3)
High at 1.5°C High/Very high at 2°C	Afforestation Improved early warning systems Flood protection systems	No poverty (SDG 1), Zero Hunger (SDG3), Clean water and sanitation (SDG 6) Sustainable cities and communities (SDG 11)
High at 1.5°C Very High at 2°C	Water management	Clean water and sanitation (SDG 6) Good health and well-being (SDG 3)
Moderate to high at 1.5°C High/very high at 2°C	Environmental protection and water management Promotion of fuel efficient stoves Leapfrogging to renewable energy sources/alternatives	Life on Land (SDG 15) Good health and well-being (SDG 3) Affordable and clean energy (SDG 7) Zero hunger (SDG 2)
Moderate at 1.5°C High at 2°C	Community seed banks Preservation of plant genetic resources Family planning campaigns	Life on land (SDG 15) Zero hunger (SDG 2) Gender Equality (SGD 5)
Uncertain	Quality health system Clean water and sanitation Sun protection	Good health (SDG 3) Clean water and sanitation (SDG 6)
Significantly higher losses at 2°C are likely, unless adaptation measures are taken	All the afore mentioned measures, plus additional risk reduction, risk financing and risk insurance	No poverty (SDG 1) Zero hunger (SDG 2) Decent work and economic growth (SDG 8)
Significantly higher losses at 2°C are likely, unless adaptation measures are taken	Enhance understanding, acknowledge, recognise and compensate non-economic loss and damage	Peace, Justice and strong institutions (SDG 16)

Nomadic people such as the Afar do have traditional coping strategies to heat and drought. But they will fail if global temperature rises to 1.5°C or higher.

for its edible seeds), barley, sorghum maize and millet are most at risk in the cereal-growing regions, whereas in the pastoralist regions massive livestock deaths will lead to the depletion of wealth and to lower standards of living.

Traditional coping strategies will fail to adapt Ethiopia's agricultural backbone to a 1.5°C scenario or even higher levels of global warming

Current and future impacts of climate variability and change threaten development successes in Ethiopia. Traditional coping strategies include the diversification of livelihoods, changing cropping and planting practices, grain storage, sale of assets such as livestock and agricultural tools, herd diversification and splitting, mortgaging land, skipping meals, collecting wild foods, debt, temporary and permanent migration in search of employment, early warning systems, improved water management systems and humanitarian assistance.

Some of the traditional coping mechanisms such as adaptive cropping and planting practices, and food storage and early warning systems, can provide a good basis for long-term adaptation strategies. Others however, such as temporary and permanent migration, could contribute to significant non-economic loss and damage, and the disintegration of the social fabric in disaster-affected households in both farming and pastoralist communities.

Climate change poses a serious risk to poverty reduction by threatening to thwart decades of development efforts. Coupled with non-climate stressors that reinforce climate risks such as a rapidly growing population (Ethiopia has already become the second largest African country with a total population of 105 million) and deforestation at a rate of close to 140,000 ha per year, the business-as-usual scenario depicts a bleak future for Ethiopia. The expansion of agriculture threatens the natural environment and biodiversity. Pastoralist lifestyles which have been resilient in the past are being threatened by mobility constraints and a loss of pastoral commons and rights as a result of the effects of climate change, demographic pressure, and choices that Ethiopia is making to promote large-scale agriculture, which is encroaching on grazing areas.

76 million people, equivalent to 73% of the Ethiopian population, directly or indirectly depend on agriculture for their livelihoods (CIA 2018). Recurrent droughts and

floods will reduce the amount of land that can be used for agriculture, and to decreasing crop productivity. Apart from staple crops, lowered productivity will also affect export commodities such as coffee, oilseeds, meat and animals, which amount to 54% of the value of Ethiopia's exports. Of particular concern is the possible impact on Ethiopia's Arabica coffee, which is its most important export and very susceptible to the effects of climate change.

Ethiopia is preparing to respond to climate-induced challenges to sustainable development

The government of Ethiopia has shown commitment to reduce poverty, improve social inclusion, foster sustainable development, and to enhance climate resilience. It has continuously stressed the possible co-benefits of implementing the SDGs, its Climate Resilient Green Economy Strategy (CRGE) and its NDC.

This approach is based on the analysis that climate change is the major factor exacerbating social and economic vulnerabilities in Ethiopia, and that continued warming will have a multiplier effect on the adverse effects already being felt. The 0.5°C difference between a 1.5°C and a 2°C scenario would make a huge difference in terms of water scarcity, large decreases in staple cereal crops, and increased vulnerability.

Higher economic growth has led to poverty reduction in both urban and rural areas. Climate change threatens to sweep away progress made towards sustainable development goals and fulfilling people's basic human rights. In 1995, approximately 35 million Ethiopians (60% of the population at that time) were living in extreme poverty. Two decades later, Ethiopia has succeeded in halving the incidence of poverty despite a 45% increase in population. The country has made remarkable progress in key human development index indicators, most notably in primary school enrolment, which has quadrupled, child mortality, which has been cut in half, and the number of people with access to clean water, which has more than doubled. Efforts to combat Malaria and HIV/AIDS have also contributed to the improved well-being of Ethiopians. Nevertheless, with frequent droughts and flooding, vulnerable people and communities are becoming even more vulnerable.

How to further close the gaps in 1.5°C-consistent mitigation, adaptation and risk management

Climate change mitigation, transformational adaptation, and innovative risk management strategies, which integrate risk reduction, risk transfer and risk-retention, are being undertaken in different parts of the country. Irrigation in agriculture is on the rise, physical and biological soil and water conservation measures are expanding, the construction of climate-resilient infrastructure is gaining momentum, and reforestation, conservation agriculture and soil carbon sequestration are growing in importance. Although not to the extent of adaptation and mitigation, climate risk transfer strategies are now being piloted in the country, namely through the R4 – Rural Resilience Initiative, which has yielded promising results with poor subsistence farmers in the Amhara and Tigray regions. R4 combines four pillars of resilience building: risk reduction in resource management, climate risk insurance, livelihood diversification and microcredit, and savings (World Food Program 2018).

Ethiopia's climate action plans are largely based on strengthening an enabling environment for climate change adaptation and mitigation, including through sustainable financing. Closing the protection gap and preparing for a 1.5°C scenario requires the following measures:

1. Strengthening inter-ministerial coordination across the government and streamlining entry points for accessing and managing climate change funds and the Climate Resilient Green Economy Facility.
2. Transformational adaptation for a climate- resilient future in the following sectors:
   - Food and water security
   - Health
   - Human resources development, education and awareness
   - Soil and watershed conservation and management
   - Biodiversity, forest and ecosystem conservation
   - Urban planning and infrastructure development
   - Energy, transport and communication.

   Transformational adaptation should aim at (i) developing effective adaptation capacities; promoting and implementing adaptation programs that support and improve communities' livelihoods; and improving climate data availability, risk assessments and monitoring.
3. Climate-risk sensitive disaster preparedness, response and recovery through the implementation of the Ethiopia: National Policy and Strategy on Risk Management (2013) with a strong focus on reducing disaster risks and potential damage through the establishment of a comprehensive and coordinated disaster risk

management system in the context of sustainable development.

4. Transitioning to secured and sustainable renewable energies and a low-carbon economy by implementing the Climate Resilient Green Economy Strategy (2011) with its quantitative targets, and receiving support through access to international finance.
5. Building climate education, awareness and community mobilisation, whilst being mindful of culture, gender and youth, including through the integration of climate change into education, enhanced use of climate data in decision-making and planning, and the promotion of gender sensitive strategies and traditional knowledge in adaptation.
6. Include effective humanitarian response capacities as a last resort in a 1.5°C-consistent strategy of climate action.

The increasing numbers of internally displaced persons due to climate extremes even tops the huge influx of refugees.

Despite the valiant efforts by both the Ethiopian government and NGOs in disaster risk management, Ethiopia is regularly affected by a large and growing number of protracted humanitarian crises caused by droughts, floods, internal conflicts and influxes of refugees from almost all of its neighbouring countries. The number of recently internally displaced persons (IDPs) due to the conflict between Guji (Oromia) and Gedeo (southern peoples, nations and nationalities) has topped the number of hosted refugees, making Ethiopia the country with the largest number of IDPs. This conflict has its roots in competition over scarce resources, exacerbated by Ethiopia's policy of ethnic regionalisation.

In 2018, 7.88 million people have needed food assistance, and 8.49 million people have required non-food assistance; this has amounted to humanitarian aid costs of USD 1.658 billion. The humanitarian community supports the Ethiopian government in mobilising funding to support the massive requirements in agriculture, livestock support, education, emergency/shelter, non-food items, food, health, nutrition, protection and water hygiene and sanitation.

In 2017, humanitarian aid represented 39% of the total foreign aid provided to Ethiopia, this compares with just 5% in each of the fields of environmental protection, economic development and democracy, human rights and governance (U.S. Department of State 2018). With each additional level of global warming, the need for humanitarian aid will increase, absorbing scarce financial means for disaster response and rehabilitation, rather than investing into the future and the achievement of the SDGs.

Moreover, deforestation and land degradation are a serious concern around the huge settlements of IDPs and refugees, hosting close to three million people. Many of the one million refugees living in Ethiopia have done so for more than 20 years and have no prospect of returning to their country in the near future.

Transitioning from fossil to renewable energy and energy-efficiency, enhancing Ethiopia's adaptive capacity – including addressing co-stressors, as these multiply the effects of climate change – and increasing investment in disaster risk reduction, are key to reducing dependency on humanitarian assistance and most importantly to contributing to the global effort of maintaining the Paris Agreement's aspirational goal of 1.5°C. Ethiopia has set up an ambitious climate green economy strategy. Its implementation now depends in high degree on international financial and technical support.

The story of Tuvalu. A low-lying Small Island Developing State in the South Pacific

Contribution to the Talanoa Dialogue by Maina Talia, Coordinator of the Tuvalu Association of Non-Governmental Organisations

1.5°C of global warming is a matter of survival for Tuvalu

Tuvalu is the second smallest atoll nation in the world. It comprises nine inhabited islands with a population of 10,640; Funafuti is its capital. Its total land area is 26 km2 with an average elevation of 1.8m above the sea level. Tuvalu is a LDC and a SIDS. The country is situated to the North of Fiji and South of the coast of Papua New Guinea. As an extremely small and isolated island state, Tuvalu is one of the most climate vulnerable countries in the world.

Climate change-caused sea level rise, storm surges, warming, and changing rainfall patterns challenge all aspects of life in Tuvalu, particularly freshwater quality and quantity, agriculture, biodiversity, human security and societal life. Considering the small size and fragility

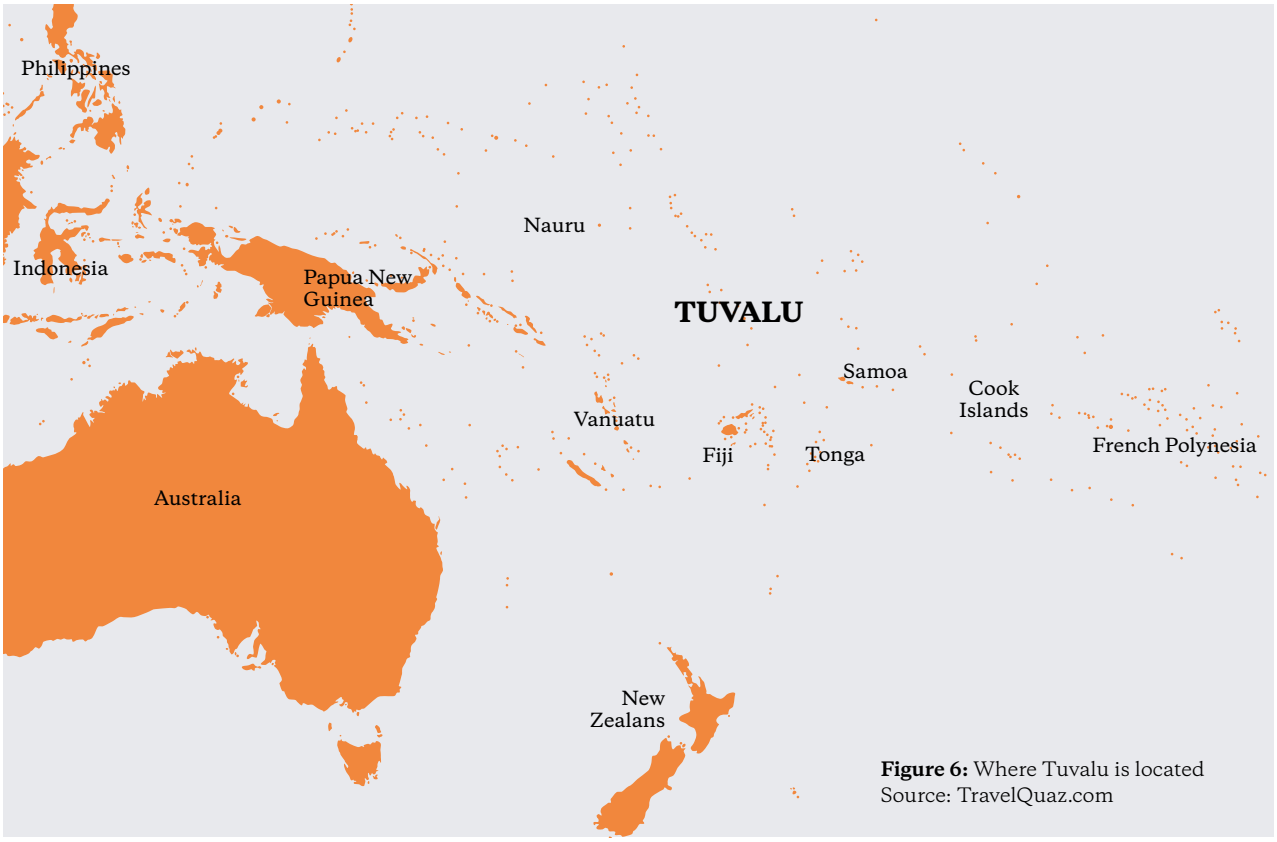

Figure 6: Where Tuvalu is located
Source: TravelQuaz.com

of the island, in addition to its physical and environmental vulnerability, Tuvalu is severely impacted by climate change and expects to become exposed to even higher risks in future. The Pacific Climate Change Science Programme (PCCSP) recently concluded that tropical cyclones are expected to decrease in number but increase in magnitude in Tuvalu. These predictions are likely to have significant implications for the future in terms of damage to human lives, infrastructure and livelihood assets. Researchers have demonstrated that the 10% most intense tropical cyclones are responsible for 93% of damage (Mendelsohn et al. 2012). The study also points out that the sea level near Tuvalu has risen by about 5 mm per year since 1999, or a total of 9 cm over this period. Under a high emissions scenario, another rise of between 4 and 14 cm is expected by 2030, and between 19 and 58 cm by 2090. The combination of intensifying cyclones and sea level rise will have a dire impact on Tuvalu. Wave overtopping during king tides and cyclones is already causing increasing levels of damage to natural assets such as to Tuvalu's fragile groundwater lens and many other economic, social and cultural assets (ibid.).

While the world continues to discuss rather than taking action to keep global temperatures well below 2°C or at 1.5°C, Tuvaluans, who contribute less than 0.000005% to global emissions (Government of Tuvalu 2015), are feeling the adverse impacts of climate change. The gathering of Polynesians leaders in Tuvalu in June 2018 highlighted grave concern about the preliminary findings of the IPCC's special report on global warming, which outlines the risks to SIDS including the destruction of marine ecosystem, sea level rise and extreme weather events that threaten the survival of island communities. Furthermore, they also noted that current global efforts to combat climate change will not be enough to prevent global warming from crossing the 1.5°C threshold, noting that limiting warming to 1.5 C is a matter of survival for SIDS (Polynesian Leaders Group 2018).

Overshooting 1.5°C would pose a severe threat to our very existence as Tuvaluans – and that is the constant fear that our people face in their daily lives: What will happen in the future if the international community does not start to make serious commitments? How long will we have to negotiate for our survival? If the worst comes

to worst, do we have a plan B despite the fact that we do not want to leave our homes? These questions will be discussed in the following.

The face of climate change in Tuvalu

In 2018, political leaders of the Pacific Island Forum emphasised that 'climate change presents the single greatest threat to the livelihood, security and well-being of Pacific people' (ibid.).

Sea level rise and the intensity and frequency of tropical cyclones leads to coastal erosion that destroys ancestral lands, to coral bleaching that forces our fish stock to move away from the coast, and to the intrusion of seawater into water resources and soils, which destroys our agricultural resources. Sea level rise has caused internal relocation – many of those who used to live close to the coast have moved further inland. Tropical cyclone Pam caused widespread damage in March 2015. 45% of the total population had to leave their homes and the total economic loss was of about USD 10.34 million.

King tides, another type of extreme event, are also becoming more frequent: 5 out of the 28 king tides that caused flooding between 1993 and 2012 occurred between 2010 and 2012. Research has demonstrated a causal link between the increase in king tides and the warming of the ocean.

A recent study by the Pacific Climate Change Science Program (PCCSP) projected that temperatures will further increase in Tuvalu. Accordingly, any additional level of temperature increase will lead to further flooding of low-lying parts of Tuvalu. Therefore, the call to keep global temperature at 1.5°C is a matter of survival for the future of low-lying atolls.

	2030 (°C)	2055 (°C)	2090 (°C)
Low emissions scenario	0.3—1.1	0.7—1.5	0.9—2.1
Medium emissions scenario	0.4—1.2	1.0—2.0	1.5—3.1
High emissions scenario	0.4—1.0	1.0—1.8	2.1—3.3

Figure 7: Projected average air temperature changes for Tuvalu
Source: PCCSP

We are committed to taking the following climate action

Tuvalu submitted its NDC in 2016, outlining the national commitment to mitigate emissions:

- Reducing GHG emissions from electricity generation by 100% by 2025.
- An indicative quantified economy-wide GHG mitigation target of 60% below 2010 levels by 2025.

In order to better monitor and implement Tuvalu's NDC and other related national commitments, the government of Tuvalu established the National Advisory Council on Climate Change (NACCC). The NACCC advises the cabinet how to effectively coordinate a whole-of-government response to the challenges of climate change. Furthermore, the government established the Climate Change Policy and Disaster Coordination Unit to coordinate the implementation of climate change mitigation and adaptation projects in the country.

The challenges facing the communities most vulnerable to climate change

Extreme poverty in Tuvalu is rare or non-existent, for reasons that include culture and community traditions. Help and support are provided by families, communities, religious groups and friends. Thus, Pacific island countries usually replace the term poverty with 'hardship' (Tauisi 2018). Haughton and Khandker (2009) define 'vulnerability' as the 'risk of falling into poverty in the future, even if the person is not necessarily poor at present; it is often associated with the effects of "shocks" from disasters and economic crises'.

The International Monetary Fund (IMF) argues that Tuvalu will continue to face significant challenges. The economy remains vulnerable to external shocks, including climate disasters. Hence, Tuvalu established the Tuvalu Trust Fund (TTF) in 1987 to maintain economic stability. The fund aims to cover revenue shortfalls for current expenditure in the national budget and enhance the country's long-term financial sustainability. International partners such as Australia, New Zealand and the United Kingdom support this initiative.

Revenues from fishing have substantially increased from 15% (2011) to 50% of GDP in 2017, accounting for 60% of total fiscal revenue. The fishing industry has created jobs for Tuvaluans working on fishing vessels. However, according to the IMF, fishing revenues are projected

Global warming is dangerous in Tuvalu since the average height of the islands is less than 2 metres above sea level.

to decline sharply around 2030, due to changes in weather patterns. As a result, fishing revenues are projected to fall to 40% of GDP, widening the fiscal deficit to 15% of GDP.

Tuvalu's current coping strategies

According to the World Bank, Tuvalu needs to invest 2% of its GDP in resilience-building to counter the negative effects of climate change, including by climate proofing infrastructure, adopting early-warning systems, and enforcing policies and plans. However, the underlying assessment focused only on protection against loss and damage caused by extreme events. It did not factor in likely non-economic losses, including those to culture and traditions.

Increasing sea surface temperature is exacerbating ocean acidification, which damages coral reefs, leading to severe coastal erosion, loss of land, and other unwanted geographical, physical, economic and social side-effects. In view of these losses, the government established the Climate Change and Disaster Survival Fund, which aims to meet the immediate needs of people before, during and after disasters. The fund has two main objectives:

1. Provide immediate vital services to the people of Tuvalu in combating the devastating impact of climate change and natural disasters.
2. Allow the government and the people of Tuvalu to coordinate effective and timely responses to the future impacts of climate change.

Accordingly, the fund is to provide financing that:

a. Supports responses to the impacts of natural disasters or which a declaration of a 'state of emergency' has been declared in accordance with the laws of Tuvalu.

b. Helps provide security to the people of Tuvalu against climate change and disasters by providing financial assistance in order to:
   I. Provide emergency relief during disasters.
   II. Assist the people to recover and adapt to adverse impacts of climate change.
   III. Assist the people to build back and rehabilitate.
   IV. Enhance resilience and protection against climate change.

Additionally, in order to provide the country with more time to strengthen people's resilience, Tuvalu has mobilised financial support provided by the Green Climate Fund for the Tuvalu Coastal Adaptation Project, comprising three main output categories:

- Strengthened institutions, human resources, awareness and knowledge for resilient coastal management.
- Reduced vulnerability of key coastal infrastructure including homes, schools, hospitals to wave-induced damages.
- The establishment of a sustainable financing mechanism for long-term adaptation measures.

Complementary to new adaptation approaches, local communities still continue with traditional knowledge-based coping strategies. Because of the limited resources, capacities and technologies that are available, it is important to revisit traditional knowledge as one of our coping strategies. Traditional knowledge is used mainly in agriculture, fisheries, health, horticulture, and environmental management (Foundation of the Peoples

Risks and Impacts	Driver	Co-stressor
Storm surges	Warming of the ocean Sea level rise	Densely populated low-lying coastlines
Coastal erosion and coastal flooding	Sea level rise	Degradation of mangroves and corals through environmental pollution
Water scarcity and droughts	Salinity encroachment El Niño/changing rainfall patterns	Denser populations Groundwater contamination Insufficient rainwater harvesting
Coral bleaching	Ocean acidification Typhoons	Ocean pollution near urban islands and shipping routes
Decline of fish stocks	Ocean warming Acidification Coral bleaching	Over-fishing Ocean pollution
Ecosystem degradation	Salinity encroachment	Denser populations Environmental pollution
Economic losses, particularly in fisheries, agriculture and tourism	All the afore mentioned drivers/ impacts	
Non-economic losses of territory, culture, traditional knowledge and social cohesion, particularly in remote outer islands	All the afore mentioned drivers/ impacts	

Figure 8: Linkages between climate risks, adaptation and the SDGs in a 1.5/2°C scenario for Tuvalu
Source: Author 2018

of the South Pacific International 2012). The body of traditional knowledge, practices and beliefs in Tuvalu is embedded in the local cultural, spiritual, social and ecological context and practised through interaction with the environment to attain basic needs such as food, medicine and housing (ibid.).

Our traditional weather forecast for example, is a very important part of early warnings, especially on outer islands: a breadfruit tree baring too many fruits indicates that cyclones are coming. If sand crabs build houses on top of their holes, it indicates that the sea will be rough soon, whereas, if these crabs locate their sand houses far from their holes, the sea will be calm and good for fishing. However, increasing weather irregularities may hamper our traditional forecasting and coping strategies.

What else can be done to close the risk protection gap?

Low-lying island atolls like Tuvalu have limited opportunities for adaptation as they have very few relevant capacities, low levels of technology and limited resources.

However, in 2014 the government of Tuvalu launched the Tuvalu 'Sky is the Limit' scholarship program with a vision 'that all Tuvaluans are given the right to pursue further education and training up to their full educational potentials, in Tuvalu and the Pacific region, to better compete in local labour markets and beyond' (Government of Tuvalu 2014). This vision has been reiterated by the prime minister, who stated that the best adaptation measure for Tuvalu is education. 'Sky is the limit' not only seeks to strengthen the adaptive capacities of people who

Difference between 1.5°C and 2°C	Measures	SDG affected
Low by mid-century, increasingly high by end of century and beyond	Early warnings Safe shelters Planned resettlement Proper early warning systems	Good health and well-being (SDG 3)
Low by mid-century, increasingly high by end of century and beyond	Coastal protection Planned resettlement	Sustainable cities and communities (SDG 11)
Rainfall likely to be significantly higher in a 1.5° scenario	Improved water management and sanitation Rainwater harvesting Drip irrigation Reverse osmosis water filters	Clean water and sanitation (SDG 6)
Between 10% and 30% of coral reefs may survive in a 1.5°C scenario; complete extinction at 2°C warming	Marine protection (including sanctuaries) and controlled management of coral reefs	Life below water (SDG 14) Decent work (SDG 8)
Projected global decline of fish catches by 1.5% at 1.5°C or 3% at 2°C compared to today's figures Decline in Tuvalu's catch probably significantly higher for coastal fisheries	Marine protection (including sanctuaries) and more restricted management of fish stocks	Life below water (SDG 14) Zero hunger (SDG 2) Decent work (SDG 8) Responsible consumption and production (SDG 12)
Degradation of fragile ecosystems on low-lying islands likely to be lower at 1.5°C	Environmental protection, water management and coastal defence	Life on Land (SDG 15) Good health and well-being (SDG 3) Zero hunger (SDG 2)
Significantly higher losses at 2°C are likely, unless adaptation measures are taken	All the afore mentioned measures plus additional risk reduction, risk financing and risk insurance	No poverty (SDG 1) Decent work and economic growth (SDG 8)
Significantly higher losses at 2°C are likely, unless adaptation measures are taken	Enhance understanding of, and acknowledge, recognise and compensate non-economic loss and damage	Peace, Justice and strong institutions (SDG 16)

1. Agriculture and Food Security

- Completed first round of food distributions targeting 4,630 people
- Engaged government to develop an agriculture and food security recovery plan
- New Zealand and Taiwan government and the Tuvalu community in New Zealand donated food items for distribution to the affected people
- 8 metric tonnes of fresh fish donated by fishing companies distributed to beneficiaries in Nui Island
- Government has plans to provide food assistance to the affected communities for a period of 6 months
- Various partners have made commitments to support food security recovery and are in the process of engaging government on prioritising recovery projects. The Department of Agriculture has developed a relief and recovery plan detailing the recovery activities.

2. Education

- An assessment of the impact on schools was conducted
- Teachers whose residences were damaged were offered alternative accommodation
- UNICEF provided 899 school bags with stationery supplies for students in lower and upper primary schools affected by the disaster
- UNICEF provided support to nine Early Childhood Centres in seven outer islands that included 1,000 drawing books, 119 exercise books and 214 packs of colour pencils
- A relief and recovery plan has been developed detailing activities to support the recovery of the education sector.

3. Health

- One emergency health kit was distributed as a backup
- Medicines, medical equipment and medical consumables including oral sachets were distributed to all affected islands
- 400 mosquito nets were distributed
- A midwife, two medical officers, trauma counsellor, intensive care nurse, public health nurse and pharmacist from Fiji's National University were deployed to Funafuti and outer islands.

4. Public utilities and infrastructure

- Government procured building materials and delivered them to the outer islands to support the reconstruction of damaged homes
- A team from the Public Works Department carried out some minor repairs on damaged the community hall in Nui
- The Tuvalu Red Cross Society (TRCS) distributed 170 tarpaulins to affected islands
- TRC also distributed non-food items including blankets, kitchen sets as well as hygiene kits.

5. WASH

- WHO provided IEC materials for public health messaging, and 300 emergency water testing kits for water quality monitoring in affected communities
- UNICEF in collaboration with the Red Cross facilitated the dissemination of information from the Ministry of Health to advise communities on measures to protect their health
- Rapid assessment teams tested water samples for salinity and E-coli; follow up water testing was also conducted
- UNICEF provided 5,000 water-purifying tablets distributed through the TRCS. The TRCS also provided advice to communities on how to use the tablets.

6. Early Recovery and Coordination

- The National Disaster Management Committee (NDC) coordinated all emergency response activities and met regularly to review the situation and provide policy guidance
- The TC Pam Foreign Relations' Sub Committee (of the NDC) was established with partners on the ground that actively helped coordinate the response and collate assessment information
- The UNDP provided three technical advisors for early recovery, debris management and donor coordination
- The UNDP also implemented on-going livelihood, environmental protection, and economic recovery projects and these were scaled up in support of Tuvalu's recovery from TC Pam and to reduce its long-term vulnerability.

Figure 9: Tuvalu's humanitarian response to Cyclone Pam
Source: Tuvalu Tropical Cyclone Pam Report: Vulnerability Reduction Plan, Government of Tuvalu

The small Funafala atoll belongs to the island state of Tuvalu which is prone to sea level rise and intense storms.

intend to remain on the island, rather it also strengthens those of people who plan to migrate.

Providing adequate humanitarian responses to extreme climate events is another priority. The following table provides an overview of the humanitarian response provided by the government and its humanitarian partners in the case of Cyclone Pam.

Concluding remarks

Reducing vulnerability and enhancing resilience is an on-going challenge for countries in the Pacific. Accessing climate finance to build resilient communities has proven to be difficult for the most vulnerable in our region, especially in Tuvalu.

Most climate finance in the Pacific is being delivered through projects, while a minimal percentage is channelled as direct budgetary support to Pacific island countries. Less than 1% of climate funds are being accessed by coconut-roots[1] community organisations such as coastal villages, women, children and adolescents and people with disabilities. A more inclusive approach is still needed to accommodate the need of people living in low-lying atolls. Donor partners should improve dialogue with these communities in order to address their needs.

Land reclamation by the government of Tuvalu provide us with more time due to costal protection. Gaining extra land serves as a symbol of hope and provides assurance to the people of Tuvalu that Tuvalu is being saved in order to save the world. Clearly, the government and the people of Tuvalu are striving together to achieve the country's NDCs and SDGs as stated in Tuvalu's National Strategy for Sustainable Development 2016-2020.

1 The term 'coconut-roots' is used to replace the word 'grassroots' which has colonial overtones.

Part 3

Policy options in support of 1.5°C-consistent pathways

Mitigation options

Neither of the Paris Agreement's temperature goals – keeping global warming well below 2°C and pursuing efforts to prevent temperatures from rising above 1.5°C – **can be reached with the emission trajectories foreseen in line with current NDCs**. Instead, by 2030, current NDCs will result in aggregated GHG emissions that are higher than those in scenarios that are compatible with limiting global warming to 1.5°C by 2100 (IPCC 2018b). Moreover, it is very likely that they will lead to **Paris goals to be overshot and result in a mean temperature increase of between 2.7°C and 3.5°C**.

All scientific climate models (see Glossary) that are currently being used to develop 1.5°C pathways demonstrate that a **fast and steep increase in mitigation ambition must take place long before 2030, preferably no later than 2020**. The vast majority of models have ruled out any scenario in which the NDCs remain unchanged until after 2030 and mean temperatures remain at – or return to – 1.5°C (IPCC 2018b). Thus, in light of the inacceptable high human, economic and environmental risks that will unfold if warming exceeds the critical 1.5°C threshold, **it is imperative that NDC mitigation targets are ratcheted up before 2020**.

All 1.5°C-coherent pathways that were analysed by the IPCC used some form of **Carbon Dioxide Removal** (CDR), either through afforestation (i.e. strengthening natural carbon sinks), biomass energy combined with carbon capture (via technical processes), storage (underground) or use (for instance by industrial processes). Most models show that CDR is an unavoidable means of neutralising emissions for which no mitigation measures could be identified (e.g. methane emissions from livestock or rice paddies). Moreover, CDR is also predicted to be necessary if **net negative emissions** are to be achieved in order to draw down any excess in carbon emissions beyond the carbon budget during the second half of the century (IPCC 2018b, Summary for Policymakers). Most 1.5°C-consistent emission reduction pathways include the deployment of afforestation and **biomass energy combined with carbon capture and storage** (BECCS). It has to be noted, however, that several recent studies argue that with radically changed lifestyles and reduced consumption, the 1.5°C climate threshold could be reached without relying on planetary-scale land-use change for carbon removal, and that the restoration of natural carbon sinks could contribute towards reliance on risky and unproven CDR technologies (Bertram et al. 2018; Grubler et al. 2018). Many people particularly criticise the large-scale use of CDR, and especially BECCS, due to the l**arge amount of land required for bioenergy crops, and the associated risks for food and water security, and biodiversity**. There is also the issue of the unproven feasibility of these technologies, and low levels of social acceptance. Assessments of the potential scale of bioenergy-driven land-use change find that the levels of land conversion that would be necessary exceeds what may be considered sustainable or feasible at scales that **exceed planetary boundaries** (Dooley et al. 2018).

Despite these problems, CDR remains an important element in modelling 1.5°C/2°C-consistent pathways. It is obvious that its deployment will have high implications in terms of land-use changes, possibly including critical trade-offs in terms of sustainable development, food security, farmers' rights, indigenous people and biodiversity.[2] Therefore, CDR requires much more research and thorough discussions before its possible implementation. The next IPCC Special Report on Climate Change and Land, which is due to be published in 2019, will provide important opportunities in this regard. For the time being, **any mitigation strategies should minimise their land-use change footprints** to diminish the negative impacts on agriculture, land rights, ecosystems and sustainable development.

Placing 1.5°C pathways in a context of justice and sustainable development also requires a consideration of other – possibly contradictory – links, such as high population growth, over-consumption and business-as-usual economics. On the other hand, possible co-benefits of ambitious emission reductions, for instance, the provision of access to sustainable energy for all, higher air quality, environmental protection and sustainable lifestyles, also need to be factored in. Decent employment,

2 According to Holz, BECCS demand for land has been pegged at about 30 to 160 million hectares (Mha) per $GtCO_2$, depending on the type of bioenergy feedstock used. Accordingly, land in the order of 600 to 3,200 Mha would be required to achieve the 20 $GtCO_2$ magnitude at the upper end of the range of annual sequestration found in the models. In contrast, current global cropland amounts to approximately 1,500 Mha suggesting that massive BECCS deployment would strongly compete with food production. See https://www.boell.de/sites/default/files/radical_realism_for_climate_justice_volume_44_8.pdf?dimension1=ds_radicalrealism (last accessed on 25 September 2018).

People in the highlands of Ethiopia are constructing new wells and water pipes to be better prepared for droughts.

food security and the eradication of poverty are elements of sustainable development that rely considerably on decarbonisation, but which could also become threatened by deep and fast mitigation strategies, depending on their specific conditionalities and profile. In conclusion, co-benefits between climate action and sustainable development are neither automatic nor assured, but highly dependent on carefully planned and implemented policies (IPCC 2018a, Chapter 5.4.1; Clarke et al. 2014).

The **remaining carbon budgets** that will be needed to prevent global warming from exceeding 1.5°C or 2°C amounts to between 420 Gt and 1300 Gt of CO2 (IPCC 2018b). 1.5°C-consistent pathways **require emissions to be reduced to 25 Gt per year by 2030**, and to 30 Gt per year in the case of a 2°C-consistent pathway. These figures are between 40 and 60% below the levels of emissions that will occur if the current NDCs for 2030 remain unchanged (between 49 and 56 Gt), and between **29% and 40% below 2017 levels (42 Gt)** (ibid.). This leads to the following conclusions:

- **Without significantly raising mitigation ambitions by no later than 2020**, it will be impossible to prevent climate change from **overshooting the 1.5°C** threshold or to return temperatures to this level. Moreover, it would lead to unacceptably high risks for humankind and nature, prevent SDGs from being achieved, and thus, leave many people behind.
- Current 1.5°C-consistent models suggest that it is very unlikely that 1.5°C can be achieved without a **temporary overshoot** (i.e. surpassing the 1.5°C threshold but returning to it in the second half of the century).
- **The IPCC argues that only limited alternatives will exist to removing CO2** from the atmosphere in the future. Furthermore, there is currently no alternative to **increasing mitigation ambitions now** in order to minimise the risks that future generations will either become dependent on risky technological pathways or face the disastrous consequences of runaway climate change.
- Whatever the solution, mitigation pathways will shape future energy and land-use massively, bearing possible co-benefits and trade-offs with sustainable development. Thus, is essential to align the implementation of the SDGs and the NDCs.
- There is more than one 1.5°C-consistent pathway.

Many factors, for instance food habits (meat), consumption patterns, land-use changes, and technical innovation, shape these pathways, alongside the choice of mitigation strategy.

- In terms of socio-economic pathways, the sustainability pathway (SSP1) (O'Neill et al. 2014; Rogelj et al. 2018) has been found to be most likely to keep temperatures at 1.5°C. It assumes low levels of population growth, a high rate of per capita growth, great technical progress, low demands for energy and food, and an environmentally-based approach. The fragmented world pathway (SSP3), in contrast, might be the most likely one, assuming that the world falls back into blocks, with high levels of population growth accompanied by low economic growth, very little innovation and a strong focus on national food and energy security. But this scenario is predicted to lead to a 3°C world.

The IPCC (2018, Chapter 2) identifies the following key elements of transition pathways that are compatible with 1.5°C of global warming in the context of sustainable development:

- Strong and fast **carbon pricing** in a range of 90 to 105 USD/t CO_2 for 1.5°C (or 30 to 70 USD/t CO_2 for 2°C).
- A fast, socio-economic transition, enabled by more ambitious, internationally cooperative and **transformative policy frameworks**.
- Strong shift in **investments** from 'brown' and unsustainable to 'green' and sustainable, including highly sustainable energy investments (between 2018 and 2050) in the range of:
  - USD 0.3–1.3 trillion per year in Asia
  - USD 0.3–0.8 trillion per year in OECD countries
  - USD 0.08–0.5 trillion per year in the Middle East and Africa
  - USD 0.07–0.2 trillion per year in Latin America
  - USD 0.05–0.2 trillion per year in Eastern Europe and the former Soviet Union.
- Turning land, soils and forests from carbon sources into carbon sinks.

Furthermore, the IPCC stresses that these mitigation elements would have to be translated into the following **sector-related approaches** (ibid.):

Energy
- Fast electrification of energy end use
- Full decarbonisation of electricity
- Decarbonisation of residual fuel mix as much as possible
- Increased energy efficiency
- Lower energy demand

Transport
- Electrification (15% of total reduction potential) and increased energy efficiency (29% of total reduction potential)
- Biofuels (36% of total reduction potential)
- Behavioural change (switch from individual to public transportation; risk avoidance; digitalisation of communication) (20% of total reduction potential)

Buildings
- Increased energy efficiency and decarbonisation of heating, cooling, and lighting
- Digitalisation and smart buildings/cities

Land-use and agriculture (Agriculture, Forests and other Land-Use (AFOLU)
- Afforestation
- More land used for biofuel production
- Less but more intensively used agricultural land; less emission-intense production methods
- Less pasture land and less livestock
- Less meat consumption

Figure 10: The main mitigation approaches needed for global warming of 1.5°C (by sector)
Source: Authors, based on IPCC 2018a, Chapter 2

Possible adaptation measures

The Paris Agreement has set the **global goal of adaptation**. The aim is to increase 'the ability to adapt to the adverse impacts of climate change and foster climate resilience' (Paris Agreement, Article 2, paragraph 1b). This qualitative goal is also reflected in SDG 13 'Climate action', most notably in target 13.1: 'Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries'.

As a first step towards implementation at national levels, these global goals and targets on climate resilience (see Glossary) should be reflected in **national climate policies**, particularly in the NDCs, national adaptation plans, and 2050 long-term strategies. So far, this has only happened in part: just 127 developing countries have **included adaptation in their NDCs**, of which 90 prioritised adaptation over mitigation (Brot fuer die Welt/Act Alliance/Germanwatch 2016b). The NDCs of most industrialised countries leave out adaptation completely. So far, **only 11 countries have submitted a national adaptation plan, and 2050 long-term strategies** have been drawn up by nine, not all of which cover adaptation. However, many more countries already have adaptation strategies, policies and action plans in place, nationally, regionally and locally. But a lot more still needs to be done to effectively plan for 1.5°C pathways, and **adaptation must be stringently aligned with development planning** throughout the world.

Adaptation needs will be lower and **less costly in a 1.5°C compared to a 2°C world** (IPCC 2018b). It is important to note, however, that for some populations, places and sectors, adaptive capacity will be exceeded in a 1.5°C world – in some cases it has already been exceeded –

Climate-resilient agriculture
- Conservation and sustainable agriculture
- Breeding and planting of resilient varieties
- Changing planting times and cropping patterns
- Mixed crop–livestock systems and pest control
- Efficient irrigation
- Traditional indigenous knowledge

Water/watershed and flood management
- Efficient water storage, supply and use
- Wastewater treatment
- Desalinisation
- Conventional watershed management
- Flood management and protection
- Restoration of floodplains
- Land-use planning

Coastal adaptation
- Sea walls, dykes and dams
- Coral reef and mangrove restoration
- Cyclone shelter, elevated and fortified houses
- Wind- and wave-breakers
- Fish stock management and aquafarming
- Early warning systems

Ecosystem-based adaptation
- Forest protection and afforestation
- Land rehabilitation (of degraded lands)
- Wet- and peatland restoration
- Erosion control
- Biodiversity protection
- Indigenous land and forest management

Health adaptation
- Preventing and combatting the spread of vector-borne tropical diseases
- Preventing and combatting heart- and circulatory diseases due to heat/heatwaves
- Combatting diarrhoea in the context of flooding and other extreme climate events
- Combatting climate-induced skin diseases

Drought/dryland management
- Combatting desertification
- Land protection and rehabilitation
- Livestock management and reduction
- Storage of food, water and fodder
- (Temporary) migration (of pastoralists)
- Early warning systems

Figure 11: Main approaches to adaptation in a 1.5°C or 2°C world (by sector)
Source: Authors, based on IPCC 2018a, Chapter 5

putting them at high risk, and thus making it essential that climate-induced loss and damage is addressed (see next sub-chapter).

The IPCC (2018, Chapter 5.3) differentiates between the following possibilities for **adaptation**:

- Governance and institutional adaptation (e.g. risk assessment and adaptation planning, legal frameworks, land-use regulation, water management, risk financing, insurance).
- Structural and physical adaptation (e.g. coastal and flood protection, water storage, plant breeding, ecosystem management).
- Social adaptation (e.g. information, capacity development, education, migration, social safety nets).

Figure 11 (p. 43) demonstrates the six sectors with the highest adaptation needs in a 1.5°C or 2°C world.

Alongside climate information and education, knowledge generation and technological innovation, people are increasingly understanding the very important role played by **traditional knowledge** (including for the in-depth understanding of the local environment and of the changes that are occurring), of ecosystem-based adaptation, and of community-based adaptation.

There are three further key factors that define successful adaptation:

- **Enabling political frameworks** (at international, national and subnational levels)
- More support in the form of **climate finance for adaptation** and a shift in private investments flows to resilient infrastructures
- More international **partnerships** and multi-stakeholder cooperation.

Climate resilient, inclusive, prosperous and healthy societies, regions, cities and communities are possible – but greater awareness of adaptation needs, better insights into co-benefits and trade-offs linked to sustainable development and climate mitigation, higher adaptation capacities and a clear commitment to strengthening equity across populations, regions and generations are needed (IPCC 2018a, Chapter 5).

The IPCC points to the fact that successful resilience building requires much more than just technical solutions. It refers to the concept of **transformational adaptation**, which it defines as adaptation that changes the fundamental attributes of a system in response to climate and its effects (IPCC 2018a, 4.2.2.2). In this respect, **resilience-building** primarily **involves addressing the root causes of vulnerability**, in other words, social exclusion, inequality, gender discrimination, injustice, and a lack of information, capacities (including financing and technology) and participation (ibid.). Transformational adaptation, therefore, is **closely inter-twined with implementing the SDGs**, tackling similar issues, as for instance with regard to SDG 1 (No poverty), SDG 5 (Gender equality) and SDG 10 (Reduced inequality). Thus, SDG implementation can significantly contribute to reducing vulnerability and increasing adaptive capacities, while transformational adaptation, in turn, can reduce climate risk exposure and thus enable SDG implementation. However, apart from these **co-benefits**, there are also **possible trade-offs** that need to be addressed: ecosystem restoration, for instance, could be an adaptation necessity, but could also lead to conflicts over agricultural land, endangering farmers' livelihoods and food security.

Climate change affects the most vulnerable populations and future generations.

Most narrow path of Funafuti main atoll of Tuvalu.

Climate risk transfer options aimed at addressing climate-induced loss and damage

Direct **damage caused by extreme climate events** alone are calculated as amounting to **USD 300 billion per year,** or USD 520 billion if indirect damages (e.g. drops in consumer spending) is taken into account (World Bank 2017). These economic losses are projected to increase further in a 1.5°C or 2°C world (IPCC 2018a, Chapter 5, Cross-Chapter Box 12). This puts vulnerable countries, particularly SIDS and LDCs, at immense risks, considering that around **26 million people are already being pushed back into poverty every year**, due to disaster-related loss and damage (Hallegatte et al. 2017). Thus, climate-induced loss and damage clearly hampers the achievement of SDG 1 (No poverty). Poverty-stricken countries with a high exposure to risk, therefore, urgently need **risk financing and transfer** options that could help them to avoid dramatic economic meltdowns. This has already happened on the island state of Dominica, which lost 77% of its GDP after being stricken by a hurricane in 2015. If countries face increasing long-term climate risks, they will also face downgraded credit ratings, which will further hamper their aspirations for development and justice (Brot fuer die Welt/Act Alliance 2017b).

Thus, collective risk retention, risk financing and risk transfer is another key pillar to prepare for 1.5°C-consistent pathways, alongside mitigation, adaptation and humanitarian responses (IPCC 2018a, Chapter 4.3.5.2).

Collective risk retention means that the damaged parties cover the costs of damage themselves, be it in form of national emergency funds (e.g. the National Disaster Fund in Mexico or the National Calamity Fund in the Philippines), by budgetary reallocation, or tax increases (ibid.).

Climate risk financing is usually credit-based and can take very different forms, as for instance contingent credit lines for disasters (e.g. the World Bank's Catastrophic Risk Deferred Drawdown Option CAT-DDO) or (concessional) loans (e.g. for reconstruction) (ibid.).

Climate risk transfer (see Glossary) in the stricter sense refers to climate risk insurance and financial market instruments such as catastrophe bonds that transfer risks. **Risk insurance** is based on the concept of bundling

Climate justice requires tranferring the compensation liability to those responsible.

and hedging individual risks in return for the cost of an insurance premium with costs varying according to the risk, the product (insurance coverage) and the size of the risk pool. The larger and the more diverse the risk pool is, the lower are the premium costs. This is why the **CVF** has considered creating its own risk insurance pool across geographical regions and with different risk types (flood, hurricane and drought), as this would reduce costs significantly compared to national risk pools (ibid.).

All these options are subject to the same overarching **concern for justice**, namely that the **polluter-pays-principle**, which would transfer the compensation liability to the responsible party, **is not applied in this case**. Thus, the financial burden remains with the countries that are being damaged (risk retention), taking on insurance (risk insurance), or others like entire societies or international donors. Furthermore, if **climate risk insurance** is to become **affordable and accessible to the poor**, it will need to apply **'pro-poor principles'** (ibid.). Finally, very few climate-induced losses can gain cost-effective insurance, and **many risks** – such as damage caused by sea level rise – **cannot be insured** against at all. Therefore, a new architecture of fair climate risk financing and transfer is needed, including a **Loss and Damage Fund, which is based on the polluter-pays-principle**, to effectively address the challenges posed by 1.5°C pathways that go beyond mitigation and adaptation (ibid. and Brot fuer die Welt 2017a).

Apart from strengthening financial and risk transfer instruments, it is essential to address the increasingly concerning trend of **displacement and migration** due to adverse climate change impacts. There is still neither an international regime of protection for people affected by environmental displacement, nor binding mechanisms to ensure support is provided to countries that experience large displacements due to climate change. The **Platform on Disaster Displacement** has developed important recommendations on how to deal with climate-induced migration and how to provide assistance to states in need. This expertise should be applied, and the Platform on Disaster Displacement deserves a more prominent role in these discussions. The same is true for the **UN Global Compact for Migration** and the **Global Compact for Refugees**. In the long-term, the establishment of a special

protection status, anchored in international law, for people displaced or forced to migrate due to the adverse impacts of climate change would be another important step.

The options available for humanitarian responses

According to the United Nations Office for Disaster Risk Reduction (UNISDR), **606,000 people lost their lives between 1995 and 2015 due to extreme climate events** (UNISDR 2016). 62% of them were very poor people who lived on less than USD 3 a day. Reducing disaster-related mortality is a humanitarian imperative and thus global warming – as its main driver – must be held at 1.5°C. However, even this situation would continue to put millions of people at risk, even more so in a 2°C world: **exceeding 1.5°C would lead to more lethal cyclones, floods and droughts**, making it very difficult, particularly in poor countries, to avoid humanitarian problems on an immense scale.

The **Sendai Framework for Disaster Risk Reduction** (see Glossary) sets the global framework for disaster risk reduction, and was adopted by the community of states in 2015. Its national implementation **should become a reference and integral part of NDC implementation**. It is essential that **nations prioritise reducing the risks faced by the most vulnerable people** and communities. The SFDRR targets should serve as a benchmark for ensuring that the NDCs are aligned with the SFDRR. In order to do so, global targets will have to be translated into national ones:

- Substantially reduce global disaster-related mortality by 2030
- Substantially reduce the number of people affected throughout the world by 2030, with the aim of lowering the average global figure by 100,000 between 2020 and 2030 compared to the period between 2005 and 2015
- Reduce direct disaster-related economic loss in relation to global GDP by 2030
- Substantially reduce disaster-related damage to critical infrastructure and disruption of basic services by improving their resilience by 2030
- Substantially increase the number of countries with national and local disaster risk reduction strategies by 2020
- Substantially enhance international cooperation with developing countries by providing adequate and sustainable support to complement their national action plans for implementing the framework by 2030
- Substantially increase the availability of and people's access to multi-hazard early warning systems and disaster risk information and assessments by 2030.

The SFDRR acknowledges both the necessity and opportunities available to enhance coherence across policies, institutions and goals, and seeks to ensure linkages between SFDRR, climate action and sustainable development. Key steps to ensure this coherence include **aligning DRR climate and development policies**, starting with reinforced climate risk assessments, addressing the root causes of vulnerability, empowerment, **enhancing social capital and social safety nets in addressing disaster-related risks**, joint planning, and supporting coordination, partnerships, and more investment in implementation. Projected disasters in 1.5°C/2°C scenarios can only be addressed if **investments from the public and private sectors are significantly increased**. Furthermore, **providing enabling environments to address disaster-related risks** would increase capacities to face up to challenges. Finally, **meaningful and substantive engagement by civil society organisations** would provide the opportunity to reach the most at risk communities and involve them in resilience-building.

Policy options for 1.5°C-consistent pathways proposed by the Climate Vulnerable Forum

'Half a degree matters'! No other group of countries insisted so strongly on **including the 1.5°C temperature goal into the Paris Agreement** as the CVF. The CVF was established in 2009. In September 2018, it counted 52 member states that covered all of the continents in the Global South. The presidency rotates in 2018 from Ethiopia to the Marshall Islands. In the past, Bangladesh, Costa Rica, the Maldives and the Philippines held have the CVF presidency. In the post-Paris period, the CVF's **Marrakech Vision** (see below) and its study Pursuing the 1.5°C Limit (2016) demonstrates that it continues to place high priority on 1.5°C-consistent pathways globally and at the national level of its members.

'The response to climate change is climate justice and social justice in action. In partnership and with the support of the international community, we aim to survive and thrive in a world where, as soon as possible and at the latest by 2030 to 2050:

1. **The dangers of climate change are kept to an absolute minimum.**

In our action, we must address underlying causes of disaster risk and climate vulnerability. This requires limiting to the maximum the increase in warming below, if not well below, 1.5 degrees Celsius, a peaking of global emissions by 2020 at the latest, and the achievement of net carbon neutrality by the 2050s [...] anticipating both the 2018 IPCC special report on 1.5 degrees [...], we commit, in the context of the provision of [...] robust and predictable support, to:

- Update our NDCs [...] before 2020 emphasizing that additional enabling support on means of implementation is indispensable to any upscaled mitigation and adaptation action [...]
- Prepare mid-century, long-term low GHG development strategies [...] before 2020, connecting our short, medium and long-term development pathways as we strive to limit warming to 1.5 degree Celsius or below, while adapting to the impacts of climate change [...]

2. **Maximum advantage is taken of the benefits of climate action.**

- We strive to meet 100% domestic renewable energy production as rapidly as possible, while working to end energy poverty and protect water and food security [...].
- Pledge to help each other [...] to transform our energy, transport and other sectors, and together ensure support is made available in terms of capacity building, financing and technology.

3. **For protection from growing dangers even with only 1.5 degrees Celsius of warming that will disadvantage the most vulnerable, maximal resilience is achieved for people, indigenous groups, livelihoods, infrastructure, cultures and ecosystems.**

- We commit to the urgent implementation of ambitious National Adaption Plans [...], promoting adaptation action at local level fully integrated with our national development strategies as a way of minimizing loss and damage resulting from slow onset and extreme events.
- We aim to strengthen participatory local risk governance and encourage members to actively engage [...] on climate risk insurance [... and] aim to extend insurance coverage to every community within the territories of our members.

4. **In embarking on a new era of the pursuit of development, ending poverty, leaving no person behind, and protecting the environment, not only are all Sustainable Development Goals and the targets and priorities of the Sendai Framework for Disaster Risk Reduction achieved by 2030 but also, where possible, their targets are exceeded or their early achievement is accomplished.**

- We commit to advocate together for an international cooperative system fully equipped to address climate change and provide adequate support for climate change mitigation and adaptation action to developing countries [...] with a particular initial focus on protecting food production and the domains outlined in our 2016–2018 Road Map: agriculture, education, health, human rights, gender, labour migration/displacement, science, tourism and water.
- Pledge to ensure our people are effectively informed about climate change and how to address it [...]

5. **As least developed and low- and middle-income developing countries, we emerge as wealthy nations achieved through strongest possible economic growth.**

- We will pursue the V20 2020 Action Plan focused on attaining a significant increase in climate investment in our countries' public and private climate finance from wide ranging sources [...]
- Noting the V20 commitment to working to establish pricing regimes, we will consider and share experiences on ways of effectively and fairly using such instruments.
- We strive to eliminate high-carbon investments and harmful subsidies, including through enhancing enabling environments both at the international and national levels [...]'

Figure 12: The CVF's Marrakech Vision and its links to climate action and development
Source: https://www.thecvf.org/wp-content/uploads/2016/11/CVF-Vision-For-Adoption.pdf

This struggle is driven by the conviction that deep and fast decarbonisation is not only a necessity if the 1.5°C threshold is not to be breeched, but also by the believe that those who take the lead in this transformational pathway will be the winners of the 21st Century. The CVF already made this clear in the Malé Declaration in 2009. Climate action is beneficial for sustainable development – this view was renewed in 2013, in the CVF's Costa Rica Action Plan, reiterating that 'action on climate change can be configured to boost socio-economic development' (Climate Vulnerable Forum 2016). The Marrakech Vision, as the outcome of the CVF's High Level Meeting at Marrakech in 2016, contains a 1.5°C vision and the following political pledge by its members.

The CVF's Marrakech Vision explicitly contains the key policy options that the IPCC considers the prerequisites for 1.5°C-consistent pathways, and indirectly refers to many more of them. Thus, the **Marrakech Vision is currently the most mature political pledge for climate, humanitarian and sustainable development action**. It was formulated by CVF members to take a **transformational climate resilient and low carbon development pathway with a view to ensuring temperatures either remain below or do not rise above 1.5°C**. It is essential that this vision is turned into action and provided with the necessary international support and cooperation.

The **CVF** has already reached agreement on a number of **flagship initiatives** to move its members towards 1.5°C-consistent pathways, including **NDC enhancement**, development of **2050 long-term strategies, renewable energy pilot projects** in the electricity sector, combined with storage, and a **carbon pricing initiative** and the establishment of a **CVF sustainable climate risk insurance pool**, both of which particularly target small island states.

These flagship initiatives reflect clear priorities, have the potential to mobilise the **triple win of adaptation, mitigation and sustainable development co-benefits**, and, thus, deserve international support. Moreover, they reflect a **partnership approach between climate vulnerable countries** which is particularly valuable.

Germany's policy options to support 1.5°C-consistent pathways

In climate and energy policy, Germany became known for its **energy transition** towards renewables, ambitious climate goals, progressive climate diplomacy and its role as one of the biggest donors of climate finance. However, **its image as one of the global climate champions has considerably suffered** in the past five years, due to the fact that the country has been **off-track in terms of its emission reductions since 2010**, will fail to achieve its 2020 targets, and hinders rather than drives reforms that would lead to the ambitious climate and energy targets needed to bring Germany and the EU on track with 1.5°C-consistent pathways.

In its Climate Action Plan 2050, Germany pledged to reduce its CO_2 emissions by between 80 and 95%; this, of course, falls behind the benchmark of becoming CO_2-neutral by this date. Furthermore, concrete measures for this strategy have yet to be drawn up. The target for 2020, namely to reduce emissions by 40% compared to 1990 levels, will not be achieved in time, and the 2030 targets are not ambitious enough either, mainly because of strong resistance to phasing out coal-fired power plants. The transport, agricultural and building sector also lack ambitious sector targets, and progress in decarbonisation in these sectors is far too slow, if it is occurring at all. The German primary energy mix is still dominated largely by fossil energies. In addition, the on-going conflictive discussions about when to start and when to complete the **phasing out of coal** is the major hurdle preventing Germany from moving towards a 1.5°C-consistent pathway. If this hurdle is not overcome soon, Germany will even **significantly fail to contribute its fair share** towards a 2°C-consistent pathway, and thus miss the Paris goals altogether.

In terms of **climate diplomacy**, Germany has continued to play **a more ambitious role at the international level than domestically**: Germany's presidencies of the **G7** in 2015 and the **G20** in 2017 were characterised by **important initiatives**, such as the InsuResilience initiative with its pledge to grant access to climate risk insurance for 400 million more vulnerable people in developing countries by 2020, and the G20 Hamburg Climate and Energy Action Plan for Growth. In terms of helping achieve the **Paris Agreement**, and contributing to its successful implementation since then, Germany has also

606,000 people lost their lives between 1995 and 2015 due to extreme climate events. Reducing disaster-related mortality is a humanitarian imperative.

played a constructive role in climate negotiations under the **UNFCCC**, particularly when it comes **to cooperating with and supporting developing countries**.

With regard to the latter, the Federal Ministry for the Environment, Nature Conservation, and Nuclear Safety and the Federal Ministry for Economic Cooperation and Development play a pivotal role, supported by the GIZ (technical cooperation), the German development bank KfW (financial cooperation), and a number of think tanks. The **Ministry for the Environment** has established its own climate finance channel called IKI (the International Climate Initiative) in 2008, allocating about EUR 200 million annually. The **Ministry for Economic Cooperation and Development** uses its traditional bi- and multilateral channels for delivering climate finance and accounts for more than 80% of Germany's total public climate finance contribution to developing countries at around EUR 3.4 billion (2016). It states that this amount is complemented by EUR 5.2 billion of concessional loans and other financial contributions, provided by the **KfW Bank Group**, and at least EUR 1.4 billion of **private climate finance**, totalling about **EUR 10 billion in public and private climate financing per year** (BMZ 2018).

Germany supports partner countries in the development and implementation of innovative instruments aimed at transformation towards climate-resilient, low-emission sustainable development pathways. Apart from policy advice, capacity building and technology cooperation, i**nnovative partnerships and cooperation** have been initiated or supported in areas such as the **NDC Global Partnership** (supporting the ambitious implementation of NDCs), **adaptation community.net, the NAP Global Network, InsuResilience Global Partnership** and others.

While Germany acknowledges that failing to achieve the climate targets will have devastating consequences, place entire regions at high risk of becoming uninhabitable, and that in some parts of the world, food production would be put in jeopardy thus leaving millions of people behind in terms of achieving the SDGs, the German government still lacks the necessary ambition to mandatorily commit to contribute its fair share and to implement the necessary measures. This includes phasing out coal by 2030. In addition, the government has yet to develop a **roadmap that applies to all sectors and for international cooperation on how to comply with a 1.5°C-consistent**

pathway, despite the fact that Germany, at COP21 in Paris, supported the demand by the CFV and others for an aspirational 1.5°C climate threshold. The government also **lacks clear commitment on how to comprehensively address climate-induced economic and non-economic loss and damage**. This situation results from climate action being taken too slowly and hesitantly, thus overhearing the demands made by the victims of these shortcomings for climate justice. In conclusion, Germany is not doing enough to overcome current and future climate injustices, increasing inequalities and massive threats to sustainable development and the environment.

However, Germany **is at a crossroads**: it is still possible for the country to overcome these inconsistencies and transition to 1.5°C-consistent pathways. Doing so requires vigorous action now, as well as a holistic long-term vision combined with a strong focus on immediate and ambitious measures in all sectors.

Necessary immediate steps to put Germany on a 1.5°C-consistent pathway include:

- Quickly phasing-out coal-fired power stations and cutting emissions from these plants by two thirds by 2020 or 2022 at the latest
- Achieve the 2020 target by 2022 at the latest
- Bring the 2050 long-term strategy and the 2030 targets in line with 1.5°C-consistent pathways
- Implement effective carbon pricing
- Accelerate the switch to renewable energies; maintain a high rate of decentralised citizen-owned renewables
- Decide on energy efficiency measures
- Decide on the fast decarbonisation of the mobility sector
- Introduce efficient carbon disclosure requirements for the business and the finance sector
- Double Germany's contribution to international climate finance by 2020
- Provide enhanced support to the CVF and countries committing to 1.5°C-consistent pathways
- Provide political, financial and technical support to create new instruments that benefit the victims to address climate induced economic and non-economic loss and damage.

Our concluding policy recommendations

Half a degree matters! The IPCC Special Report Global Warming of 1.5°C shows the choice we have: overshooting 1.5°C with disproportionally high risks for the poor and vulnerable or a 1.5°C-consistent, human rights-based transformational pathway of climate resilient zero carbon sustainable development, with less damage, lower climate risks, higher per capita income, more human security, sustained livelihoods, more equality, justice and multilateral cooperation. Thus, **it is worth making every sustainable effort to ensure mean temperatures do not rise more than 1.5°C and to agree on a global compact for the future that we all want**. In view of the IPCC's findings, we recommend the following key elements for framing such a compact:

1. **Precaution and multilateral cooperation:** climate action in the context of the SDGs and DRR must seek to avoid unknown or high risks. The latest scientific research shows that a maximum amount of resources and multilateral cooperation must be invested if we are to keep global warming at 1.5°C.
2. **Close knowledge gaps and build in-country capacities:** there are still numerous knowledge and capacity gaps related to climate risks and mitigation pathways. Systematically addressing them has to be made a second priority if we are to responsibly respond to climate change.
3. **Equity and climate justice:** addressing equity and justice, including gender and inter-generational justice by multilateral and domestic action is essential if we are to overcome the root causes of vulnerability, achieve the SDGs, and ensure global warming does not go above 1.5°C.
4. **The triple win of mitigation, adaptation and sustainable development:** mobilising the co-benefits of climate action and sustainable development, including by aligning the NDCs and development plans, and minimising potential trade-offs, is a recipe for success.
5. **Transformational adaptation:** climate change related impacts and risks are often side-specific. Therefore, governments need to develop and implement country-driven national adaptation plans (NAPs) and NDCs, as well as local area adaptation plans, that are based on science and facts, and that address root causes of vulnerability and the particular needs of specifically vulnerable people and sectors first.
6. **Enhanced protection of people displaced by climate change:** ensure that the human rights of displaced people and those who have been forced to migrate due to adverse impacts of climate change are respected, protected and fulfilled, and that the community of states supports those in need, building on the recommendations of the Platform for Disaster Displacement.
7. **De-couple economic growth from GHG emissions:** a fast and deep economic transition relies on a sustainability pathway, in other words, behavioural change, sustainable consumption, low population growth, high human development, technical progress and low energy and food demands.
8. **Deep and fast emission reduction:** there is no alternative to a vigorous reduction in emissions by the year 2030 to around 25 Gt or less, including through carbon pricing and high investments in 100% renewable energies and energy efficiency. This is the only way of stabilising global warming at or below 1.5°C. Given a fast and deep emission reduction, combined with enhanced carbon sequestration through the restoration of natural carbon sinks, the need for BECCS and other risky CDR technologies can be minimised.
9. **Minimise the land-use footprint of climate action:** 1.5°C-consistent mitigation pathways will massively shape future energy and land-use, bearing possible co-benefits and trade-offs with sustainable development. Thus, minimising the land-use footprint is pivotal.
10. **Shift investments:** ensuring investments change from 'brown' and unsustainable to 'green' and sustainable, requires high investment in sustainable energy (between 2018 and 2050) in a range of up to USD three trillion per year.
11. **New architecture of fair climate risk financing and transfer including a loss and damage fund:** even in a 1.5°C world, millions of people and many vulnerable countries are at high risk of becoming trapped in poverty. Thus, climate risk transfer and financing, based on justice and the polluter-pays principle, is a necessary means of avoiding a humanitarian catastrophe and ensuring that the SDGs can be met.

Abbreviations

BECCS	Biomass energy combined with carbon capture and storage
CDR	Carbon dioxide removal
CCS	Carbon capture and storage
CCU	Carbon capture and use
CVF	Climate Vulnerable Forum
CRDP	Climate-resilient development pathways
GDP	Gross Domestic Product
GHG	Greenhouse gases
HLPF	High-level Political Forum on Sustainable Development
IKI	International Climate Initiative (Germany)
IPCC	Intergovernmental Panel on Climate Change
LDCs	Least Developed Countries
LTS	2050 Long-term (Low Emission/Decarbonisation) Strategies
NACC	National Advisory Council on Climate Change (NACCC)
NAP	National Adaptation Plan
NDC	Nationally Determined Contribution (part of the Paris Agreement)
NELD	Non-Economic Loss and Damage (associated with climate change)
RCP	Representative Concentration Pathways (emission scenarios)
SDGs	Sustainable Development Goals (part of Agenda 2030)
SE4All	Sustainable Energy for All (UN Initiative of the UN Secretary General)
SFDRR	Sendai Framework for Disaster Risk Reduction
SIDS	Small Island Developing States
SR15	IPCC Special Report Global Warming of 1.5°C
SSP	Shared Socio-Economic Pathways
UNFCCC	United Nations Framework Conventions on Climate Change
UNISDR	United Nations Office for Disaster Risk Reduction

Glossary

Biome: A community of plants and animals that have common characteristics for the environment they exist in.

Carbon Budget: The cumulative amount of greenhouse gas emissions, expressed in $GtCO_2$ equivalents, which still can be deposited in the atmosphere without overshooting a certain level of global warming, such as a temperature increase of 1.5°C or 2°C.

Carbon Dioxide Removal (CDR): Technologies that remove CO_2 from the atmosphere through geo-engineering, enhance carbon sequestration by activating carbon sinks (e.g. afforestation), or avoid emissions by using carbon capture and storage (absorbing CO_2 emissions and storing them underground) or carbon capture and usage (absorbing CO_2 and using it for industrial processes). CDR is viewed as a way of neutralizing emissions for which no mitigation measures could be identified (such as methane emissions from livestock or rice fields), and achieving net negative emissions to draw down carbon emissions are prevent them from exceeding the carbon budget.

Climate Justice: ACT Alliance defines climate justice as a term for framing climate change as an ethical and political issue. It links climate policies to human rights and sustainable development, and safeguarding the rights of the most vulnerable people and sharing the burdens and benefits of climate change and climate policies equally and fairly. Climate justice can also cover aspects of intergenerational and environmental justice, access to sustainable energy for all and a just transition for those whose jobs or livelihoods are endangered by ambitious climate policies.

Climate Projections: The IPCC emphasises that the term 'projection' can be used in two ways. In general usage, projections are any description of the future and the pathway that leads to it. A more specific interpretation has been attached to the term 'climate projection' by the IPCC when referring to model-derived estimates of future climate. Modelling is necessary to project future trends of climate change that can be non-linear, and, thus, go beyond projections derived from linear updates of observed climate data.

Climate Resilience: Climate resilience is defined as the capacity of a socio-ecological system to absorb stresses and maintain its function in the face of external burdens imposed upon it by climate change. Furthermore, it describes a system's capacity to adapt, re-organise, and evolve into more desirable configurations that improve its sustainability, and leave it better prepared for the impact of climate change in the future.

El Niño: A climate phenomenon associated with a band of warm ocean water that develops in the Pacific. El Niño causes regional and global changes of temperature and rainfall, leading to drought or heavy rainfall, depending on the region.

Nationally Determined Contributions (NDCs): Climate action plans, including specific nationally determined climate targets by state parties to the Paris Agreement, define how they intend to contribute to achieving the goals of the Paris Agreement. NDCs have to be submitted to the UNFCCC every five years, with a first commitment period starting in 2020.

Paris Agreement (PA): A global agreement drawn up in 2015 under the auspices of the UNFCCC, which deals with mitigation, adaptation, loss and damage and climate finance. The first commitment period for parties to the PA stars in 2020.

Precautionary Principle: The precautionary principle is used to make and justify decisions to avoid possible harm, without having final scientific certainty about the likeliness and magnitude of the harm expected.

Risk Transfer: Transfer of the risk of suffering loss and damage from potentially affected parties to a broader collective, be it through risk insurance, through markets (catastrophe bonds), by use of the solidarity principle (to the society, community of states or other donors), or to those who are responsible for the loss and damage that occurred ('polluter pays').

Sendai Framework for Disaster Risk Reduction (SFDRR): Global framework for disaster risk reduction, agreed by the community of states in 2015. It includes five goals and seven targets.

Shared Socio-Economic Pathways (SSPs): Pathways are science-based, coherent, internally consistent and plausible descriptions of future routes for societal and economic development. The five Shared Socio-Economic Pathways that the IPCC refers to have been elaborated in terms of both quantitative socio-economic models and qualitative storylines.

Sustainable Development Goals (SDGs): A set of 17 goals and related targets for sustainable development that are to have been reached by 2030. They are enshrined in Agenda 2030, which was agreed by the community of states in 2015.

Talanoa Dialogue: Inclusive, non-offensive dialogue used to take stock of climate change-related trends and impacts, and to understand, address and minimise them. Talanoa originates from a form of discussing and commonly resolving problems that is practised on Pacific islands.

Transformational Adaptation: Term used by the IPCC for a holistic understanding of adaptation in the context of sustainable development, defined as adaptation that changes the fundamental attributes of a system in response to climate and its effects.

Bibliography

Arent, D.J. et al. (2014): Key economic sectors and services. In: Climate Change 2014: Contributions of Working Group II to the Fifth Assessment Report of the IPCC

Arnell, N.W. et al. (2018): The impacts avoided with a 1.5°C climate target: A global and a regional assessment. In: Climate Change, March 2018, Volume 147, Issue 1–2, pp. 61–76

Bertram, C. et al. (2018): Targeted policies can compensate most of the increased sustainability risks in 1.5 °C mitigation scenarios. In: Environmental Research Letters 13

BMZ (2018): Financing climate action. Available at: http://www.bmz.de/en/issues/klimaschutz/climate-finance/index.html

Brot fuer die Welt/ACT Alliance (2016a): The Paris Climate Agreement. Towards a climate-friendly future. Berlin and Geneva

Brot fuer die Welt/ACT Alliance/Germanwatch (2016b): Making Paris work for vulnerable populations. Closing the climate risk gap. Berlin and Geneva

Brot fuer die Welt et al. (2017a): Non-economic loss and damage. Berlin and Geneva

Brot fuer die Welt/Act Alliance (2017b): Protected against climate change? Berlin and Geneva

Business Green (2017): Climate-related disasters set to make 2017 most expensive on record, insurers warn. Available at: https://www.businessgreen.com/bg/news/3021707/climate-disasters-set-to-make-2017-most-expensive-on-record-insurers-warn (last accessed on 14 October 2018).

Calvin (n.d.): The GCAM Shared Socioeconomic Pathways (SSPs). Available at: https://www.globalchange.umd.edu/data/annual-meetings/2016/Calvin_SSPs.pdf (last accessed on 14 October 2018).

CIA (2018): The world factbook – Ethiopia. Available at: https://www.cia.gov/library/publications/the-world-factbook/geos/et.html. (last accessed on 14 October 2018).

Clarke, L.E. et al. (2014): Assessing transformation pathways. In: 5th Assessment Report of the IPCC

Climate Vulnerable Forum (ed) (2016): Pursuing the 1.5°C Limit

Dooley, K. et al. (2018): Missing Pathways to 1.5°C: The role of the land sector in ambitious climate action.

Coumou, D. et al. (2018): The influence of Arctic amplification on mid-latitude summer circulation. In: Nature Communications

Dargie, G.C. et al. (2017): Age, extent and carbon storage of the central Congo Basin peatland complex. In: Nature 542, pp.86–90

Dasgupta, S. et al. (2010): Vulnerability of Bangladesh to cyclones in a changing climate: Potential damages and adaptation costs

FES/Brot fuer die Welt (2017): Guiding principles and lessons learnt for a just energy transition in the Global South. Berlin

Foundation of the Peoples of the South Pacific International (2012): Indigenous Peoples and Climate Change in Tuvalu

Government of Tuvalu (2014): The Tuvalu "Sky is the Limit" Scholarship Policy on Implementation.

Government of Tuvalu (2015): Intended Nationally Determined Contributions

Grubler, A. et al. (2018): A Low Energy Demand Scenario for Meeting the 1.5°C Target and Sustainable Development Goals without Negative Emission Technologies. In: Nature Energy

Hallegatte, S. et al. (2017): Unbreakable. Building the resilience of the poor in the fence of natural disasters. Climate change and development. Edited by World Bank. Washington

Haughton, J. /S. Khandker (2009). Handbook on Poverty and Inequality. Edited by World Bank. Washington

Holland, G./C. L. Bruyere (2014): Recent intense hurricane response to global climate change. In: Climate Dynamics 42, pp. 617–627

Hsiang, S. et al. (2017): Estimating economic damage from climate change in the United States. In: Science 356

IDMC (2015): Global estimates 2015: People displaced by disasters. Geneva

IPCC (2014a): Climate Change 2014. Synthesis Report. Geneva

IPCC (2014b): Climate Change 2014: Impacts, Adaptation and Vulnerability. Geneva

IPCC (2018a): Special Report Global Warming of 1.5°C. Geneva

IPCC (2018b): Global Warming of 1.5°C. Summary for Policymakers. Geneva

Islam R.M./M. Shamsuddoha (2017): Socioeconomic consequences of climate induced human displacement and migration in Bangladesh. In: International Sociology 32, pp. 277–298

Kopp, R.E. et al. (2014): Probabilistic 21st and 22nd century sea-level projections at a global network of tide-gauge sites. In: Erath's Future 2, pp. 383-406

Lucas C. et al. (2014): The expanding tropics: A critical assessment of the observational and modelling studies. In: Wiley Interdisciplinary Reviews: Climate Change 5, pp. 89-112

Mendelsohn, R. et al. (2012): The impact of climate change on global tropical cyclone damage. In: Nature Climate Change 2, pp. 205–209

O'Neill, B.C. (2017): The roads ahead: Narratives for shared socioeconomic pathways describing world futures in the 21st century. In: Global Environmental Change 42, pp. 28–37

Open Education (2018): Climate change in Ethiopia. Available at: See http://www.open.edu/openlearncreate/mod/oucontent/view.php?id=79973andprintable=1 (last accessed on 19 September 2018).

Petris, F. et al. (2017): Uncertain impacts on economic growth when stabilizing global temperatures at 1.5°C or 2°C warming. In: Philosophical Transactions A

Polynesian Leaders Group (2018): Amatuku Declaration on Climate Change and Oceans

Rasmussen, D.J. et al. (2017): Coastal flood implications at 1.5°C, 2°C, and 2.5°C temperature stabilization targets in the 21st and 22nd century

Ray, D.K. et al. (2015): Climate variation explains a third of global crop yield variability. In: Nature Communications 6

Rogelj, J. et al. (2018): Scenarios towards limiting global mean temperature increase below 1.5 °C. In: Nature Climate Change

Schleussner, C.F. et al. (2016): Armed-conflict risks enhanced by climate-related disasters in ethnically fractionalized countries. In: Proceedings of the National Academy of Science of the United States of America. 113, pp. 9216–9221

Schleussner, C.F. et al. (2017): In the observational record half a degree matters. In: Nature Climate Change 7, pp.460–462

Steffen, W. et al. (2018): Trajectories of the earth system in the Anthropocene. In: Proceedings of the National Academy of Science of the United States of America. August, 2018

Sultan, B./M. Gaetani (2016): Agriculture in West Africa in the twenty-first century. In: Frontiers in Plant Science 7

Tauisi, T. (2018): Economics of disaster risk and resilience in Small Developing Island States. Wellington

UNEP (2016): The Adaptation Gap Finance Report. Nairobi

UNFCCC (2018): National Adaptation Plans. Available at: http://www4.unfccc.int/nap/News/Pages/national_adaptation_plans.aspx (last accessed on 19 September 2018)

UNISDR (2016): The human cost of weather-related disasters 1995-2015. Available at: https://www.unisdr.org/we/inform/publications/46796 (last accessed on 19 September 2018)

USAID (2018a): Ethiopia – Water. Available at: https://www.usaid.gov/ethiopia/water-and-sanitation (last accessed on 19 September 2018).

USAID (2018b): Ethiopia – Nutrition Profile. Available at: https://www.usaid.gov/what-we-do/global-health/nutrition/countries/ethiopia-nutrition-profile (last accessed on 24 September 2018)

U.S. Department of State/USAID (2018): Foreign Assistance. Available at: https://www.foreignassistance.gov (last accessed on 19 September 2018)

WHO (2014): Quantitative risk assessment of the effects of climate change on selected causes of death, 2030s and 2050s. Geneva

World Bank (2017): Sovereign climate and disaster risk pooling. Washington

World Food Program (2018): The R4 Rural Resilience Initiative. Available at: http://www1.wfp.org/r4-rural-resilience-initiative/ (last accessed on 19 September 2018)

WWF (2016): Science of a 1.5 °C temperature limit. London

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