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Chapter 21: Review of the Climate Change Situation in Namibia: Projected Trends, Vulnerability and Impacts

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1 Introduction

Climate change is one of the biggest challenges and threats that humanity has ever faced. It has been acknowledged as "one of the greatest challenges of our time" by many organisations including the United Nations. The United Nations Framework Convention on Climate Change (UNFCCC) defines climate change as "a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods".[1] This definition slightly differs from the definition of the Intergovernmental Panel on Climate Change (IPCC), which refers to climate change as "a change in the state of the climate that can be identified by changes in the mean and/or the variability of its properties, and that persists for an extended period, typically decades or longer".[2] The IPCC's definition therefore refers to any change in climate over time, irrespective of the causes, whether due to natural variability or anthropogenic causes.

Climate change has largely resulted from anthropogenic influences on the climate system. In 2014, the IPCC reported that human influence on the climate system is clear, and that recent anthropogenic emissions of greenhouse gases are the highest in history. The IPCC[3] estimated that human activities have caused approximately 1.0°C of global warming above pre-industrial levels, and is likely to reach 1.5°C between 2030 and 2052 if it continues at current rate. These influences have had widespread impacts on human and natural systems. These impacts necessitate global actions to mitigate its causes, adapt to, and cope with the impact thereof. Actions to do the above are being taken through commitments to international instruments such as the United Nations Framework Convention on Climate Change and the Paris Agreement.[4] It has been acknowledged that a certain amount of climate change is apparently unavoidable, regardless of reductions in emissions, thus necessitating adaptation.[5] Human adaptation to a changing environment has been going on for millennia, but the current scenario calls for the need to up-scale and accelerate multi-level and cross-sectoral climate

1 UN (1992).
2 IPCC (2007d).
3 IPCC (2018).
4 UN (2015).
5 IPCC (2007c).

change mitigation strategies and transformational adaptation.[6] Namibia ratified the United Nations Framework Convention on Climate Change (UNFCCC) in 1995 as a Non-Annex I Party. Namibia therefore has an obligation to submit information in accordance with Article 4, paragraph 1 of the UNFCCC. Such Reports include the National inventory of anthropogenic greenhouse gas (GHG) emissions by sources and removals by sinks GHGs, National Communications to the Convention, and Biennial Update Reports (BURs). Namibia's Initial National Communication to the Conference of Parties of the UNFCCC was submitted in 2002[7] in accordance with decisions taken at various COPs to the UNFCCC. The Second National Communication was submitted in 2010.[8] The Third National Communication was submitted in 2015[9] while the Fourth National Communication was submitted in 2020.[10] However, with the adoption of the Cancun Agreements at COP16 in 2011 held in Mexico, the reporting by non-Annex I Parties in national communications, including national GHG inventories should also include information on mitigation actions, their effects and support received. Such Parties should also submit Biennial Update Reports (BURs). Thus, Namibia submitted its first BUR in 2014,[11] the second BUR in 2016[12] and the third BUR in 2018.[13] According to the requirements, BURs should contain updates on national GHG inventories, information on mitigation actions, needs and support received and institutional arrangements done by the Party and should be submitted every two years. Namibia also submitted its Intended Nationally Determined Contributions (INDC) in 2015[14] and an updated Nationally Determined Contribution in 2021[15] in readiness for COP26 which was held in November 2021 in Glasgow, Scotland. The Ministry of Environment, Forestry and Tourism (MEFT) through the Directorate of Environmental Affairs (DEA), Division of Multilateral Environmental Agreements, is responsible for overseeing the coordination of climate change issues in Namibia.

Despite its insignificant contributions to greenhouse gas emissions, southern Africa is very susceptible to the impacts of climate change, including sea level rise, increased frequency and intensity of extreme weather events such as floods and droughts. Most of southern Africa is already largely water-stressed, with high frequencies of drought. Climate change is exacerbating this problem, considering that the region's susceptibility in the agricultural sector is rooted in its widespread rain-fed agriculture.[16] The

6 IPCC (2018).
7 GRN (2002d).
8 GRN (2011a).
9 GRN (2015a).
10 GRN (2020).
11 GRN (2014a).
12 GRN (2016c).
13 GRN (2018g).
14 GRN (2015a).
15 GRN (2021a).
16 CEEPA (2006); IPCC (1997); Hulme (1996).

vulnerability of the region's agricultural sector to climate change has been well documented over the last two decades in the respective National Communications to the UNFCCC of several southern African countries. Moreover, scientific modelling suggests that southern Africa will be hit harder by climate change than most regions of the globe, becoming hotter and drier.[17]

In many countries of the southern African region, close to 70% of the population lives in rural areas where their direct dependence on the natural ecosystems with their goods and services is high. The impacts of climate change are more pronounced in these rural communities, who are often poor and marginalised. Their livelihoods are largely dependent on agriculture, a sector which is very sensitive to climate change. Studies have identified several sectors where Namibia is most vulnerable to climate change. These include water resources, fisheries and marine resources, agriculture, biodiversity and ecosystems, coastal zones and systems, health, and energy. Therefore, Namibia has to continue taking measures and actions designed to mitigate climate change and to capacitate communities to cope with and adapt to the effects of climate change.

This Chapter highlights the projected changes in climate in southern Africa, with particular focus on Namibia. The vulnerability of Namibia to climate change and the impacts of climate change on various sectors of the economy and on biodiversity are also reviewed. Some of the measures taken by the Namibian Government and other stakeholders to deal with the challenges of climate change are also summarised.

2 Namibia's Contribution to Greenhouse Gas (GHG) Emissions

Parties to the United Nations Framework Convention on Climate Change (UNFCCC) are categorised into three main groups according to differing commitments. Thus, certain groups of developing countries are recognised as being especially vulnerable to adverse impacts of climate change, including countries with low-lying coastal areas and those prone to desertification and drought. These are classified as non-Annex 1 countries, and most developing countries including Namibia belong to this group. According to the UNFCCC process, the baseline values for greenhouse gas (GHG) emissions for non-Annex 1 countries are pegged at 1994 as the base year. The IPCC Guidelines[18] require that GHG emission estimates should be compiled for the sectors of Energy, Industrial Processes and Product Use (IPPU), Agriculture, Forestry, and Other Land Use (AFOLU) and Waste.

A wealth of scientific literature indicates clear evidence that global climate has changed and will continue to change over the next century, both globally and locally

17 IPCC (2007c and 2018).
18 IPCC (2006).

due to increased GHG concentrations in the atmosphere. These increases are mainly due to human activities, most notably the use of fossil fuels. Africa's contribution to greenhouse gas emissions is insignificant at only 3.8% compared to the largest emitters China (23%), United States of America (19%), and the European Union (13%) of global emissions.[19] Just like many other countries in southern Africa, except South Africa, Namibia's contribution to greenhouse gas emissions is insignificant.[20] Globally, Agriculture, Forestry and Other Land Use (AFOLU) activities accounted for around 13% of CO_2, 44% of methane (CH_4), and 81% of nitrous oxide (N_2O) emissions from human activities during 2007-2016, representing 23% of total net anthropogenic emissions of GHGs.[21]

Namibia neither produces fossil fuels of its own, nor refines any fossil fuels though explorations have been taking place. Currently there are oil and gas explorations in Kavango Region and in southern Namibia by ReconAfrica and Shell, respectively. Therefore, only fossil fuel consumed and combusted in the country was used to estimate emissions in the energy sector under Fuel Combustion Activities.[22] The Namibian economy is not energy-intensive, as it relies primarily on agriculture, fisheries and mining without much secondary processing.[23] A greenhouse gas emissions inventory of Namibia has been performed in 1994[24] and compared and reviewed comprehensively in 2000.[25] Stand-alone GHG Inventory Reports are also available.[26] However, estimates in these and other documents tend to vary somewhat but those given in the Third Biennial Report (BUR3) are the latest and best estimates of emissions in light of available data and information.[27]

Namibia's Fifth National Development Plan (NDP5) aims to expedite the implementation of the country's development strategy, including environmental sustainability. To this end, tackling climate change is high on the country's agenda. The country is committed to complement the international efforts in curbing GHG emissions in accordance with the UNFCCC provisions. Namibia has compiled and submitted GHG inventories in accordance with Article 4.1(a) of the Convention. The country has recorded an increase of 12.1% in emissions from 1994 to 2014.[28] The Agriculture, Forestry and Other Land Use (AFOLU) sector remained the leading emitter throughout this period (91.7% in 1994 to 81.5% in 2014) followed by Energy, which increased from 1,464 Gg CO_2eq (7.8% in 1994) to 3,234 Gg CO_2eq (15.3%) in 2014. Emissions

19 Sy (2015).
20 GRN (2002d); Hartz / Smith (2008).
21 IPCC (2020).
22 GRN (2014a).
23 GRN (2002d).
24 Du Plessis (1999a).
25 Hartz / Smith (2008).
26 GRN (2015c; 2016d; 2018h).
27 GRN (2018g).
28 Ibid.

from the AFOLU sector increased from 17,328 Gg CO_2eq in 1994 to 19,275 Gg CO_2eq in 2012 before declining to 17,271 in 2014 (a 0.3% decrease from the 1994 to 2014). Hence, the main target is to reduce deforestation rate and achieve a decrease in CO_2eq by over 13.5Mt by 2030.[29] The Industrial Processes and Product Use (IPPU) became the third emitter from 2003. Emissions from the IPPU sector increased from 22 Gg CO_2eq in 1994 to 522 Gg CO_2eq in 2014, a very sharp increase accounted for by the commencement of Zinc production in 2003 and cement production in 2011.[30] Emissions from Waste doubled between 1994 and 2014 (from 75 Gg CO_2eq in 1994 to 153 Gg CO_2eq in 2014). Despite the increases in emissions stated above, the country has remained a net sink of GHG over the period 1994 to 2014 whereby removals exceeded emissions. The net removal of CO_2 increased by 26.3% from 1994 to 2014 (increase of 20,484 Gg CO_2eq from 77,770 Gg CO_2eq in 1994 to 98,254 Gg CO_2eq in 2014). Trends in emissions and removals are summarised in the Table below (NB: 1994 is the base year).

Table 1: GHG Emissions by Sector and Removals from 1994 to 2014

	EMISSIONS (Gg CO_2eq)					REMOVALS (Gg CO_2eq)	
YEAR	Energy	IPPU	AFOLU	Waste	TOTAL	AFOLU	Net
1994	1,464	22	17,328	75	18,889	-96,659	-77,770
2000	1,934	25	16,637	88	18,684	-108,067	-89,383
2002	2,163	27	16,073	91	18,353	-112,687	-94,333
2004	2,521	237	15,879	103	18,742	-114,949	-96,208
2006	2,823	255	17,003	112	20,194	-109,119	-88,925
2008	2,752	291	16,256	117	19,416	-114,977	-95,561
2010	2,923	301	17,365	131	20,720	-107,364	-86,644
2012	3,003	515	19,875	149	23,542	-104,485	-80,943
2014	3,234	522	17,271	153	21,180	-119,434	-98,254

Source: Table compiled by the author based on figures from GRN (2018g).

Emissions analysis by respective gases did not change during the period 1994 to 2014. CO_2 has remained the main contributor, followed by CH_4 and N_2O. The share of CO_2 increased while that of CH_4 and N_2O declined between 1994 and 2014. In 2014 the contributions were 63.44% CO_2, 23.98% CH_4 and 12.58% N_2O.[31] Emissions of indirect GHGs (CO, NO_X and Non-methane volatile organic compounds (NMVOC)) and SO_2 showed varied trends: nitrogen oxides (NO_X) decreased from 48.4 Gg in 1994 to 38.2 Gg in 2014; Carbon monoxide (CO) decreased from 2198 Gg in 1994 to 939 Gg

29 GRN (2021a).
30 Ibid.
31 GRN (2018g).

in 2014; NMVOC increased from 15.9 Gg in 1994 to 24.5 Gg in 2014; Sulphur dioxide (SO_2) varied between 1.9 Gg and 4.2 Gg (2.6 in 1994 and 2.7 in 2014).[32]

Namibia aimed for a reduction of 89% of its GHG emissions by 2030 compared to the BAU scenario, meaning that the projected GHG emissions to be avoided in 2030 is of the order of 20000 Gg CO_2eq (inclusive of sequestration in the AFOLU sector) compared to the 'Business as Usual' (BAU) scenario of 24.167 MtCO_2eq.[33] However, this target was recently revised to aim at a reduction of 91%.[34] This revised target has been viewed by some quarters as being ambitious due to the lack of clarity on where the necessary funding would come from.[35] The estimated amount for both adaptation and mitigation is about USD 5.33 billion.[36] With reference to the AFOLU sector, it is important to note that vegetation growth captures CO_2 thereby acting as a sink. The clearing of vegetation has the opposite effect. Namibia has a significant land area that is bush-encroached by species such as *Senegalia mellifera*, *Terminalia sericea*, and *Dichrostachys cinerea*. Bush encroachment largely results from poor rangeland management practices which lead to overgrazing and upsetting the natural balance between woody plants and grasses such that the woody component proliferates. Though agriculturally undesirable, the impact of bush encroachment is highly significant for Namibia's greenhouse gas emissions profile because bush-encroached areas serve as huge sinks for CO_2. It remains to be seen how the on-going de-bushing programmes and commercial charcoal production will impact this profile in future.

3 Climate Trends and Projections

Future trends in climate are predicted using modelling approaches based on past and present patterns. There are several climate models used worldwide to provide the basis for projections of future climate change scenarios, the most used being General Circulation Models (GCMs). The IPCC's Fourth Assessment Report[37] discussed and evaluated these models at length while the IPCC Fifth Assessment Report[38] highlighted the current situation and future trends in global climate. The heterogeneity in the new generation of climate models and an increasing emphasis on estimates of uncertainty in the projections raise questions about how best to evaluate and combine model results in order to improve the reliability of projections.[39] GCMs work on a spatial scale of

32 Ibid.
33 GRN (2015b).
34 GRN (2021a).
35 Odendaal (2021).
36 GRN (2021a).
37 IPCC (2007c).
38 IPCC (2014a).
39 IPCC (2010).

200-300 km, therefore this limits their projections for changes at a local scale.[40] Nevertheless, GCMs remain a fundamental tool used for assessing the patterns in past change and projecting changes in the future.

There is undisputed evidence for climate change at global scale, much of which is attributed to anthropogenic activities. However, understanding how global climate change may manifest itself at the local level is still a challenge.[41] At a global scale, it is widely recognised that there has been a detectable rise in temperature over the last few decades. This rise in temperatures cannot be explained unless human influence is taken into account.[42] In fact, human activities are estimated to have caused about 1.0°C of the recorded global warming above pre-industrial levels and warming likely to reach 1.5°C between 2030 and 2052 if it continues to increase at the current rate.[43] The regional distribution of temperature increases is not uniform; some regions have experienced greater change than others.[44] Globally, the rate of average temperature increase has been quicker during the latter half of the 20th century than before. This increase in the rate of change is expected to continue, potentially resulting in more rapid changes of climate in the future.[45] Surface temperature is projected to rise over the 21st century under all assessed emission scenarios in GCMs.[46] Rising temperatures will result in more frequent heat waves which will last longer, and that extreme precipitation events will become more intense and frequent in many regions of the world. The ocean will continue to warm and acidify, and global mean sea level will rise. In fact, the IPCC warns that continued anthropogenic emissions of GHGs will cause further warming and long-lasting changes in all components of the climate system which would increase the likelihood of severe and irreversible impacts on people and ecosystems.[47]

There is greater variability in global rainfall, therefore changes in rainfall are harder to detect, both spatially and temporally. Changes in global rainfall patterns have been detected in many parts of the globe. In southern Africa, there have been moderate decreases in annual rainfall and there have also been detectable increases in the number of heavy rainfall events. Trends also indicate an increase in the length of the dry season and increases in average rainfall intensity,[48] suggesting a shorter but more intense rainfall season. Other aspects of global change are increases in intensity and spatial extent of droughts since the mid-1970s; increases in the duration of heat waves during the latter half of the 20th century; shrinking of arctic ice caps since 1978; widespread shrinking of glaciers, especially mountain glaciers in the tropics; increase in upper

40 DRFN / CSAG (2010).
41 Ibid.
42 IPCC (2001).
43 IPCC (2018); Singh *et al*. (2018).
44 DRFN / CSAG (2010).
45 Ibid.
46 IPCC (2014a).
47 Ibid.
48 New *et al*. (2002).

ocean heat content; increases in sea level at a rate of 1.8 mm per year between 1961 and 2003, with a faster rate of 3.1 mm per year between 1993 and 2003.[49] The IPCC[50] predicted that by 2100 the global mean sea level rise will continue well beyond 2100, the magnitude and rate of which will depend on future emission pathways.

There are few studies detailing historical climate trends of Namibia. Due to the arid nature of the country, natural variability is extremely high and is complicated by decadal variability. There is evidence that changes in temperatures in Namibia have followed global trends as described above. There has been a tendency for warmer temperatures in the latter half of the 20th century, which is generally 1-1.2°C warmer than at the beginning of that century. Namibia experienced significant increases in temperature over the past century, with greater increases in winter than in summer, and the largest increases of up to 0.5°C were recorded in the northeast.[51] Namibia's average annual temperature has been increasing at a rate of 0.0123°C annually over the period 1901 to 2016.[52] Maximum temperatures have been getting hotter over the past few decades with significant increases in the frequency of days exceeding 35°C and declines in the frequencies of days with temperatures below 5°C, suggesting an overall warming.[53] This magnitude of warming in Namibia is greater than the global mean temperature change,[54] which is worrisome for Namibia. An increase of 1°C generally implies an increase in evaporation of 5%. For a country with already high evaporation rates (reaching more than 2,660 mm per annum in some areas) this has serious negative consequences, as will be discussed in a separate section below.

Meteorological data for 25 years from the Namibia Meteorological Services indicate that there have been consistent increases in daily maximum temperatures at seven stations (Lüderitz, Keetmanshoop, Windhoek, Hosea Kutako International Airport, Sitrusdal, Grootfontein and Okaukuejo).[55] Long-term temperature and rainfall records from 15 weather stations that had data with durations of between 25 and 60 years in Namibia and the Northern Cape (South Africa) have been examined, and 53% of the stations showed significant increases in temperature over their recording period, while none showed a significant decline.[56] Generally, it is predicted that Namibia will become hotter with predicted increases in temperatures of between 1°C and 3.5°C in summer and 1°C to 4°C in winter over the period 2046 to 2065.[57]

Rainfall patterns are a bit difficult to decipher compared to temperatures. The long-term rainfall records for Namibia (1915 to 1997) suggest an overall national mean of

49 IPCC (2007c).
50 IPCC (2018).
51 Spear *et al*. (2018).
52 GRN (2020a).
53 GRN (2011a).
54 Midgley *et al.* (2005).
55 DRFN / CSAG (2010).
56 Midgley *et al*. (2005).
57 GRN (2011a).

272 mm. In the period from 1981 to 1996 only two of the 16 years had rainfall above this mean.[58] The variation in rainfall year-to-year is extremely high (in excess of 30% everywhere in the country, rising to 70% in southern Namibia and 100% in the Namib Desert). DRFN and CSAG[59] reported that there are no obvious trends in rainfall patterns over a 100-year period, between 1901 and 2000 in Namibia. However, there have been significant increases in the length of the dry season and decreases in the number of consecutive wet days in some areas. The onset of the rainy season is delayed in the north and the end of the rains is earlier than before.[60] Recent experiences by local communities combined with meteorological data confirm real changes in climate patterns over the last few decades in Namibia. Delayed on-set of the rainy season and the shortening of the growing season have been reported. Using different climate modelling scenarios, for the winter period, the lower estimates of change suggest a drying in the south and wetting in the north, whilst upper estimates of change suggest a wetting over most of the country except in the far southwest where reduced rainfall is projected.[61] During summer, the lower estimate of change suggests drying over most of the country except for an increase in rainfall over the coastal regions.

There have been unbearably hot summer temperatures and more frequent droughts. Communities in the northern and north-eastern parts of the country have experienced more severe flooding which has caused significant suffering among local communities. A study conducted in Ohangwena reveals that communities reported variability in rainfall patterns characterised by high intensity of rainfall over a shorter period of time, late coming of the rain, quick disappearance of surface water, less cold winters than before and much stronger and hotter summer sun.[62] These trends in rainfall and temperature patterns, observed by communities in northern Namibia, were confirmed through trend analysis[63] of the period 1900 to 2000. Droughts have also become more frequent, with a very devastating drought during 2018/2019 season throughout the whole country. In Africa, dryland areas (such as Namibia) are also expected to become more vulnerable to desertification caused by climate change.[64]

58 GRN (2002d).
59 DRFN / CSAG (2010).
60 Ibid.
61 Ibid.
62 Nunes *et al*. (2010).
63 Mitchell *et al*. (2004) in Midgley *et al*. (2005).
64 CDKN (2019).

4 Potential and Actual Impacts of Climate Change

4.1 Climate Situation and Vulnerability

Arid environments are areas that receive 100 mm to 250 mm of rain per annum, semi-arid environments receive between 250 mm and 500 mm and hyper-arid environments receive less than 100 mm per annum. In Namibia, annual rainfall is low and highly variable between years, ranging from an average of 25 mm in the southwest to 700 mm in the northeast. Thus, the greatest proportion of the Namibian environment is arid to semi-arid. The coefficient of variation of rainfall is also very high, ranging from 25% in the northeast to more than 80% along the coast in the west.[65] Not only does Namibia receive little rain, it also experiences high rates of evaporation due to high solar radiation, low humidity and high diurnal summer temperatures. This makes the arid nature of the country even worse because the availability of water to plants, animals and humans is limited. It is estimated that only about 1% of rainfall ends up replenishing the groundwater aquifers.[66] This makes the Namibian environment 'harsh' for most organisms, including people. This aridness of the country is caused by weather patterns prevailing in regions with oceanic cold currents – the cold Benguela Current that flows north along the west coast – and situated between 20° and 30° North and South, where dry air of the Hadley Cells descends resulting in persistent high pressure off the coastline.

Global climate change has resulted in changes to the normal patterns of weather and climate in Namibia, causing significant stress on various economic sectors of the country. Overall, it is predicted that there will be a 10% decrease in rainfall in the northern and southern regions of Namibia, and a 20% decrease in the central regions by 2050, and that these figures will worsen to 20% and 30% respectively by 2080.[67] The natural conditions described above make Namibia very susceptible to the effects of climate change because it is already a stressed environment. In general, countries in southern Africa are vulnerable to effects of climate change to varying degrees depending on their local conditions. The likelihood that an individual or group of people will be exposed to, and will be adversely affected by new climatic circumstances depends on the characteristics of the individuals or groups of people in terms of their capacity to anticipate, cope with, resist and recover from the impacts of environmental change.[68] The capacity to adapt to climate change varies among countries and socio-economic groups in the sense that those with the least capacity to adapt are generally the most vulnerable. This also depends on the resources available for mitigation and adaptation.

65 Mendelsohn *et al*. (2002).
66 GRN (2002d).
67 GRN (2010b).
68 Galvin *et al*. (2004).

Africa is, and will continue to be negatively affected by climate change, more so because of the poor socio-economic conditions which exacerbate the vulnerability of the continent's population. This is particularly so because vulnerability to environmental change does not only depend on changes in frequency or duration of climatic conditions but also on the capacity to respond adequately to those changes as stated above.[69] Poverty and prevailing levels of income disparities influence the resource base of households and this determines the resilience of households to deal with impacts of climate change. Africa's capacity to respond is severely hampered by lack of resources. Given the above situation, there is no doubt that climate change will affect the attainment of most of the United Nations Sustainable Development Goals (SDGs). Namibia's situation is not very different from neighbouring southern African countries. If anything, the local environmental conditions make Namibia even more vulnerable to the effects of climate change. Namibia is an upper middle-income country with a per capita GDP of N$ 74 489 in 2017 and among the highest inequalities in the world of 0.59 Gini coefficient[70] with about 17.4% of the population living in poverty.[71] There are considerable income disparities as reflected by the Gini-coefficient stated above. Being a country that is highly dependent on its natural resource base of minerals, fisheries, agriculture and wildlife, coupled with variable rainfall, frequent droughts and heavy reliance on subsistence agriculture, Namibia is highly vulnerable to climate change.

In Namibia, human vulnerability to climate change is mainly driven by social, political, economic and structural factors – factors which have huge influence on their livelihoods.[72] The vulnerability of Namibia to the effects of climate change have also been reviewed by comparing two contrasting Regions, the Zambezi and Karas Regions, in the northeast and south, respectively.[73] These two regions differ in their average climatic conditions and livelihood systems. Zambezi receives higher rainfall than Karas. Livelihood systems in Zambezi are based on subsistence-oriented maize cultivation, which is combined with a small number of goats and cattle for domestic purposes, approximately supporting 12,000 farming households.[74] Livelihoods in Zambezi used to be flexibly organised around seasonal movement of water but nowadays the region is considered vulnerable to flooding of wetlands. In Zambezi natural shocks such as floods for those living in low-lying wetlands, droughts and climate change, livestock diseases and pests are factors that make people vulnerable. In 2009, close to 700,000 people were either directly or indirectly affected by floods in the north

69 Ibid.
70 NSA (2019).
71 Ibid.
72 Some of these factors have discussed by a number of authors, including van Wyk (2015), the EIF (2019) Lendelvo *et al*. (2018) and Spear *et al*. (2018), among others.
73 DRFN / CSAG (2010).
74 Ibid.

and north-eastern parts of Namibia which cost an estimated N$ 1.7 billion (1% of GDP) worth of damages and losses, both public and private.[75] On the other hand, natural conditions and livelihood systems in southern Namibia are very different from Zambezi. Rural production is dominated by raising small stock such as goats and sheep. In the Karas Region, vulnerability is related to loss of employment, disability and sickness (including HIV and AIDS), having many dependents and orphans.[76]

A number of sectors of the Namibian economy were identified as being particularly vulnerable to the effects of climate change, namely agriculture, biodiversity, ecosystems and tourism, coastal zone, human health and well-being, fisheries and marine resources, energy and water resources. These are discussed below.

4.2 Agriculture

Agricultural production is closely linked to climate, especially precipitation and temperature. IPCC[77] reported that climate change has already affected food security due to warming, changing precipitation patterns, and greater frequency of some extreme events such as floods and droughts. The Namibian climate is characterised by semi-arid and hyper-arid conditions and highly variable rainfall (though about 8% of the country is classified as semi-humid or sub-tropical). These conditions alone pose a great challenge to agricultural production in the country. The sector contributed 7.19% to GDP in 2018[78] and supports over 70% of the population.[79] However, the contribution of this sector has declined from 8.58% in 2010 to a lowest of 5.9% in 2015 before the recent slight rise noted above. Much of this can be attributed to the impacts of climate change. Climate change events have mostly manifested themselves in the forms of droughts, floods and heat waves. About 56.7% of Namibians live in rural areas and the main basis for their livelihoods is subsistence agriculture. Farming is an important source of livelihood for the majority of Namibians living in rural areas.[80] It is estimated that 70% of Namibians are directly dependent on agriculture for their daily livelihoods.[81] Some urban dwellers are also full-time, part-time or weekend farmers. Crop production plays an important role in household food security, particularly in the northern parts of the country where pearl millet (mahangu) is a subsistence dry-land crop and a major staple food. However, mahangu harvests have been affected by

75 GRN (2009).
76 DRFN / CSAG (2010).
77 IPCC (2020).
78 Plecher (2020).
79 GRN (2011b:3).
80 Lendelvo *et al*. (2018).
81 Uebelhoer *et al*. (2015).

extensive flooding and poor yields in the last few years,[82] an indication of possible impacts of climate change on crop production. Maize, wheat, rice and other grains and horticultural crops are also produced. Livestock production (especially cattle, goats and sheep) is the driver of the agricultural economy, with meat being a major export of Namibia, particularly to Europe. Less than 10% of the land surface is used for crop production while livestock production takes place on about 75% of the land.[83]

There have been attempts to model the potential impacts of climate change on agricultural production,[84] but such attempts have been constrained by the lack of reliable data (in some cases) as well as the inherent uncertainties within the General Circulation Models (GCMs) themselves when applied to local scales such as farms. A modelling attempt for Rundu, in the Kavango East Region has indicated that the number of days exceeding 34°C during the six hottest months of the year will increase from 67 to 118 between 2046 and 2065.[85] This means that even a hardy crop such as mahangu will struggle to withstand such prolonged dry periods. Models were developed by the Africa Adaptation Project Namibia[86] to determine potential yields and planting windows for the middle of the 21st century for maize and millet production but the models were inconclusive. Current climatic trends suggest a shorter growing season with a late onset of the rains and an early cessation of the rains. This is already being witnessed in some areas with significant negative impacts on agricultural production.

During the 2008/9 season, the Agronomic Board of Namibia commented that "floods and droughts can easily occur simultaneously and even within close geographic proximity, as we have seen for the past few years". [87] They contended that grain production, especially millet surplus production, could seriously be hampered if solutions in terms of crop insurance, production methods, cultivars, alternative crops, and financing schemes are not found. These are not encouraging signs as climate projections indicate that the growing season will start later than usual in the northeast, with onset of rains delayed by about half a day per year (meaning that currently the season starts about 20 days later than during the last century). This indicates early cessation of the growing season and significant negative impacts on the agriculture sector.

The livestock subsector is also currently suffering the effects of climate change and will further be negatively affected. Grazing rangelands are affected by alterations in precipitation regimes, temperature and atmospheric concentrations of CO_2. All these factors affect net above-ground primary productivity (NPP). There is likely going to be shifts in ratios of C3/C4 species of grasslands, changes in evapotranspiration and

82 NAB (2006).
83 GRN (2021a).
84 Dirkx *et al*. (2008).
85 Ibid.
86 UNDP (undated).
87 NAB (2009).

run-off and changes in forage quality. If the quantity and quality of NPP is reduced as predicted, then cattle production will also decline. The 2018/19 season experienced one of the worst climate change-induced droughts in recent times throughout Namibia. There was wide-spread deficit of forage and water resulting in over 88,000 livestock deaths.[88] Changes in climate will lead to alterations in the boundaries between rangelands and other biomes such as deserts and woodlands through shifts in species composition and indirectly through changes in wildfire regimes and opportunistic cultivation. Modelling analysis projected significant changes in vegetation structure and function in several areas of Namibia by 2080, where arid vegetation types will increase in cover by almost 20% by 2050, and up to 43% by 2080 in the absence of CO_2 fertilisation effect.[89]

Heat and water stress on livestock will lead to decreases in feed intake, milk production and rates of reproduction.[90] The 2018 IPCC Special Report[91] paints dire potential consequences a 1.5°C warming would have on agriculture. Fewer areas would be viable for livestock production but this requires more data to be certain. Risks to food security will intensify due changes in crop nutrient content, yield reduction, increase in pests and price escalation. These negative impacts will have major implications for hunger and poverty eradication and overall attainment of the SGDs. Higher average temperatures have been reported to reduce conception rates in cattle, largely due to the positive correlation between high rectal temperatures and lower fertility rates, and partly as a consequence of appetite-suppressing tendencies of heat stress.[92] Changes in climate may affect the distribution of livestock diseases as well as the timing of their outbreaks or their intensity. For vector-borne diseases, the distribution patterns of the vectors may be altered by changes in temperature and rainfall, thus influencing potential distribution of diseases. It is reported that climate appears to be more frequently associated with the seasonal occurrence of non-vector borne diseases than their spatial distribution.[93] The changes that may be necessary in Namibian farming systems to enable adaptation to climate change were discussed by various authors.[94]

4.3 Biodiversity, Ecosystems and Tourism

Despite the harsh arid climatic conditions described above, the Namibian landscape supports remarkable biodiversity, especially its plant and animal species. More than

88 Hartman (2020).
89 Midgley *et al*. (2005).
90 DRFN / CSAG (2010).
91 IPCC (2018)
92 Newsham / Thomas (2009).
93 Ibid.
94 E.g. by Wilhelm (2012); Kuvare *et al*. (2009) and Van Wyk (2015).

4,500 plant taxa have been recorded,[95] almost 700 of which are endemic to the country, and a further 275 of which are Namib Desert endemics shared with southern Angola.[96] The endemism of plant species is concentrated in five centres, namely the Kaokoveld in the northwest, the Otavi highland in the Kalahari basin in the east, the Kavango regions in the northeast, the Auas Mountains on the western edge of the central plateau, and the succulent-rich southern Namib.[97] These landscapes and biodiversity are important tourist attractions for the country. The mammal fauna of Namibia comprises 250 species, representing about 75% of the southern Africa's species richness, of which 14 are endemic.[98] Most of the endemic mammals occur in the Namib Desert, pro-Namib transition zone and the adjoining escarpment. Close to 14% of Namibia is set aside as State protected areas while 86 registered communal conservancies constitute 20.2% of the country's land area. All these areas support amazing landscapes and significant biodiversity which attract a lot of tourists.

However, the natural ecosystems are vulnerable to climate change. Before the 2005 assessment,[99] there had been no previous quantified assessments of vulnerability of plant biodiversity to climate change in Namibia. Projections for warming and drying are harsh for central and western parts of southern Africa, with extreme warming centred on Botswana. Terrestrial areas that are particularly vulnerable to climate change are the western escarpment and the south-western succulent Karoo.[100] A dynamic global vegetation model (DGVM) has been used[101] to explore the effects of climate change on ecosystem structure, function and dominance of plant functional types in Namibian ecosystems. The main plant functional types they analysed were broad categories such as C4 grasses, deciduous trees and C3 herbaceous and shrub types. Elevated CO_2 levels that may result from anthropogenic causes potentially increase the water-use and nutrient-use efficiency of plants that use the C3 photosynthetic pathway,[102] and this will favour woody plants with a high degree of investment in carbon-rich support tissue (such as trees) relative to herbaceous species.[103] Seven vegetation structural classes are defined as occurring in Namibia under the current and future conditions by the DGVM, namely desert, arid shrub land/grassland, grassy savanna, mixed savanna, woody savanna, mixed shrub land/grassland and C3 shrub land/grassland. Projections of impacts on total vegetation cover were monitored through analyses of changes in bare ground and leaf area index (LAI).

95 Barnard (1998).
96 Maggs *et al*. (1998).
97 Maggs *et al*. (1994).
98 Griffin (1998).
99 Midgley *et al*. (2005).
100 GRN (2010b).
101 Midgley *et al*. (2005).
102 Drake *et al*. (1997).
103 Bond / Midgley (2000); Bond *et al*. (2003).

Results of projections of the impacts of climate change on biodiversity indicated a reduction in vegetation cover over the central highlands by 2050, with further reductions to 2080. The greatest absolute cover reductions are projected for the Kaokoveld region in the extreme northwest, and in the Kalahari basin in the southeast, with less significant reductions recorded at higher altitudes in the central highlands. It has also been shown that direct effects of rising atmospheric CO_2 on total cover were not significant and projected changes in LAI were more diverse, indicating significant reductions in areas of highest decrease in vegetation cover as expected.[104] However, such areas are of limited spatial extent, and much of the country is projected to experience LAI changes of between +10% and –10%. There will be an expansion of the two most arid vegetation types, desert and arid shrub land/grassland, mainly at the expense of grassy savanna and mixed savanna vegetation types. The arid vegetation types are projected to increase by almost 20% by 2050, and up to 43% by 2080, in the absence of a CO_2 fertilisation effect, but with CO_2 amelioration, the expansion of desert in 2080 is reduced from 43% to just less than 30%.[105]

The current grassy savanna vegetation of Namibia is projected to decline substantially by 2050, with significant cover and biomass reductions in the central highlands and north-eastern plains, a scenario which will be exacerbated by effects of elevated CO_2 by 2080. The effect of elevated CO_2 is by facilitating the increase of currently relatively scarce C3-dominated vegetation types, woody savanna, mixed grassland, and C3 grassland/shrub land. This means that currently uncommon vegetation types will become widespread in the north-eastern part of the country, suggesting a strong potential for bush encroachment in these regions. In addition, the potential fire frequency is predicted to increase somewhat in the northeast region under the elevated CO_2 scenarios only. The distribution of deciduous trees will also decline in extent – they will suffer a reduction in both biomass and cover throughout their current range, showing a general retreat towards the north-eastern Kalahari. Projections also suggest that NPP will be significantly reduced by between 0.5 and 1 t/ha in the central-north-western regions and by up to 0.5 t/ha in the north-eastern Kalahari.[106] Overall, the SDGVM projections reveal a significant negative impact of climate change on ecosystem NPP, vegetation structure and cover, and the distribution of dominant plant functional types. These effects are strongest in the central/northwest regions and the north-eastern parts.

Impacts of climate change at species level will lead to high species losses, with mean species loss of between 40% and 50% by 2050 and between 50% and 60% by 2080.[107] However, these patterns of species loss and turnover will vary markedly in

104 Midgley *et al*. (2005).
105 Ibid.
106 Ibid.
107 Ibid.

space. There will also be significant changes in plant community composition resulting from these species losses. Changes in habitat composition and structure will result in changes in the faunal complement of these habitats. Species turnover ranges of between 40% and 70% were projected, with much of the change to occur under climate regimes projected for 2050. Projected local extinctions at the pixel scale, assuming that there are no species migrations, are in excess of 80% in the north-eastern and northern Kalahari, dropping to below 20% from the edge of the escarpment into the coastal desert zone.[108] There will be high species turnover in the north-eastern parts of the country, with an overall trend of a reduction in turnover from northeast to west and south-west. The majority of species will suffer declining range size while a minority will experience significant increases in range size. This finding suggests that future climate change may be an advantage to a small subset of species that might be able to capitalise on the novel climatic conditions expected in this country, but that this will depend strongly on their migration capacity.[109] Endemic species will have overall lower susceptibility to climate change (19% and 12% will be classified extinct and critically endangered, respectively by 2080) than non-endemic species. This is largely due to the fact that endemics are both arid-adapted and located in regions of lower projected climate change. The above predicted changes may also be affected by, and have synergistic effects with other processes such as desertification, deforestation and overall land-use changes.

The tourism sector contributes significantly to the Namibia economy, either directly or indirectly. It is the third largest contributor to the country's Gross Domestic Product (GDP) and contributed 20.5% in 2012[110] but declined to 10.2% in 2015 and 10.5% in 2016, with an estimated 11.7% in 2020.[111] However, the corona virus disease (COVID-19) pandemic and associated worldwide lockdowns have hit the tourism sector hard in 2020. In Namibia, an estimated zero tourist arrivals were expected in the country between March and August and possibly for the entire 2020.[112] Government used the Tourism Climate Index (TCI) for the period 2035 to 2065 as a proxy for the suitability of the climate of an area for outdoor tourism activities and showed that Regions which will have high exposure to future climate stressor are Otjozondjupa, Oshana, Oshikoto, Omaheke and Ohangwena while Hardap, Omusati, Kunene, Erongo and Khomas will be least exposed.[113]

The effects of climate change on ecosystems and biodiversity described above will also negatively impact on tourism. Projected declines in vegetation cover in most parts of the country, and significant changes in vegetation structure with associated changes

108 Ibid.
109 Ibid.
110 MET (2016).
111 NTB (2016).
112 Shifeta (2020).
113 GRN (2015a).

in fauna will negatively impact on tourism. Livelihoods of rural communities will be negatively affected since a significant number rely on tourism ventures within communal conservancies. Increasing temperatures due to climate change will increase operational costs associated with the cooling of tourist accommodation facilities. Floods can damage infrastructure and affect accessibility to tourist destinations and facilities and may also lead to increases in incidences of vector-borne diseases.[114] One of the biggest drawcards of Namibia as a tourist destination is the political stability.[115] However, climate change has potential to increase risk of political or other conflict as reported by IPCC.[116] Such a situation will damage the tourism industry if it happens in Namibia.

4.4 Coastal Zone

Worldwide, coastal areas are very important economic zones which provide many goods and services to humanity. About 40% of the world's population lives within 100 km of a coastal area. These human communities who are in close connection with coastal environments are exposed to changes in the ocean and cryosphere. One of the impacts of climate change is a rising sea level due to melting glaciers and ice caps of the Arctic and Antarctica (i.e. widespread shrinking of the cryosphere). The IPCC[117] indicated that globally, the sea level rose at a rate of 1.8 mm per year between 1961 and 2003, with a faster rate of 3.1mm per year between 1993 and 2003. Sea level is projected to rise by between 30 cm and 100 cm by the year 2100, relative to the 1990 level. The rate of rise is projected to be relatively steady, accelerating slightly over time, although storm surges are expected to be the main source of damage to coastal infrastructure. Coasts will be exposed to increasing risks of coastal erosion and by 2080 more millions of people than today will experience floods every year due to sea level rise. The most affected people will be those in low-lying, densely-populated mega deltas of Asia and Africa.[118] The global ocean has warmed since 1970 and it has taken up more than 90% of the excess heat in the climate system, resulting in increases in marine heat-related events.[119] Namibia will not be spared from some of these effects. However, compared to other countries in the region, the Namibian coastline is relatively invulnerable to climate change impacts.[120]

114 Spear *et al*. (2018).
115 GRN (2015a).
116 IPCC (2020).
117 IPCC (2007c).
118 IPCC (2007b).
119 IPCC (2019).
120 Theron / Rossouw (2008).

Namibia's coastline stretches some 1,800 km long and consists of 78% sandy beaches, 16% rocky shores and 4% mixed sandy and rocky shores, with only 2% of the shore backed by lagoons. The coastline is very important for tourism and recreation activities, which contribute significantly to the Namibian economy. Four major towns are situated along the coast, namely Lüderitz, Walvis Bay, Swakopmund and Henties Bay. Walvis Bay is located between one and three metres above sea level, in a semi-sheltered bay surrounded by an erodible coastline. The coastal aquifers which supply water to the town are susceptible to salt intrusion which would be further exacerbated by sea level rise. A sea level rise of 0.3 m, now regarded as virtually certain, will flood significant areas, and a 1m rise would inundate most of the town during high tide.[121] The other three towns, Swakopmund, Henties Bay and Lüderitz, are less vulnerable to rising sea levels due to their relatively safe topographic positions. It was reported that in the near future, most of Namibia's coastal towns would be able to deal with impacts of severe weather conditions but in the long-term they need to carefully plan adaptation strategies to deal with the effects of climate change.[122] Walvis Bay was cited as particularly vulnerable and should safeguard its continued economic activity by properly planning for future effects. The vulnerability of Walvis Bay to rising sea levels was already reported way back,[123] and potential increased coastal erosion, inundation, increased saline intrusion, raised water tables and reduced protection from extreme events have been highlighted. Some of these effects are already being experienced.[124] Overall, coastal areas will experience increased incidence of flooding and inundation. Potential increased storminess due to climate change may increase the difficulty of coastal diamond mining in certain areas of the Namibian coast.[125]

4.5 Energy

There is an intrinsic link between energy and development.[126] This makes the impact of climate change on the energy sector an important one since a number of economic sectors are dependent on various types of energy. The demand for energy is increasing partly due to the increase in human population. Poverty and lack of adaptive capacity and limited coping strategies of most rural communities in Namibia exacerbate the situation. The most dominant energy source in Namibia is imported liquid fuel which accounts for about 63% of total energy consumption (mainly in the transport sector), followed by electricity (17%), coal (5%) and other sources such as solar, wood and

121 GRN (2002d).
122 Consulting Services Africa *et al*. (2009).
123 Hughes *et al*. (1992).
124 Rowswell / Fairhurst (2011).
125 Theron and Rossouw (2008).
126 Bradley-Cook (2008).

wind (15%).[127] While contributing between 8% and 16% to the GDP, the mining sector is also a major consumer of energy. Namibia imports most of its electricity but has limited local generation at the Van Eck coal-fired power station in Windhoek, the Paratus and Anixas diesel power stations at the coast and the Ruacana hydro-electric power station on the Kunene River. Recent droughts have severely reduced electricity generation from the Ruacana plant. Given the projected decline in rainfall and more frequent droughts that are likely to result from climate change, hydro-electric power generation will be severely curtailed. In areas where rainfall is anticipated to increase in the tropical regions of southern Africa including the catchments of the Kunene River in Angola, there may be potential for increased generation of hydro-electricity during some seasons. Energy consumption is projected to increase and high fuel prices will directly affect accessibility of transport, price of goods and services and the cost of living in general.

With plenty of sunshine most of the year, Namibia has great potential to develop solar-powered electricity. This is an option worth serious consideration given the looming energy crisis, not just in Namibia but in the whole southern African sub-region. It has been projected that bush encroachment may increase in some parts of the country as a result of climate change.[128] Encroacher bushes may provide more firewood to local communities, and in urban areas where charcoal is also sold. Charcoal production from encroacher bushes (mainly *Senegalia mellifera*) is on the increase, and some of the charcoal is exported overseas.[129] However, care must be taken not to reduce the carbon sink through excessive de-bushing and at the same time increasing greenhouse gas emissions through biomass burning and charcoal production.

4.6 Human Health and Well-Being

Human health, well-being and livelihoods are strongly dependent upon the state of global ecological and biophysical systems. Climate change is one of the global change factors which have adverse effects on human health. Changes in temperature, precipitation and other factors may lead to short-, medium- and long-term changes in the physical environment, many of which may have direct and/or indirect impacts on human health.[130] This may be through its impacts on aspects such as water quality and availability, nutrition status of humans, and distribution and abundance of vector organisms due to changing temperatures and rainfall patterns. The impact of climate change on human health has increasingly attracted attention after it was highlighted in

127 GRN (2018g).
128 Midgley *et al*. (2005).
129 Namibia Charcoal Association (2018).
130 DRFN (2009).

the IPCC's First[131] and Second[132] Assessment Reports. In its Fourth and Fifth Assessment Reports, the IPCC projected that globally there will be increased malnutrition, diarrhoea, cardio-respiratory and infectious diseases; increased morbidity and mortality from heat waves, floods and droughts, changes in distribution of some vectors and substantial burden on health services.[133] Existing knowledge on the impacts of climate change on health in the SADC region has been reviewed and the review suggested that that there have been no substantial studies assessing the association between climate change and health in the SADC region, and where research has been done it focused only on infectious diseases (particularly malaria).[134] As discussed above, drought negatively impacts food security, particularly in rural populations, at the same it reduces the availability of clean water. Limited food supply during prolonged droughts and the absence of safe drinking water can result in poor nutritional and mental status.[135] Heat waves are likely to increase mortality among the elderly, infants and people whose health is already weak.

Namibia's health system is decentralised to enable it to be responsive to the needs of the population. Thus, the public healthcare system is organised into directorates at the national and regional levels. The Government has invested tremendously in the healthcare system since Independence. Despite this, general life expectancy has not improved, partly because of the HIV/AIDS pandemic.[136] About 15% of the population aged 15 to 49 is living with HIV/AIDS, but the infection level appears to have stabilised, 7% of which are under the age of 15 and 60% are women.[137] The main causes of adult mortality are HIV and AIDS, tuberculosis (TB) and malaria. High incidence of TB is fuelled by the HIV/AIDS epidemic (38% of TB patients are also HIV-positive) and this has reduced life expectancy from 62 years in 1991 to 49 years currently.[138] Recently, the COVID-19 pandemic has also claimed significant numbers of adults. Infant mortality is higher in rural areas and in the wetter north, compared to urban areas and the more arid south, with main causes of death being diarrhoea (42%), malnutrition (40%), malaria (32%) and acute respiratory infections (30%).[139] These causes of death have a strong link to environmental influences, especially climatic factors. For instance, drought decreases the nutritional status of humans and reduces availability of clean water rendering the population vulnerable and susceptible to attacks by various infections.

131 IPCC (1990).
132 IPCC (1995).
133 IPCC (2007c and 2014).
134 Young *et al*. (2010).
135 UNDP (undated).
136 DRFN (2009).
137 GRN (2020a).
138 Ibid.
139 GRN (2002d).

About 60% of the Namibian population lives in areas where malaria is prevalent. These areas are predicted to expand southwards into the central inlands.[140] Such shifts may already be occurring with the warming effects. Namibia aims to eliminate malaria by 2022. However, recent successes in controlling the disease have been punctuated by occasional increases in the disease over the past few years.[141] Increased flood risk also increases the risk of the spread of other serious waterborne diseases such as cholera and bilharzia. This gives an indication of the magnitude of the impacts of changing temperature on the range of the *Anopheles* mosquito, the vector for the malaria parasite. Indeed, it has been reported that rising temperatures are likely going to lead to increased frequency, greater spread and increased transmission rates of vector borne diseases.[142] Sleeping sickness, carried by the tsetse fly (*Glossina morsitans)*, is currently not present in Namibia although the cattle version (nagana) occurs in eastern Zambezi.[143] Both these forms of disease are projected to decrease under future climate projections because of a reduction in habitat availability for the tsetse fly. Government also predicts the possibility of incursion of lymphatic filariasis (elephantiasis), dengue fever and yellow fever from countries to the north with changes in climatic conditions.[144]

Therefore, major impacts of climate change on health will result from decreasing crop yields and food insecurity, increasing water scarcity in some areas, extreme weather events (floods, droughts, heat waves, etc.), and changes in the distribution patterns and abundance of parasites and disease vectors. In the final analysis, the effects of climate change on Namibia will increase the pressure on human health and other health-related aspects of the economy and may lead to an increase in disease burden and poverty in communities.

4.7 Fisheries and Marine Resources

The fisheries sector contributed only 2.8% to GDP in 2014, which is a decline from 4.6% in 2009.[145] Namibia's fisheries sector is largely dependent upon the highly productive marine ecosystem driven by the upwelling of the cold, nutrient-rich Benguela Current in the Benguela Current Large Marine Ecosystem (BCLME) while comparatively limited production is from inland fisheries. The upwelling in the BCLME is caused by the interaction of south-easterly winds with the north-flowing current and the topography of the seabed. Currently there are no reliable scientific projections to

140 UNDP (undated).
141 Jacobson *et al*. (2019).
142 Husain / Chaudhary (2008).
143 GRN (2002d).
144 Ibid.
145 GRN (2018g).

suggest either an increase or a decrease in the Benguela fisheries yield as a result of climate change.[146] Links between environmental variability and fisheries dynamics are also poorly understood and large environmental anomalies or extreme events, such as the Benguela Niño, have negative impacts.[147] Because the BCLME upwelling-driven, it is naturally highly variable and complex, making it difficult to predict long-term climate change-related trends apart from the warming of the surface water at the northern and southern boundaries and the cooling of inshore waters.[148] Recent studies have shown that sea surface temperatures over the northern Benguela region appear to have become persistently warmer since 1993, consistent with global predictions of rising surface water temperature. It is possible that observed reductions in pilchard stocks since 1993 could be partially explained by warmer seas.[149]

Any changes in the distribution and intensity of winds would affect the fisheries sector as it has direct impact on the upwelling dynamics of the Benguela system. Four possible scenarios that could result from climate change have been described.[150] The first is a possible reduction in coastal upwelling intensity through a slackening of the south Atlantic trade wind circulation. This would reduce the productivity of the ecosystem and the species that characterise the Benguela system could suffer major reductions in stock size and distribution. The second would be an increase in average summer wind stress and coastal upwelling intensity which would enhance enrichment and potential primary production. This could benefit some pelagic species and their predators due to increased productivity. However, it has been commented that, contrary to a popular assumption, there is little evidence to suggest that there have been large-scale inter-annual changes in primary production in response to changing wind fields.[151] The third is that the frequency and severity of Benguela Niño events would increase, with a direct risk of large-scale population fluctuations, particularly of pelagic species; the Benguela Niños have the most obvious consequences for marine life in the northern Benguela, and intrusions of warm, nutrient-poor water from southern Angola has affected a wide range of species from small pelagic fish to top predators.[152] These events have led to increased reduction in oxygen in Namibian shelf waters. The distribution of hake, and possibly other demersal species, could be substantially altered as a result, making the fish less available to trawl and long-line fleets. This has serious negative consequences on the economy and livelihoods of fishing communities. The fourth is a possible best-case scenario but probably the least possible where there would be low amplitude gradual affects that would lead to a succession of rapid regime

146 GRN (2002d).
147 Reid *et al*. (2007).
148 Hampton (2012).
149 Ibid; MFMR (2002).
150 Roux (2003).
151 Ibid.
152 Ibid.

shifts between semi-stable states of the system. These regime shifts would affect primarily the dominant pelagic species, which would in turn, induce large changes in the entire system.[153]

4.8 Water Resources

Predictions are that southern Africa will receive 10% to 20% less rainfall by 2050. Such reductions in areas with rainfall regimes of 400-1,000 mm per annum may lead to a drop in perennial surface drainage of 75% and 25%, respectively by 2050.[154] The magnitude of surface water shortage may even be higher in drier areas of Namibia, which actually form the bigger proportion of the country. Even in the absence of climate change, water is an extremely scarce resource in Namibia.[155] The agriculture sector is the major user of water in Namibia, consuming close to 75% of water in the country.[156] Several other sectors such as mining (3.3%), services (2.9%) manufacturing (2.4%) and domestic (12.2%) sectors also have significant demands for water. Any changes that result in a decline in water supply will have serious repercussions on human livelihoods and the economy of the country in general.

Increases in temperature will have a marked increase in evaporation. It is estimated that for every degree of temperature rise, evaporation increases 5%. Therefore, there will be less water available for recharge and storage with increased atmospheric warming. The length of inundation of seasonally flooded terrestrial wetlands will therefore decrease due to increased evaporation. In some instances, this may lead to increased salt content of pans and pools and make them less suitable for human and animal consumption. Increased temperatures will also lead to increases in evaporation from plants, which will mean that plants will pump out more ground water, further depleting underground water. All this will lead to a reduction in the size and productivity of many wetlands,[157] negatively affecting human livelihoods that are critically dependent on these wetlands particularly in the north and north-eastern parts of the country.

It is predicted that rainfall over the Angolan catchments of the Zambezi, Kavango, Cuvelai and Kunene rivers will decrease by 10-20% between 2045 and 2065 leading to a 25% reduction in run-off and drainage into these river systems.[158] Of all the rain that falls in Namibia, less than 1% recharges groundwater and only 2% remains as surface water storage while the rest evaporates.[159] Groundwater recharge is predicted

153 Reid *et al*. (2007).
154 Ibid.
155 Spear *et al*. (2018).
156 GRN (2002d).
157 DRFN / CSAG (2010).
158 GRN (2011a:6).
159 GRN (2002d).

to suffer a reduction of 30-70% across the country.[160] The whole of Namibia experiences a net water deficit, meaning that evaporation exceeds rainfall throughout Namibia, with average water deficit being highest in the southeast (-2,300 mm/year) and lowest in Zambezi (-1,300 mm/year).[161] Recent estimates put these deficits at -4000 mm/year in the south-east and -1600 mm/year in the north-east.[162] Water deficit in southern areas result in most terrestrial wetlands being ephemeral.

An estimated 60% of Namibia's population lives near the major wetlands, with the highest population density along the perennial Kavango River.[163] Most of these communities are largely poor and highly dependent on the river and floodplains for water and other resources. The projections outlined above therefore spell gloomy prospects for these people, who were identified as being extremely vulnerable to environmental change. The above situation will further be worsened by increased demand from a growing population in general - demand for irrigation and demand in urban areas in response to projected heat stress.[164]

5 Compliance, Mitigation and Adaptation to Climate Change: Summary of Selected Actions Taken

The above account has highlighted the vulnerability of Namibia to climate change and the effects this may have on the environment, the economy and human livelihoods. The country is experiencing an increase in frequency and severity of disasters such as floods, droughts and heat waves. The potential losses due to disasters is set to increase as the impacts of climate change continue to unfold.[165] The IPCC warns that many aspects of climate change and associated impacts will continue for centuries, even after anthropogenic emissions of greenhouse gases have been stopped.[166] It is therefore important that the country takes steps to mitigate climate change and capacitate communities to adapt to these effects. Under the UNFCCC and other international instruments, Parties to these conventions and treaties have obligations to introduce measures in order to mitigate further environmental deterioration and to reduce the effects these changes have on humanity and the environment. As a party to the UNFCCC and the Paris Agreement Namibia is obliged to put in place structures, policies and measures that meet the above objectives.

160 Spear *et al*. (2018).
161 DRFN / CSAG (2010).
162 GRN (2021a).
163 Heyns *et al*. (1998).
164 GRN (2015a).
165 GRN (2011c).
166 IPCC (2014a).

Available literature highlights why climate change adaptation and mitigation are critical issues not only for Namibia and southern Africa, but the world over. It is conceded though, that a certain amount of climate change is unavoidable regardless of reductions in greenhouse gas emissions.[167] It must be noted that effects of climate change will act in combination with other drivers of ecosystem degradation, for instance, communities in the region already face high levels of vulnerability and numerous stresses due to poverty, HIV/AIDS, food insecurity, and political instability.[168] Hence measures put in place must take cognisance of these interactive effects and approach them in a holistic manner.

Namibia established the Namibian Climate Change Committee (NCCC) in 2001 with the main function of advising and making recommendations to Government on climate change including how to meet its obligations to the UNFCCC. The NCCC is hosted by the Directorate of Environmental Affairs in the Ministry of Environment, Forestry and Tourism. Its membership is drawn from representatives of various Government ministries, NGOs, parastatals and the private sector. Thereafter, Cabinet approved the first National Policy on Climate Change (NPCC) in 2011[169] and the National Climate Change Strategy and Action Plan (NCCSAP): 2013-2020 in 2014[170] to aid in the implementation of the Policy on Climate Change by setting out the country's direction towards addressing climate change mitigation.

Thus, Namibia has taken several steps in addressing the issue of climate change and other global change challenges. In addition to the formation of the NCCC, other important steps under the obligations of the UNFCCC include (but are not limited to) the following:

- National policies and laws related to global change challenges and environmental management and protection are in place, including the Namibian Constitution, Vision 2030, National Development Plans, Environmental Management Act No. 7 of 2007, various sector policies and Cabinet directives. These policies are discussed in various Chapters of this Book. This includes the development of the National Policy on Climate Change for Namibia, development of the National Climate Change Strategy and Action Plan stated above;
- Initial National Communication to the UNFCCC in 2002;
- Second National Communication to the UNFCCC in 2010;
- Third National Communication to the UNFCCC in 2015;
- Fourth National Communication to the UNFCCC in 2020;
- Intended Nationally Determined Contributions (INDC) to the UNFCCC in 2015;

167 IPCC (2007c).
168 Shackleton *et al*. (2008); Ziervogel *et al*. (2006a).
169 GRN (2011b).
170 GRN (2014b).

- Intended Nationally Determined Contributions (INDC) to the UNFCCC in 2021;
- First Biennial Update Report (BUR1) to the UNFCCC in 2014;
- Second Biennial Update Report (BUR2) to the UNFCCC in 2016;
- Third Biennial Update Report (BUR3) to the UNFCCC in 2018;
- First National GHG Inventory Report (NIR1) in 2015;
- Second National GHG Inventory Report (NIR2) in 2016;
- Third National GHG Inventory Report (NIR3) in 2018;
- Assessment of capacity needs required to implement Article 6 of the UNFCCC was completed in 2005;
- A Directorate of Disaster Risk Management is operational in the Office of the Prime Minister. A National Disaster Risk Management Plan was developed;[171]
- A National Drought Policy and Strategy was developed in 1997;
- Continuous reviews and updates of national circumstances concerning impacts of climate change on various sectors are done;
- A Technology Needs Assessment was conducted in 2005 to identify requisite financial and research needs;
- Local-level activities are on-going for communities to adapt to climate change through improvement of traditional crops and livestock farming in several regions; and enhancing the adaptive capacities of farmers, pastoralists and natural resource managers to climate change in agricultural and pastoral systems in the country; a number of projects have been, and are being implemented across the country;
- Efforts are being made to increase access to climate change information and improved access to alternative resources by local communities, farmers and other stakeholders in the country;
- Namibia has integrated climate change issues in its development plans and has implemented numerous mitigation measures in various economic activities to curb emissions; the mitigation actions are summarised in the various Biennial Update Reports listed above; and
- The Environmental Investment Fund (EIF) was established in 2001 with the objective of mobilising funds to support activities and projects which promote sustainable use and efficient management of natural resources. To-date, the EIF has funded numerous projects on community resilience, capacity building, adaptation, mitigation etc. which have made a significant improvement of community livelihoods.

171 GRN (2011c).

6 Concluding Remarks

Climate change continues to be one of the greatest challenges of all time as it is cross-cutting all sectors of the economy. Namibia is very vulnerable to the effects of climate change due to the arid nature of the country, limited capacity to deal with its effects and inadequate technical and financial capacity for adaptation, given that there is a myriad of other challenges (e.g. poverty, HIV and AIDS, malaria, unemployment, and the COVID-19 pandemic) that need to be dealt with in addition to climate change. The evidence of climate change in Namibia are very clear, manifested by more intense flooding, shortening of the growing season, more frequent droughts, rising average summer and winter temperatures, frequent heat waves, among many other effects. These conform to predictions from General Circulation Models (GCMs) that paint a gloomy picture of rising temperatures and declining rainfall in most areas, though the applicability of GCMs remains limited at local spatial scales. There will be an accelerated decrease in biodiversity (particularly in the originally less arid areas), increasing evaporation leading to water scarcity, low crop yields leading to food shortages and insecurity, declining marine productivity due to sea warming and predicted declining oxygen levels in the continental shelf, flooding and erosion of coastal areas and changes in the distribution of disease patterns and their vectors. As a signatory to the UNFCCC and other related international instruments, Namibia is taking concrete steps to minimise the impacts of climate change on the people and the economy by putting in place relevant policies, structures and institutions for dealing with climate change and enhancing adaptive and mitigation capacity. With assistance from national and international partners and stakeholders, Namibia has implemented a significant number of interventions in order to achieve the above. Namibia's greenhouse gas emissions are insignificant, and the country has remained a net sink for CO_2 as far as the latest (2018) analyses show. Hence, efforts should be less on cutting down current emissions but more on curbing any potential increases in GHG emissions, adaptation, coping strategies, and disaster preparedness and management.

Chapter 22: Climate Change *de Facto* and *de Jure*: Legal and Regulatory Aspects Relevant to Namibia

Oliver C. Ruppel

1 Introduction

Namibia's development is guided by its 5-year periods National Development Plans within its long-term National Policy Framework, Vision 2030, and the Harambee Prosperity Plan (HPP). The country is currently in its Fifth (2017/18 – 2021/22) National Development Plan (NDP5)[1] that *inter alia* outlines a development strategy aiming at improving the living conditions of every Namibian through sustainable development and a low carbon economy.[2]

Namibia is one of the driest countries in southern Africa. The cold Benguela current along the west coast and Namibia's location traversing the subtropical high-pressure belt greatly influences the main features of the climate. The climate of Namibia is characterised by high variability. Namibia is very vulnerable due to the arid nature of the country, limited capacity to deal with the effects and inadequate technical and financial capacity for adaptation, given that there is a myriad of other challenges (e.g. poverty, HIV and AIDS, unemployment) that need to be dealt with in addition to climate change.

Climate change in Namibia has an impact on access to water and sanitation, health, agriculture, fisheries and marine ecosystems, forestry, energy, and human settlements.[3] The combined impact of climate change is expected to reduce livelihood opportunities even further, to reduce biodiversity and food security; the prevalence of drought and flooding will increase. Impacts associated with temperature increases include a further rise in sea levels, changes in precipitation patterns, and the resultant threat to food security and sustainable development in general, with more people being caught up in the poverty trap. Limited adaptive management puts Namibia's population and its natural resources at risk. Thus, integrating adaption and mitigation strategies into the legal framework is essential.

During the past centuries the world's population increased rapidly and a global population of 9.7 billion people is projected for the year 2050.[4] The expansion of mankind, both in numbers and per capita exploitation of the earth's resources, has been

1 GRN (2017a).
2 GRN (2020a:1).
3 Karuaihe *et al*. (2007:34).
4 See https://bit.ly/3HLkPJf, accessed 15 February 2022.

astounding. In an age primarily shaped by people, the so-called *Anthropocene,*[5] the depletion of natural resources, the transformation of land surface by human action, and the increase in atmospheric concentrations of carbon dioxide are some of the impacts of human activity on Earth and atmosphere. The consequences of human activity are inseparably linked with observed changes in climate and mankind is faced with enormous challenges posed by the effects of climate change,[6] *de facto* and *de iure*.[7]

2 *De Facto:* Aspects of Human Vulnerability

With the increasing possibility, through science, of predicting foreseeable events, such as extreme weather, increasing obligations rest on governments to perform duties to guard their citizens against harm. The science base is provided by the Intergovernmental Panel on Climate Change (IPCC), which was established by the United Nations Environment Programme (UNEP) and the World Meteorological Organisation (WMO) in 1988. It is the ultimate role of the IPCC to assess – on a comprehensive, objective, open and transparent basis – the scientific, technical and socioeconomic information relevant to understanding the scientific basis of risk of human-induced climate change, its potential impacts and options for adaptation and mitigation. The IPCC provides rigorous and balanced scientific information to decision-makers, and by endorsing the IPCC reports, governments acknowledge the authority of their scientific content. The work of the IPCC is meant to be policy-relevant and yet policy-neutral, never policy-prescriptive.[8] The 2021/2022 publication of the IPCC's Sixth Assessment

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5 The term has initially been coined in 2000 by the famous atmospheric chemist and Dutch Nobel Prize winner Paul Crutzen and has ancient Greek roots: *anthropo* meaning *human* and *cene* meaning *new*. In 2000 Crutzen realised that we live in an age primarily shaped by people and that anthropogenic drivers have become major factors regarding the changes of our planet Earth. Crutzen suggested this age be called *Anthropocene* – "the age of man". See Crutzen / Stoermer (2000).

6 According to the IPCC (2014b:1758), climate change refers to "a change in the state of the climate that can be identified (e.g. by using statistical tests) by changes in the mean and/or the variability of its properties, and that persists for an extended period, typically decades or longer. Climate change may be due to natural internal processes or external forcing's such as modulations of the solar cycles, volcanic eruptions, and persistent anthropogenic changes in the composition of the atmosphere or in land use. Note that the Framework Convention on Climate Change (UNFCCC), in its Article 1, defines climate change as: "a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods". The UNFCCC thus makes a distinction between climate change attributable to human activities altering the atmospheric composition, and climate variability attributable to natural causes."

7 See Ruppel (2013:29).

8 See http://www.ipcc.ch/organization/organization.shtml#.URelrmhpvos, accessed 17 February 2021.

Report (AR6) will update scientific findings that provide further guidance for policy-makers.

In its *5th Assessment Report (AR5) on Climate Change,*[9] the IPCC has again most rigorously reviewed and assessed the most recent scientific, technical and socioeconomic information produced worldwide relevant to the understanding of climate change. IPCC reports are of great relevance with regard to all aspects of climate change and contain a solid base for further debate on this important topic. A general message from the report can be summarised as follows: there is no doubt that we live in a world which is altered by climate change, one of the greatest challenges of the 21st century. Climate change poses risks to human and natural systems and has the potential to impose additional pressures on the various aspects of human security.[10] The risks and impacts related to climate change can be reduced by improving society to decrease vulnerability and hand down the overall risk level (adaptation)[11] and by reducing the amount of climate change that occurs, particularly by decreasing emissions (mitigation).[12]

Human influence on the climate system is clear, and recent anthropogenic emissions of greenhouse gases are the highest in history. Recent climate changes have had widespread impacts on human and natural systems.[13]

Evidence shows that the atmosphere and ocean have warmed, the amounts of snow and ice have diminished and sea level has risen and there is no doubt that human influence has been the dominant cause of the warming observed since 1950.[14] Climate change has caused widespread and consequential impacts on all continents and across the oceans and poses a broad range of future risks for human and natural systems.[15] The IPCC's analysis of observed climate trends and future projections reveals that that it is very likely that mean annual temperature has increased over the past century over most of the African continent,[16] and that temperatures on the continent will rise faster than the global average increase during the 21st century.

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9 Report available from http://www.ipcc.ch/report/ar5/, accessed 8 May 2021.
10 Adger *et al*. (2014).
11 Adaptation is defined as "The process of adjustment to actual or expected climate and its effects. In human systems, adaptation seeks to moderate or avoid harm or exploit beneficial opportunities. In some natural systems, human intervention may facilitate adjustment to expected climate and its effects." See IPCC (2014b:1758).
12 Mitigation of climate change is defined as "a human intervention to reduce the sources or enhance the sinks of greenhouse gases." See IPCC (2014b:1769).
13 See IPCC (2014a:2).
14 Ibid.
15 Ibid:6.
16 With the exception of areas of the interior of the continent, where the data coverage has been determined to be insufficient. See Niang / Ruppel (2014:1206).

Box: Selected Executive Summary Statements of the IPCC AR5 Africa Chapter[17]

Evidence of warming over land regions across Africa, consistent with anthropogenic climate change, has increased (high confidence). Decadal analyses of temperatures strongly point to an increased warming trend across the continent over the last 50 to 100 years.

Mean annual temperature rise over Africa, relative to the late 20th century mean annual temperature, is likely to exceed 2°C in the Special Report on Emissions Scenarios (SRES) A1B and A2 scenarios by the end of this century (medium confidence). Warming projections under medium scenarios indicate that extensive areas of Africa will exceed 2°C by the last 2 decades of this century relative to the late 20th century mean annual temperature and all of Africa under high emission scenarios.

A reduction in precipitation is likely over Northern Africa and the southwestern parts of South Africa by the end of the 21st century under the SRES A1B and A2 scenarios (medium to high confidence). Projected rainfall change over sub-Saharan Africa in the mid- and late 21st century is uncertain.

African ecosystems are already being affected by climate change, and future impacts are expected to be substantial (high confidence). There is emerging evidence on shifting ranges of some species and ecosystems due to elevated carbon dioxide (CO2) and climate change, beyond the effects of land use change and other non-climate stressors (high confidence). Ocean ecosystems, in particular coral reefs, will be affected by ocean acidification and warming as well as changes in ocean upwellings, thus negatively affecting economic sectors such as fisheries (medium confidence).

Climate change will amplify existing stress on water availability in Africa (high confidence). Water resources are subjected to high hydro-climatic variability over space and time, and are a key constraint on the continent's continued economic development. The impacts of climate change will be superimposed onto already water-stressed catchments with complex land uses, engineered water systems, and a strong historical sociopolitical and economic footprint. Strategies that integrate land and water management, and disaster risk reduction, within a framework of emerging climate change risks would bolster resilient development in the face of projected impacts of climate change.

Climate change will interact with non-climate drivers and stressors to exacerbate vulnerability of agricultural systems, particularly in semi-arid areas (high confidence). Increasing temperatures and changes in precipitation are very likely to reduce cereal crop productivity. This will have strong adverse effects on food security.

Climate change may increase the burden of a range of climate-relevant health outcomes (medium confidence). Climate change is a multiplier of existing health vulnerabilities (high confidence), including insufficient access to safe water and improved sanitation, food insecurity, and limited access to health care and education. Climate change is projected to increase the burden of malnutrition (medium confidence), with the highest toll expected in children.

17 Taken from Niang / Ruppel (2014:1202).

In all regions of the continent, national governments are initiating governance systems for adaptation and responding to climate change but evolving institutional frameworks cannot yet effectively coordinate the range of adaptation initiatives being implemented (high confidence). Progress on national and subnational policies and strategies has initiated the mainstreaming of adaptation into sectoral planning. However, incomplete, under-resourced, and fragmented institutional frameworks and overall low levels of adaptive capacity, especially competency at local Government levels, to manage complex socio-ecological change translate into a largely ad hoc and project-level approach, which is often donor driven. Overall adaptive capacity is considered to be low. Disaster risk reduction, social protection, technological and infrastructural adaptation, ecosystem-based approaches, and livelihood diversification are reducing vulnerability, but largely in isolated initiatives. Most adaptations remain autonomous and reactive to short-term motivations.

Growing understanding of the multiple interlinked constraints on increasing adaptive capacity is beginning to indicate potential limits to adaptation in Africa (medium confidence). Climate change combined with other external changes (environmental, social, political, technological) may overwhelm the ability of people to cope and adapt, especially if the root causes of poverty and vulnerability are not addressed.

There is increased evidence of the significant financial resources, technological support, and investment in institutional and capacity development needed to address climate risk, build adaptive capacity, and implement robust adaptation strategies (high confidence). Funding and technology transfer and support is needed to both address Africa's current adaptation deficit and to protect rural and urban livelihoods, societies, and economies from climate change impacts at different local scales. Strengthening institutional capacities and governance mechanisms to enhance the ability of national governments and scientific institutions in Africa to absorb and effectively manage large amounts of funds allocated for adaptation will help to ensure the effectiveness of adaptation initiatives (medium confidence).

Climate change and climate variability have the potential to exacerbate or multiply existing threats to human security including food, health, and economic insecurity, all being of particular concern for Africa (medium confidence). Many of these threats are known drivers of conflict (high confidence). Causality between climate change and violent conflict is difficult to establish owing to the presence of these and other interconnected causes, including country-specific socio-political, economic, and cultural factors. For example, the degradation of natural resources as a result of both overexploitation and climate change will contribute to increased conflicts over the distribution of these resources. Many of the interacting social, demographic, and economic drivers of observed urbanization and migration in Africa are sensitive to climate change impacts.

2.1 Impacts of Climate Change

AR5 presented strong evidence that the impacts[18] of climate change in Africa are already being felt across various sectors. Climate change poses challenges to economic growth and sustainable development and to the various facets of human security. Although detection of and attribution to climate change are often difficult given the role of drivers other than climate change, there are substantially more impacts in recent decades now attributed to climate change.[19] Various examples show, however, that climate change exerts extensive pressure on different ecosystems such as terrestrial, freshwater, and coastal/ocean ecosystems.[20] The health, livelihoods and food security of people in Africa are all affected by climate change. And as "Africa as a whole is one of the most vulnerable continents due to its high exposure and low adaptive capacity",[21] innovation and technology, smart policy making, high levels of Government attention, effective diplomacy, and international cooperation are required to effectively address the current and future challenges related to climate change.

The African Union draft climate strategy makes explicit and relevant reference to the issue of change governance, which[22]

> refers to the exercise of power and authority by formal institutions of governments with a view to minimize the impacts of climate change on communities, ecosystems, and the wider environment in general. It entails development of legislation, policies, institutional and management frameworks, at continental, regional and national levels. Further, it is to deal with governance of sectoral, cross sectoral and regional issues; and harmonization across sectors and levels of governance. Climate change governance in the continent should also deal with matters of compliance and mutual accountability on global, regional and national levels. (...) Addressing the challenges of climate change require active involvement of multi-disciplinary, multi-national, and stakeholders actions from global to local levels. African Union needs to deal with various issues of governance, including engagements with global climate change governance, mutual accountability on climate change commitments, enforcement and compliance with agreements, mechanisms of monitoring and reporting of climate change programmes; and building capacities of member states to access climate change funds. This thematic area is to ensure that the African Union (AU) continues providing the required leadership in climate change governance in Africa to promote and defend the continent's interest in all areas including issues related to environment, disaster risk reduction and climate change, among other challenges. Such leadership roles should

18 Impacts of climate change are the "effects on natural and human systems of extreme weather and climate events and of climate change. Impacts generally refer to effects on lives, livelihoods, health, ecosystems, economies, societies, cultures, services, and infrastructure due to the interaction of climate changes or hazardous climate events occurring within a specific time period and the vulnerability of an exposed society or system. Impacts are also referred to as consequences and outcomes. The impacts of climate change on geophysical systems, including floods, droughts, and sea level rise, are a subset of impacts called physical impacts." IPCC (2014c:5).

19 IPCC (2014a:7).

20 See Niang / Ruppel (2014:1214).

21 Ibid:1205.

22 AMCEN-15-REF-11.

also be undertaken in close partnerships with the international community, Regional Economic Communities (RECs) and African Member States as well as other stakeholders.

2.2 Future Risks and Opportunities

> Climate change will amplify existing risks and create new risks for natural and human systems. Risks are unevenly distributed and are generally greater for disadvantaged people and communities in countries at all levels of development.[23]

Risk is "the potential for consequences where something of value is at stake and where the outcome is uncertain, recognizing the diversity of values."[24] Risk results from the interaction of vulnerability, exposure, and hazard. Risks from a changing climate in general come from a lack of preparedness making people vulnerable and the exposure of people or assets to harm, overlapping with triggering climate events (hazards). Key risks are potentially severe impacts of climate change and are considered 'key' due to the high intensity of hazard or the high vulnerability of societies and systems exposed, or both. One major finding of AR5 is that the higher the increase in warming is, the higher is the risk.[25]

Particular challenges for less developed countries and vulnerable communities, given their limited ability to cope are the key risks as identified in AR5 as risks with high confidence, spanning sectors and regions, including but not limited to the following:[26]

- Risk of death, injury, ill-health, or disrupted livelihoods in low-lying coastal zones and small island developing states and other small islands, due to storm surges, coastal flooding, and sea-level rise;
- risk of severe ill-health and disrupted livelihoods for large urban populations due to inland flooding in some regions;
- systemic risks due to extreme weather events leading to breakdown of infrastructure networks and critical services such as electricity, water supply, and health and emergency services;
- risk of mortality and morbidity during periods of extreme heat, particularly for vulnerable urban populations and those working outdoors in urban or rural areas;
- risk of food insecurity and the breakdown of food systems linked to warming, drought, flooding, and precipitation variability and extremes, particularly for poorer populations in urban and rural settings;

23 IPCC (2014c:13).
24 Ibid:5.
25 Niang / Ruppel (2014:1238).
26 IPCC (2014c:13).

- risk of loss of rural livelihoods and income due to insufficient access to drinking and irrigation water and reduced agricultural productivity, particularly for farmers and pastoralists with minimal capital in semi-arid regions;
- risk of loss of marine and coastal ecosystems, terrestrial and inland water ecosystems, biodiversity, and the ecosystem goods, functions, and services they provide for livelihoods.

For Africa in particular, the following key risks have been highlighted:[27] Risks of stress on water resources, sea level rise and extreme weather events, shifts in biome distribution, degradation of coral reefs, reduced crop productivity, adverse effects on livestock, vector- and water-borne diseases, under nutrition, and migration.

The risks associated with climate change need to be reduced by limiting the rate and magnitude of climate change. AR5 reveals that risks are reduced substantially under the assessed scenario with the lowest temperature projections. Furthermore, reducing climate change can also reduce the scale of adaptation that might be required.

In order to manage the risks of climate change, various approaches for adaptation come into consideration. Risk reduction strategies used in African countries to offset the impacts of natural hazards on individual households, communities, and the wider economy include early warning systems, emerging risk transfer schemes, social safety nets, disaster risk contingency funds and budgeting, livelihood diversification, and migration. Various adaptation approaches can be overlapping and are often pursued simultaneously. Most national governments in Africa are initiating governance systems for adaptation. Efforts to reduce vulnerability include disaster risk management, adjustments in technologies and infrastructure, ecosystem-based approaches, basic public health measures, or livelihood diversification.

Building more resilient societies is another means to cope with the challenges associated with climate change. Climate change, along with land-use change, degradation of ecosystems, poverty and inequality is one of the stressors that impinge on resilience. Climate resilient pathways must be identified by decision-makers that lead to a more resilient world, *inter alia* through adaptive learning, increasing scientific knowledge, effective adaptation and mitigation measures, and other choices that reduce risks.

Changes in Africa's climate have been observed during the past decades and impacts are occurring across a variety of sectors such as ecosystems, human health, livelihoods and food security. Climate change will generate new risks and amplify existing risks for society and the environment. Africa must prepare for future changes in climate as even under low-emission scenarios, warming will continue at least until around the middle of this century. The impacts of climate change can be reduced through adaptation actions moderating the harm of climate risks and exploring new opportunities. Risk management must be in the focus of decision-making to cope with the impacts and risks related to climate change. On the positive side it should be noted that the

27 See Niang / Ruppel (2014:1237).

experience of adaptation measures on the African continent is growing as governments are increasingly developing National Adaptation Plans of Action and other national adaptation policies. Furthermore, opportunities for low-carbon, climate-resilient development are increasingly being explored and realised. It is clear that required global emissions reductions will mean that countries have to transform themselves into low-carbon economies over the long run. This will require efforts at various levels, including substantial changes in lifestyle.[28] From a behavioural science perspective, this mandates that we limit ourselves as individuals and nations for a more global common good. The constraints we are being asked to accept are experienced in the present, while the impacts of our negligence may only be felt in the future. This is why the law plays an increasingly important role.

Box: Green Hydrogen from Namibia?

Green Hydrogen, Climate Neutrality and Regulatory Challenges

President Geingob already announced during the launch of the country's second Harambee development plan early in 2021, that the government already worked hard to establish a green hydrogen production industry. "Given our world class renewable energy resources, Namibia will develop a national strategy for developing green hydrogen and ammonia. As we pursue this strategy, we have the opportunity to become the first country in Africa to achieve carbon neutrality and utilise the African Continental Free Trade Area (AfCFTA) to export clean energy to our neighbours," he said. In turn, the director general of the National Planning Commission (NBC), Obeth Kandjoze, announced the establishment of the Green Hydrogen Council of Namibia, which has been set up in the meantime with eight members, supported by a 15-member technical committee. The economic advisor to President Geingob, James Mnyupe has been appointed as Namibia's Green Hydrogen Commissioner.[29]

Green hydrogen is hydrogen that is produced using an electrolyser, powered by renewable energy, such as wind, solar, hydraulic or biomass plant. From an electrochemical reaction, the electrolyser will split water into dihydrogen and dioxygen and produce hydrogen. Until now, green hydrogen has been far more expensive than versions produced using fossil fuel, including the dominant "grey" hydrogen that relies on natural gas. But high gas prices due to strong demand and lower stocks have driven up the cost of making the carbon-emitting version, meaning the cleaner technology can start to compete.[30] Opponents of the hydrogen drive say it is inefficient because to

28 Ohlendorf / Gerstetter (2009).
29 Cf. https://bit.ly/3LxYYXX, accessed 15 February 2022.
30 Available at https://www.euractiv.com/section/energy/news/lets-reach-for-the-stars-eu-aims-for-green-hydrogen-below-e2-kg-by-2030/, accessed 28 December 2021.

scale up, it will require vast amounts of clean energy production and future cost reductions are uncertain. Yet, hydrogen is expected to play a key role in a future climate-neutral economy, enabling emission-free transport, heating and industrial processes as well as inter-seasonal energy storage. Clean hydrogen produced with renewable electricity is a zero-emission energy carrier but is not yet as cost- competitive as hydrogen produced from natural gas.[31]

The EU hydrogen strategy, adopted in July 2020, aims to accelerate the development of clean hydrogen, ensuring its role as a cornerstone of a climate-neutral energy system by 2050. To reach this goal, the strategy envisions a gradual trajectory, initially including blue hydrogen projects. Several key actions are to be implemented over the course of three strategic phases between 2020 and 2050. The strategy points to the existing status quo, concluding that hydrogen (and in particular renewable hydrogen) plays only a minor role in the overall energy supply today, with challenges in terms of cost- competitiveness, scale of production, infrastructure needs and perceived safety.[32]

The European Union's Hydrogen Strategy sets development of renewable hydrogen as a priority for the region, while recognizing that low-carbon hydrogen (nuclear and fossil-based hydrogen with carbon capture) will be necessary in the short and medium term to rapidly decrease GHG emissions of existing hydrogen production facilities and accelerate infrastructure development.[33]

In 2020, the Commission adopted a new dedicated strategy on hydrogen in Europe. It will bring together different strands of action – from research and innovation via production and infrastructure to the international dimension. The strategy explores how producing and using renewable hydrogen can help decarbonise the EU economy in a cost-effective way, in line with the European Green Deal (and also helping the post-COVID-19 economic recovery).[34]

According to the European Commission, cooperation across the entire supply-chain and across the public and the private sector is essential to delivering an enabling regulatory framework and the critical mass in hydrogen research and deployment investments, deemed necessary to ensure the scale-up.[35]

With the launch of the European Clean Hydrogen Alliance, a forum has been established, bringing together industry, public authorities and civil society, to coordinate investments for scaling up production and increasing demand. The strategy has a clear focus on ensuring the appropriate priority and proper access to finance for clean

31 From https://www.europarl.europa.eu/RegData/etudes/BRIE/2021/689332/EPRS_BRI(2021)689332_EN.pdf, accessed 28 December 2021.

32 Ibid.

33 With further references https://sdg.iisd.org/commentary/guest-articles/making-green-hydrogen-a-global-trade-commodity-for-enhanced-climate-ambition/, accessed 28 December 2021.

34 Cf. https://ec.europa.eu/energy/topics/energy-system-integration/hydrogen_en, accessed 28 December 2021.

35 Cf. https://bit.ly/3uVaHtN, accessed 15 February 2022.

hydrogen projects. The alliance is expected to deliver an investment pipeline and ensure adequate policy coordination.[36]

Germany in particular has put strong emphasis on the role of hydrogen in the country's decarbonisation programme. Germany signaled to only count on fossil-free hydrogen to meet the climate policy goals, and target state support only to green hydrogen technologies. The German national hydrogen strategy has a goal of 5GW production capacity by 2030 and 10 GW by 2040. Significant funding has been earmarked for research and technology transfer from lab to market, including separate funding for industry. Recognising the limitations to producing the hydrogen needed within Germany, a budget of €2 billion has been proposed for fostering international partnerships.[37]

In this light, Germany also sealed off a deal with Namibia rendering a helping hand and €40 million to boost its green hydrogen production, in return for a future cheap supply of the gas. "There is already a race around the world for the best hydrogen technologies and the best locations for hydrogen production. From our point of view, Namibia has particularly good chances in this competition. To produce clean hydrogen, electricity is needed from a renewable source to split water into oxygen and hydrogen. The resulting hydrogen is carbon-free and can be used to decarbonise industries such as steelmaking and aviation that rely on fossil fuels. Hydrogen is seen as a key energy source that will play a major role in helping countries become carbon neutral. Germany wants to lead the way, becoming a world-leading clean hydrogen economy, but has few of the renewable energy sources that are needed for this.[38]

For Namibia, the new partnership means investment, jobs and potential leadership in the future market.[39] In Africa, Namibia wants to lead the charge. The cooperation of Namibia and Germany also shows that historical relations might have a positive influence on energy cooperation.[40] Desalination will be a major focus of the partnership, with the lessons learned then available for use in other arid regions, boosting clean hydrogen production globally.[41]

Climate Neutrality and COP 26

To comply with the Paris Agreement on climate change, a growing number of countries are setting ambitious greenhouse gas (GHG) emissions reduction targets for the coming decades to achieve climate neutrality.[42] While mid- and long-term climate commitments have become more ambitious in many parts of the world, policymakers

36 Ibid.
37 See https://bit.ly/3uVaHtN, accessed 15 February 2022.
38 See https://bit.ly/3JsyhSH 15 February 2022.
39 Ibid.
40 Ibid.
41 Ibid.
42 Cf. https://bit.ly/3h3usaF, accessed 15 February 2022.

are searching for policies and technologies to deliver on announced pledges. The versatility of hydrogen as chemical storage, energy carrier, and feedstock for industrial production is compelling for politicians and business. Increased hydrogen use can substantially reduce GHG emissions in hard-to-abate sectors, particularly steel and cement production, heavy-duty transportation, shipping, and aviation, help to address challenges in balancing intermittent renewables, and reduce air pollution.[43]

As world leaders have come under growing pressure to tackle climate change, green hydrogen is gaining traction as an important part of the solution. The potential of this carbon neutral energy source to meet up to 25 percent of global power demand made it a key topic of debate at the United Nations Climate Change Conference (COP26) in Glasgow in November 2021.[44]

In light of COP 26 Namibia also submitted its Nationally Determined Contribution (NDC) that sets out its goals for tackling climate change during the next five years.[45] In this global context, Namibia considers its contribution to the fight against climate change a 'strategic bet'. President Hage Geingob and the Namibian government understand that Namibia has a once-in-a-generation opportunity to significantly reduce its emissions - and that of its neighbours - by leveraging its natural endowments to attract much-needed foreign direct investment.[46]

In the Statement by his Excellency Dr Hage Geingob on the Occasion of the High-Level Segment of COP 26 on 2 November 2021 it is explicitly mentioned that:[47] "Namibia has amplified its 2015 pledge in the Nationally Determined Contributions, we now aspire to reduce our emissions by 91% before the end of this decade. The estimated investment required to achieve this target is approximately USD 5.3 billion, 10% of which is unconditional. These ambitions are matched by the highest levels of political commitment. The green and blue economy, including a green hydrogen industry, are cornerstones of the Second Harambee Prosperity Plan (HPP-II) launched in March this year. Green economy initiatives such as our Southern Corridor Development Initiative will drive a more sustainable, post-COVID recovery. (...) We will announce how Namibia is unlocking over 5,700 square kilometers in our Karas region for the potential development of green hydrogen and ammonia assets, expected to double the region's employment and triple the installed renewable energy generation capacity for the entire country. We are taking these bold steps to enhance our energy security, decarbonize our country, assist our regional and global peers to reduce their emissions and build a more resilient economy."

43 Ibid.
44 Available at https://www.dw.com/en/hydrogen-whats-the-big-deal/a-59076741, accessed 28 December 2021.
45 With further references https://conservationnamibia.com/blog/b2021-climate-change-pt3.php, accessed 28 December 2021.
46 Cf. https://bit.ly/3uPE1lr, accessed 15 February 2022.
47 Available at https://bit.ly/3HTRHPZ, accessed 15 February 2022.

Green hydrogen and Namibian development are intrinsically linked. In November 2021, a Letter of Intent between the Ministry of Economic Affairs and Climate Policy of the Netherlands and the National Planning Commission of Namibia was concluded on cooperation in the field of energy resources, recognising a common interest in the energy sector, specifically in green hydrogen, sourced from renewable energy, as an energy carrier to decarbonise the economy and meet each country's emission reduction policy goals and commitments adopted under the Paris Agreement; and the benefits of working together in supporting the creation of an international market, the development of technologies, the deployment of infrastructure, and the setting up of export-import corridors for green hydrogen between Namibia and the Netherlands, as a gateway to Europe.

Moreover, Namibia's port operator, the Namibian Port Authority (NAMPORT), signed a memorandum of understanding (MOU) with Europe's largest port operator, the Port of Rotterdam, to build the necessary infrastructure to transport these clean fuels to Europe. By doing so, Namibia is meaningfully contributing to a just and equitable energy transition in Southern Africa and beyond.[48] When looking at land availability Namibia is uniquely gifted. Given its territory of more than 824,000 km^2, population of just 2.5 million people, Namibia posts an energy-demand density score of three megawatt-hours per square kilometre every year. Land availability, is not a constraint to developing large scale renewable energy systems.[49]

Hydrogen Regulation Challenges to be Addressed Tailor-made

So far, Namibia has no law that directly speaks to the implementation of green hydrogen projects, which emphasises a need for government to fast track a governance framework. A guideline on how the government is going to regulate this industry would thus be useful for a start. The Namibian green hydrogen industry is new with unique components that are not included in the existing laws, which adequately ensure protection, growth and diversification of such industry to guarantee that every Namibian benefits from the renewable resources.[50] Moreover, hydrogen is an explosive and flammable gas, which also applied to its production, storage and transport, which should become subject to strict regulatory requirements, impact assessment and classified installations for the optimal protection of Namibia's environment. Same applies in regard to use and emergency management measures, all of which are necessary procedures to protect public health, safety and the environment. A number of international standards are also relevant to hydrogen production, storage, transport, hydrogen-powered equipment and the safety of hydrogen systems. Various elements of hydrogen

48 Cf. https://bit.ly/3uPE1lr, accessed 15 February 2022.
49 Ibid.
50 From https://bit.ly/3BuEJ9a, accessed 15 February 2022.

production, transport, storage and distribution process fall within the remit of different sectors, while other aspects remain without clear regulation.

Germany, for example, is one of the jurisdictions to have already passed dedicated legislation by updating its Energy Act to provide for regulation of hydrogen networks.[51] This example could be relevant to look at in Namibia, while the country needs to investigate its legislative needs and also search for best practices. A sound legal and political framework is important. Technical regulations for hydrogen, transmission fees and regulation for customs regulations should also be addressed therein. This is a multisectoral exercise that should accompany a proper planning scheme for green hydrogen development in Namibia to overcome existing regulatory gaps and uncertainties. The latter is no doubt deterrent to investors.

While the International Energy Agency (IRENA) estimates that global energy demand will increase by up to 30% by 2040,[52] the emergence of a clean hydrogen economy depends on sound policies, predictable regulation and a secure hydrogen infrastructure. A fully functional hydrogen economy needs to be tailor-made. In fact, such hydrogen economy is an international project, where cross-border cooperation is key. Europe is likely to import more and more green hydrogen from Africa. Green hydrogen has the highest potential to fuel train, cars, planes and industrial parks worldwide with zero emissions. At the same time, it can help Namibia to contribute towards de-risking the climate and the environment yet elevating the economic status.[53]

3 *De Jure*: Legal and Regulatory Aspects of Climate Change in Namibia

Science and law need to be brought together to make a significant and timely difference to humanity in the face of climate change, especially to those most severely affected. As demonstrated above, AR5 already presented strong evidence that the impacts[54] of climate change, especially in Africa are being felt across various sectors,

51 On the national level in Germany, "green hydrogen" is defined in the Ordinance on the Implementation of the RES Act 2021 and in the Amendment of other Energy Regulations ("Ordinance on the Implementation of the Erneuerbare-Energien-Gesetz, "EEG 2021") of the Federal Government (Bundesregierung) dated 19 May 2021. The regulation of green hydrogen in Germany is focused not only on hydrogen production, but also on infrastructure issues for transportation of green hydrogen. In particular, on 25 June 2021, the German Industry Act (Energiewirtschaftsgesetz, "EnWG") was amended with regard to the hydrogen network regulation. Cf. Hritsyshyna / Hutarevych (2021).

52 From https://bit.ly/3BuEJ9a, accessed 15 February 2022.

53 See https://www.namibianewsdigest.com/kandjoze-calls-for-implementation-of-law-in-green-hydrogen-project/, accessed 28 December 2021.

54 Impacts of climate change are the "effects on natural and human systems of extreme weather and climate events and of climate change. Impacts generally refer to effects on lives, livelihoods, health, ecosystems, economies, societies, cultures, services, and infrastructure due to the

posing challenges to economic growth, sustainable development and to the various facets of human security. AR6 has become even clearer. Although detection of and attribution to climate change are often difficult given the role of drivers other than climate change, there are substantially more impacts in recent decades now attributed to climate change.[55]

The 2015 Sustainable Development Goals (SDGs), provide a universally accepted framework to foster global collaboration with a strong emphasis on the rule of law and human rights. While Agenda 2030 is aimed at fostering and renewing multilateralism and international cooperation on the global but common challenges, the SDGs include economic and social development goals that potentially involve trade-offs with environmental sustainability. SDG 13 commits Namibia to act against climate change, and the effects that greenhouse gas emissions.[56] Namibia has embarked on the implementation of all SDGs, within the context of existing regional and national strategic plans - such as the African Union's Agenda 2063 and the country's National Development Plan (NDP) 2030. Not only does Agenda 2063 articulate a Pan-African vision of integration, solidarity, and unity on a continental level, but it also calls for coordination and cooperation in mutually beneficial partnerships between regions and continents to enable the realisation of this African vision. By adopting the 2030 Agenda, Namibia is committed 'to leave no one behind' in the implementation of the SDGs. This means that the specific vulnerability needs must be addressed for sustained, inclusive, and sustainable economic growth and social progress.[57] The consecutive sections in this chapter aim to first introduce (certain aspects of) Namibia's legal position in relation to climate change on the national level, while also highlighting international law obligations.

3.1 Legal Climate Change Action?

Changes in climate are most often analysed in terms of their impacts and adaptation and mitigation strategies. Relatively undiscussed are the general questions of how climate change may affect current law-giving and its implementation. For instance, human-induced (that is human-made) climate change raises the question whether and to what extent previously termed 'Acts of God', may be used as an actual or implied

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interaction of climate changes or hazardous climate events occurring within a specific time period and the vulnerability of an exposed society or system. Impacts are also referred to as consequences and outcomes. The impacts of climate change on geophysical systems, including floods, droughts, and sea level rise, are a subset of impacts called physical impacts." IPCC (2014c:5).

55 IPCC (2014a:7).

56 Lofts *et al*. (2017:185).

57 Cf. https://bit.ly/3HLniU1, accessed 15 February 2022.

defence in a legal process. If an 'Act of God' is defined as an unforeseeable natural phenomenon, due to natural causes and which could not have been prevented via human planning and foresight, then it would seem that climate change falls foul of all these conditions. The fact is, (1) climate change is increasingly foreseeable, (2) it is only partly a natural phenomenon and (3) it can be prevented, at least partially, by appropriate action or actions via mitigation.

Where climatic changes become increasingly foreseeable, courts will need to determine the delimitations of the 'Act of God' defence justification. And in order to avoid negligence politicians should become 'climate active' and start getting ready to apply due diligence and reasonable precautionary measures in good time. In face of this and despite the fact that climate change action goes beyond the capacity of national governments, it seems most likely that challenges at the national level will be the preferred to deal with climate change inaction. Climate change law has the potential to shake the foundations of previously held ideas of the grounds for litigation by groups, regions or governments given environmental damage caused by climate change.[58]

3.2 Constitutional Aspects of Climate Change

In Namibia, climate change is not explicitly enshrined in the Constitution. However, as climate change is and will continue to be one of the major environmental challenges for Namibia, the Constitution needs to be interpreted and applied in a manner that meets the requirements of effective mitigation and adaptation. And, in fact, the Constitution offers various mechanisms to do so as will be shown in the following.

International law and its application through Article 144 of the Constitution plays a significant role with regard to climate change. Namibia is a state party to a large number of Multilateral Environmental Agreements (MEAs). This emphasises Namibia's strong environmental commitment. Every membership of a MEA brings about benefits as well as obligations for Namibia. The relevance of international relations and cooperation has been highlighted in the recently launched Government's action plan towards prosperity for all titled Harambee Prosperity Plan 2016/17 – 2019/20,[59] in which climate change and biodiversity conservation are explicitly mentioned as areas for envisaged actions and strategies within international cooperation.

As a member of the United Nations (UN), the African Union (AU) and the Southern African Development Community (SADC), Namibia has signed many international agreements relevant for environmental protection and environmental covenants,

58 Ruppel *et al*. (2020).
59 GRN (2016a).

treaties, conventions and protocols and is, therefore, obliged to conform to their climate related objectives and obligations.[60]

As a party to the United Nations Convention on Climate Change (UNFCCC) and other international instruments. Namibia is a Non-Annex I Party (group of Parties mostly developing countries) to the UNFCCC. To date, Namibia has submitted four national communications under the UNFCCC, with the last one in 2020.[61] In Namibia's initial communication to the United Nations Framework Convention on Climate Change (UNFCCC) in 2002,[62] it is stated that trends in climate change predict that temperature will increase, specifically in central inland areas, rainfall will be variable and the rainy season is predicted to be shorter. Furthermore, an increase of potential evaporation at a rate about 5% per degree of warming and a sea level rise of up to 30 cm was predicted. Namibia's second national communication to the UNFCCC dated 2011 reveals that:[63]

> The projected temperature increases will result in evaporation and evapotranspiration increases in the range of 5-15%, further reducing water resource availability and dam yields. It is predicted that, even without the additional stresses of climate change on the water resources, demand will have surpassed the installed abstraction capacity by 2015.

The UNFCCC is of course not implemented in isolation of other global environmental frameworks that include among others[64] the Convention on Biological Diversity (CBD), the Convention to Combat Desertification and Land Degradation (UNCCD) and the 2015 Sustainable Development Goals (SDGs).

At the continental level, the African Climate Change Strategy has four thematic pillars, i.e climate change governance; promotion of research, education, awareness raising and advocacy; mainstreaming and integrating climate change imperatives in planning, budgeting, and development processes; and promotion of national, regional, and international cooperation. Implementation of the strategy will be through African Union (AU) the Committee of African Heads of State and Government on Climate Change (CAHOSSC) and the African Ministerial Conference on the Environment (AMCEN). The Southern African Development Community (SADC) Climate Change Strategy and Action Plan aims to provide a broad outline for harmonized and coordinated regional and national actions to address and respond to the impacts of climate change in line with global and continental objectives. The strategy takes cognisance for the need of enhanced adaptation to the impacts of climate change bearing in mind the diverse and gender differentiated levels of vulnerabilities that are more pressing for the region. However, it also aims to trigger and support nationally and regionally

60 Ruppel (2015).
61 GRN (2020a:1).
62 GRN (2002d).
63 GRN (2011a:6).
64 For relevant developments in other regimes, e.g. under the Montreal Protocol, International Maritime Law or International Aviation Law, see Mayer (2018:51-65).

appropriate mitigation actions given mitigations' potential opportunities for sustainable development. It shall guide the implementation of the SADC climate change programme over a fifteen-year period (2015 - 2030) and provide a short, medium to long term framework for implementing elaborate and concrete climate change adaptation and mitigation programmes and projects. The strategy is divided into 3 categories: adaptation, mitigation, and means of implementation, monitoring and evaluation. It complements several existing sectoral protocols, policies, plans and regulations as found in the Chapter on SADC environmental law in this volume.[65]

Namibia's first Nationally Appropriate Mitigation Action (NAMA) and National Adaptation Plan (NAP) were developed with the objective to "better guide the country on its way to mitigate and adapt to climate change."[66] Furthermore, Namibia has submitted its (Intended) Nationally Determined Contribution ((I)NDC) in September 2015 and its Updated Nationally Determined Contribution in 2021.[67] Within the NDC, Namibia has stated that it "aims at a reduction of about 89% of its GHG emissions at the 2030 time horizon compared to the BAU scenario."[68] The NDC covers four sectors, namely energy; industrial production and product use; agriculture forestry and other land use (AFOLU) changes; and waste. Identified measures contributing to climate change mitigation with the highest amount of GHG include: to reduce the deforestation rate by 75%; to reforest 20,000ha per year; to restore 15 M ha of grassland; and to increase the share of renewables in electricity production from 33% to 70%.

Namibia's NDC is "fair, equitable, ambitious and adequate", given Namibia's development status and national circumstances.[69] Namibia's President Hage Geingob, signed the Paris Agreement at the UN head Quarters in New York on 22 April 2016. Namibia ratified the Paris Agreement on Climate Change on 21 September 2016. The Paris Agreement is an agreement under international law. It is an agreement between states under the Vienna Convention on the Law of Treaties of 1969. For the first time in human history, the international community has agreed under international law to a quantified climate protection goal in Article 2.1 (a). These concrete terms are to be reached above all through Nationally Determined Contributions (NDCs). It is now the time to fill out the Paris Agreement with national measures. It is now the responsibility of national policy makers to ensure that the necessary legal response measures are in place. Namibia has committed itself in the NDCs to ensure political stability, good governance, an independent efficient judicial system, appropriate legislation, provision of incentives, and implementation of robust awareness campaigns as prerequisites for a successful and quick implementation of the NDCs.

65 SADC (2015:9-12).
66 GRN (2015b:5).
67 GRN (2015b and 2021a).
68 See GRN (2015b:2); BAU is the abbreviation for business as usual.
69 See GRN (2015b:4).

3.3 Implementing Article 44 of the Constitution: Legislation Relevant for Climate Change

According to Article 44

> the legislative power of Namibia shall be vested in the National Assembly with the power to pass laws with the assent of the President as provided in this Constitution subject, where applicable, to the powers and functions of the National Council as set out in this Constitution.

It can be argued that although Namibian environmental legislation does not explicitly address climate change, many relevant general concepts and principles applicable to climate change are contained in the legal environmental framework. This is true for framework legislation such as the Environmental Management Act No. 7 of 2007, which promotes the sustainable management of the environment and the use of natural resources by establishing principles for decision-making on matters affecting the environment. One of these principles, which is relevant for climate change is that "renewable resources must be used on a sustainable basis for the benefit of present and future generations".[70] A further example is the principle that "damage to the environment must be prevented and activities which cause such damage must be reduced, limited or controlled".[71] Climate change can thus be considered in various ways in decision-making processes. But also, sectoral legislation can be applicable to climate change. The Forest Act No. 12 of 2001, which provides for the protection of the environment and the control and management of forest fires, and the Disaster Risk Management Act No. 10 of 2012, which provides "for an integrated and coordinated disaster management approach that focuses on preventing or reducing the risk of disasters, mitigating the severity of disasters, emergency preparedness, rapid and effective response to disasters and post-disaster recovery" are prominent examples of national legislation pertinent to climate change. However, Government has also recognised that "there is an urgency to review existing legislation, regulations and norms to frame these in accordance with climate change concerns."[72] Several topics have been identified as priority areas of law and/or regulation to be subject to review and update:[73]

- Feed-in tariffs for the general public and other organisations to supply the grid with electricity;
- finalise Power Purchase Agreements rapidly following the delivery and signature of IPP licences;
- implement regulations on energy efficiency, particularly energy audits in the industrial sector that are heavy consumers of energy;

70 See Section 3(2)(a).
71 See Section 3(2)(l).
72 See GRN (2015b:17).
73 Ibid.

- implement the DSM strategy and set regulations to ensure import of energy efficient appliances;
- review the taxation policy and legislation to promote the update of cleaner technologies and promote energy savings;
- strengthen the enforcement of legislation and regulations;
- review the legislations regulating forest exploitation to fit them to the new agenda; and
- implement land policy reforms to promote reforestation and afforestation by the different landowner groups.

3.4 Implementing Article 95(l) of the Constitution: Namibia's Climate Change Policy

The State's mandate to promote the welfare of the people by adopting policies aimed to maintain ecosystems, essential ecological processes and biological diversity of Namibia and to utilise living natural resources on a sustainable basis for the benefit of all Namibians, both present and future as enshrined in Article 95(l) of the Constitution is the principle foundation for Namibia's commitment to address the challenges related to climate change, which stipulates that the state shall actively promote and maintain the welfare of the people by adopting policies, which include

> the maintenance of ecosystems, essential ecological processes and biological diversity of Namibia and utilisation of living natural resources on a sustainable basis for the benefit of all Namibians; in particular, the Government shall provide measures against the dumping or recycling of foreign nuclear and toxic waste on Namibian territory.

Article 95(l) is a Principle of State Policy in line with Article 101, which states that the Principles of State Policy are not legally enforceable but serve as societal goals in making and applying laws to give effect to the fundamental objectives of the different principles. The principles must also be employed in the interpretation of Namibian law and guide the state in its decision-making processes. Constitutional principles of state policy serve as a stimulus for new initiatives or endeavours – especially where existing policy, law or programmes seem inadequate to attain the principles' objectives.[74] The principles must similarly be employed as direction indicators in setting Government priorities. Also, the judiciary should apply the principles of state policy in constitutional interpretation and use them to fill gaps in the legislative framework when and where necessary. These generic features of constitutional principles of state policy arguably also apply to Namibia's obligation to protect its environment and to promote a sustainable use of its natural resources as spelled out in Article 95(l), which in turn has resulted in a variety of policies.

74 Du Plessis (2008:177).

To this end, Namibia's National Policy on Climate Change has been prepared and officially launched by the Ministry of Environment and Tourism in October 2011. The general aim of the Policy is to contribute to the attainment of sustainable development in line with Namibia's Vision 2030 through strengthening of national capacities to reduce climate change risk and build resilience for any climate change shocks.[75]

4 Climate Law

When it comes to climate change, the law is the major instrument by which mature societies consolidate their internal and external relationships. And without legal rules, the life of a society becomes unpredictable and aleatory in the climate crisis we are facing.[76] Subsuming climate change under any such legal structure is a challenging task due to the endless ramifications of climate change and particularly due to its complexity, interdisciplinary nature and impacts on various – if not all - segments of our planet and society. This is why climate change can – if at all - only be tackled through a combination of political but particularly legal and natural science tools.

When climate change is looked at from a legal perspective, it has, of course, given rise to the evolution of various principles and concepts of international law, including the notion of common concern of humankind and the need for protection of the most vulnerable.[77] Climate law is both international and domestic in nature and includes complementary dimensions, procedural and substantive.[78]

4.1 International Climate Law

In a wider sense, the intersections of international climate change law and multiple overlapping regulatory bodies reflect the fragmentation of global climate change governance. This comprises different climate change (related) regimes, which can be observed in various United Nations conventions, the international human rights regime, the world trade order under the World Trade Organisation (WTO), multilateral environmental agreements (MEAs) and other international legal instruments that (directly or indirectly) deal with climate change, such as the Vienna Convention on Ozone Depletion, the Montreal Protocol,[79] the Convention on Biodiversity, the London

75 See 4.2. in this Chapter below for further details on the Climate Change Policy.
76 Tomuschat (2012:1283).
77 Schrijver (2011:1285).
78 For further details see Rayfuse / Scott (2012).
79 The 1987 Montreal Protocol introduced a series of effective steps to phase out the global production and consumption of ozone-depleting substances in the 1980s. The Protocol and

Dumping Convention, the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), the RAMSAR Convention on Wetlands of International Importance and the Convention on the Conservation of Migratory Species of Wild Animals, among others. Same applies for geo-engineering, nuclear technology, intellectual property, international investment, and finance regimes.[80]

In a narrower sense, international climate change law focuses on four basic issues: (1) mitigation of climate change – that is, limiting it or preventing it from happening; (2) adaptation to climate change, in order to limit its harmful effects; (3) financial and other means of support for mitigation and adaptation; and (4) international oversight to promote effectiveness, compliance, and implementation.[81]

International climate law consists of multilateral agreements on the global, regional and sub-regional level, bilateral (and unilateral) agreements, general principles of law, customary international law, case law, and other instruments such as declarations, agendas are authoritative sources of climate law. Reference is therefore made to the chapter on international law and its domestic application (Article 144 of the Constitution) in Namibia.

It has been stated with regard to climate change and transboundary harm that:[82]

> States must ensure that activities conducted under their jurisdiction do not result in significant transboundary harm. To promote compliance, international negotiations have led to successive international climate agreements which adopted collective objectives and defined national commitments. Objectives and commitments have also been adopted under other regimes. States have resorted to a variety of methods to reduce GHG emissions under their jurisdiction, including not only classical command and control regulation, but also price-based incentives and measures of economic, scientific and cultural leadership. Although national commitments and measures of implementation have certainly had a non-negligible result, these efforts remain insufficient to fulfil the obligation of States not to cause significant transboundary harm.

International climate law is still a relatively young field of law that is developing primarily out of public international law. The most relevant international climate treaties consist of the 1992 United Nations Framework Convention on Climate Change (UNFCCC), the 1997 Kyoto Protocol and the 2015 Paris Agreement. Each party to the

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successor agreements are not only regarded as highly successful examples of international environmental regulatory cooperation, there are also lessons to be learned from the ozone layer experience in dealing with climate change. The Montreal Protocol has made a substantial commitment to climate goals, and there are substantial proposals on the way to increase this. Having phased out 97% of almost 100 ozone-depleting substances (ODSs) it placed the ozone layer on a path to recovery. "Because many ODSs are also potent greenhouse gases (GHGs), their phase-out under the Montreal Protocol has provided an often overlooked bonus for climate mitigation: by the end of the decade, the Montreal Protocol will have done more to mitigate climate change than the initial Kyoto Protocol reduction target, reducing emissions in terms of carbon dioxide (CO2), equivalent to 135 billion tonnes between 1990 and 2010 and delayed climate impacts – including abrupt and irreversible impacts – by about 12 years". See http://www.igsd.org/montreal/index.php (also for further references), accessed 16 May 2021.

80 Ruppel (2013).

81 Bodansky *et al*. (2017:11).

82 Mayer (2018:131).

UNFCCC is expected to be bound to individually, in spite of the collective nature of damage and the adverse effect of climate change. Article 4 of the UNFCCC imposes an obligation on all parties to take measures to mediate climate change by addressing anthropogenic GHG emissions. Article 4.2 provides a more stringent obligation for the state parties listed under Annex I (developed countries) to limit their anthropogenic emissions of GHG, which reflects the common but differentiated responsibility under Article 3.

This obligation to reduce emissions is spelled out in concrete terms by the Kyoto Protocol, which specifies the quantified target for emissions limitations under a defined timeframe. Article 3 of the Kyoto Protocol specifies the content of the obligation under Article 4 of UNFCCC. The Kyoto Protocol thus framed the obligation of reducing emissions (mitigation) in the form of an individually allocated carbon budget (or the level of emissions reduction) for Annex I state parties, which changed in the post-Kyoto scheme under the Paris Agreement.

The Paris Agreement, as part of the UNFCCC regime, in its Preamble includes the explicit acknowledgement "that climate change is a common concern of humankind" and that "Parties should, when taking action to address climate change, respect, promote and consider their respective obligations on human rights". As such the agreement binds its parties regarding activities on their respective territories and under their control.

The Paris Agreement supplements the UNFCCC and the Kyoto Protocol by incorporating existing elements of this regime. According to Article 2, the Paris Agreement's overarching objective is to keep the increase in global temperature well below 2°C, or even 1.5°C. Parties are required to prepare and present individual climate plans (Nationally Determined Contributions - NDCs) every five years that set out how the party intends to contribute to the collective objectives.

The Paris Agreement expects the NDCs to reflect a more nuanced classification according to respective national circumstances for all member states. As such, Article 4(2) of the Paris Agreement states that each Party shall prepare, communicate and maintain successive nationally determined contributions that it intends to achieve. Thus, it is the primary obligation under the Paris Agreement to respect the parties' respective domestic policy choices in defining individual routes and scenarios in GHG reduction.

Namibia signed and ratified the UNFCCC. The UNFCCC is a treaty in terms of international law and Article 2(1)(a) of the Vienna Convention on the Law of Treaties. It acceded to the Kyoto Protocol and ratified the Paris Agreement respectively. As such Namibia is obliged to report certain elements of information in accordance with Article 4, paragraph 1 of the UNFCCC. In order to meet its reporting obligations, Namibia has submitted four national communications (NCs). Parties to the Paris Agreement have expressed their domestic intentions to address climate change in the form of Nationally Determined Contributions (NDCs); and, before the end of 2020, renew or revise their

NDCs reflecting increased ambition to be communicated to the UNFCCC. Namibia has submitted its updated NDC in 2021.[83]

What is worthwhile mentioning is that Namibia's multi-sectoral National Climate Change Committee (NCCC) is chaired by the Ministry of Environment, Forestry and Tourism (MEFT) with the Climate Change Unit (CCU) being under the Department of Environmental Affairs (DEA) of the MEFT. The Cabinet of Namibia is the Government entity entrusted with the overall responsibility for the development of Policies, including those on the NCCC, comprising representatives of the various ministries and other stakeholders. It was established as early as 1999 by a Cabinet directive to advise Cabinet on climate change issues, including reporting obligations. MEFT, the official government agency acting as national focal point of the UNFCCC, is responsible for coordinating and implementing climate change activities, including the preparation of National Reports to enable the country meets its reporting obligations.[84]

4.2 Domestic Climate Policy

Owing to the fact that climate change is multi-disciplinary in nature, no definite legal or policy framework related to climate change exists in Namibia. As in the case of all matters generally related to the environment, climate change issues span over a broad framework of national policy, legislation, strategies and action plans. However, developments in the past years reflect that climate change is playing a more dominant role, especially in the field of policy making and national planning. Based on local and national commitment and efforts to deal with the risks and challenges related to climate change and on international cooperation, a broad variety projects in the field of climate change have been and are being initialised and emphasise the importance of climate change mitigation and adaptation.

Namibia's 2011 National Policy on Climate Change (NPCC) formulates its rationale as follows:[85]

> The policy seeks to outline a coherent, transparent and inclusive framework on climate risk management in accordance with Namibia's national development agenda, legal framework, and in recognition of environmental constraints and vulnerability. Similarly, the policy takes cognizance of Namibia comparative advantages with regard to the abundant potential for renewable energy exploitation. The goal of the National Policy on Climate Change is to contribute to the attainment of sustainable development in line with Namibia's Vision 2030 through strengthening of national capacities to reduce climate change risk and build resilience for any climate change shocks.

83 GRN (2021a).
84 GRN (2020a:1).
85 See GRN (2011b:iii).

The policy also serves to guide "Government on the development and enactment of climate-specific legislation to establish appropriate legal mechanisms for policy implementation."[86] The policy identifies five objectives, sets out a set of guiding principles and proposes a framework for sectoral strategies to address the impacts of climate change:

- To develop and implement appropriate adaptation strategies and actions that will lower the vulnerability of Namibians and various sectors to the impacts of climate change;
- to develop action and strategies for climate change mitigation;
- to integrate climate change effectively into policies, institutional and development frameworks in recognition of the cross-cutting nature of climate change;
- to enhance capacities and synergies at local, regional and national levels and at individual, institutional and systemic levels to ensure successful implementation of climate change response activities; and
- to provide secure and adequate funding resources for effective adaptation and mitigation investments on climate change and associated activities.

Namibia's current adaptation priorities are identified in the NPCC and the National Climate Change Strategy and Action Plan (NCCSAP).[87] The NCCSAP was approved by Parliament in 2014. Its priorities are aligned with those sectors identified as being particularly vulnerable to climate change. The NCCSAP contains guiding principles relating to climate change, identifies priority action areas for adaptation and mitigation and pinpoints various funding mechanisms.

A total of 32 programmes and projects were identified. Most of the current climate change adaptation projects, and programs in Namibia are directed in the areas of agriculture, fisheries, sustainable land management, government, climate information and research, ecosystems and biodiversity, forestry and energy. The projects tend to focus on capacity building, knowledge communication, field implementation, and policy formation and integration, with all nationally implemented projects supporting community-based adaptation:[88]

> Government recognizes that many of its sectoral policies were developed before climate change emerged as a key issue for the country, and as such, these policies must be revised to better integrate climate change considerations. However, despite on-going efforts, climate change issues are not yet adequately mainstreamed into key national policies and sectoral strategies. A rapid review of national policies and sectoral strategies in key vulnerable sectors such as agriculture, water resources, tourism, and health, shows that climate change issues, although recognized, have not always been mainstreamed (...). For instance, the National Water Policy (2008), National Health Policy Framework (2015), and National Agriculture Policy (2015), among others,

86 Ibid:iv.
87 GRN (2014b).
88 GRN (2020a:9 and 129).

recognize climate change as a potential risk/threat, but do not include concrete actions to mitigate climate change risks.

In terms of mitigation, Namibia has embarked on various projects and activities aiming at curbing GHG emissions and increasing its sink capacity. Sinks policies generally relate to land use, land-use change, and forestry (LULUCF), and include measures to reduce emissions from deforestation and forest degradation (REDD+) and to encourage afforestation. Other mitigation policies serve to reduce emissions and inter alia include energy efficiency standards, subsidies for renewable energies, a carbon tax, emissions trading systems, transport, technology, research and development.

Recognising that sustainable development and ensuring environmental sustainability can contribute significantly to climate change adaptation and mitigation, the policy outlines the roles and responsibilities of stakeholders including the general public; the private sector; NGOs and faith and community-based organisations; training and research institutions; the media; and international development partners.

Although the Policy has been criticised for being "in conflict with existing sectoral policy instruments and even sectoral national development aspirations"[89] – it is an important instrument to further Namibia's commitment to addressing the multi-faceted challenges related to climate change. It is founded in the multidisciplinary nature of climate change that conflicts or overlaps with other policy instruments and strategies arise. This also applies to the question of institutional responsibility for issues related to climate change. Although it could be argued that virtually every ministry is somehow concerned with issues related to climate change, the Ministry of Environment and Tourism is the key responsible line ministry for climate change.[90]

With its ambitious aim laid down in the NDC[91] to achieve "a reduction of about 89% of its GHG emissions at the 2030-time horizon compared to the BAU [Business as Usual] scenario" climate related law and policy moves to the centre of Namibia's mitigation strategies as the ambitious aim is to be achieved by way of mitigation predominantly in the agriculture, forest and other land use (AFOLU) and the energy sectors. The reduction of the deforestation rate by 75%, reforestation and restoration of grassland will demand a progressive and effective implementation of existing forest related law and policy based on the pillars of Namibia's Constitution.

4.3 Domestic Climate Law

In terms of national law, it consists of constitutional law, statutory law, common law, case law, customary law, policies, strategies and action plans and other relevant

89 Zeidler *et al*. (2014:23).
90 Ibid:22.
91 At http://www4.unfccc.int/Submissions/INDC/Published%20Documents/Namibia/1/INDC%20of%20Namibia%20Final%20pdf.pdf, accessed 7 May 2021.

instruments. And then there is the demarcation between 'hard' and 'soft' law. While some of the sources of national and international law are obligatory, others are of non-binding nature. Ultimately, climate law consists of the sum of legal provisions protecting the climate itself and those that protect the climate and society from the negative effects of climate change. In this light, sound law making is not possible without scientific results providing the necessary guidance.

To date, no specific climate-change legislation is on the radar in Namibia. However, the domestic dimension of climate change law is far reaching and incorporates among others constitutional law, administrative law, environmental law, water law, criminal law, the law of nuisance, the law of delict, insurance law and even tax law. This scale ranges from environmental law (with its multiple sub-branches such as biodiversity law, environmentally relevant provisions within the law of the sea, outer space law, energy and mining law, and specific legal instruments relating to climate change, etc.) to human rights law, humanitarian law, trade and investment law, the law on the use of force, criminal law, and liability law among others.[92]

It can be argued that although Namibian environmental legislation does not explicitly address climate change, many relevant general concepts and principles applicable to climate change are contained in the legal environmental framework. This is true for framework legislation such as the Environmental Management Act No. 7 of 2007, which promotes the sustainable management of the environment and the use of natural resources by establishing principles for decision-making on matters affecting the environment. One of these principles, which is relevant for climate change is that "renewable resources must be used on a sustainable basis for the benefit of present and future generations".[93] A further example is the principle that "damage to the environment must be prevented and activities which cause such damage must be reduced, limited or controlled".[94] Climate change can thus be considered in various ways in decision-making processes. But also sectoral legislation can be applicable to climate change. The Forest Act No. 12 of 2001, which provides for the protection of the environment and the control and management of forest fires, and the Disaster Risk Management Act No. 10 of 2012, which provides "for an integrated and coordinated disaster management approach that focuses on preventing or reducing the risk of disasters, mitigating the severity of disasters, emergency preparedness, rapid and effective response to disasters and post-disaster recovery" are prominent examples of national legislation pertinent to climate change. However, Government has also recognised that "there is an urgency to review existing legislation, regulations and norms to frame

92 See with further references Ruppel (2013).
93 See Section 3(2)(a).
94 See Section 3(2)(l).

these in accordance with climate change concerns."[95] Several topics have been identified as priority areas of law and/or regulation to be subject to review and update.[96]

For the purpose of national legislation and regulation, it can be stated that the larger and more certain the body of evidence is that confirms, for instance, the effects of GHG emissions, the better. The most important projects in many Nationally Determined Contributions (NDC's) are aimed at reducing the consumption of fossil fuels. This requires legislative efforts informed by science at the national level that – for example - guarantee internationally agreed standards for international trade and the certification of emissions.

Lastly, Namibia and other countries in southern Africa[97] are made up of a melting pot of cultures, religions and community practices that make up the complex and all-encompassing nature of the legal system.[98] This plurality of laws not only makes the Namibian legal system an object of fascination to comparative lawyers as well as to legal ethnologists and sociologists. This plurality including customary law and indigenous knowledge into climate change policies is likely to contribute to the development of more effective adaptation strategies that are cost-effective, participatory and sustainable. After all, indigenous people have always been tasked to develop flexible mechanisms to cope with climatic conditions and their vulnerability.[99]

Climate change poses a threat to indigenous peoples in Namibia, who often live in marginal lands and fragile ecosystems, which are particularly sensitive to changes in weather.[100] Climate change could become a driver of migration and population displacement and it is acknowledged that indigenous people living in dry-lands are among the most vulnerable communities, as a result of water scarcity. Indigenous peoples have been voicing their concerns about the impacts of climate change on their rights as distinct peoples, and the importance of giving them a voice in policymaking on climate change at both national and international levels; further, to take into account and to build on their traditional knowledge. Customary law[101] and indigenous knowledge should therefore be incorporated into climate change policies in order to foster the development of cost-effective, participatory and sustainable adaptation strategies.[102]

Populations whose rights are poorly protected are likely to be less well-equipped to understand or prepare for climate change; they would be less able to lobby effectively for Government or international action; and are more likely to lack the resources

95 See GRN (2015b:17).
96 Ibid.
97 Ruppel / Ruppel-Schlichting (2011).
98 Du Plessis (2019:15).
99 Ruppel (2011b:200).
100 Cf. studies on Biodiversity Hinz / Ruppel (2008a).
101 Ruppel (2010c).
102 Cf. Mfune at al. (2009a and b).

needed to adapt to expected change in their environment and economic situation. The efforts that have been made so far to place rights at the centre of any future climate change-mitigating dispensation have not been human rights focused. However, human rights impacts are a relevant concern. To mobilise the policy value, and indeed the legal force, of human rights in the construction of a climate change mitigating dispensation, requires the assessment of likely human rights impacts and outcomes of climate change. The specific rights potentially affected by climate change, such as rights to food, water, shelter, and health or rights associated with gender, children and indigenous peoples, must be addressed in context. Each of the human rights[103] affected by climate change need to be identified and addressed in order to infuse relevance into on-going consultations, political negotiations, global cooperation discussions and other actions, whether internationally, regionally and nationally.

Rights and responsibilities regarding the utilisation of environmental resources need to be distributed with greater equity among communities, both globally and nationally. In this context, political participation, access to information and broad public involvement are just as important to the realisation of human rights as the development of quality climate change related education and interdisciplinary research of high standard.[104]

4.4 Private Law Litigation

Courts have an important role to play in climate change litigation. This includes providing judicial legitimacy; developing relevant legal principles; considering numerous factors that contribute to the state of climate change liability; increasing statutory enactments regulating climate change issues; establishing precedent and enforcing environmental rights.[105] Disputes can be concerned with different aspects of climate laws and policies, including mitigation, adaptation and response measures. They can inter alia consist in private law litigation on tort or "extra-contractual" responsibility.[106]

4.4.1 The Law of Delict

As a point of departure, it can be stated here, that 'duty of care' is imposed under Section 3(1)(j) of the Environmental Management Act No. 7 of 2007, where it is stipulated that

103 Ruppel (2008a).
104 Ruppel (2010a).
105 Rumble / Summers (2016).
106 Mayer (2018:244).

> a person who causes damage to the environment must pay the costs associated with rehabilitation of damage to the environment and to human health caused by pollution, including costs for measures as are reasonably required to be implemented to prevent further environmental damage.

While this chapter will not deal with criminal law aspects, it should at least be mentioned here that EMA explicitly refers to the Criminal Procedure Act 1977 No. 51 of 1977, which provides for (private) environmental prosecution.

In terms of private law climate litigation, it is available to litigants who wish to seek redress for particular climate change losses suffered at the hands of identified corporations or entities. Private law climate change actions, in terms of the laws of delict consist of parties spanning from citizens and corporations to NGO's.[107]

In Namibian jurisprudence, relevant climate private law litigation for damages could be founded on delictual actions under the law of delict. Delictual actions provide parties with a legal mechanism to seek redress or other relief for losses or harm caused by climate change impact.[108] The advantage of utilising delictual remedies is the possibility of obtaining compensation for wrongful conduct. However, a disadvantage in utilising delictual remedies is the high cost in determining the wrongful conduct and liable party. There are three actions that can be taken in terms of delictual claims, namely the Aquilian action (*actio legis aquiliae*) for patrimonial loss; the action for pain and suffering for compensation for actual pain and suffering from the conduct; and the *actio iniuriarum* for harm to personality interests.[109] To better understand the use of delictual claims in climate change liability it is best to look at the Aquilian action for patrimonial loss, where climate related damages can be measurable in monetary terms. The primary object of an award for damages is to compensate the person who has suffered harm.[110]

The purpose of pursuing delictual actions is to receive compensation for damages suffered, as such it is essential to determine the extent and impact of such damages (both non-patrimonial and patrimonial in nature). Patrimonial damages are easier to identify given the strictly financial nature of the damage suffered such making it quantifiable. For example, property damage, in terms of climate change liability, may include coastal land, buildings, structures, infrastructures, and agriculture, which defendants should consider in claims presented and based on the present costs of preventing future harm.[111] This also highlights a general duty by defendants to ensure that future harm, as a result of climate change, is minimal and that they do everything reasonably possible to prevent damages.

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107 Baudoin / Ziervogel (2017:692).
108 Rumble / Summers (2016:6-18); Glazewski / Collier (2012:333).
109 Du Bois (2009:1093).
110 Neethling *et al*. (2015:3-17).
111 Thorpe (2008).

4.4.2 Omissions and Negligence

In respect of a claim in terms of the Aquilian action, its aim is to restore the plaintiff's patrimony and, as far as possible, to place him/her in the position he/she would have occupied in had the delict not been committed. In order to succeed with a delictual claim a plaintiff must demonstrate conduct by the defendant that was negligent (fault) and wrongful, thus causing patrimonial loss.[112] Conduct, in terms of delictual action, can take the form of a positive act (physical activity or statement)[113] or an omission (failure to act).[114] Positive acts are easier to prove than omissions, however, climate change liability will mostly rely on a failure to act or to take reasonable preventive measures, namely to exercise the duty of care.[115]

Liability for omissions in climate change cases, requires consideration of a number of factors, namely preceding positive conduct, which has created a source of danger; control of a dangerous object or situation; existence of a special relationship between the parties; an obligation to act in terms of common law or statute; and obligations which arise out of a particular office.[116]

The weakest standard of culpability is negligence.[117] The 'negligence enquiry' on the one hand requires looking to the state of mind of the defendant in assessing the conduct against that of a reasonable person in the same situation, thereby determining fault.[118] Negligence arises if a reasonable person 'would have foreseen the reasonable possibility of such conduct injuring another person and causing harm; would have taken reasonable steps to guard against such occurrence; and that the defendant failed to take such steps'.[119] In other words, if the defendant failed to act in a manner that a reasonable person would have in the given situation, then the defendant is at fault. The 'wrongfulness enquiry' on the other hand looks at the harmful conduct and whether policy and the legal convictions of the community, also from a constitutional point of view, regard it as acceptable. I.e. is it reasonable to impose liability on a defendant for the damages flowing from the specific conduct? Judicial determinisation in this regard also depends on public and legal policy in accordance with constitutional norms.[120]

112 Ahmed (2019:5).
113 Loubser (2004).
114 Van der Walt / Midgley (2016:92); Loubser *et al*. (2018:95); Burchell (1993:37).
115 Glazewski / Collier (2012:333).
116 Ibid:336.
117 Posner / Sunstein (2008:1598).
118 Loubser (2004:98-99).
119 See the 'negligence enquiry' at *Kruger v Coetzee* 1966 (2) SA 428 (A) 430E-F.
120 See with further references Rumble / Summers (2016:6-18, 6-21).

4.4.3 Fault and Wrongfulness

Fault associated with climate change liability often takes the form of negligence, which is more difficult to prove. When looking at climate liability an important consideration with fault is the 'foreseeability of harm' and whether the actions taken were 'reasonable in response to the harm' in question. Foreseeability can be an easier element to tackle due to strong arguments and reports providing scientific evidence, explaining the climate change related harm that is to be expected from, for instance, greenhouse gas emitting activities. However, determining the reasonableness of conduct in terms of climate change liability is a strenuous task given the scientific considerations of climate change determinations.

In the South African case of *Kruger v Coetzee*,[121] a clear definition and criteria for negligence was established:

> For the purposes of liability *culpa* arises if a *diligens paterfamilias* [a reasonable person] in the position of the defendant - would foresee the reasonable possibility of his conduct injuring another in his person or property and causing him patrimonial loss and would take reasonable steps to guard against such occurrence and the defendant failed to take such steps.

A reasonable person, for the purpose of establishing liability, 'is not an exceptionally gifted, careful or developed person; neither is he underdeveloped, nor someone who recklessly takes chances or who has no prudence'.[122] The reasonable person is the 'normal citizen', who does not necessarily contain expert knowledge.[123]

It is essential under delictual action to provide the unreasonable nature of the defendant's conduct in order to meet the delictual requirements. South African (and arguably Namibian) common law requires unreasonableness to be weighed up against usefulness (or social utility) of the defendant's conduct.[124] If it is found that essential services, though creating climate change related harm, have acted reasonably to provide social utility then such conduct may be seen as appropriate under the given circumstances. In weighing up social utility and unreasonableness courts must consider the cost of abatement, available technologies, available resources and functionality, and time constraints. Reasonableness can be better determined when conduct is compared with established regulations or legislation. In the context of climate change litigation, it is likely that most defendants have some knowledge of the possible negative consequences that may arise from their actions although they may not have the direct intention to cause harm through global warming.[125]

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121 1966 (2) SA 428 (A) 430E-F.
122 Neethling *et al*. (2015:135).
123 Glazewski / Collier (2012:338).
124 Rumble / Summers (2016:6-24).
125 Glazewski / Collier (2012:339).

Liability for harm caused depends greatly on proving that the conduct in question was in fact wrongful.[126] Wrongfulness 'concerns whether it would be reasonable to impose liability on a defendant for damages flowing from specific harmful conduct.'[127] It is established based on legal convictions of the community, political, social and economic concerns with imposing liability.[128] This element is particularly essential in deterring hazardous unreasonable conduct by a defendant, especially where climate change concerns are not effectively regulated by statute.

Infringing rights or breach of a duty, i.e. a duty of care, can result in the establishment of wrongfulness. However, where no clear duty or right has been breached or infringed, determining wrongfulness may be more difficult to determine.[129] With the adoption and the implementation of relevant legislation, Namibian courts may rely on clearer provisions in apportioning wrongfulness in terms of climate change liability.[130]

4.4.4 Causation

The challenging element of climate change liability is establishing the causal link between the harm suffered by the plaintiff and the conduct of the defendant.[131] One is required, under any delictual action, to establish that there was both legal and factual causation. Factual causation speaks to whether the conduct of the defendant caused the harm that establishes the claim, which is determined using the *conditio sine qua non* test.[132] Legal causation speaks to whether there is a sufficiently close link between the conduct and the harm and based on this whether it would be reasonable to impose liability.

It is the factual and legal causal link that can be particularly difficult to establish climate change liability due to insufficient scientific or supporting evidence.[133] Such constraints are maintained by demanding certainty where perhaps only certain degrees of likelihood can be provided in an environment consisting of concurrent causes.[134] It is, however, important to note that despite these constraints, courts in some jurisdictions have reflected willingness to play their part in developing stricter precedent regarding climate change liability.[135]

126 Ibid:335.
127 Rumble / Summers (2016:6-26).
128 Neethling (2006:210).
129 Stevens (2017:22).
130 Glazewski / Collier (2012:335).
131 Rumble / Summers (2016:6-26).
132 Glazewski / Collier (2012:340).
133 Rumble / Summers (2016:6-27).
134 Minnerop / Otto (2020).
135 Rumble / Summers (2016:6-27).

4.5 Neighbour Law and Nuisance Claims

While a neighbour law dispute is private, nuisance claims can either be public or private, depending how the nuisance was constituted. While a basic underlying principle is related to the Latin maxim *sic utere tuo ut alienum non laedas*, meaning to use one's property as not to injure another's property, the law of neighbours consists of a mix of common law, Roman and Roman-Dutch law principles with claims that 'may give rise to an interplay of principles of property law and the law of delict'.[136] Public or private nuisance claims are actions that can be sought within the umbrella of common law claims. Such claims can be aimed at for instance stopping greenhouse gas emissions.[137]

Public nuisance is considered 'an act or omission or state of affairs that impedes, offends, endangers or inconveniences the public at large.[138] It can be suppressed or stopped by an interdict or abatement order.[139] The adverse impacts of climate change on the environment and communities may be sufficient to show damage or inconvenience to health and safety, in both short term and long-term considerations. There is already established scientific evidence that can support such claims in making it easier to bring forward a public nuisance argument, since the elements to prove public nuisance are less than that of a purely delictual claim. A perpetrator's action is unlawful if he/she is found guilty of causing injury, damage or inconvenience to the health and safety of the general public. Moreover, the preparator's action is unlawful if it is found to be in conflict with certain statutory regulations.[140]

4.6 Public Climate Litigation

Most domestic climate litigation cases around the world have been brought against governments, but there is also a rise in lawsuits brought directly against companies. These actions and the nature thereof are subject to developments in national legislation and regulations addressing climate change concerns.[141] In fact, judicial findings offer enormous potential for enhancing public understanding of climate science with an educating effect.[142]

> Litigation has repeatedly sought to promote climate change mitigation. Climate change has thus been invoked a in a host of disputes on projects ranging from the construction of pipelines to that of power plants or airports. The cases which have had the greatest influence on the conduct of

136 Glazewski / Collier (2012:343).
137 See Flatt / Zerbe (2019).
138 Samuels (2015).
139 Prest (1996).
140 Also see Spier (2014:1).
141 Rumble / Summers (2016:6-1, 6-4).
142 Cf. Ruppel *et al*. (2020).

> States, however, concerned more generally the national laws and policies on climate change mitigation and their implementation. [143]

Such for instance, in the South African case *Earthlife Africa Johannesburg v Minister of Environmental Affairs And Others*[144] the Gauteng High Court handed down a judgment on 8 March 2017.[145] The applicant was Earthife Africa, while the Minister of Environmental Affairs, the Chief Director of Integrated Environmental Authorisations Department of Environmental Affairs (DEA), the Director of Appeals and Legal Review Department of Environmental Affairs and the Thabametsi Power Project (Pty) Ltd were the respondents.[146] In this matter, the court was required to deal with two issues, namely a review of the decision of the Minister of Environmental Affairs relating to the granting of environmental authorisation for the construction of a coal-fired power plant, and the obligation of the Minister to reconsider conducting a climate change impact assessment report for the proposed coal-fired power station.[147] The decision illustrates the role of South Africa's courts in affirming the country's international climate change obligations and the duty and responsibility of the state to limit the unfavorable impacts of climate change in the context of socio-economic development activities.[148] The case concerns the proposed construction of a 1200 MW coal-fired power station in the Limpopo Province that will be in operation until 2061.[149] The project intends to address the serious energy challenges that hinder South Africa's socio-economic development.[150] In 2015 the Chief Director of the DEA granted an environmental authorisation to Thabametsi for the construction of the said proposed coal-fired power station.[151] It is estimated that during the forty year period of the power station's activity, that it would emit greenhouse gas that will have a negative impact of climate change and result in consequences for not only the area in Limpopo, but also the rest of the country.[152] The authorisation application was made and considered in terms of the Environmental Impact Assessments (EIA) Regulations of the National Environmental Management Act that provides the procedures to be followed in conducting EIAs.[153] The applicant argued that the climate change impacts of the proposed station were significant factors that the Chief Director should have considered when

143 Mayer (2018:244).
144 [2017] ZAGPPHC 58 (2017) 65662/16.
145 This was arguably the first climate litigation case on the African continent; cf. Conference Presentation on the 'Thabametsi Case' at the International Conference on Climate Change, Responsibility and Liability, Faculty of Law, University of Graz, Austria on 8.11.2018; Ruppel (forthcoming 2022).
146 Ashukem (2017).
147 Ibid.
148 Ibid.
149 Ibid.
150 Ibid.
151 Ibid.
152 Ibid.
153 Ibid.

formulating his decision to allow the construction of the station.[154] The respondents proceeded to reject this claim and argued that there is no domestic legislation and no regulations or policies that explicitly stipulate a requirement to conduct a climate change impact assessment prior to the granting of an environmental authorisation.[155] The only obligation for South Africa is to reduce its greenhouse gas emissions, which is broadly framed without prescribing particular measures of how this should be accomplished or measured.[156] In response, the respondents argued that measures to reduce greenhouse gas emissions are discretionary and that the South African government, in exercising this discretion, has taken suitable steps and measures, including the development of a complicated set of mitigations procedures, to address climate change impacts in the context of socio-economic development activities in the form of the National White Paper on Climate Change of 2011.[157] They further argued that although coal-fired power stations are substantial emitters of greenhouse gases, the applicant failed to consider the broader development context in recognising South Africa's energy crisis, and that the government was taking measures such as the construction of a coal-fired plant to address said energy crisis.[158]

After a long deliberation of both parties arguments and an analysis of both views, the court came to the conclusion that it would suspended the grant of the environmental authorisation until a full investigation and consideration of the climate change impacts assessment report of the proposed coal-fired power station had been conducted.[159] This instance saw success for the consideration of climate change. This case was one of the first of its kind with regards to climate change litigation in South Africa. Following the case, there came an appeal as to its findings. The judge in the appeal case considered the judgement of the North Gauteng High Court of 8 March 2017, relevant material information contained in the relevant project file, the final Climate Change Impact Assessment Report, of 1 June 2017, the comments receive on the final Climate Change Impact Assessment Report of 31 July 2017 and the recommendations by the EOH Coastal and Environmental Services.[160] It was decided that the judge would confirm the Environmental Assessment issued for the establishment of the power station.

In another recent case, the German Federal Constitutional Court partially upheld complaints by several young activists. The legislator must regulate the reduction of greenhouse gas emissions for the period after 2030 in more detail by the end of next year, the Federal Constitutional Court in Karlsruhe declared.[161] The young people's

154 Ibid:38.
155 Ibid.
156 Ibid.
157 Ibid.
158 Ibid.
159 Ibid:41.
160 Appeal decision of [2017] ZAGPPHC 58 (2017) 65662/16 3.
161 BVerfG, Press Release No. 31/2021 of 29 April 2021. Order of 24 March 2021: 1 BvR 2656/18, 1 BvR 96/20, 1 BvR 78/20, 1 BvR 288/20, 1 BvR 96/20, 1 BvR 78/20.

basic rights were violated by provisions of the German Climate Protection Act (*Klimaschutzgesetz*). It also follows from the German Constitution (the Basic Law) that greenhouse gas emissions must be reduced, the judges explained.[162] The provisions of the Climate Protection Act, however, irreversibly postpone high burdens for the reduction of emissions to the time after 2030. In order to achieve the limitation of the temperature increase stipulated in the Paris Climate Agreement, the reductions that would then still be necessary would have to be implemented more urgently and at shorter notice. Practically most basic rights and freedoms (to which all humans are considered to be entitled, often held to include the rights to life, liberty, equality, and a fair trial, freedom from slavery and torture, and freedom of thought and expression etc.) are potentially affected by these obligations, because almost all areas of life are connected with the emission of greenhouse gases. The court was of the opinion, that the legislator should therefore have taken precautions to mitigate these burdens. Extensive consumption of the CO_2 budget already by 2030 would exacerbate the risk of infringement of basic rights. One generation should not be allowed to consume large parts of the budget under comparatively mild reduction burdens if this would comprehensively restrict the freedom of subsequent generations. The German Climate Protection Act was only passed at the end of 2019. It stipulates how much carbon dioxide individual sectors such as the energy industry or transport may still emit in the coming years. Emissions of climate-damaging greenhouse gases are to be reduced by 55% by 2030, compared to 1990 levels.

In many foreign climate law suits, especially in the United States, the entry point is anchored in air pollution. In *Asghar Leghari v Federation of Pakistan* – the Lahore High Court claimed that the government's inaction in implementing the policies to address the consequences of climate change offended fundamental rights (life, a healthy and clean environment, human dignity, property and the information), which are to be read with the constitutional principles of democracy, equality, social, justice, and the international principles of sustainable development, the precautionary principle, environmental impact assessment, inter- and intra-generational equity and the public trust doctrine. In its judgement the Court said: "For Pakistan, climate change is no longer a distant threat we are already feeling and experiencing its impacts across the country and the region."

162 The protection of life and physical integrity according to Art. 2 para. 2 sentence 1 GG includes protection against impairments of fundamental rights by environmental pollution, no matter by whom and through what circumstances they are threatened. The rights deriving from Art. 2.2 sentence 1 of the Basic Law also includes the obligation to protect life and health from the dangers of climate change. and health from the dangers of climate change. It can also justify an obligation to protect under objective law with regard to future generations. Article 20a of the Basic Law obliges the state to protect the climate. This also aims at the achievement of climate neutrality.

In November 2020, for the first time, the highest administrative court in France, the Conseil d'État does not consider climate change a question of politics that would not fall under the control of the judiciary, because the judiciary controls government's action set under French and European law. It further stated that the Paris Agreement must "be taken into consideration in the interpretation of the provisions of national law", putting the state under the obligation to make the climate a priority.[163]

Many more cases could be mentioned here as "climate cases have nearly doubled over the last three years and are increasingly pushing governments and corporations to implement climate commitments, while setting the bar higher for more ambitious climate change mitigation and adaptation."[164]

4.7 International Climate Litigation

Climate litigation has come to play a growing role in the development of the international law in recent years brought before international jurisdictions.[165] Yet, access to international jurisdictions is often barred by various procedural or political obstacles, which is why domestic courts have generally played more prominent role. There are multiple courts and tribunals addressing international disputes, although many of them have limited jurisdiction. [166]

The International Court of Justice (ICJ) would be the most obvious forum for adjudicating cases regarding the obligations of States in response to climate change. Alternatively, cases could be brought before the International Tribunal for the Law of the Sea (ITLOS), established under the United Nations Convention on the Law of the Sea (UNCLOS).[167] Both, the UNFCCC as well as the Kyoto Protocol provide for dispute settlement before the International Court of Justice. Article 14(2)(a) UNFCCC refers disputes concerning the interpretation or application of the Convention to the ICJ. In turn, both Article 19 of the Kyoto Protocol and Article 24 of the Paris Agreement refer to Article 14 UNFCCC, which shall apply mutatis mutandis. So far, no case concerning a climate change issue has been referred to the ICJ, nor to the ITLOS despite many previous cases ITLOS related to the protection of the marine environment.

Proceedings before international courts or tribunals could contentious or advisory in nature. A contentious case relates to a dispute between two States: an applicant and

163 Conseil d'État Decision N° 427301, at https://www.conseil-etat.fr/fr/arianeweb/CE/decision/2020-11-19/427301, accessed 7 July 2021.

164 Cf. UNEP (2020) providing an overview of the current state of climate change litigation globally, as well as an assessment of global climate change litigation trends. It finds that a rapid increase in climate litigation has occurred around the world. The growing tidal wave of climate cases is driving much-needed change.

165 Verheyen / Zengerlin (2013).

166 Mayer (2018:244).

167 Ibid.

a defendant. By contrast, advisory proceedings could be brought by an international institution or through a multilateral agreement on any legal question, whether related to a concrete situation or not. Contentious and advisory proceedings would face a series of legal and political obstacles. If successful, however, any such proceedings could be instrumental to the development of a better understanding of States' obligations under general international law.[168]

The Dispute Settlement Body (DSB) and the Appellate Body under the World Trade Organisation (WTO) Dispute Settlement Understanding (DSU), provide another forum for disputes involving national climate policies that implicate trade law. The DSB can only intervene insofar as the dispute involves two or more Members of the WTO and has a trade-related dimension.[169] WTO reform to better accommodate climate change measures is an increasingly urgent issue. Such reform could entail legal changes, namely amending the WTO agreements to accommodate climate change measures; introducing a waiver that temporarily relieves WTO members from their legal obligations under the WTO agreements when pursuing climate action; adopting an authoritative interpretation clarifying the scope of WTO rules in relation to climate policies; and introducing a time-limited peace clause pursuant to which WTO members will not challenge the climate policies of other members. Such changes would, however, involve complex political processes that – for a variety of reasons – would be difficult to implement in practice. In the meantime, existing flexibilities under current WTO law should be utilised to advance climate action, while it is not unlikely that conflicts between the trade and climate regimes will sooner or later surface in the WTO's dispute settlement system. WTO waivers would require WTO members to for instance agree on a new legal interpretation of existing rules on for instance border tax adjustments.[170]

Under the International Centre for the Settlement of Investment Disputes (ICSID) several cases have arisen that tangentially relate to climate change, involving the issuance of permits for coal fired plants. Claims might *inter alia* also be possible challenging subsidies for renewable energy.[171]

168 Ibid.
169 Maljean-Dubois (2019:para. 40).
170 Ruppel (2021a:523).
171 Bodansky *et al*. (2017:289).

And as we see more human rights climate litigation action[172] beyond and across national borders,[173] technical and procedural barriers also often constrain international

172 Relevant but by no means conclusive case law: 0907346 [2009] RRTA 1168 (10 December 2009). Refugee Review Tribunal of Australia. *Advocate Padam Bahadur Shrestha v The office of the Prime Minister and Council of Ministers, Singhadurbar, Kathmandu and others*, Decision no. 10210, NKP, Part 61, Vol. 3. *Armando Ferrão Carvalho and Others v The European Parliament and the Council* T-330/18. "The People's Climate Case" – Order of the General Court of the European Union, dated 15 May 2019. A Request for an Advisory Opinion from the Inter-American Court of Human Rights Concerning the Interpretation of Article 1(1), 4(1) and 5(1) of the American Convention on Human Rights OC-23/17. Advisory Opinion of the Inter-American Court of Human Rights, dated 15 November 2017. *Court on its own Motion v State of Himachal Pradesh and Others* and *Abhimanyu Rathor v State of Himachal Pradesh and Others* 237 (THC)/2013 (CWPIL No.15 of 2010). Petition by the Court on its own motion before the National Green Tribunal Principal Bench, New Delhi. *Environnement Jeunesse c. Procureur Général du Canada*, 2019 QCCS 2885. Decision before the Canadian Superior Court, dated 11 July 2019. *Family Farmers and Greenpeace Germany v Germany* 00271/17/R /SP. Application and Complaint filed on 25 October 2018. *Family Farmers and Greenpeace Germany v Germany* VG 10 K 412.18. Draft judgment dated 31 October 2019. *Friends of the Earth Germany, Association of Solar Supporters, and Others v Germany* 64S/18 FH-sk. Complaint filed on 22 November 2018. Friends of the Irish Environment CLG and The Government of Ireland, Ireland and the Attorney General [2020] IESCDET 13. Neutral Citation. *Future Generations v Ministry of the Environment and Others* STC4360-2018 Radicacion No. 11001 22 03 000 2018 00319 00. "Demanda Generaciones Futuras v. Minambiente". *Föreningen Greenpeace Norden and Others v The Government of Norway through the Ministry of Petroleum and Energy* 16-166674TVI-OTIR/06. *Föreningen Greenpeace Norden and Others v The Government of Norway through the Ministry of Petroleum and Energy* 18-060499ASD-BORG/03. Appeal. *Greenpeace and Others v Austria* G 144- 145/2020-13, V 332/2020-13 30.09.2020. *Gbemre v Shell Petroleum Development Company of Nigeria Ltd. and Others* FHC/B/CS/53/05. Ruling of the Federal Court of Nigeria dated 30 November 2005. In re: AD (Tuvalu) [2014] NZIPT 501370-371. Immigration and Protection Tribunal of New Zealand, decision dated 4 June 2014. *Ioane Teitiota v The Chief Executive of the Ministry of Business, Innovation and Employment* [2015] NZSC 107. Decision of the New Zealand Supreme Court. *La Rose and Others v Her Majesty the Queen in Right of Canada and the Attorney General of Canada* 2020 FC 1008. Decisions of the Federal Court of Canada, dated 27 October 2020. *Leghari v. Federation of Pakistan* (2015) W.P. No. 25501/201. Decision of the Lahore Court Green Bench. *Maria Khan et al. v Federation of Pakistan et al*. No. 8960 of 2019. Order of the Lahore High Court, dated 15 February 2019. *Neuzelle Agricultural Cooperative v Head of Administrative Services of Oder-Spree rural district authority* [2013] EU ECJ C-545/11. *Agrargenossenschaft Neuzelle eG v. Landrat des Landkreises Oder-Spree* Decision of the European Court of Justice, dated 14 March 2013. *Notre Affaire à Tous and Others v France* 1904698. Brief Juridique submitted to the Administrative Court of Paris on March 14, 2019. *Plan B Earth and Others v The Secretary of State for Business, Energy, and Industrial Strategy* [2018] EWHC 1892 (Admin). Neutral Citation, Decisions of the High Court of Justice Queens Bench Division, Administrative Court. *Plan B Earth and Others v The Secretary of State for Transport* [2020] EWCA Civ 214. *The United Kingdom Court of Appeal. Sabo and Others v European Parliament and Council of the European Union* T-141/19. *EU Biomass Plaintiffs v European Union* Order of the General Court of the European Union, dated 6 May 2020. *Verein KlimaSeniorinnen Schweiz et al. v Federal Department of the Environment, Transport, Energy and Communications (DETEC)* 1C_37/2019. *Union of Swiss Senior Women for Climate Protection v Swiss Federal Council and Others* Federal Supreme Court [of Switzerland], Public Law Division I, Appeal against the

jurisdiction. An increase in climate complaints to the United Nations Human Rights Committee is noticeable: Such in the 2019 case of *Torres Strait Islanders v Australia*, a group brought a complaint against Australia over its inaction on climate change, as their home, low-lying islands is affected by sea-level rise – which endangers them becoming displaced in violation of fundamental human rights under the International Covenant on Civil and Political Rights (ICCPR) Article 27 (the right to culture), Article 17 (the right to be free from arbitrary interference with privacy, family and home), and Article 6 (the right to life). On similar grounds in 2015 an individual seeking asylum from the effects of climate change, launched an unsuccessful complaint in the Kiribati climate change refugees case against New Zealand. In 2019 the United Nations Committee on the Rights of the Child received a petition on behalf of 16 children from across the world against Argentina, Brazil, France, Germany and Turkey seeking relief in that climate change is a children's rights crisis, recklessly perpetuated by respondent states in violation of children's rights to life, health and prioritisation of the child's best interests, as well as the right of indigenous children to their culture. The children also wanted the respondent states to review and amend their national laws to accelerate mitigation and adaptation to climate change.

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judgment of the Federal Administrative Court, Section 1, of 5 May 2020. *Urgenda Foundation v State of the Netherlands* [2015] HAZA C/09/00456689. Dated 24 June 2015; aff'd 9 October 2018, District Court of the Hague and the Hague Court of Appeal. Views adopted by the Committee under article 5(4) of the Optional Protocol, concerning communication CCPR/C/127/D/2728/2016. Views adopted by the Human Rights Committee under the United Nations International Covenant on Civil and Political Rights, dated 7 August 2017. *Brazilian Socialist Party and Others v Brazil: Urgent Application to the Honorable Minister Rosa Weber* ADO No. 59; ADPF No. 747; ADPF No. 755, filed 11 November 2020. *Youth for Climate Justice v Austria and others: Complaint filed with European Court of Human Rights*, filed 2 September 2020. *Greenpeace Mexico v Minister of Energy and Others*: Complaint filed in the District Court of Mexico City, Mexico, filed 20 August 2020. *Asociación Civil Por La Justicia Ambiental y otros c/ Entre Ríos, Provincia de y otros* (*Asociación Civil por la Justicia Ambiental v Province of Entre Ríos*): Complaint filed in Argentinian Supreme Court, filed 2 July 2020. Hearing on Climate Change Before the Inter-American Commission on Human Rights: Petition filed and heard at the Inter-American Commission on Human Rights, heard 22 May 2020. *Dini Ze' Lho'imggin and Dini Ze' Smogilhgim v Her Majesty The Queen In The Right Of Canada*: Complaint filed in Canadian Federal Court, filed 10 February 2020. *Neubauer and Others v Germany*: Complaint filed in German Federal Constitutional Court. Petition To The Inter-American Commission on Human Rights Seeking Relief From Violations Resulting from Global Warming Caused By Acts and Omissions of the United States P-1413-05. Ruling on Modification to Ethanol Fuel Rule 610/2019: Draft Decision of the Mexican Supreme Court, filed 22 January 2020. Rights of Indigenous People in Addressing Climate-Forced Displacement: Complaint filed to the United Nations, filed 15 January 2020. *Sacchi and Others v Argentina, Brazil, France, Germany & Turkey Communications* n°105/2019 (Brazil), n°106/2019 (France), n°107/2019 (Germany): Petitioners' Reply to the Admissibility Objections of Brazil, France, and Germany. Commune de Grande-Synthe v France 2019: filed in the Conseil d'Etat, the highest administrative court in France.

173 Roschmann (2013).

Regional courts and human rights tribunals, such as the Inter-American Commission or the European Court of Human Rights also need to be mentioned here next to the relevant international bodies under the auspices of the African Union including the African Commission on Human and Peoples' Rights amongst others. In terms of existing African and REC courts these have great opportunity and potential for the future. Until now, however, frequent failures largely prevented these judicial bodies to enfold their real face value. After all, it has been rightfully stated that international courts and tribunals must become the new environmental sentinels in international law.[174]

5 Conclusion

This chapter dealt with climate change from a *de facto* and a *de jure* perspective. Fact is, climate change impacts are felt in Namibia and across the globe, affecting people, nature and the economy. To mitigate climate change, we need to reduce global emissions of greenhouse gases significantly. But how does this coincide with the purpose of the UNFCCC, which is to achieve "stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system"?

The answer is given in the 2015 Paris Agreement, which builds upon the UNFCCC and which in its Preamble explicitly linked human rights and climate change in that

> parties should, when taking action to address climate change, respect, promote and consider their respective obligations on human rights, the right to health, the rights of indigenous peoples, local communities, migrants, children, persons with disabilities and people in vulnerable situations and the right to development, as well as gender equality, empowerment of women and intergenerational equity.

The Paris Agreement also refined the concept of a safe climate to be "well below" a 2ºC increase in the average global temperature, and ideally limited to a 1.5ºC increase. This places national objectives, commitments and policies within a wider perspective, but it does - not per se - provide litigants with a cause of action by itself. Countries' National Determined Contributions (NDCs) are also not enforceable as such, which is why claimants turn to human rights as a legal tool against climate change. All of the aforementioned prompts the assumption that there is still a lot of work in progress, especially for courts. It is therefore hoped that the implementation of the Paris Rulebook will provide further impetus for human rights litigation aimed at directing political institutions to synchronise NDCs with the overall goals of the Paris Agreement.

Although the failure to reach the NDC targets is not per se sanctionable according to the Paris Agreement, countries are expected to make national provisions to

174 Desai / Sidhu (2020).

guarantee enforcement of their commitments, or to issue sanctions in the case of non-attainment. It is now the time to fill out the Paris Agreement with legal national measures.[175]

It is also predicted that other countries in Africa will follow the 2016 Kenyan example and pass laws clarifying that large-scale greenhouse gas emitters can be sued for their contributions to climate change – a game changer that could force greenhouse polluters to "internalize" the true costs of pollution. The Kenyan Climate Change Act No. 11 of 2016 allows citizens to sue private and public entities that frustrate efforts to reduce the impacts of climate change.[176] Climate-related litigation efforts and the advancement of a more comprehensive climate protection law (i.e. a Climate Change Bill) are bound to increase the levels of legal certainty and general awareness, while at the same time promoting more climate resilient development pathways.[177] Green hydrogen may become such development pathway for Namibia.

In this light, the importance of sound legislation and the opportunity for public participation in environmental decision-making processes cannot be overestimated.[178] When people's rights are potentially infringed, those affected and living in a state governed by the rule of law should be able to take legal action.[179] In South Africa's legal system the role that public interest litigation plays in setting a model through which climate change jurisprudence is growing.[180]

Unlike in Namibia, in South Africa, class action or *actio popularis* is possible. Public interest litigation is provided for in Section 38 of the South African Constitution with legal standing (*locus standi*) for class action and public interest litigation.[181] Anyone listed in Section 38 has the right to approach a competent court, alleging that a right in the Bill of Rights has been infringed or threatened, and the court may grant appropriate relief, including a declaration of rights. The persons who may approach a court are (a) anyone acting in their own interest; (b) anyone acting on behalf of another person who cannot act in their own name; (c) anyone acting as a member of, or in the

175 Ruppel / Wulff (2016).
176 Cf. http://kenyalaw.org/lex/actview.xql?actid=No.%2011%20of%202016, accessed 7 May 2021.
177 Ruppel *et al*. (2020).
178 Ashukem (2019).
179 In this regard the Aarhus Convention is important to mention as it takes a human-centred approach to addressing environmental problems. It is the only legally binding international instrument encouraging protection of every person to live in an environment adequate to his or her well-being by ensuring access to information, participation and access to justice. The Aarhus Convention grants the public rights regarding access to information, public participation and access to justice, in governmental decision-making processes on matters concerning the local, national and transboundary environment. It focuses on interactions between the public and public authorities. Namibia is not a ratifying state of the Convention of which most ratifying states are in Europe and Central Asia.
180 Ruppel *et al*. (2020).
181 Rooney (2017).

interest of, a group or class of persons; (d) anyone acting in the public interest; and (e) an association acting in the interest of its members. Public interest litigation allows interested parties to identify possible gaps and failings in current laws and seek the judiciary's assistance in finding ways to fill those gaps and/or address such failings.

It is important to note, that the rule of law plays an important role in the Namibian Constitution according to which Namibia is established as a democratic and unitary state founded on the principles of democracy, the rule of law and justice for all. [182] Central to the notion of democracy is, however, also access to public participation and access to justice. In the context of climate change this seems still to be work in progress despite the fact that Namibia has embarked on an ambitious development programme aimed at reducing poverty, creating employment, promoting human rights and economic empowerment, stimulating sustained economic growth, reducing inequalities in income distribution, reducing regional development inequalities, promoting gender equality and equity, enhancing environmental and ecological sustainability.[183]

Thus, at least *de facto* climate change can no longer be denied in Namibia. *De jure* the state of explicit recognition of climate change, its legal consideration and possibilities of redress still need to be adjusted. So far there has been no case of climate litigation in Namibia. Nevertheless, the growing number of national laws and policies that address climate change (at least indirectly) inevitably contribute to creating a more solid legal basis for future litigants seeking to hold public and private actors to account for climate obligations to mitigate or adapt.[184]

According to Article 2 of the International Covenant on Economic, Social and Cultural Rights (ICESCR)[185] there is a recognition that socioeconomic rights have to be realised over time and the progress towards full realisation is dependent on the availability of resources.[186] In light of this provision, the progressive realisation qualification requires a state to strive towards fulfilment and improvement in the enjoyment of socio-economic rights to the maximum extent possible, even in the face of resource constraints. A state's performance in terms of the progressive realisation would depend on, among other things, both the actual socio-economic rights people enjoy at a given moment as well as the society's capacity of fulfilment.[187] Namibia has become a State party to the ICESCR in 1994 by way of accession, while its Constitution has directive principles that contribute – for instance - to the realisation of the right to adequate

182 Ruppel / Ambunda (2011:2).
183 Ibid.
184 Further readings on the topic relevant to Namibia: Alogna / Clifford (2020); Dewaele (2019); Preston (2018); Setzer / Byrnes (2019).
185 At https://bit.ly/3HQeE6Q, accessed 15 February 2022.
186 Chenwi (2013:743).
187 Ibid.

food.[188] In this sense, Namibia is obligated in terms of its international human rights treaty obligations to mobilise and allocate the maximum available resources for the progressive realisation of economic, social and cultural rights, as well as for the advancement of civil and political rights and the right to development. Addressing climate change in this context should complement ongoing efforts to pursue the full realisation of such rights while minimising the negative impacts of climate change for the benefit of the poor and most vulnerable.[189]

188 Cf. http://www.fao.org/right-to-food-around-the-globe/countries/nam/en/, accessed 17 May 2021.

189 Cf. submission of the Office of the High Commissioner for Human Rights to the 21 Conference of the Parties to the United Nations Framework Convention on Climate Change, at https://www.ohchr.org/Documents/Issues/ClimateChange/COP21.pdf accessed 17 May 2021.