



APRIL 2021

# CLIMATE CHANGE IMPACTS ON HEALTH AND LIVELIHOODS: **MALDIVES ASSESSMENT**

## ACKNOWLEDGEMENT

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The authors would like to thank staff from the Maldivian Red Crescent and Technical Advisors at IFRC Asia Pacific Regional Office, and IFRC Country Cluster Delegation for South Asia for their generous time and input into the assessment.

The authors would also like to thank the following people for their involvement in the conception, facilitation and management of the study:

**Fleur Monasso**, Red Cross Red Crescent Climate Centre; **Meghan Bailey**, Red Cross Red Crescent Climate Centre; **John Fleming**, IFRC; **Sanna Salmela-Eckstein**, IFRC; **Udaya Kumar Regmi**, IFRC; **Bettina Koele**, Red Cross Red Crescent Climate Centre.

This guide was designed by Eszter Sarody, and copy-edited by Sarah Tempest.

The authors also wish to thank the Finnish Red Cross, the Ministry for Foreign Affairs of Finland, and the IFRC for their financial contribution to this assessment.

April 2021.

The views in this report are those of the authors alone and not necessarily the Red Cross Red Crescent Climate Centre, the IFRC, ICRC or any National Society.

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## EXECUTIVE SUMMARY

The global climate crisis poses an existential threat to the Maldives. Sea-level rise of 0.84 metres by the end of the century could see islands completely underwater. Even staying below 1.5°C of warming, the Maldives will see a further 70–90 per cent deterioration of the surrounding and life-giving coral reefs (high confidence). Over 2°C of warming and it is expected that there will be a >99 per cent loss of coral reefs by 2100 (high confidence). In the intervening decades, coastal flooding will significantly increase (high confidence). The Maldives, already a hot tropical country, will also experience increased average temperatures and more ‘hot’ days (high confidence). The islands will see a short-term trend in decreased annual rainfall, especially in the southern regions, but an overall long-term trend of increased annual rainfall (likely). Extreme rainfall will increase: this means already wet days will be substantially wetter with flooding consequences (likely). In addition, storms and stronger winds will increase in frequency (likely). The impacts these changes will have on livelihoods and health, without substantial global action and national adaptation, are significant.

Climate change has the potential to trigger wide-ranging and strong negative feedback loops between livelihoods and health.

On the one hand, a loss in livelihoods will negatively impact people’s ability to afford healthcare. Climate change threatens all the major livelihood sectors – agriculture, fisheries, tourism and related ancillary activities like food and fish processing, boat making, trade and handicrafts, as these activities are all heavily reliant on the natural environment. Communities living in remote islands are at higher risk because of the lack of diversified incomes. Women, persons with disabilities, and migrants face numerous systemic economic and social barriers, placing them at increased risk. Climatic stresses and shocks on economic opportunities had – until the COVID-19 pandemic – been increasing displacement and migration towards urban areas, especially by men, leaving behind more female-headed households in the atolls. How this dynamic will shift as a result of the pandemic is unfolding.

Whilst on the other hand, impacts to health (notably via heat exhaustion, malnutrition and increased food insecurity, the emergence of vector-borne diseases such as Dengue Fever, Zika virus and Chikungunya, and an increased burden of waterborne diseases) will reduce people’s ability to work and earn a livelihood. Climate change is catalyzing changes in water and sanitation access due to extreme weather events and the flooding of sanitation systems, driving an increase in waterborne diseases. Further, climate change is threatening food and water security, particularly in rural communities, because of damages to fishery and agricultural livelihoods. The cascading effects of this food insecurity are driving concerns over malnutrition and malnourishment in the Maldives, where women and children are at particularly high risk. Higher migration is leading to an urbanization of health problems and mental health challenges.

The urgency to act is clear. The purpose of the report is to act as a reference document on the likely impacts – direct and indirect – of the climate crisis on the wellbeing of people in terms of their health and livelihoods. The intention is that this report can act as a springboard for planning and implementing activities and programmes focused on climate action and adaptation. Some recommendations and opportunities for action have been offered, however, these should be considered as only a starting point to further complement and expand existing programmes and projects. Cross-sector and widespread collaboration between National Societies, government agencies and services, the private sector, NGOs, civil societies and our communities is key as no one organization alone can tackle the increased risks posed by climate change nor alleviate the exacerbated risks of vulnerable populations. Together, acting now, with the evidence at hand, it is possible to avert the most dire consequences of the climate crisis.

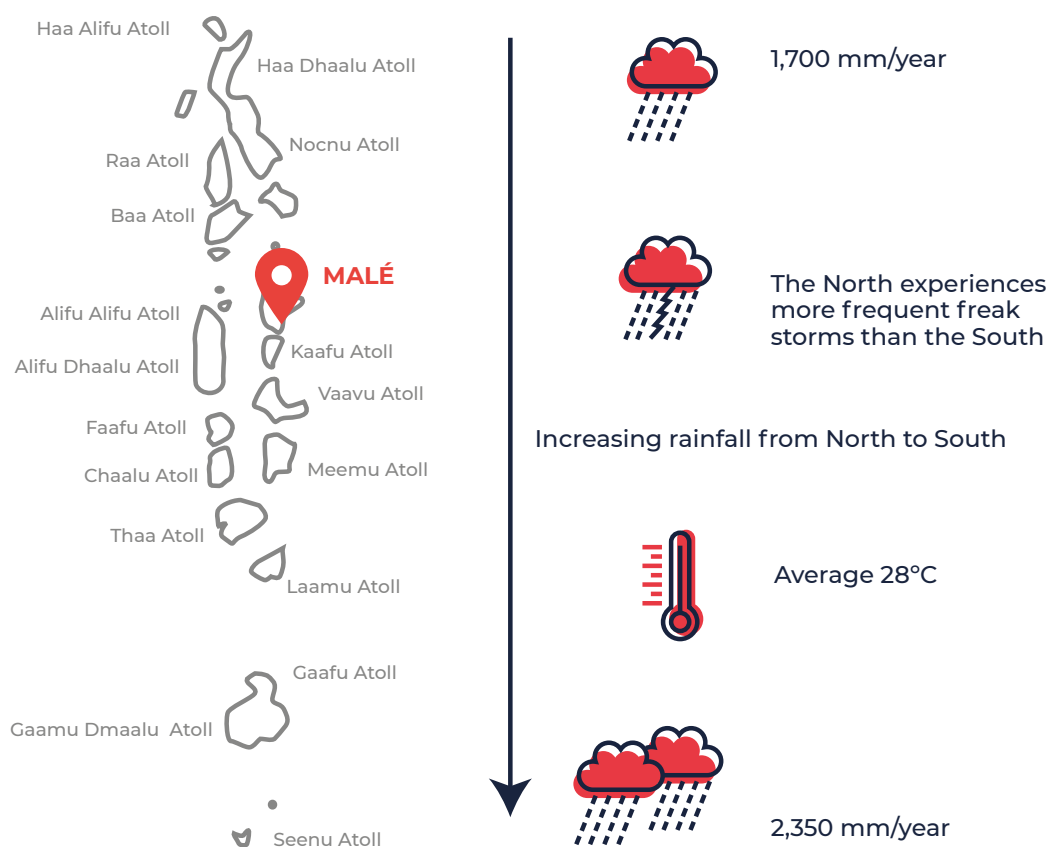


# 1. CLIMATE PROFILE AND PROJECTIONS

## 1.1. CLIMATE

The Republic of Maldives is an archipelago of small islands that lie no higher than 1.5m above sea level and experience a tropical climate, with a relatively constant annual mean temperature of 28°C (varying from 31°C in daytime to 23°C in nighttime) (Stojanov *et al.* 2017; MMS 2020). The weather is dominated by two monsoon periods, the south-west monsoon from May to November and the north-east monsoon from January to March. The south-west monsoon system is controlled by continental scale circulations during which moisture is transported from the Arabian Sea to the Bay of Bengal (UNDP 2013). For the rest of the year, the process is reversed, with low activity between February and May (UNDP 2013). This produces a slightly longer rainfall season over the southern Maldives. The average annual rainfall for the Maldives is 2,124mm, however, this rainfall varies regionally.

**Figure 1.** Map of the Maldives



## 1.2. CLIMATE CHANGE TRENDS

OBSERVED CHANGES	CLIMATE PROJECTIONS
<p><b>TEMPERATURE</b></p> <p>Observed changes in annual average temperature vary quite a bit across the atolls of the Maldives. Mean annual temperatures have increased in the central region (e.g. Malé). Minimum temperatures have increased in both the north and south regions, meaning that the cool days in the Maldives are getting warmer. Maximum temperatures have increased (i.e. hot days have become hotter) in the northern regions, while the hot days have become very slightly cooler in the southern regions (Ministry of Environment and Energy 2016; UNDP 2013).</p> <p><b>Sea surface temperature</b> (SST) has warmed throughout the archipelago (0.11–0.15°C/decade) (Ministry of Environment and Energy 2016; UNDP 2013).</p>	<p><b>TEMPERATURE</b></p> <p>By 2050, average <b>temperatures will continue to rise</b>: from 1.15–1.95°C above the baseline (in both ‘high’ and ‘conservative’ scenarios) (World Bank 2020; Ministry of Environment and Energy 2016). By 2100, temperatures could be 3.6°C hotter than the baseline (WHO 2015). This will mean more hot days (a baseline of 30 hot days is projected to increase to 360 hot days by 2100) and higher annual average temperatures for an already hot country (WHO 2015).</p> <p><b>Sea surface temperature</b> (SST) is expected to <b>continue increasing</b> over the decades, which will negatively affect ocean ecosystems on which the islands rely (by 0.76–1.33°C by 2030, 1.01–1.93°C by 2050, and 1.27–3.40°C by 2080) (UNDP 2013).</p>
<p><b>RAINFALL</b></p> <p>An overall trend in <b>decreasing annual rainfall</b> and <b>decreased number of days with at least 1mm of rain</b> has been observed over the Maldives (1967–2012). The most pronounced decrease in annual rainfall appears to have occurred in the north, even though the number of days of rainfall has not decreased; however, there is some uncertainty as there is limited historical data in the north (Ministry of Environment and Energy 2016).</p>	<p><b>RAINFALL</b></p> <p>Despite an overall historic trend in <b>decreasing annual rainfall</b>, future projections of rainfall are not so clear. Different regions will experience different patterns of rainfall between 2021–2050. <b>The north and central regions</b> may face an <b>increase in rainfall</b>. Whilst the <b>southern region</b> may face a <b>decrease in rainfall</b>.</p> <p>Monthly projections for the period 2020–2039 anticipate a slight <b>decrease</b> in average rainfall during May, June and July (early south-west monsoon season) and a slight <b>increase</b> in rainfall is projected for September, October and December (late south-west monsoon season).</p> <p>Overall, however, annual rainfall is projected to rise towards the end of the century (World Bank 2020; Ministry of Environment and Energy 2016).</p>

OBSERVED CHANGES	CLIMATE PROJECTIONS
<b>RAINFALL</b>	<b>RAINFALL</b>
	There is uncertainty around the changes in the timing of rainfall. Under a high emissions scenario, the longest dry spell is indicated to increase slightly from an average of about 30 days in 1990 to about 33 days in 2100, with continuing large year-to-year variability (WHO 2015).
<b>SEA-LEVEL RISE</b>	<b>SEA-LEVEL RISE</b>
The <b>sea level is unequivocally rising</b> , and the <b>rate at which it has been rising has been accelerating</b> . Prior to 2006, the sea level had increased by 1.4mm per year; between 2006–2015, sea level had risen by 3.6mm per year (Oppenheimer <i>et al.</i> 2019).	<b>Sea level rise is an existential threat to the Maldives</b> . By 2100, sea level rise projections of 0.61–1.10m relative to the baseline correspond to a loss of between 77–100 per cent (i.e., completely underwater) of land in the Maldives (Oppenheimer <i>et al.</i> 2019; Anthoff <i>et al.</i> 2010; Ministry of Environment and Energy 2016).
<b>EXTREME EVENTS</b>	<b>EXTREME EVENTS</b>
Apart from the Indian Ocean Tsunami in 2004, the country has <b>rarely experienced major disasters</b> . Recent years have observed more losses and damages due to small-scale and recurrent hazards, such increased rainfall, cyclonic winds, storm surges, salt water intrusion and coastal floods (UNDRR 2019). <b>Rainfall induced floods</b> are the most frequent natural events in the Maldives (Ministry of Environment and Energy 2016).	<b>Rainfall induced floods</b> (due to more days with heavy rainfall fall, >20 mm per day) as well as <b>coastal flooding</b> (due to sea-level rise) are predicted to <b>increase in intensity</b> (UNDRR 2015; Ministry of Environment and Energy 2016; WHO 2015). Daily rainfall of 150mm in the northern region, which is now a 300-year return event, is predicted to be a 23-year return event by 2100 (Ministry of Environment and Energy 2016).

### 1.3. CLIMATIC VARIABILITY AND EXTREME WEATHER

The climate is influenced by large continental systems and the El Niño Southern Oscillation (ENSO) (UNDP 2013). Historically, whilst rainfall in the central regions of the Maldives has shown larger year-to-year variations as compared to the southern zones, temperature has not varied too significantly from year-to-year across the country (UNDP 2013; Republic of the Maldives 2007). Nevertheless, temperatures are steadily increasing and rainfall patterns are changing.



“Traditional knowledge with elderly Maldivians had helped them know the seasons and weather patterns and they could plan different activities. But seasons and the weather are now changing. The intensity of rain and heat has increased and a lot of developmental practices have exacerbated the problems.” (KI 4)

The Maldives lies out of the tropical cyclone zone, though it does experience cyclonic disturbances during the south-west monsoon season (specifically from October to January); and – though extremely rare – 11 cyclones have crossed the Maldives (in 1877–2004) (Ministry of Environment and Energy 2016; UNDP 2006). There remains the possibility of future cyclones (Republic of the Maldives 2007).

There is a clear pattern of the northern Maldives being exposed to more frequent freak storms than the south (UNDP 2006). Gust-winds of 50 miles per hour are almost an annual event across the Maldives, while winds of 60 miles per hour have return periods of 2–3 years and 4–7 years in the central and southern regions respectively (Ministry of Environment and Energy 2016). Maximum storm surge height is reported to be 1.32m with a return period of 500 years (UNDP 2006).

**Table 1.** Seasonal calendar

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
NE Monsoon				SW Monsoon							
									Cyclonic Disturbances		

## SUMMARY: PAST CLIMATE TRENDS AND FUTURE CLIMATE PROJECTIONS

The whole low-lying archipelago of the Maldives faces an existential threat from sea-level rise by the end of the century. Sea-level rise will further erode the retreating coast; and, combined with increasing intensity of rainfall, cause coastal flooding and saltwater intrusion, which will affect water security. Freshwater is limited across the islands, and especially in the remote atolls. Decreases in rainfall in the northern regions may place these islands at particular risk of freshwater insecurity, while a rise in extreme rainfall events will see increased flooding. In addition, the Maldives is projected to continue experiencing increased temperatures. Already a hot tropical climate, the rising temperatures will increase the number of 'hot' days and nights significantly. Increased global temperatures will also affect the sea surface temperature, which is very important for islanders who rely on the health of the surrounding oceans.

## RECOMMENDATIONS

1. Raise awareness among communities, especially at-risk groups, on the main climate change stress and shocks, especially in remote areas where there is less access to this information.
2. Collaborate with the meteorological department to build staff and volunteers' capacities on weather alerts, forecasts and climate projections.
3. Explore digital and other means to communicate alerts and forecasts to the 'last mile' so that everyone remains aware and prepared.

## 2. MOST AT-RISK POPULATIONS

### 2.1 COMMUNITIES IN THE REMOTE ATOLLS

Communities residing in the peripheral atolls are more at risk to the effects of climate change because: 1) they have higher levels of poverty and limited access to resources to reduce their exposure, as the majority of wealth and resources are located in urban centres; 2) healthcare facilities are limited in the peripheral atolls; 3) they have a greater dependence on natural resources-based livelihoods, with limited options to diversify livelihoods; women, in particular, tend to totally depend on agriculture and fishing; and 4) men are more likely to migrate for better economic opportunities, while women shoulder the triple burden of productive, household and care work, leading to a rise in female-headed households here (FAO 2019).

### 2.2 MIGRANTS AND INTERNALLY DISPLACED PERSONS

Approximately 26 per cent of the population of the Maldives are migrants from other countries (mostly South Asia, and especially from Bangladesh) (UN 2020) (KI2, KI3, KI4). There is also high inter-atoll migration as people move for better education, livelihoods and living conditions. A large number of irregular and undocumented foreign migrants (at least 60,000 people) do not feature in official statistics (HRW 2020). About 9 per cent of the migrant workers are women, mostly from India, the Philippines and Nepal, working in informal sectors such as domestic work with no health and livelihoods security (FAO 2019; NBS 2020). Most foreign migrants find low-skilled jobs in the construction and tourism industries (IOM 2018). The Maldivian Red Crescent (MRC) Strategic Plan 2019–2030 notes that many foreign migrants do not have medical insurance, their living conditions are unfavourable, they do not have proper work permits and face exploitative situations at work with long hours and improper wages. They are not able to access government support during extreme events and emergencies. Intra-Maldives migration is also likely to increase due to climate change, and the migrants have been shown to experience weaker social cohesion and even systemic discrimination (IOM 2018). Climate change may increase the number of internally displaced persons (IDPs). Migrants are prone to increased exposure of infectious diseases during transit and resettlement, transmission of diseases between migrants and host populations, or altered social factors, structures and health behaviours that increase communicable disease risk among migrants (McMichael 2015).

“All the problems with climate change are exacerbated for the migrant population: their living conditions are 10 times worse, and the impacts are much more severe. Construction workers have to work and live in harsh conditions. We hear reports of heat rash, dehydration and dermatological problems in the living quarters. They do not make the climate linkage themselves, but we are hearing it.” (KI 7)

## 2.3 CHILDREN

Children can face lifelong consequences from malnutrition, limited access to fresh drinking water and exposure to extreme heat. The northern part of the country is most densely populated with children, and is also considered to be the least developed region of the Maldives, with higher poverty rates and lower access to services. These children may be especially vulnerable to the adverse effects of climate change, because they have limited opportunities for education and good health facilities (UNICEF 2018). Low health development will impact their potential to work hard on land and the sea and face climate vagaries.

## 2.4 PERSONS WITH DISABILITIES

In the Maldives, people with disabilities face higher risks of poverty, violence and food insecurity and, therefore, have lower capacities to adapt to climate change. They face higher discrimination and exclusion from health, education, work and social participation (Banks *et al.* 2020). This exclusion is higher for disabled people living outside of Malé. Women among persons with disabilities (PWD) have fewer resources and skills, face higher social discrimination, and have limited work opportunities compared to non-PWD women. More women also work as care-givers, for both men and women with disabilities, even as they face gender-based barriers with regard to access to health facilities and secure livelihoods.

## 2.5 WOMEN

The Maldives saw an increase of 32 per cent in its Human Development Index in 1995–2018 and is categorized within the ‘High Human Development Group.’ Yet, the Gender Inequality Index (GII) 2016 shows Maldivian women face high discrimination in health, empowerment and the labour market (FAO 2019). This makes them more vulnerable to climate change impacts and impairs their capacities to adapt. The decline in the fishery sector impacted women the most. Women largely work in low-growth informal sectors – domestic, education, social work and manufacturing (World Bank 2015). Access to sexual and reproductive healthcare services is limited and domestic violence is also a harsh reality for many (FAO 2019). Most rural women depend for their livelihoods on climate-sensitive natural resources, doing subsistence

farming, home gardening, coconut collection, handicrafts, rope weaving and fish processing (FAO 2019). Male migration also leaves many female-headed houses in atolls (>50 per cent of households are female-headed). Female-headed households are poorer, compared to other households, due to lower income and limited control over household assets (World Bank 2015).

“Oftentimes, men are not living on the rural islands as they work in tourism, fisheries or are in the capital. The women rule the household in a kind of matriarchal society, they are mainly involved in agriculture and work outside a lot.” (KI 7)

## SUMMARY: MOST AT-RISK POPULATIONS

Faced with accelerating sea-level rise, higher temperatures in an already hot climate and more frequent extreme rainfall events, the most at-risk population groups in Maldives include poor, especially rural, women and children, foreign and domestic migrants and IDPs, persons with disabilities and the communities residing in the northern remote and less developed atolls. These people are more exposed to climate change impacts and have less capacity to adapt to the impacts. These groups are not mutually exclusive. Overlaps between these groups are especially concerning, such as poor or single women living with disabilities in remote atolls.

## RECOMMENDATIONS

1. Ensure the voices of these highly at-risk groups are represented during vulnerability and capacity assessments and in community-based committees dealing with short- to medium-term future risks arising from climate change.
2. Develop, in a participative manner, viable adaptation strategies for these groups to deal effectively with climate change impacts on their health, food and water security and livelihoods.
3. Include the concerns and voices of the at-risk groups in adaptation-related planning and policy dialogues at the island and country levels.

### 3. HOW WILL LIVELIHOODS BE AFFECTED BY CLIMATE CHANGE?

Livelihoods are “the ensemble or opportunity, set of capabilities, assets, and activities that are required to make a living” (Chambers and Conway 1992; Ellis 2003). Livelihoods are dynamic, and depending on internal and external stressors, people may shift, adapt and transform their livelihoods. Some livelihoods, in particular, are more sensitive to a changing climate, such as – in the context of the Maldives – rainfed agriculture, fishing and tourism. According to the IPCC, there is high confidence that climate change, climate variability, and climate-related hazards exacerbate other stressors, worsen existing poverty, exacerbate inequalities, trigger new vulnerabilities and typically have negative outcomes on livelihoods (Olsson *et al.* 2014).

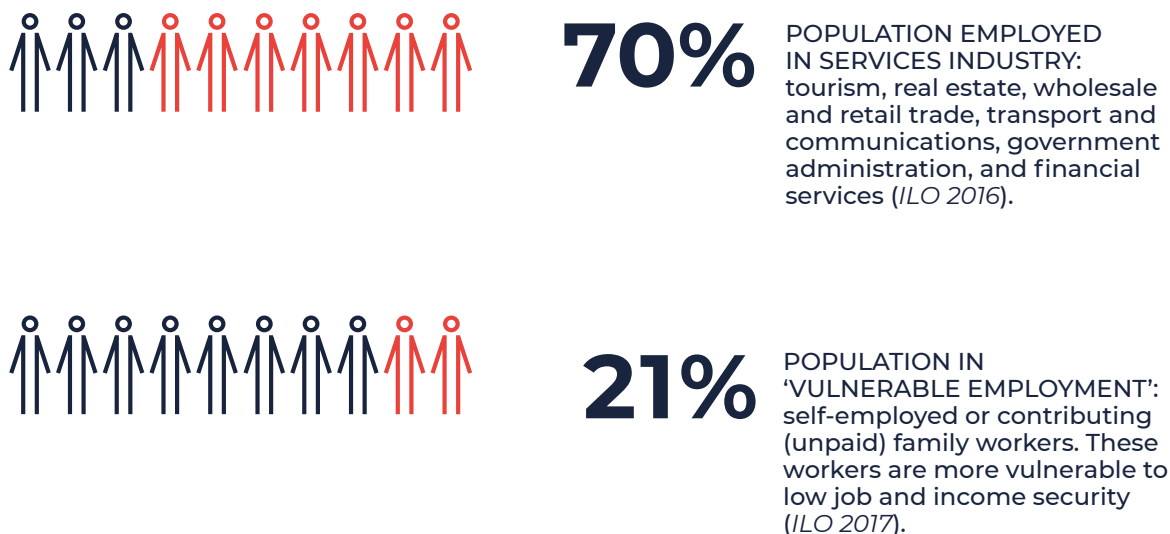
The following sections briefly outline the livelihood profile of the Maldives. First, addressing how climate change affects the major sectors of tourism, agriculture and fisheries, with a particular focus on food security as a major link between climate change, health and livelihoods. Finally, impacts of climate change on physical and financial assets owned by the people.

#### 3.1. COUNTRY LIVELIHOOD PROFILE

The Maldives, a Small Island Developing State (SIDS), depends heavily on the health of its marine and island ecosystem for survival and for its development. The Maldivian economy is primarily based on nature-based tourism which has grown rapidly over the past decades (World Bank 2015). The capital city of Malé is the primary seat of government and most of the services, businesses and administration-related employment is located here. Rural atolls offer limited employment opportunities (UN HABITAT 2015).



**Figure 2.** Employment statistics. Source: ILO 2017



A majority of micro-, small- or medium-sized enterprises (MSME) are involved in the climate-sensitive agriculture, fishing and retail trades. Most of these operate informally; although they play a crucial role in the local economy. Rural populations mostly earn a living by doing fish processing and food processing; gathering and processing coconut; making handicrafts – woven mats, rope, crafts, jewellery. Boat building is a major activity on atolls and islands. In the city, climate change impacts are already affecting and will directly affect all workers, though not equally.

## 3.2. TOURISM

The Maldives economy is highly dependent on income from tourism which accounts for 70 per cent of the country's revenue (Republic of the Maldives 2007). Tourism supports many different services, including accommodation, catering, outdoor activities, handicrafts and transportation. This is both on 'tourist' islands and increasingly for 'guest houses' on locally inhabited islands. The rural economy also depends highly on demand from the tourism sector for food. A combination of climate change impacts threaten tourism because tourism requires guaranteed "favourable" weather and healthy coral reefs. Rising sea surface temperatures have been sounding an alarm for a reduction in biodiversity and reef health, thus threatening tourism. Coastal erosion due to sea-level rise, frequent and intense tidal patterns, waves, and storm surges, as well as human activities <sup>1</sup> is affecting small island resorts which are often the major source of income for the local population (Republic of the Maldives 2007; Hosterman and Smith 2015).

<sup>1</sup> It is worth noting that coastal erosion is only partly attributable to climate change, and that other factors such as the environmental impacts of land reclamation, harbour construction and other infrastructure projects also contribute to coastal erosion (KI1, KI3, KI4, KI6).

“Tourism is the main economic sector for the country: We sell the sun, sand and sea. The ecosystem health determines the attractiveness of the destination. If this is affected by climate change, our income will be affected.” (KI 4)

### 3.3. AGRICULTURE AND FISHERIES

Although agriculture and fisheries contribute only marginally to GDP (4 per cent in 2014) and agriculture directly employs less than 10 per cent of the population, they remain the most important source of livelihoods and food security in the remote and rural islands (UNDRR 2019; ILO 2016). This is because families adopt a basket of these livelihoods – farming and fishing and using natural resources to make handicrafts.

**Agricultural** productivity is restricted by land availability as the Maldives has only 28 square kilometres of land suitable for agriculture (Republic of the Maldives 2007). Subsistence farming is done mostly by women in their home gardens where they grow vegetables, fruits and traditional starchy varieties; and to a limited extent on small farms. Men dominate the production of high-value commercial crops such as banana, cucumber, mango and watermelon (FAO 2019). Crop production already has and will likely continue to be negatively impacted by climate change because of: 1) reduced water availability and the salinization of aquifers; 2) loss of (already limited) land through sea-level rise; 3) heat stress on plants via higher temperatures; and 4) changes in rainfall patterns (Republic of the Maldives 2007).

Climate change will negatively impact **fisheries** via two main mechanisms. First, warmer air and higher sea temperatures alter ocean currents, which will degrade the coral reef ecosystem, leading to loss of habitat for reef organisms and a reduction in fish population. Second, rising global sea surface temperature will impact tuna feeding grounds in the open seas and, therefore, the migratory behaviour of tuna, causing decreases in tuna stocks (Republic of the Maldives 2007). Livelihoods of the vast majority of fisherfolk living in peripheral islands may suffer disproportionately due to their limited ability to diversify their livelihoods (McNamara *et al.* 2019).

“The coastline and shoreline is where a lot of the nature-based livelihood activities take place. If these are damaged, women are particularly affected – as are fishermen.” (KI 4)

## Food security

Compared to urban populations, rural populations rely heavily on fisheries and primarily rainfed agriculture for household food security and they will be affected more by climate change. Food storage (emergency and long-term) is virtually absent in the atolls and limited to only Malé and nine other islands (Republic of the Maldives 2007). All islands rely on imported foods. Urban islands depend heavily on food imports of major staples, such as rice, flour, sugar, oil and fresh foods. Vegetables and fruit, where available, are preferably sold by rural people to cities rather than consumed (Golder *et al.* 2001). Peripheral islands must wait for food imports to pass via the urban islands and major international ports before being transported to the atolls. This means that islanders further from major ports may face limited access to fresh and healthy food products (Asra *et al.* 2020).

Food security in Maldives is thus vulnerable to:

- Climate change-related impacts on agriculture in countries from where Maldives imports food crops
- Delays in transport (both from food exporting countries to the Maldives, and within the Maldives between the main islands and the outer islands)
- Climate change-related impacts on national fisheries, because a decrease in fish stocks would not only affect the Maldives internal staple food supply, but also its ability to pay for imported food (Asra *et al.* 2020; Republic of the Maldives 2007)
- A lack of livelihood diversification opportunities to address food and income security in the remote islands that are dependent on fishing as the major source of household income.

## 3.4 PHYSICAL ASSETS (HOMES AND WORKPLACES)

In the island archipelago, 47 per cent of all housing infrastructure lies within 100 metres of the coast and 80 per cent of the islands' land is less than 1 metre above sea level (Republic of the Maldives 2007). This leaves half the population's homes and many workplaces exposed to the impacts of increasingly frequent and severe coastal floods (tidal, rainfall and sea-level rise related) and strong winds during extreme weather events. Poor quality construction materials of houses are unable to withstand extreme weather; and stormwater drainage is not adequate. A study concluded that in the southern islands, around 60 per cent of the existing houses are located in the floodplains (UNDP 2007). Houses seldom have a high enough (?) (Das *et al.* 2010). About 70 per cent of the infrastructure for fisheries and most of the powerhouses are within 100m of coastlines, threatening the livelihoods of the people working here. Shoreline erosion is also very high with 97 per cent of the islands witnessing this and 64 per cent of the islands reporting 'severe' shoreline erosion (UNDRR 2019).

“Intense rainfall often causes flash floods on the islands, with a lot of damage to household goods, infrastructure and belongings. They also impact crops and vegetation. All of this in some islands is really critical for food and shelter of people.” (KI 7)

## SUMMARY: HOW WILL LIVELIHOODS BE AFFECTED BY CLIMATE CHANGE?

All major livelihoods in the Maldives are climate-sensitive. These include agriculture, fisheries, tourism and related ancillary activities like food and fish processing; also handicrafts, boat-building, trade and water transportation. A majority of homes and physical assets, like infrastructure for fisheries and powerhouses, lie within 100m of the coastline and people working here are threatened by sea-level rise and coastal flooding. Communities living in remote islands, especially resource-poor women and women whose menfolk migrate for better work possibilities, are at higher risk from climate impacts, because they lack livelihood diversification opportunities. Rising temperatures and urban floods will impact people's ability to work.

## RECOMMENDATIONS

1. Promote nature-based solutions to protect natural resources at the community-level, while engaging with planners and decision-makers to help nurture the livelihoods base of poor people. This includes helping to arrest coastal erosion and salinity ingress through coastal plantation, harnessing rainwater for drinking purposes and promoting climate-smart agricultural practices.
2. Leverage government development programmes to protect people's fragile livelihoods, build their productive assets and diversify their livelihoods to reduce the risk of loss of income or assets due to climate change, particularly for communities living and working near the coastline and people living on remote atolls.
3. Ensure livelihood support to women farmers, home-based workers, migrants and IDPs and other vulnerable and exposed community groups to help them adapt better to climate change impacts.

## 4. HOW WILL HEALTH BE AFFECTED BY CLIMATE CHANGE?

### 4.1. MORTALITY AND NON-COMMUNICABLE DISEASES

In 1988–2007, 80 per cent of all disaster events in the Maldives were climate-related and accounted for 45 per cent of deaths and 79 per cent of economic losses during this period (Republic of the Maldives 2011). Mortality from major flooding events may be high because “knowledge of swimming in Maldives is rather limited” (KI 1). The Department of Meteorology (now called the Maldives Meteorological Service) has historically provided weather updates twice daily to all regions in the Maldives, which can serve as an early warning system for adverse events (Asian Disaster Reduction Centre 2005). Today, real-time weather alerts are available from the met. service, but public dissemination mechanisms remain weak (UNDRR 2019). An increase in hydro-meteorological disasters indicates the potential for increased climate change-related morbidity and mortality in the Maldives (Republic of the Maldives 2011).

As the average temperature is already high in the Maldives, and temperatures will continue to rise, there will likely be negative health impacts (heat exhaustion, heat-related deaths) due; to 1) more heatwaves (extreme acute events); and 2) overall chronic heat exposure (i.e. 360 days may be ‘hot’ by 2100). This will affect people’s ability to work during the daytime, and sleep properly at night. Heat-related conditions such as skin irritation and skin diseases, urinary tract infections (from dehydration), eye irritation and respiratory diseases are already all on the rise (Ministry of Environment and Energy 2016).

“Fishermen have told me they now feel more heat during fishing, and sometimes faint because of it.” (KI 6)

“We are good at showing the issues like sea-level rise, but what is happening to local health and livelihoods with temperature rise and rainfall change is not emphasized enough.” (KI 6)

Mortality from non-communicable diseases may also increase from ambient and indoor air pollution due to higher peak temperatures and more frequent floods which force people to stay at home. Many homes in the city of Malé, for instance, are small. In rural areas, about 9 per cent of the population uses solid fuels for cooking (WHO 2015). Women and girls are primarily responsible for cooking and they bear the larger

burden of morbidity and mortality associated with indoor air pollution in rural and urban areas (WHO 2015).

“People are talking about heat effects more often, but no-one has looked at how it affects their ability to work or other problems yet. Heat is not on the mind of policy people.” (KI 6)

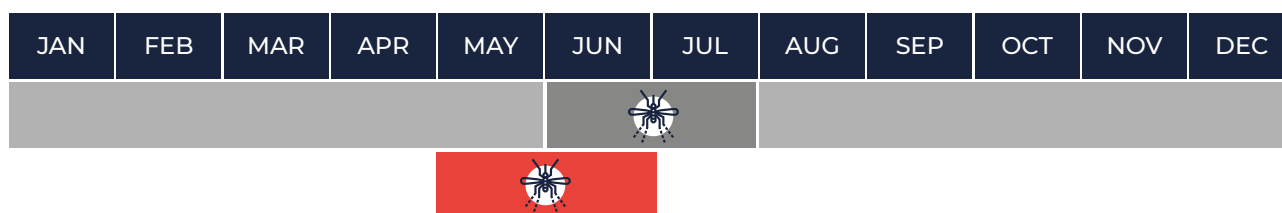
## 4.2. VECTOR-BORNE DISEASES

Vector-borne diseases pose significant health impacts and are highly sensitive to changing climatic conditions (temperature, rainfall, humidity), which exert a strong influence on the life cycles of the vectors (such as mosquitoes). Vector-borne diseases are also influenced by non-anthropogenic factors – which are not the focus of this report – such as population growth, urbanization, and prevention and control measures.

Vector-borne diseases such as Dengue Fever (which has seasonal outbreaks linked to ENSO), Chikungunya and Zika Fever (which are new diseases in the atolls) are emerging as top public health challenges related to climate change (Republic of the Maldives 2007; WHO 2018). Water saturation and inundation of the low-lying atolls creates more favourable conditions for the breeding of vectors, increasing the risk of vector-borne diseases (Ahmed and Suphachalasai 2014). Historical outbreaks of Dengue Fever have been shown to be associated with disruptions (e.g. by extreme weather events) of economic and social activities in the atolls (Moosa 2008). In particular, vulnerable and exposed people living in remote, under-developed atolls are highly vulnerable to climate-related transmission dynamics of vector-borne diseases (Republic of the Maldives 2007).



DENGUE FEVER incidence will **increase** under climate change projections, with knock-on disruptions to people’s livelihoods and the economy



Already, the rainy season which coincides with seasonal dengue fever peaks, has shifted in the Maldives, from June-July to May-June (UNICEF, 2015).



“Rainfall patterns and temperature increase are allowing vectors to increase. They breed more during intense rainfall. However, urbanization is also a major exacerbating factor because of the way buildings and roads are constructed – building sites are big breeding grounds for Dengue.” (KI 6)

## 4.3. WATER, SANITATION AND HYGIENE

This section covers the main health issues related to Water, Sanitation and Hygiene (WASH) and how they will be impacted by climate change.

### Water supply

Freshwater availability in the Maldives has always been a challenge and the concern is now deepening because of climate change-induced seasonal changes. Already, the country is seeing longer than usual dry days and the frequency with which the National Disaster Management Center is called upon to deliver emergency water is increasing (UNDP 2016). Remote islands (especially in the northern and central regions) depend heavily on rainwater for drinking water, collected via tanks on households' roofs. With decreasing rainfall, communities will have to increase their storage capacity of rainwater to cope with longer dry spells. Groundwater reservoirs are very shallow (1–1.5m deep) and are facing severe depletion and salinization due to over-extraction and aggravated by sea-level rise and low rainfall (Jaleel *et al.* 2020; Bailey *et al.* 2015). Malé and other urbanized islands use desalinated piped water for drinking. Where rainwater yields diminish due to lower rainfall or when the dry season extends, households face water scarcity and this has been linked with higher malnutrition and incidence of water-borne diseases (Republic of the Maldives 2007).

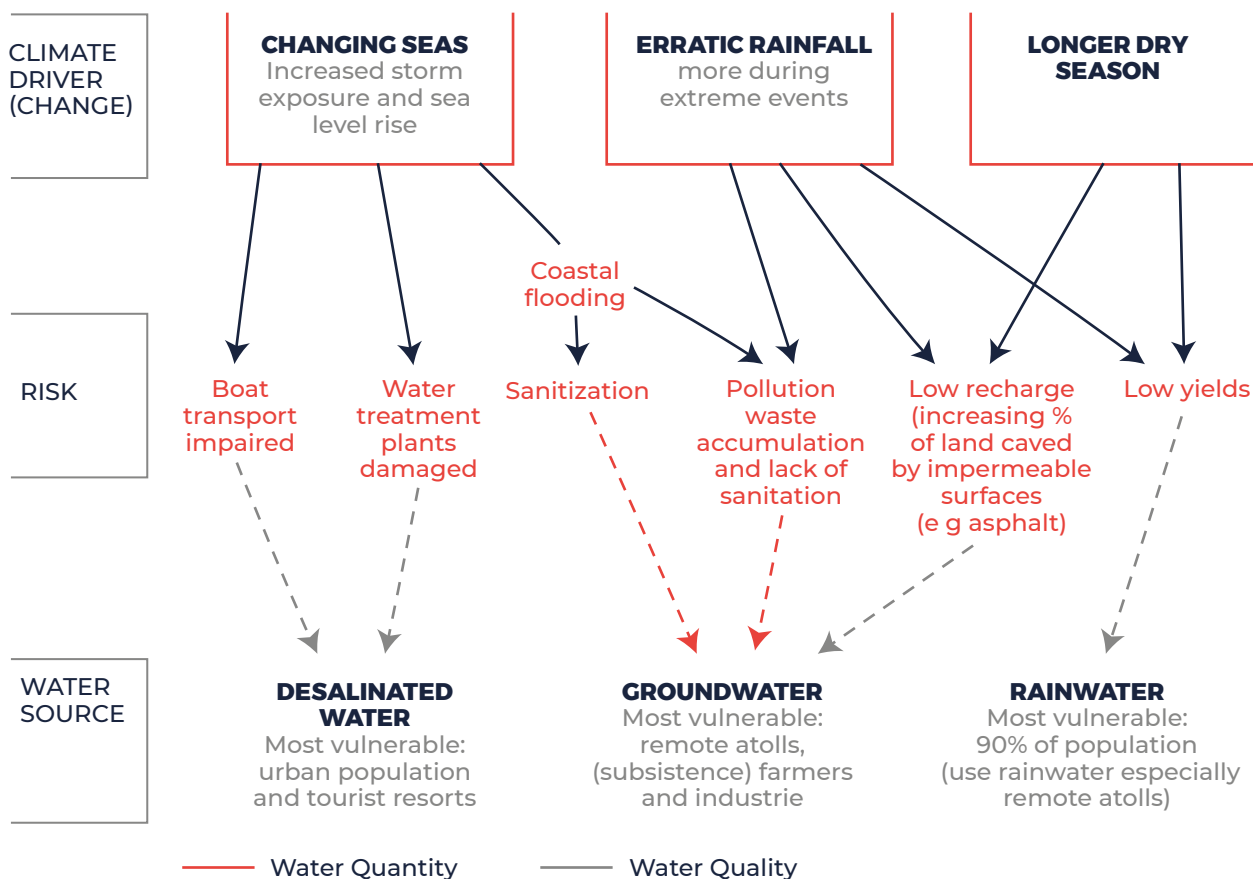


**90%**

of drinking water is from rainwater in remote islands

“Normal annual rainfall is slightly increasing, but the number of days with rain is becoming less. When rain falls we get short bursts of intense rain – unlike normal patterns. If people rely on rainwater for drinking, they will not be able to capture it easily. If they use the roofs, they need to be cleaned and maintained before. If rains happen suddenly and people do not have time to prepare, they cannot capture it. Furthermore, if the number of dry days will increase, people will face water shortages.” (KI 6)

**Figure 3.** Interactions of water scarcity and vulnerability



## Sanitation

Increasingly intense rainfall and subsequent flash flooding increases the risk of contamination of drinking water and the environment with faecal waste, as sanitation systems are poorly maintained and prone to leakage (Ibrahim, Bari and Miles 2002) (KI 4 and 6). Studies reveal that more than 90 per cent of all islands face floods annually (UNDRR 2019).



**41%**

of the population had access to safe water supply systems with metered house connections (MEE 2017)



**48%**

of the population had access to sewer networks (MEE 2017)

“The combination of floods with poor sanitation systems have led to a breakdown of sanitation lines and spills waste onto the island with flooding. There is a need for much more WASH awareness and better stormwater drainage.” (KI 4)

- **Water-borne diseases.** People in the atolls are more vulnerable to diarrhoeal diseases than in Malé and this disparity is more pronounced in children under five years of age (Republic of the Maldives 2007). Water-borne diseases of the rainy season include Cryptosporidiosis, E.coli, Giardiasis, Hepatitis A and E and Typhoid-Shigella (Moosa 2008). Acute Gastroenteritis is the main food- and water-borne disease reported in Maldives. It is a bacterial disease transmitted through the ingestion of food or drink contaminated by the faeces or urine of infected people (Ministry of Environment and Energy 2016). Cases of diarrhoea correlate to the monsoon season and spiked after floods caused by the tsunami in 2004 (Moosa 2008). As the number of days with extreme rainfall is projected to increase, there is the risk that water-borne disease may increase if there is not concomitant improvement in the sanitation facilities across the Maldives.
- **Solid waste management.** Besides sanitation challenges, solid waste management is considered one of the major environmental issues in the Maldives (Ministry of Environment and Energy 2016). The majority of waste is generated in the Malé region and transported to an artificial island to be burnt in an uncontrolled manner (Ibrahim and Mathur 2017). Severe storms, including sea surges that lead to flooding, and damaging winds threaten these waste disposal routes, and may cause the spread of waste into the sea (Peterson 2013). In most islands, waste is dumped at usually unmanaged designated sites along the shoreline with significant risks for coral reefs and human health (Jaleel *et al.* 2020). Waste disposal sites are major vector breeding sites and sources of groundwater pollution (UNDRR 2019). The Maldives also faces a serious problem of annually disposing of millions of tonnes of plastic waste, given its use of plastic mineral water bottles, single-use plastic drinking water bottles and plastic bags (UNICEF 2019). As a positive step forward, the Government of the Republic of the Maldives has pledged to phase out certain single-use plastics from mid 2021 (Republic of the Maldives 2020).

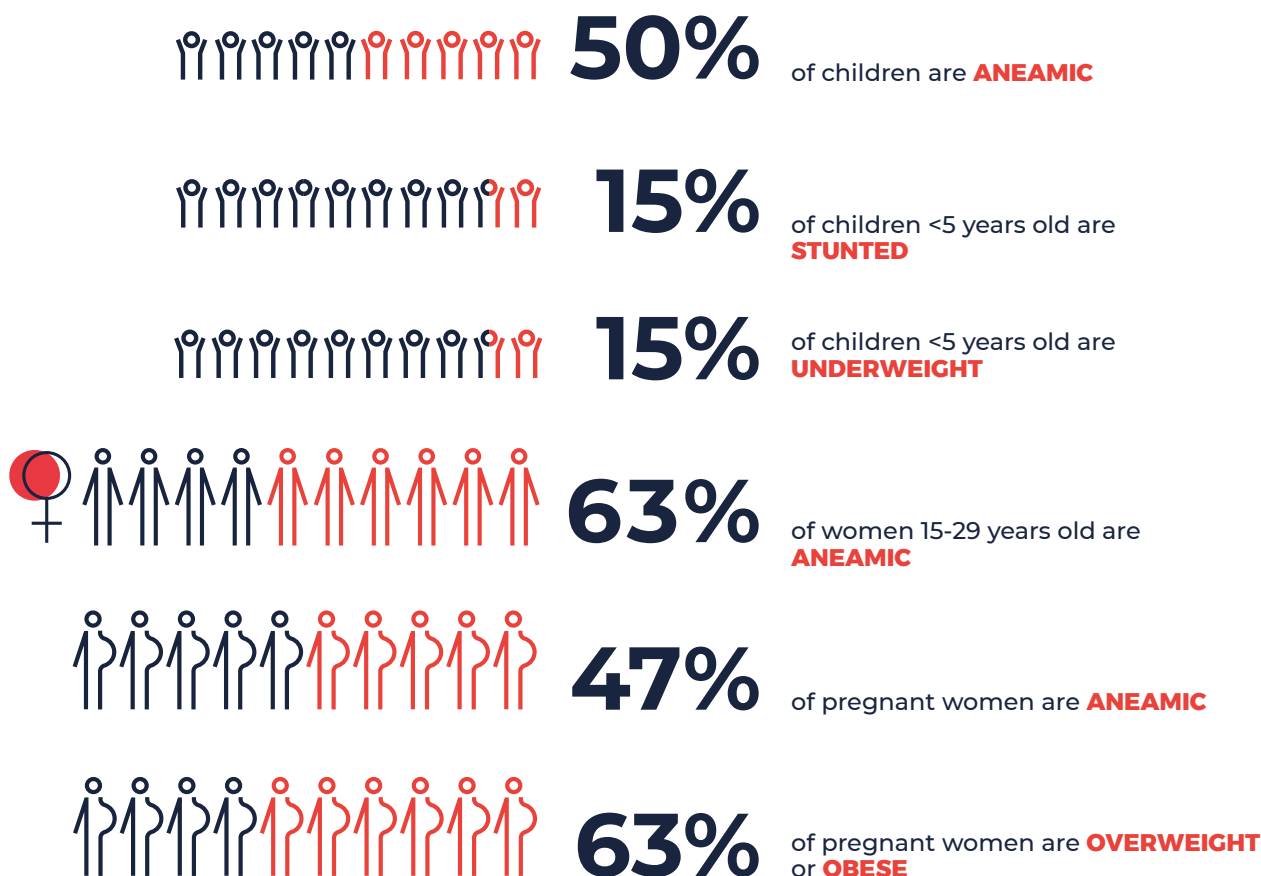
## 4.4. MALNUTRITION

The adverse effects of climate change on food security will worsen the nutritional status of people, especially in rural areas and particularly women and children. A significant proportion of children already experience stunting, wasting and being underweight (signs of acute and chronic malnutrition), especially in children aged 0–5 months and 36–47 months (Asra *et al.* 2019). The nutritional status of children and adults varies across the atolls, and the limited fresh foods available results in an inadequate intake of nutrients (Haq *et al.* 2020). In general, women’s and children’s diets contain sufficient protein and carbohydrates thanks to the consumption of tuna and starchy crops grown in home gardens. Climate change (alongside over-extraction),

however, is already affecting fish stocks and agricultural productivity in the Maldives. Diets tend to be **deficient** in iron, fat and micronutrients (especially vitamin A), which is linked to low fruit consumption (Golder *et al.* 2001; MoH 2016). Tropical vegetables and fruit, such as guava, lemon, mango, moringa and papaya, are grown in the Maldives (including in home gardens) and represent an opportunity to increase the intake of vitamins (Golder *et al.* 2001). However, warmer temperatures, decreasing rainfall but with intense showers threaten the yield of some climate-sensitive plants, whilst others (for example, moringa) are more resilient to climate variability.

“Nutrition and food security are important. Agriculture is now considered critical since Covid exposed our dependency on imported food. Nutrition-related diseases are there, low availability of fresh foods and vegetables is the main issue.” (KI 6)

Figure 4: MoH and ICF 2018; UNICEF 2019



## 4.5. DISPLACEMENT AND MIGRATION

“Migration is considered by some island nations as a solution to the rising sea levels. It is not a solution for the Maldives – we are not an island but a [country of] 1,000 islands and it is a big population to move. Is a difficult scenario to execute. Mitigating and adapting are still the preferred approaches in my opinion.” (KI 7)

The existential threat from floods, loss of coral reefs and rising sea levels mean that the Maldives could be completely submerged by 2100 – the migration of an entire population is a huge feat. The Maldives is investing in both ‘hard’ and ‘soft’ adaptation measures to deal with this. For example, desalination water plants are being promoted and water storage systems are being elevated (Republic of the Maldives 2015). The country’s government has adopted measures such as building sea-walls – as around the capital city of Malé – and large-scale land reclamation to build artificial islands like Hulhumalé, so families from vulnerable atolls can move to these urban centres (Republic of the Maldives 2007). The trade-off is between being completely submerged and living with the adverse effects of reclamation on the local natural habitat (MoHI, 2016). These ‘hard’ adaptation measures are also challenged by medium- to long-term sea-level rise, loss of biodiversity and flooding due to coastal erosion and intense rain showers. The ‘soft’ intervention plans are towards sustainable development and include improved waste management, enhancing water harvesting and promoting deep-sea tuna harvests and are detailed in Maldives’ 2019 First Biennial Update Report (Republic of the Maldives 2019).

“For Maldivians, climate change is not felt as a main reason to migrate. They associate it with access to services and employment access, so development-related internal migration.” (KI 4)

## 4.6. MENTAL HEALTH


Climate change has been shown to lead to increases in anxiety and depression (Berry *et al.* 2010) possibly related to concerns over diminishing livelihoods and physical stresses on the body (e.g. from heat). The Maldives hosts a concerning high prevalence of neuropsychiatric disorders (2.7 DALYs/1000 capita) (WHO 2009). Mental health issues are especially on the rise in Malé, where there are migrants. The 2004 tsunami that made landfall in the Maldives resulted in the widespread destruction of the islands. This forced several thousands of people to migrate to different atolls, many of whom are still internally displaced over a decade later, leading to reduced community cohesion and assimilation (UNICEF 2018). As living conditions play a large role in our mental and social health, these internally displaced people experienced

higher rates of depression and anxiety as well as a greater number of alcohol and drug disorders, as compared to their neighbours (Bonney 2007; Orłowska 2015). As people with alcohol or drug disorders have a higher risk of heat-related mortality (Cusack *et al.* 2011), and because climate change is likely to result in increased temperature in the Maldives, this finding is concerning.

As a result of the 2004 tsunami, the government of the Maldives has outlined a plan to relocate residents on low-lying islands to slightly higher islands (IOM 2008). This forced relocation plan, while well-meaning, may unintentionally increase the susceptibility of residents to the adverse mental health impacts of climate change through internal displacement.

## 4.7. CRITICAL INFRASTRUCTURE AND HEALTHCARE SYSTEMS

The proximity of critical infrastructure to the coastline makes a large proportion of the population highly vulnerable to climate-related impacts. Approximately 75 per cent of all communication infrastructure, 80 per cent of all power sources, and 90 per cent of all waste disposal sites are located within 100m of the coastline. Disruption to these critical infrastructure – through flooding, high winds or other extreme weather events – would have knock-on effects for the 184 healthcare facilities and hospitals serving communities across the 200 inhabited islands in the Maldives (Republic of the Maldives 2007).


*The story of the Maldives is ‘the story of a 100 feet’ – all critical infrastructure is within 100 feet of the ocean, including hospitals, schools and all the coastal livelihood activities.” (KI 4)*



## 4.8. SEXUAL, REPRODUCTIVE, MATERNAL, NEWBORN AND CHILD HEALTH

Climate change already is, and will continue to, affect men and women as well as boys and girls differently (IUCN 2020). Gender imbalances remain a key issue in the Maldives, resulting in unequal access to legal support, political and economic empowerment (UNDRR 2019). The Maldives ranks 123 out of the 153 countries in the Global Gender Gap Index, placing it at the lowest end of the Index, indicating significant inequality (WEF 2020). Large differences between healthcare service provision policies, quality and access exist between the atolls and Malé. In addition, female-headed households tend to be poorer compared to male-headed households, and are more at risk from the adverse effects of climate change on their livelihoods. In combination, these facts indicate that young women, pregnant women and their children may be less well placed to cope with the health impacts of climate change (UNFPA 2017).

Some key trends bear consideration with regards to sexual, reproductive, maternal, newborn and child health (SRMNCH) and climate change:

- **Sexual health:** Gender-based violence and sexual violence have been shown to increase in several countries in disaster situations (Castañeda Carney *et al.* 2020). The prevalence of intimate partner violence is high in the Maldives: 24 per cent of married women aged 15–49 experienced physical, emotional and sexual violence from their partners, with 41 per cent sustaining injuries; yet only 42 per cent of these women sought help, indicating that most women suffer in silence (MOH and ICF 2018). Whilst climate projections do not suggest a major increase in extreme events such as cyclones, the stresses posed by sea-level rise, flooding, increasing temperatures and reduced precipitation can contribute towards increased individual and community stress, whereby individuals may rely on harmful coping mechanisms such as substance abuse, which could lead to increases in violent behaviour.
- **Reproductive health:** Only 2 per cent of women aged 15–19 years are either pregnant or have already had their first child (MOH and ICF 2018). Therefore, the risk of complications from pregnancy (which is a leading cause of death amongst girls aged 15–19) is low. Furthermore, 90 per cent of women do receive antenatal care, with 95 per cent of all births happening in a healthcare facility. Overall, there has been a positive trend in access to WASH and menstrual hygiene management practices (MOH and ICF 2018). Gains in this area need to be safeguarded as water scarcity increasingly becomes an issue.
- **Maternal health:** Pregnant and lactating women may experience more dehydration and exhaustion as the number of hot days increase and water scarcity problems become more acute.
- **Newborn and child health:** The level of malnutrition amongst children is high and may be exacerbated as food insecurity increases (See section on Malnutrition).

## SUMMARY: HOW WILL HEALTH BE AFFECTED BY CLIMATE CHANGE?

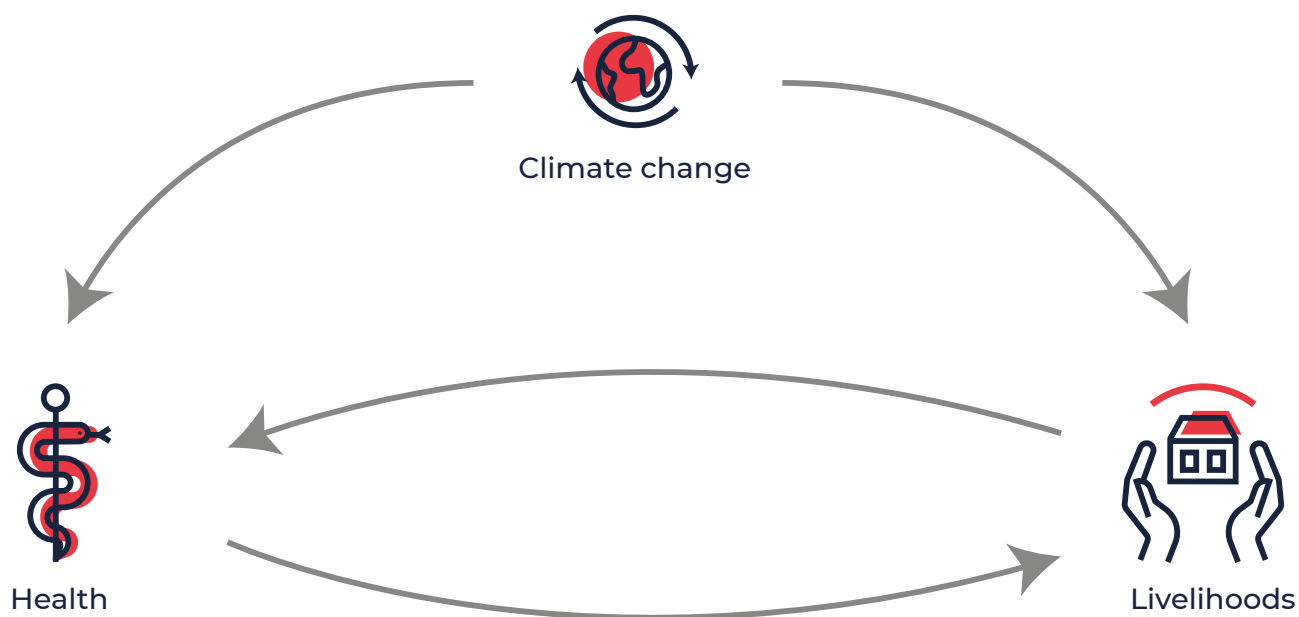
The main climate change-induced health risks relate to the re-emergence of vector-borne diseases (such as Dengue Fever and Malaria) as well as food and water security, which may increase nutrient deficiencies, dehydration and the spread of waterborne diseases. Communities in the remote atolls are particularly at risk of freshwater shortages, which may lead to existing water sources becoming contaminated with pathogens increasing the burden of diarrhoea. Rising temperatures will lead to heat exhaustion-related complications. People whose health is already compromised will be impacted more as will children who already bear a high burden of undernourishment and malnutrition, especially in the remote atolls. Inadequate health infrastructure will exacerbate the health impacts of climate change. Climate change impacts on SRMNCH will become stronger with higher incidence of stress and mental health problems, worsening malnutrition and dehydration among pregnant and lactating women, and an increase in gender-based sexual, physical and mental violence in times of climate change-induced economic stress. Sanitation and waste disposal will be further threatened by peak temperatures, a rise in extreme rainfall events and more frequent flooding.

## RECOMMENDATIONS

1. Improve and expand the surveillance systems for vector-borne diseases, factoring in the seasonal shifts in peak temperatures and wet days.
2. Continue the emphasis on WASH awareness-raising, with a focus on water conservation, enhanced sanitation and proper waste disposal.
3. Focus on community-based means to harvest rainwater and store this in safe containers.
4. Develop more nature-based solutions to heat management, both in cities and across islands.
5. Prioritize working with women and local community groups to support home gardens for higher household consumption of fruit and vegetables to combat micronutrient deficiencies.
6. Generate awareness regarding gender-based sexual, physical and mental violence due to the increasing frequency and intensity of climate change-related stressors.

## 5. LINKAGE BETWEEN CLIMATE IMPACTS ON LIVELIHOODS AND HEALTH

Climate change has the potential to affect health and livelihoods in a negative feedback loop. When climate change negatively affects livelihoods, people do not have sufficient money to ensure good health and pay for healthcare, causing a spiralling of acute or chronic conditions. Likewise, when climate change negatively affects health, people may be unable to work and thereby earn sufficient money to pay for the healthcare they need, further reducing their ability to get better. A popular idiom in South Asia says: *jaan hai to jahan hai* – “the world exists when life exists” where ‘life’ denotes a healthy, well-provisioned existence.



Increased average temperatures (certain) will affect the already hot country, resulting in 360 days per year being considered ‘hot’ by the end of the century. Over the coming decades, this has the potential to cause an increased incidence of heat exhaustion among outdoor and home-based workers, reduce overall productivity and increase healthcare costs. Coupled with food and water scarcity, due to adverse weather conditions, there is a danger that more people may be trapped in the vicious circle of low health levels and low income levels. In urban areas, migrant workers who do not have medical insurance, cannot access healthcare facilities and live in overcrowded spaces will be more at risk of heat stress and loss of wage days, deepening the crisis of already tenuous employment.

Higher temperatures also increase the chances of other health conditions (such as skin irritations, urinary tract infections) as well as dehydration (especially dangerous for pregnant or lactating women and their babies). Rising temperatures affect children and the elderly more and worsen pre-existing morbidities such as pulmonary and heart conditions, kidney disorders and psychiatric problems (van Oldenborgh *et al.* 2018). This will affect the productivity of the workforce. A higher incidence of vector-borne diseases will also impact incomes and increase healthcare costs.

Too much water due to more frequent floods and too little water due to rising water scarcity will both lead to an increase in water-borne diseases, impacting health, sanitation and the ability to work and earn an income. Too much and too little water will also impact the food security of already vulnerable populations. The northern atolls will be at greater risk because: 1) projections of peak temperatures are higher for the northern atolls compared to the southern atolls; 2) people here already have low health-related and other development levels; 3) there is a heavy reliance on climate-sensitive livelihoods; and 4) there is heavy male distress migration leading to a greater number of resource-poor female-headed households with low adaptive capacities.

Climate change-related food insecurity will worsen nutrition among vulnerable populations, especially women dependent on subsistence farming. It will also exacerbate the already high levels of malnourishment in children – again found in greater numbers in the northern islands. This can impact the livelihoods potential of the next generation. The projected slight decrease in rain in the better developed southern islands and the resulting impacts on agriculture and fisheries can create an even heavier reliance on imported food, leading to higher household-level expenditure on food. Nutrition and healthcare may be compromised in such cases.

Global climatic systems will increase sea surface temperatures (certain). Combined with overfishing and pollution, this will heavily impact people working in the fisheries sector across the supply chain. It also means reduced sources of protein, iron and nutrients. Sea surface temperature increases will also affect tourism as coral reefs die off and ocean biodiversity decreases, further reducing the incomes of people all over the islands. In recent years, there has been increased home tourism, with locals opening up their homes to tourists to earn a living. As household incomes are squeezed and the natural resource base is reduced, households may find it harder to cope and may turn increasingly to cheaper, processed unhealthy foods, thereby increasing the burden of chronic diseases such as obesity and diabetes.

An increase in extreme events, such as storms and tropical depressions (likely) can: 1) affect all sectors and especially tourism, thereby reducing the revenue and government's ability to spend on healthcare and livelihoods infrastructure; 2) threaten the health and livelihoods infrastructure that lies within 100m of the coastline; and 3) cut remote atolls off from food imports, water, medicines and healthcare services. Remote islands already store low volumes of emergency food and water as well as medicines, and extreme events can spiral populations into poverty and increased

vulnerabilities. Higher rural-urban or intra-island migration due to extreme events will leave fewer resources for adaptive livelihoods for those left behind and result in decreased mental wellbeing.

### SUMMARY: WHAT ARE THE KEY LINKAGES BETWEEN CLIMATE CHANGE, HEALTH AND LIVELIHOODS?

The four key climate change trends that will impact both health and livelihoods are sea-level rise, rising ambient and sea temperature (and thus loss of coral reefs), erratic rainfall patterns and more frequent flooding. This will adversely impact food production and adequate water supplies, especially among already at-risk populations, and impact people's health. Lower levels of health will reduce people's work potential. On the other hand, loss of livelihoods based on climate-sensitive natural resources will result in household-level food and water insecurity, leading to adverse health outcomes. Extreme events will also adversely affect livelihoods and health, including the ability to afford adequate healthcare.

### RECOMMENDATIONS

1. Recognize the organic linkages between health, WASH, livelihoods and climate change across all projects and programmes.
2. Highlight and facilitate the inclusion of the voices of at-risk groups in adaptation plans on health, WASH and livelihoods at the community level, because these groups will face challenges across all sectors.
3. Engage with planners and policy-makers to ensure that adaptation plans and interventions result in co-benefits to health, WASH and livelihoods and do not lead to a trade-off between these integrated needs of the affected communities.
4. Ensure projects and programmes in one sector yield co-benefits in another sector. For example, the promotion of climate-smart agriculture invests in nutritive food crops; interventions on vector-borne diseases include supporting communities to protect their environment through improved sanitation and heat reduction strategies.

## CITY ASSESSMENT: KULHUDHUFFUSHI ISLAND

Kulhudhuffushi island, part of Haa Dhaalu atoll in the north of the Maldives, was recently declared a city, having surpassed 10,000 inhabitants (current population: 10,399 people) (Gov, 2020). It is one of the biggest islands in the northern Maldives, acting as the administrative capital of the South Thiladhunmathi Atoll. Indeed, the majority of the island's inhabitants work in public service, as there is no agriculture nor manufacturing on the island.

Kulhudhuffushi island is an example of the challenges of urban development in a climate-sensitive island ecosystem. In 2017, one of its two mangrove areas was reclaimed to build an airport, despite adverse impacts cited by the Environmental Impact Assessment prepared by the Ministry of Housing and Infrastructure (MoHI, 2016). This included worsening of seawater quality and irreversible loss of coral habitat. There are now plans to restore part of the mangroves as the airport runway prevents seawater from entering the remaining mangrove area.<sup>2</sup> Extreme rainfall events are already a reality here, followed by floods. The island is susceptible to sea-level rise, storm surges and cyclonic winds and mangroves can be a natural protective wall for the residents of the island. There is no viable disaster mitigation plan in place yet and residents use sandbags to bolster embankments and dig channels to clear the water logged areas<sup>3</sup> in the reclaimed areas.

Mangroves are a well-established natural barrier to waves, winds and water, an important nature-based solution to disaster risk reduction and a source of livelihood especially for women. The destruction of the mangroves affected 400 women who were reliant on it for their livelihoods. As explained by a city-level informant:

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“ They were not notified of the reclamation prior and it badly affected them, they were often single mothers.” (KI 5)

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2 <https://maldivesindependent.com/environment/international-group-to-help-restore-kulhudhuffushi-mangrove-144048>

3 <https://www.hrw.org/news/2019/12/13/reckless-development-worsens-maldives-environmental-crisis>



And highlighted by another city-level informant:

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“Impacts are mostly through unsustainable development; then again, unsustainable can be related to climate change, as climate change makes any scenario more severe.” (KI 5)

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Kulhudhuffushi has experienced a shift in the rainy season alongside more frequent intense rainfall events, which cause flash flooding in the built-up urban environment (KII3; KII5). These flooding events are being monitored in the city (KII3), and are causing significant concern as explained by one key informant:

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“One island counsellor told me that back in the days, whenever it rained, he could enjoy the rain with his children. Now when it rains, he has to be on alert and he is sure he is going to get calls from flooded households. There has been a shift in what is happening in the city.” (KI 5)

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Rising cases of Dengue Fever are linked with rains and the rainy season and are of particular public health concern in the city (KII4; KII5).

The damage of the fragile ecosystem has caused other damages in the city. During the dry season, the poor quality of water in the lagoon gives a bad odour and fewer fish survive here. Higher temperatures and increased salinity are also killing the fish. Livelihoods are further impacted by the loss of a coconut husk soaking area, especially for women who earn a living by making the traditional coconut husk coir rope at home. At least 400 families depend on this livelihood. The quality of groundwater is also deteriorating (Report to the Ministry of Environment 2019).<sup>4</sup> In a bid to boost tourism, a passenger-cum-cargo ferry service, carrying 2,000 tonnes of cement along with passengers, set sail in September 2020 from the city of Kochi in Kerala, India to the Kulhudhuffushi island.

The amplification of climate change pressures due to what some people deem to be “environmental malpractice” (KI 1) in construction and other development is a general trend in the Maldives.

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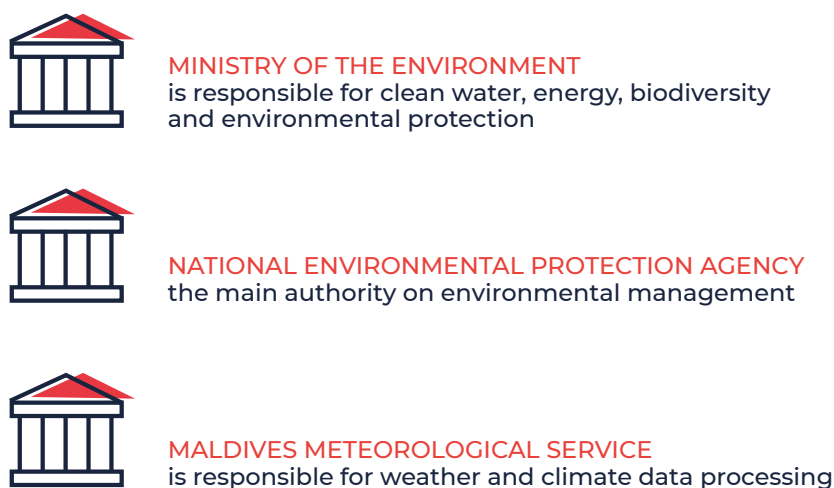
4 <https://www.environment.gov.mv/v2/wp-content/files/2019/downloads/20190627-dld-preliminary-site-survey-of-kulhudhuffushi-mangroves.pdf>

## 6. EXISTING CAPACITIES, STAKEHOLDERS AND PROGRAMMES

### 6.1. POLICY LANDSCAPE

There are several relevant climate policies and action plans as outlined in Annex B, a brief summary is provided in Table 2, below.

**Figure 4:** Institutional framework





“ We are living in an important time where these policies can really reshape the future of the Maldives” (KI 4)

**Table 2:** Brief overview of the main climate policy documents

POLICY	DESCRIPTION OF CLIMATE-LIVELIHOODS-HEALTH FOCUS
<b>National Adaptation Programme of Action (NAPA 2007)</b>	<p>This is the guiding document on <b>climate action</b> in the Maldives.</p> <p>It identifies key actions for <b>health adaptation</b>: vector control, improved access to treatment and care, awareness-raising and the promotion of healthy lifestyles.</p> <p>It also outlines key actions for <b>livelihood adaptation</b>:</p> <ul style="list-style-type: none"> <li>• Tourism: focus on climate change-policy integration in tourism planning</li> <li>• Fisheries: diversify and explore new technologies/strategies</li> <li>• Agriculture and food security: introduce new technologies for more local food production (ranks third in priorities)</li> </ul> <p>The health section only addresses vector- and water-borne diseases, while this report outlines a wider spectrum of climate-induced health issues. For livelihood-oriented action, there is limited attention on the implications for vulnerable communities and support for those who might lose their main livelihood opportunity due to climate change.</p>
<b>Intended Nationally Determined Contributions (INDC 2015)</b>	<p>This was submitted to the UNFCCC and outlines the Government's commitments to the mitigation of, and adaptation to, climate change. As the Maldives contributes minimally to global greenhouse gas emissions, it primarily considers adaptation to the adverse impacts of climate change covering food and water security, public health, infrastructure resilience, safeguarding livelihoods (tourism, fisheries, coastal protection and coral reefs, and biodiversity) as well as expanding the observation network, improving weather forecasting and strengthening early warning systems.</p>
<b>The Sustainable Development Strategic Action Plan (SAP2019–2023)</b>	<p>This is the main governance framework for development and particularly considers climate-resilient livelihoods under the “blue economy” of the Maldives, and a healthy population under its “island living strategy” (SAP 2019). This document covers:</p> <ul style="list-style-type: none"> <li>• Food security (Goal 2): Sustainable agricultural practices are considered key</li> <li>• Health (Goal 3): No mention of environmental stressors on public health, but outbreaks of vector-borne diseases such as Dengue Fever and Chikungunya are considered key priorities alongside noncommunicable diseases and lifestyle changes.</li> <li>• Resilient infrastructure (Goal 9): “Establishing disaster risk reduction and mitigation measures through innovative and sustainable methods is necessary” (Voluntary National Review (VNR) 2017)</li> <li>• Climate change action (Goal 13): Priority given to the protection of natural resources and support to critical industries (tourism and fisheries).</li> </ul> <p>In the VNR (2017), climate change and extreme weather events are emphasized as a major challenge to the achievement of the Sustainable Development Goals. In particular, beach erosion, flooding and sea-level rise are considered the main threats (VNR 2017). SAP also highlights social protection as a priority area for adaptation.</p>

POLICY	DESCRIPTION OF CLIMATE-LIVELIHOODS-HEALTH FOCUS
<b>Update of Nationally Determined Contribution (NDC 2020)</b>	<p>The updated NDC (first published in 2015) emphasizes the need for adaptation:</p> <ul style="list-style-type: none"> <li>• Agriculture and food: The development of social protection systems, research into climate-smart practices and the expansion of storage for food are all prioritized.</li> <li>• Infrastructure: Integrating climate risks into construction plans is listed.</li> <li>• Public health: Emphasizes the importance of the healthcare infrastructure as well as vector control measures; also recognizes heat stress, pollution and mental health as important impacts that require more awareness.</li> <li>• Water security: Prioritizes decentralization as well as the strengthening of policies and attention on stormwater management.</li> <li>• Adaptation measures for coral reef bBiodiversity, fisheries and tourism Focuses on knowledge production, awareness and climate-sensitive practices.</li> <li>• Early warning and systematic observation: recognizes this as an important sector that requires expansion.</li> </ul> <p>The updated NDC addresses the same sectors as its predecessor and largely corresponds to the main sectors in this report. Although the renewed commitment to adaptation is important, the measures proposed do not represent more ambitious plans. The new recognition of heat issues in the public health sector and vulnerable communities is welcomed, yet actions remain focused on vector control and health infrastructure.</p>
<b>Climate Change Bill (2020)</b>	Under review in Parliament; meetings on the content ongoing as of February 2021.
<b>Land Use Planning Bill</b>	Under review in Parliament; meetings on the content ongoing as of February 2021.

## 6.2. CAPACITIES

STRENGTHS		CHALLENGES
<b>GOVERNMENT OF THE MALDIVES</b>		
<ul style="list-style-type: none"> <li>A strong international advocate for climate change action.</li> <li>Climate and weather data gathering and processing capacity is improving quickly (KI4; KI6)</li> <li>The Maldives Meteorological Services is operating a comprehensive multi-hazard real time warning system for seismological and hydro-meteorological alerts. However, public dissemination mechanism is still very under-developed and steps are being taken to enhance early warning outreach. The forthcoming National Disaster Management Plan also has early warning early action as its mandate.</li> </ul>		<ul style="list-style-type: none"> <li>The division of adaptation responsibilities amongst government bodies is unclear (NAPA 2007; INDC 2015)</li> <li>Access to finance and government capacity remains a major issue (INDC 2015)</li> <li>Data limitations on weather and climate: only 5 measurement stations (KI 6)</li> <li>Geography: 186 islands to provide services to</li> <li>Political priorities: KI's do indicate that climate change action is a low priority domestically</li> <li>Barriers to meaningful public involvement in climate change adaptation, especially civil society organizations</li> </ul>
<b>MALDIVIAN RED CRESCENT</b>		
<ul style="list-style-type: none"> <li>10 local branches and 1500 active volunteers (including migrants)</li> <li>Leading NS in DRR work, supporting the Government of the Maldives closely</li> <li>Enthusiastic and committed youth</li> <li>Climate change is core to the 2019-2030 Strategy</li> </ul>		<ul style="list-style-type: none"> <li>Access to finance at the local community level</li> <li>Staff and volunteers could expand their technical capacity further for early actions and preparedness</li> </ul>

“Volunteers are our backbone so we are able to empower and harness the unique talents of the volunteers in their communities so they are able to have that agency for change, to build the resilience that is urgently needed” (KI1).

“Overall, I would say that we are a young NS with an enthusiastic young group and governing board with the same mind and thoughts. We promote a learning culture, a results-based framework and we want to work to make better decisions. We want to advocate on these issues and find solutions. Our strategy will always be to facilitate the process of resilience.” (KI 4)



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## 7. RECOMMENDATIONS AND OPPORTUNITIES

### **RECOMMENDATION 1: Build public awareness and knowledge on climate change trends and recurrent climate-related disasters**

**Gap:** Lack of adequate resilience to the increasing recurrence of rapid-onset climate-related disasters such as storm surges, cyclonic winds, intense rainfall and coastal floods is threatening developmental gains for the public (UNDRR 2019). Key informants confirmed that small-scale floods have been occurring more frequently, damaging houses, home gardens and workshops (KI4; KI6).

**Opportunity for action:** 1) build the capacities of staff and volunteers on linking climate knowledge and information to impacts on health, WASH, DRR and livelihoods; 2) adopt these messages as part of sector-specific programmes and projects to enable people to take action to build resilience; 3) identify communities and groups of people who are most vulnerable and exposed to these recurring disasters through participative climate-responsive vulnerability capacity assessments –these vulnerable groups may be different socio-economic groups of people, residents of remote atolls, those not covered by public safety nets or lacking access to remittances; 4) prioritize groups facing multiple vulnerabilities, for example, resource poor female-headed households near the shoreline in northern atolls; and 5) build evidence with data, impacts and best practices to inform disaster and adaptation related plans, policies and laws as well as social protection programmes when engaging with public authorities and planners.

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“We should make weather-conscious decisions. The topics are very technical, the public does not need to understand the jargon. We need to be downscaling climate science and apply it to the local context.” (KI 7)

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## RECOMMENDATION 2: Explore innovative, low cost, nature-based ways to manage heat

**Gap:** On an already hot island, increasing average temperatures (certain) will have a cascading effect across all sectors and walks of life. Informants indicate that heat effects remain under-explored in the Maldives (KI1; KI4; KI6). This needs to be addressed in cities and rural areas.

**Opportunity for action:** 1) build knowledge and capacities of staff on how heat affects health, sanitation and the livelihoods of vulnerable and exposed populations in cities and rural islands; 2) collaborate with weather services, disaster authorities and local administration to disseminate impact-based early warning on peak temperatures affecting health, WASH, DRR and livelihoods; 3) pilot and promote innovative low-cost and nature-based solutions on how to keep yourself and your environment cool – these could include staging flash mobs on heatwave messaging, providing adequate drinking water to vulnerable and exposed people, and improving the local climate by planting mangroves, expanding home gardens, advocating for more shaded public spaces and promoting ‘green’ roofs; 4) expand health, WASH and livelihoods programmes to factor in heat impacts and appropriate actions; and 5) collaborate with local authorities to help create island-wide comprehensive Heat Action Plans.

“People do not really associate climate change with health. In Maldives we throw ‘climate change’ around a lot, the larger population does not understand the complexity of climate change. The climate-health link is something we do not think about, but it does have a lot of impact. Building knowledge and advocacy on the role of the environment in our health is one of the main areas we should focus on, which can lead to behavioural change and policy changes.” (KI 2)



### **RECOMMENDATION 3: Pilot and promote more integrated water resource management, especially in remote locations for gains in health, WASH, DRR and livelihoods**

**Gap:** Rainfall is projected to be uneven across the country, more erratic and with a higher frequency of extreme rainfall events. Combined with accelerating sea-level rise, saltwater intrusion and limited groundwater there is an urgency to establish locally appropriate integrated water resource management (IWRM) projects.

**Opportunity for action:** 1) include water security as part of programmes on health, WASH, DRR and livelihoods; 2) collaborate with authorities to pilot and promote different strategies for IWRM, which includes rainwater harvesting, bioretention (i.e. rain gardens) and water conservation at the household and community levels to increase local resilience to climate shocks; 3) prioritize the 3Rs – reduce, reuse, recycle – in all messaging and sector-specific implementation programmes; 4) promote ways of storing water safely to improve sanitation and hygiene; and 5) address water security in interventions on livelihoods and DRR which require the ‘greening’ of coastlines, farms and home gardens.

## **RECOMMENDATION 4: Home gardens and coastal protection for improving access to micronutrients and securing livelihoods**

**Gap:** Research and action on exacerbated vulnerabilities related to food and nutritional security are limited. Agriculture and fisheries will face spiralling shocks and stresses due climate change, including extreme events. Despite an overall trend since 2001 of the decreasing prevalence of malnutrition and undernourishment, the 2004 tsunami was associated with a spike in undernourishment in the Maldives (FAOSTAT 2018 cited in Global Nutrition Report) indicating the vulnerability of the system to disruptions or shocks. Government initiatives towards climate-smart agriculture, protection and the rehabilitation of mangrove forests and coral reefs are yet to be strengthened.

**Opportunity for action:** 1) link health and climate-smart livelihood interventions by supporting communities to grow and consume tropical fruit and vegetables to increase their intake of vitamins (Golder *et al.* 2001); 2) harness, promote and scale-up women's traditional knowledge on low-cost, varied and nutritive home-based recipes; 3) facilitate access to climate-smart farming practices, by firstly promoting endemic superfood species (such as breadfruit, moringa and screwpine), and secondly introducing salt-resilient seeds and adaptive farming practices such as altering the agriculture calendar, agroforestry and vertical farming; and 4) collaborate with authorities and research institutes, such as the Maldives Marine Research Institute, to involve communities in initiatives to protect and rehabilitate coral reefs and mangroves for augmenting marine life.

## RECOMMENDATION 5: Strengthen climate change policy in partnership with the Government

**Gap:** The Maldivian Government's Strategic Action Plan (SAP), endorsed in 2019, is a blueprint of the country's National Adaptation Programme of Action with a focus on 'building resilient communities' by working with different stakeholders to achieve results. This activity needs to be locally driven, participative and inclusive.

**Opportunity for action:** 1) proactively collaborate with relevant government authorities on SAP to help identify the medium- to long-term adaptation needs of at-risk community groups in cities and rural areas; 2) facilitate community groups to be represented at decision-making tables to influence plans and strategies to address their needs; 3) ensure the implementation of adaptation programmes at island and national level are participatory and inclusive; 4) engage with planners and policy-makers to highlight health–livelihoods–climate change linkages to ensure people's health and livelihoods are not affected by changes in temperature and precipitation; 5) share data, best practices and ground knowledge with planners and implementing authorities to contribute to the better governance of adaptation interventions; 6) leverage government's development funds to help build local resilience among communities, especially at-risk groups; 7) facilitate the integration of adaptation measures into social protection schemes to help vulnerable and exposed populations; 8) support communities to access climate finance to help them adapt to climate vagaries and build local resilience; and 9) facilitate the better legal protection of migrants where their vulnerabilities are deepened due to climate change impacts.

“MRC has a role to play in policy-making – we are already commenting on legislation that is climate-related. Lobbying and policy-making is a different approach that is important too.” (KI 7)

## **RECOMMENDATION 6: Scale-up climate-smart programming which adopts a multi-hazard early warning early action approach to preparedness**

**Gap:** Available information and knowledge about climate projections and climate change trends are not in the public domain. Early warning and early action approaches are limited in the Maldives, especially when it comes to robust mechanisms for public dissemination of weather forecasts and alerts (UNDRR 2019).

**Opportunity for action:** 1) adopt a climate-smart programming approach, especially for climate-sensitive diseases e.g. vector-, water- and food-borne diseases, by systematically integrating medium- and long-term climate information to anticipate, prepare for and reduce the health impacts in high-risk rural and urban areas; 2) invest in anticipation, or Early Warning Early Action (EWEA), by collaborating with the national hydro-meteorology services, disaster management authorities and local administration to train and scale-up EWEA through Red Crescent volunteers; 3) prioritize a multi-hazard early warning early action approach and risk-informed early action programmes, such as forecast-based action/financing; 4) use accessible secondary literature on climate projections and assess climate risks using toolkits available within the International Federation of Red Cross (IFRC) and Red Crescent Societies and the Red Cross Red Crescent Climate Centre; and 5) facilitate and support vulnerable communities to access public and private finance to help them reduce climate change impacts on their health and livelihoods.





## REFERENCES

- Ahmed, Mahfuz, and Suphachol Suphachalasai. 2014. 'Assessing the Costs of Climate Change and Adaptation in South Asia'. Asian Development Bank.
- Anthoff, David, Robert J. Nicholls, and Richard S. J. Tol. 2010. 'The Economic Impact of Substantial Sea-Level Rise'. *Mitigation and Adaptation Strategies for Global Change* 15 (4): 321–35. <https://doi.org/10.1007/s11027-010-9220-7>.
- Asian Disaster Reduction Centre. 2005. 'Report on the Assessment of Early Warning Systems in the Maldives'. Asian Disaster Reduction Centre. [https://www.preventionweb.net/files/14228\\_14228AssessmentofEWSinMaldivesfinal.pdf](https://www.preventionweb.net/files/14228_14228AssessmentofEWSinMaldivesfinal.pdf).
- Asra, Mariyam, Xiaofang Lin, Ijaz Ul Haq, Asfia Banu Pasha, Yingying Shao, Rui Qin, Manli Hu, Ye Ding, and Zhixu Wang. 2020. 'Malnutrition Associated Factors on Children under 5 Years Old in Lhaviyani Atoll, Maldives'. *Journal of Biomedical Research* 34 (4): 301–8. <https://doi.org/10.7555/JBR.33.20180141>.
- Bailey, Ryan T., Abedalrazq Khalil, and Vansa Chatikavanij. 2015. 'Estimating Current and Future Groundwater Resources of the Maldives'. *JAWRA Journal of the American Water Resources Association* 51 (1): 112–22. <https://doi.org/10.1111/jawr.12236>.
- Banks, Lena Morgon, Shaffa Hameed, Sofoora Kawsar Usman, and Hannah Kuper. 2020. 'No One Left Behind? Comparing Poverty and Deprivation between People with and without Disabilities in the Maldives'. *Sustainability* 12 (5): 2066. <https://doi.org/10.3390/su12052066>.
- Berry, Helen Louise, Kathryn Bowen, and Tord Kjellstrom. 2010. 'Climate Change and Mental Health: A Causal Pathways Framework'. *International Journal of Public Health* 55 (2): 123–32. <https://doi.org/10.1007/s00038-009-0112-0>.
- Bonnefoy, Xavier. 2007. 'Inadequate Housing and Health: An Overview'. *International Journal of Environment and Pollution* 30 (3–4): 411–29. <https://doi.org/10.1504/IJEP.2007.014819>.
- Castañeda Carney, Itza, Laura Sabater, Cate Owren, and A.E. Boyer. 2020. *Gender-Based Violence and Environment Linkages: The Violence of Inequality*. Edited by Jamie Wen. IUCN, International Union for Conservation of Nature. <https://doi.org/10.2305/IUCN.CH.2020.03.en>.
- Chambers, R, and G Conway. 1992. *Sustainable Rural Livelihoods: Practical Concepts for the 21st Century*. UK: Institute of Development Studies. <https://opendocs.ids.ac.uk/opendocs/bitstream/handle/20.500.12413/775/Dp296.pdf?sequence=1ANT>.



- Cusack, Lynette, Charlotte de Crespigny, and Peter Athanasos. 2011. 'Heatwaves and Their Impact on People with Alcohol, Drug and Mental Health Conditions: A Discussion Paper on Clinical Practice Considerations'. *Journal of Advanced Nursing* 67 (4): 915–22. <https://doi.org/10.1111/j.1365-2648.2010.05551.x>.
- Das, R, L Granat, C Leck, PS Praveen, and H Rodhe. 2010. 'Chemical Composition of Rainwater at Maldives Climate Observatory at Hanimaadhoo (MCOH)'. MCOH.
- Ellis, F. 2003. 'A Livelihoods Approach to Migration and Poverty Reduction.' Overseas Development Group.
- FAO. 2019. 'Country Gender Assessment of Agriculture and the Rural Sector in Maldives'. Male, Maldives: Food and Agriculture Organization of the United Nations (FAO).
- Golder, Andrea M., Jürgen G. Erhardt, Veronika Scherbaum, Mohamed Saeed, Hans K. Biesalski, and Peter Fürst. 2001. 'Dietary Intake and Nutritional Status of Women and Pre-School Children in the Republic of the Maldives'. *Public Health Nutrition* 4 (3): 773–80. <https://doi.org/10.1079/PHN2000101>.
- Haq, Ijaz Ul, Mariyam Asra, Qing Tian, Bilal Ahmed, Nadar Khan, Muhammad Ijaz Ahmad, Chenming Ji, and Jianguang Luo. 2020. 'Association of Infant and Child Feeding Index with Undernutrition in Children Aged 6-59 Months: A Cross-Sectional Study in the Maldives'. *The American Journal of Tropical Medicine and Hygiene* 103 (1): 515–19. <https://doi.org/10.4269/ajtmh.19-0972>.
- Hosterman, Heather, and Joel Smith. 2015. 'Economic Costs and Benefits of Climate Change Impacts and Adaptation to the Maldives Tourism Industry - Increasing Climate Change Resilience of Maldives through Adaptation in the Tourism Sector'. Ministry of Tourism.
- HRW. 2020. 'Maldives: Covid-19 Exposes Abuse of Migrants'. 2020. <https://www.hrw.org/news/2020/08/25/maldives-covid-19-exposes-abuse-migrants>.
- Ibrahim, HE Abdulla Nazim, and Arvind Mathur. 2017. 'Climate Change and Health in Maldives: Protecting Our Common Future'. *WHO South-East Asia Journal of Public Health* 6 (2): 1. <https://doi.org/10.4103/2224-3151.213785>.
- Ibrahim, Shaheedha Adam, Mohamed Rasheed Bari, and Leon Miles. 2002. 'Water Resources Management in Maldives with an Emphasis on Desalination'. Male, Maldives: Maldives Water and Sanitation Authority.
- ILO. 2016. 'The ILO in Maldives'. International Labour Organisation. [https://www.ilo.org/wcmsp5/groups/public/---asia/---ro-bangkok/---ilo-colombo/documents/publication/wcms\\_366559.pdf](https://www.ilo.org/wcmsp5/groups/public/---asia/---ro-bangkok/---ilo-colombo/documents/publication/wcms_366559.pdf).

- IOM. 2008. 'Migration and Climate'. IOM Migration Research Series. Geneva, Switzerland: International Organization for Migration.
- . 2018. 'Migration in Maldives: A Country Profile 2018'. International Organization for Migration. <https://publications.iom.int/books/migration-maldives-country-profile-2018>.
- Jaleel, Mohamed Ibrahim, Shaheeda Adam Ibrahim, Afsal Hussain, Mohamed Mustafa, and Assela Pathirana. 2020. 'A Screening Approach for Assessing Groundwater Quality for Consumption in Small Islands: Case Study of 45 Inhabited Islands in the Maldives'. *Water* 12 (8): 2209. <https://doi.org/10.3390/w12082209>.
- McMichael, Celia. 2015. 'Climate Change-Related Migration and Infectious Disease'. *Virulence* 6 (6): 548–53. <https://doi.org/10.1080/21505594.2015.1021539>.
- McNamara, Karen E., Rachel Clissold, Annah Piggot-McKellar, Lisa Buggy, and Aishath Azfa. 2019. 'What Is Shaping Vulnerability to Climate Change? The Case of Laamu Atoll, Maldives'. *Island Studies Journal* 14 (1): 81–100. <https://doi.org/10.24043/isj.67>.
- Ministry of Environment and Energy. 2016. 'Second National Communication of Maldives to the United Nations Framework Convention on Climate Change'. [https://unfccc.int/sites/default/files/resource/SNC%20PDF\\_Resubmission.pdf](https://unfccc.int/sites/default/files/resource/SNC%20PDF_Resubmission.pdf).
- MMS. 2020. 'Climate of Maldives, Maldives Meteorological Service'. 2020. <https://www.meteorology.gov.mv/climateofmaldives>.
- MoH. 2016. 'Integrated National Nutrition Strategic Plan 2013-2017'. Male, Maldives: Ministry of Health, Republic of Maldives. <http://extwprlegs1.fao.org/docs/pdf/MDV177452.pdf>.
- MOH and ICF. 2018. 'Maldives Demographic and Health Survey (2016-17 MDHS)'.
- Moosa, S. 2008. 'Adaptation Measures for Human Health in Response to Climate Change in Maldives'. In *REGIONAL HEALTH FORUM WHO South-East Asia Region*. Vol. 12. WHO Regional Health Forum South-East Asia. <https://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.475.3878&rep=rep1&type=pdf#page=57>.
- NBS. 2020. 'National Bureau of Statistics, Republic of Maldives'. 2020. <http://statisticsmaldives.gov.mv/>.



- Olsson, L, M Opondo, P Tschakert, A Agrawal, SH Eriksen, S Ma, LN Oerch, and SA Zakieldeem. 2014. 'Livelihoods and Poverty'. In *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*, 793–832. Cambridge, United Kingdom and New York, NY, USA: Cambridge University Press. [https://www.ipcc.ch/site/assets/uploads/2018/02/WGIIAR5-Chap13\\_FINAL.pdf](https://www.ipcc.ch/site/assets/uploads/2018/02/WGIIAR5-Chap13_FINAL.pdf).
- Oppenheimer, Glavovic, Jochen Hinkel, van de Wal, Alexandre, Amr Abd-Elgawad, Cai, et al. 2019. 'Sea Level Rise and Implications for Low Lying Islands, Coasts and Communities'. In *IPCC Special Report on the Ocean and Cryosphere in a Changing Climate*.
- Orłowska, Justyna. 2015. 'Climate Change and Its Effect on Children'. UNICEF. <https://www.unicef.org/maldives/media/291/file/Climate%20Change%20and%20its%20Effect%20on%20Children.pdf>.
- Peterson, Charles. 2013. 'Assessment of Solid Waste Management Practices and Its Vulnerability to Climate Risks in Maldives Tourism Sector'. Male, Maldives: Ministry of Tourism, Arts and Culture. [https://archive.tourism.gov.mv/downloads/tap/2012/reports/Assessment\\_of\\_solid\\_waste\\_management\\_practices\\_and\\_its\\_vulnerability\\_to\\_climate\\_risks\\_in\\_maldives\\_tourism\\_sector.pdf](https://archive.tourism.gov.mv/downloads/tap/2012/reports/Assessment_of_solid_waste_management_practices_and_its_vulnerability_to_climate_risks_in_maldives_tourism_sector.pdf).
- Republic of the Maldives. 2007. 'National Adaptation Programme of Action (NAPA) Maldives'. Male: Ministry of Environment, Energy and Water. <https://unfccc.int/resource/docs/napa/mdv01.pdf>.
- . 2011. 'Maldives Strategic National Action Plan for Disaster Risk Reduction and Climate Change Adaptation 2010-2020'. Provisional Draft. The Republic of the Maldives. [https://www.preventionweb.net/files/60595\\_maldivesstrategicnationalactionplan.pdf](https://www.preventionweb.net/files/60595_maldivesstrategicnationalactionplan.pdf).
- . 2015. 'Maldives' Intended Nationally Determined Contributions (INDC)'. Ministry of Environment and Energy. <https://policy.asiapacificenergy.org/sites/default/files/Maldives%20INDC%20.pdf>.
- . 2019. 'Maldives First Biennial Update Report'. The Republic of the Maldives. <https://www.environment.gov.mv/v2/en/download/9906>.
- . 2020. 'President Declares List of Single-Use Plastics Prohibited to Import from June 1, 2021'. The President's Office. 2020. <http://presidency.gov.mv/Press/Article/24211>.

- Stojanov, Robert, Barbora Duží, Ilan Kelman, Daniel Němec, and David Procházka. 2017. 'Local Perceptions of Climate Change Impacts and Migration Patterns in Malé, Maldives'. *The Geographical Journal* 183 (4): 370–85. <https://doi.org/10.1111/geoj.12177>.
- UN. 2020. 'Addressing the Socio-Economic Impact of COVID-19 on the Maldives. Reducing the Impact of the Health Crisis on the Most Vulnerable and Sustaining Progress towards the 2030 Agenda'. Male: United Nations in the Maldives. [https://www.undp.org/content/dam/undp/library/covid19/Maldives\\_Socio-Economic-Impact-Analysis.pdf](https://www.undp.org/content/dam/undp/library/covid19/Maldives_Socio-Economic-Impact-Analysis.pdf).
- UN HABITAT. 2015. 'Urbanization and Climate Change in Small Island Developing States'. [https://sustainabledevelopment.un.org/content/documents/2169\(UN-Habitat,%202015\)%20SIDS\\_Urbanization.pdf](https://sustainabledevelopment.un.org/content/documents/2169(UN-Habitat,%202015)%20SIDS_Urbanization.pdf).
- UNDP. 2006. 'Developing a Disaster Risk Profile for Maldives'. [https://www.preventionweb.net/files/11145\\_MaldivesDisasterRiskProfileFinalRep.pdf](https://www.preventionweb.net/files/11145_MaldivesDisasterRiskProfileFinalRep.pdf).
- . 2007. 'Detailed Island Risk Assessment in Maldives (Final Report) Volume I: Executive Summary'. <http://www.ndmc.gov.mv/assets/Uploads/DIRAM-Vol1-Executive-Summary-V2.pdf>.
- . 2013. 'COUNTRY REPORT CLIMATE RISK MANAGEMENT IN MALDIVES: Regional Integrated Multi-Hazard Early Warning System for Africa and Asia (RIMES)'.
- . 2016. 'Protecting (Scarce) Fresh Water in the Maldives'. <https://www.undp.org/content/undp/en/home/blog/2016/4/15/Protecting-scarce-fresh-water-in-the-Maldives.html>.
- UNDRR. 2015. 'Sendai Framework for Disaster Risk Reduction 2015 - 2030'. Geneva.
- . 2019. 'Disaster Risk Reduction in Republic of Maldives: Status Report 2019'. Bangkok, Thailand: United Nations Office for Disaster Risk Reduction (UNDRR), Regional Office for Asia and the Pacific. [https://reliefweb.int/sites/reliefweb.int/files/resources/68230\\_4maldivesdrmstatusreport.pdf](https://reliefweb.int/sites/reliefweb.int/files/resources/68230_4maldivesdrmstatusreport.pdf).
- UNFPA. 2017. 'Sexual and Reproductive Health and Rights in Maldives Policy Briefing'. Policy Brief. United Nations Population fund (UNFPA). [https://reliefweb.int/sites/reliefweb.int/files/resources/Sexual%20and%20Reproductive%20Health%20and%20Rights%20in%20Maldives\\_Policy%20Briefing%20FINAL.pdf](https://reliefweb.int/sites/reliefweb.int/files/resources/Sexual%20and%20Reproductive%20Health%20and%20Rights%20in%20Maldives_Policy%20Briefing%20FINAL.pdf).
- UNICEF. 2018. 'Climate Change and Its Effect on Children'. 2018. <https://www.unicef.org/maldives/reports/climate-change-and-its-effect-children>.

- . 2019. 'Ending Plastic Pollution: The FenFulhi Launch Events in Addu City and Fuvahmulah Island'. 2019. <https://www.unicef.org/maldives/stories/ending-plastic-pollution-fenfulhi-launch-events-addu-city-and-fuvahmulah-island>.
- WEF. 2020. 'Global Gender Gap Repprt 2020'. World Economic Forum. [http://www3.weforum.org/docs/WEF\\_GGGR\\_2020.pdf](http://www3.weforum.org/docs/WEF_GGGR_2020.pdf).
- WHO. 2009. 'Country Profile of Environmental Burden of Disease Maldives'. Geneva: World Health Organization (WHO). [https://www.who.int/quantifying\\_ehimpacts/national/countryprofile/maldives-rev.pdf?ua=1](https://www.who.int/quantifying_ehimpacts/national/countryprofile/maldives-rev.pdf?ua=1).
- . 2015. 'Maldives Climate and Health Country Profile'. World Health Organization (WHO). [https://www.who.int/docs/default-source/searo/wsh-och-searo/mav-c-h-profile.pdf?sfvrsn=9fded0f7\\_2](https://www.who.int/docs/default-source/searo/wsh-och-searo/mav-c-h-profile.pdf?sfvrsn=9fded0f7_2).
- . 2018. 'Maldives-WHO Country Cooperation Strategy 2018-2022'. Male: World Health Organization, Country Office for Maldives;
- World Bank. 2015. 'Maldives Systematic Country Diagnostic'. Colombo. <http://documents1.worldbank.org/curated/en/340571467992519800/pdf/102283-SCD-P152631-PUBLIC-Box394829B-Maldives-SCD-non-board-version-23-10-2015.pdf>.
- . 2020. 'Climate Change Knowledge Portal | for Global Climate Data and Information - Maldives'. 2020. <https://climateknowledgeportal.worldbank.org/country/maldives/climate-data-projections?variable=pr>.

# ANNEX A

## NEAR-TERM CLIMATE PROJECTIONS MALDIVES (2020–2039)<sup>1</sup>

**Basic climatology.** There is a year-round increase in monthly temperature projected of 0.55–0.88°C in the next 20 years, depending on the global emission scenario. The monsoon season is typically from May–October in Maldives, yet in the next 20 years there may be a delay in this rainfall, as May (and June under RCP2.6) rainfall decreases. Total monsoon rains may increase, as the other months' rainfall is projected to increase.

**Climatic extremes.** It should be emphasized that trends in extreme rainfall events are very difficult to establish due to the small landmass of the Maldivian islands compared to the surrounding sea. This also complicates early warning systems for extreme rainfall in the Maldives. Trends for the relative amount of rain falling during 'very wet days' as well as the frequency of rainfall events with more than 20mm and 50mm precipitation are inconclusive. The only indicator with a clear trend is the five-day rainfall intensity, where both RCP2.6 and RCP8.5 project a slight increase. Furthermore, the 10- and 25-year return level events are projected to see a slight increase in intensity under both RCP2.6 and RCP8.5.

The Maldivian climate is projected to become hotter already in the next 20 years; maximum temperatures shift upwards by 0.72°C (0.36–1.4°C likely range; RCP2.6) to 0.87°C (0.51–1.61°C likely range; RCP8.5). However, there are no projections available for hot days and nights due to dataset limitations.

**Agricultural indicators.** While many farmers and home gardeners depend on groundwater, rainwater is a crucial water source as well. Both RCP2.6 and RCP8.5 predict that dry spells will increase in duration slightly while wet spells will become shorter in the next 20 years. On the other hand, the Mean Annual Drought Index is increasing by a mean 0.20 (RCP2.6) to 0.04 SPEI (RCP8.5), which does suggest a very slight shift to wetter conditions. Again, this is not a clear and established trend. Severe drought likelihood is increasing by 5 per cent under both RCP2.6 and RCP8.5 – although this, too, should be interpreted with caution given the uncertain rainfall projections.

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<sup>1</sup> Projections in this Annex are based on the AR5 CMIP5 dataset used by the IPCC, sourced from the World Bank Climate Portal – supplied under the Creative Commons 4.0 license. For more information, please refer to the Methodology section.

## SUMMARY OF KEY POINTS:

1. There is **high certainty that temperatures will continue to rise** in the Maldives, which already has a hot climate. This will result in a significant increase in the mean temperature regimen and the number of hot days in the near-term.
2. **For precipitation (rainfall) and all related indicators (agricultural, extreme events etc.) there is very high uncertainty and limited data available** which lack a definitive direction/trend. Due to high uncertainty about precipitation trends, we know little about short-term changes in rainwater availability, extreme rainfall exposure and potential drought risk. Planning activities should consider a wide range of potential future water outcomes, rather than assuming predictions of one model or assessment as certain.

# ANNEX B

## SUMMARY IMPACTS OF CLIMATE CHANGE ON LIVELIHOODS IN THE MALDIVES

CLIMATE CHANGE TRENDS	PHYSICAL IMPACT	IMPACTS ON RURAL LIVELIHOODS <i>MALE/FEMALE (M/F)</i>	IMPACTS ON URBAN LIVELIHOODS <i>MALE/FEMALE (M/F)</i>
Sea-level rise	Coastal erosion and flooding increases	Tourism (M/F) Boatbuilding (M) Houses in remote atolls (M/F, F livelihoods)	Tourism industry (M) Commercial fish trading (M)
	Coastal inundation: sea-level rise of 0.84 metres by the end of the century could see islands completely underwater	Loss of habitat (M/F)	Loss of habitat (M/F)
	Salinization of groundwater and agricultural fields	Agriculture yields decline, impacting related sectors (vendors (often F), workers, transport) Long-term degradation Water stress and quality decline may become an impairment to capacity to work	Increasing reliance on desalinated water, may be vulnerable to impacts from disasters (loss of alternatives) and more expensive

CLIMATE CHANGE TRENDS	PHYSICAL IMPACT	IMPACTS ON RURAL LIVELIHOODS <i>MALE/FEMALE (M/F)</i>	IMPACTS ON URBAN LIVELIHOODS <i>MALE/FEMALE (M/F)</i>
<b>Ocean acidification continues</b>	Fishstock loss/change	Fisheries and related industries damaged (M)  Tourism industry: loss of marine biodiversity may decrease appeal to tourists, leading to a loss of jobs in the marine excursion sector and reduced spending of tourists on the islands	Fish traders, processing and related industries.
<b>Ocean warming (increasing sea surface temperature SST)</b>	Coral bleaching	Aquatic resources threatened. Bait fisheries and related industries impacted as coral biodiversity declines  Tourism industry	Vending and trade of coastal products
	Changes in tuna feeding grounds	Fisheries: already tuna catch decline (pole and line fishermen), with implications for food security in rural areas	Limited availability of fish protein at urban markets
<b>More erratic precipitation</b>	Soil: water deficit/irrigation systems needed/less groundwater recharge	Agricultural yields lower (M mainly commercial, F subsistence activities)	Lower groundwater table and unpredictable rainwater harvesting yields – increased costs of water and health implications for all
	Decrease in rainy season precipitation (May–July)	Local water stress more frequent and prolonged	
	Slight increase in dry season rainfall (Oct–Dec) and long-term trend (2050–2080) of increased rainfall	Potentially positive impacts on drinking and agricultural water security	Idem
<b>Increased number of days with extreme rainfall</b>	Flash floods and longer term floods, especially in southern islands	Damage to housing, workplaces, agriculture, home gardens, fishing gear and ecosystems.  Potential pollution of water resources	Idem

CLIMATE CHANGE TRENDS	PHYSICAL IMPACT	IMPACTS ON RURAL LIVELIHOODS <i>MALE/FEMALE (M/F)</i>	IMPACTS ON URBAN LIVELIHOODS <i>MALE/FEMALE (M/F)</i>
<b>Higher temperatures (increasing trend, does vary across the atolls). Increased annual temperatures over all regions, that may reach levels of “extreme temperature” for most days of the year</b>	High outside temperature	Workers’ capacity impaired, especially outside and in settlements without air-conditioning  Heat stress effects on livestock, homegardens and water and food quality.	Work capacity impaired – impacts on home-based workers (F), street vendors (M/F) and construction workers (M)
	Increased evapotranspiration	Agricultural yields reduced due to soil water deficit	Stress on basic amenities – water and sanitation  Health impacts
<b>Storms and cyclones more frequent and intense</b>  <b>Increased frequency in storms and stronger wind (especially in northern regions)</b>  <b>Increased cyclonic disturbances or tropical cyclones</b>	Floods from tidal surges and swells	Inundation of fields and villages, damaging workplaces and livelihoods  Damage to critical infrastructure  Transport sector hindered cutting off access to markets for rural communities	Damage to physical assets – critical infrastructure and market-traded goods



# ANNEX C

## EXISTING POLICIES AND STRATEGIES

The table below provides an overview of existing policy and strategy relating to climate change, and readers are encouraged to read the specific documents.

<b>CLIMATE CHANGE AND ENVIRONMENTAL ACTION DOCUMENTS (2007 ONWARDS)</b>	
National Adaptation Plan of Action or NAPA (2007)	2007
Climate Change Strategy	2009
Maldives National Strategy for Sustainable Development	2009
Third National Environmental Action Plan, 2009–2013 (NEAP 3)	2009
Maldives Strategic National Action Plan 2010–2020 (SNAP)	2010
National Community-Based Disaster Risk Reduction Framework	2014
Climate Change Policy Framework Maldives 2015–2025	2015
The National Biodiversity Strategy and Action Plan 2016–2025	2016
National Water and Sewerage Policy	2017
National Action Plan on Air Pollutants	2019
Strategic Action Plan (SAP) Maldives 2019–2023	2019
National Water and Sewerage Plan 2020–2025	2020
<b>UNFCCC COMMUNICATION</b>	
First communication of the Maldives to the UNFCCC	2001
First communication of the Maldives to the UNFCCC	2001
Maldives Intended Nationally Determined Contribution	2015
Second National Communication of The Republic of Maldives to The UN Framework Convention on Climate Change	2016
Maldives First Biennial Update Report (BUR)	2019
Update of Nationally Determined Contribution of Maldives	2020

# ANNEX D

## EXISTING PROGRAMMES/PROJECTS

### MALDIVIAN RED CRESCENT CLIMATE-RELATED ACTIVITIES

Most informants indicate that the COVID-19 pandemic stretches the resources and capacities of the Maldivian Red Crescent (MRC). As a result, planned programmes and activities have largely been placed on hold. However, there are several ongoing activities related to climate change in the National Society:

**Climate-sensitive strategy development:** the Strategy Plan 2019–2030 of the MRC is currently under development; climate change has links to all six of its priorities (KI 4):

1. **Strengthening emergency response;** training people for climate-related emergencies; to respond to slow onset climate-related scenarios; and to be climate watchers.
2. **Strengthening first aid, psychosocial support and community-based programming;** when communities living along the shoreline are forced to relocate, there are important mental health aspects to consider that the MRC can assist with.
3. **Facilitating planning for resilience:** VCAs are a major component. Through the support of IRM funding from the Netherlands Red Cross and the Red Cross Red Crescent Climate Centre, MRC is redesigning the VCA process to make it more climate informed and geared to resilience. Other relevant activities include supporting the island development strategies and island disaster management plans.
4. **Promoting health and wellbeing in a changing environment:** this includes health emergency responses, prevention and preparedness responses, climate induced health risks, and conducting activities in communities such as sessions on the awareness and prevention of Dengue Fever.
5. **Fostering humanitarian values and volunteerism:** one KI said: “We hope to be prepared to work as humanitarian actors to advocate the importance of climate change. Strong humanitarian values are important under the threat of what is to come” (KI 4)

**6. Organisational development:** organizing the MRC to be effective in carrying out climate-related activities:

- **Policy advocacy:** a topical example is the active role MRC has taken in providing its perspective on the Climate Change Bill (under review in parliament as of end 2020).
- **Environmental Vulnerability Capacity Assessments (eVCAs):** the MRC is working with the IFRC and Netherlands Red Cross on localizing the VCAs with a climate focus. A critical part of the VCA is seasonal calendar adaptation (see box, below).
- **Programming** for awareness-raising of climate issues and supporting vulnerable populations, particularly migrants and the elderly.

“The seasonal calendar that we do is broadly categorizing from January to December: environmental, economic and social activities and issues that happen over the year. For example, for June and July, farmers talk about the crops they grow, health professionals discussing the (seasonal) disease patterns. The rainy season, erosion and heavy rainfall are discussed. Farmers report that this is a bad period for them – health workers report higher diseases. We make the linkages through the assessment that we do. When doing disaster management plans we were able to incorporate this a lot. The seasonal calendar is a great tool to visualize the rate of activities” (KI 4)

For more information, please refer to the Climate Centre Shifting Seasonal Calendar Tool

## MALDIVES NATIONAL PROGRAMMES

The Maldives has developed into a global advocate for climate action, drawing attention to the fate of low-lying small island development states in major inter-governmental meetings and through the press. At the same time, there is much attention on the climate crisis nationally. The government is actively pursuing climate-resilient agriculture that is less soil-based through investments in hydroponic agriculture, small loans to (female) smallholder farmers and promoting access to other relevant technologies (KI 6). Furthermore, mariculture is explored as an alternative to traditional fishing (KI 6). The government is attempting to mainstream renewable energy, water security and biodiversity protection measures as well. The Maldives has also attracted significant donor activity related to climate change.

A selection of recent donor-funded initiatives include:

1. *World Bank Maldives Urban Development and Resilience Project* (signed Feb. 2020)
2. *Informal Working Group to Discuss the Implementation of the Pacific Islands Action Plan on Climate Change and Health* (2019–2023) WHO 2019
3. *"Maldives Green Climate-Smart Hospitals"* WHO 2018
4. *Integration of Climate Change Risks into the Maldives' Safer Island Development Programme* UNDP 2009
5. *Climate Trust Fund* 2009

