APRIL 2021

CLIMATE CHANGE IMPACTS ON HEALTH AND LIVELIHOODS:

FIJI ASSESSMENT

IFRC

Climate Centre

ACKNOWLEDGEMENT

This assessment was written by **Aditi Kapoor** (Project Lead), Red Cross Red Crescent Climate Centre; **Tilly Alcayna** (Lead Consultant), Red Cross Red Crescent Climate Centre; **Tesse de Boer** (Consultant), Red Cross Red Crescent Climate Centre; **Kelsey Gleason** (Consultant), University of Vermont; with support from **Bivishika Bhandari** and **Dorothy Heinrich**.

The authors would like to thank staff from the Fiji Red Cross and Technical Advisors at IFRC Asia Pacific Regional Office, and IFRC Country Cluster Delegation for Pacific 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; **Elizabeth Macdonald**, IFRC; **Jennifer Stewart**, IFRC; **Jomari Borlongan**, 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.

CONTENTS

Cover photo: © IFRC

EXECUTIVE SUMMARY

Pacific island countries like Fiji have made near negligible contributions to global climate change, yet they will be the first to suffer its consequences. Climate change primarily affects Fiji through rapid sea-level rise (certain), ocean acidification (certain), rising temperatures (highly likely) and more extreme rainfall events (likely). Fiji is projected to experience more extreme wet and dry conditions (TNC 2020). Salinization of water and land and higher exposure to flooding events will affect communities in low-lying coastal regions. Combined with the dynamics of the El Niño Southern Oscillation (ENSO), climate change jeopardizes Fiji's traditionally important coastal and marine ecosystems. On the islands, temperatures will continue to rise, resulting in sharp increases in the number of hot days and nights already in the near-future. Rainfall trends are highly uncertain and strongly influenced by climatic variability. Nonetheless, extreme rainfall events will become more frequent with implications for flooding and landslide exposure. Tropical cyclones are projected to be less frequent but more intense in the long-term.

The impacts of these changes on livelihoods and health will be significant in a country where over half of the population lives off natural resources-based farming and fisheries; and natural capital fuels tourism, which provides employment to almost 40 per cent of the people. Climate change has the potential to trigger wide-ranging, strong negative feedback loops between livelihoods and health unless climate change adaptation is taken up across health, water and sanitation, livelihoods and disaster risk reduction.

A loss in livelihoods will negatively impact people's ability to afford healthcare and nutritious foods. Up to 4 per cent of the population may be pushed into poverty each year by 2050 due to climate-related disasters, through damage to assets, loss of income sources and severe health issues that limit work capacity. Agriculture and fishing are an especially important source of income for poor households in Fiji and changes in rainfall, more extreme events, higher average temperatures, sea-level rise and ocean acidification will negatively affect yields of crops, fisheries stock and livestock health – particularly affecting subsistence farmers in remote locations. The tourism sector faces potential losses already by 2030 through the degradation of marine biodiversity and rising health risks.

Impacts to health (notably via heat exhaustion, malnutrition and increased food insecurity, the emergence of vector-borne diseases such as Dengue Fever, disturbance in the access to healthcare facilities, and the increased burden of waterborne diseases) will reduce people's ability to work and earn a livelihood. More hot days and water stress are projected to indirectly aggravate the high burden of noncommunicable diseases in Fiji (80 per cent of deaths), through reduced physical activity, high blood pressure, dehydration, food insecurity and poor nutrition. Infectious diseases like Dengue Fever and diarrhoeal diseases are highly climate-sensitive and may rise significantly, especially due to flooding and water

access challenges. As climate change creates more extreme weather and more stressful conditions, the concern is that the already high rate of gender-based exclusion in terms of resource ownership, agency and gender-based violence (72 per cent) may increase and mental health may be affected.

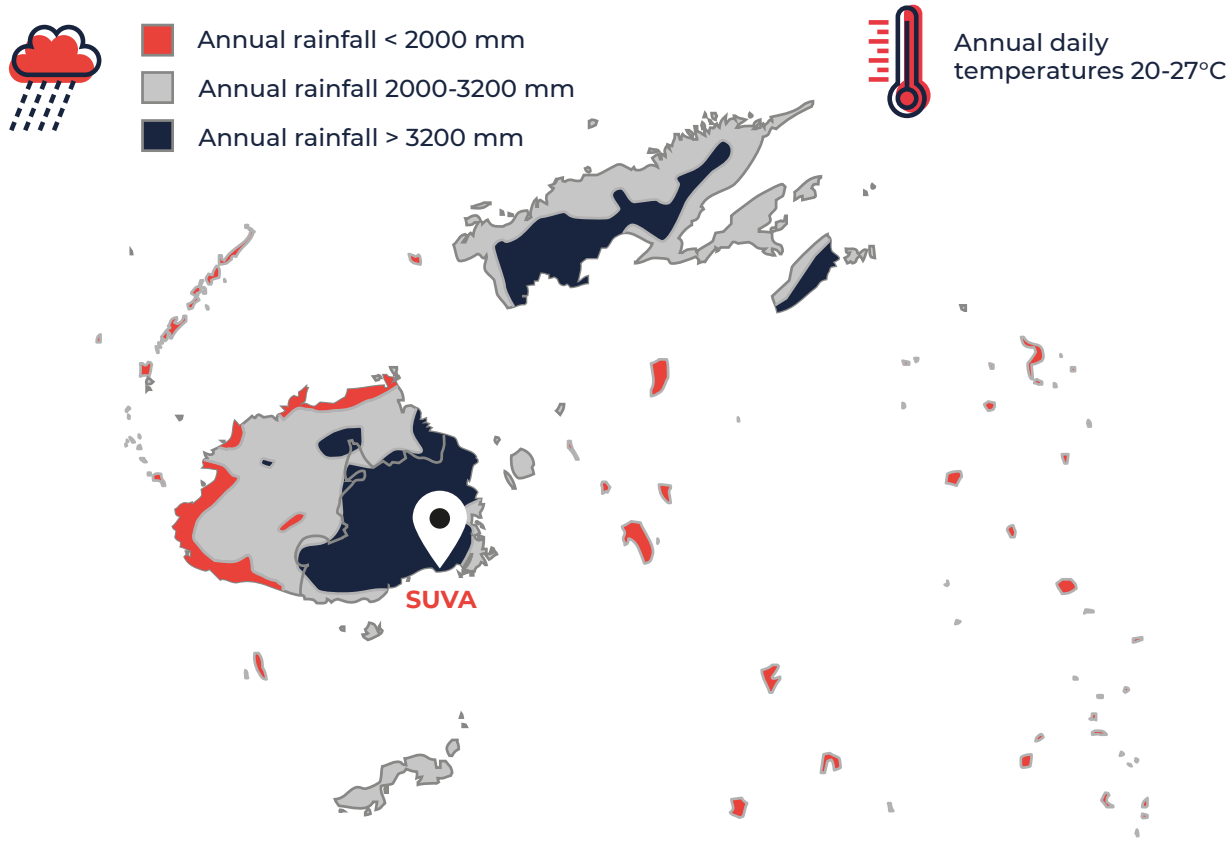
The urgency to act is clear. The purpose of the report is to act as a reference document on the likely impacts – direct and indirect – of the climate crisis on the wellbeing of people in terms of their health and livelihoods. The intention is that this report can act as a springboard for planning and 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

Fiji has an oceanic tropical climate with two distinct seasons – a warm, wet season in November–April and a cooler dry season in May–October. Rainfall across the islands of Fiji varies seasonally as well as due to geographical features. The position of the South Pacific Convergence Zone (SPCZ) has a strong influence on rainfall over Fiji. During the rainy season, the SPCZ is positioned above Fiji bringing in more than 70 per cent of the national annual average rainfall; during the dry season, the SPCZ is positioned to the north-east of Fiji (SNC 2014; PCCSP 2014). The two main islands, Viti Levu and Vanua Levu, both feature a central mountain range which influences how much rain falls across the east-west and north-south axis (SNC 2014; PCCSP 2014). Average daily temperatures remain relatively stable year-round, fluctuating between

Figure 1. Annual rainfall classes of Fiji. Image source: Atherton (2005) using data from Fiji Department of Forestry and Fiji Meteorological Department



20–27°C, depending on the season (SNC 2014; PCCSP 2014). However, around the coast, the average temperature can be as low as 18°C, and the average maximum temperature can reach up to 32°C in daytime (PCCSP 2014).

Table 1. Seasonal calendar

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Wet and warm season				Dry season						Wet and warm season	

1.2. CLIMATE CHANGE TRENDS

OBSERVED CHANGES	SHORT-TERM PROJECTIONS (2020–2039)	LONG- TERM PROJECTIONS (UP TO 2100)
TEMPERATURE	**TEMPERATURE**	**TEMPERATURE**
Both annual and seasonal maximum and minimum temperatures over Fiji are increasing. Warm season temperatures are warming at a faster rate than the cool season. Maximum temperatures have increased most over the period 1961–2012 (SNC 2014).	Projections suggest monthly average, minimum and maximum temperatures will increase by 0.50–0.75°C under a high global emissions scenario (RCP8.5), resulting in slightly higher monthly changes up to 1°C. Nonetheless, these changes are below the global average projected change (WBCCKP 2020).	**Average air temperatures will continue to increase.** Under a high emission scenario, the annual mean temperature is projected to increase in the range of 1.1–1.7°C by 2055 and 2.0–3.2°C by 2090 (PCCSP 2014). Strongest temperature increases are projected during the warm, wet season (Jan–April) (WBCCKP, 2020).
RAINFALL	**RAINFALL**	**RAINFALL**
There is no observed significant change in rainfall. Overall change over the last century has been about +7.3 per cent annual rainfall, but this is attributed to substantial variation in year-to-year rainfall (driven by ENSO events) (SNC 2014). Wet season rainfall has decreased while the dry seasonal rainfall has slightly increased, but these are very weak trends (SNC 2014).	In the short- (and medium-) term the effect of climate change on average rainfall may not be obvious due to natural variability (TNC 2020).	L**ong-term rainfall projections are inconsistent across climate models; however, dry season rainfall is projected to decrease, and the wet season rainfall is projected to increase in the long-term** (PCCSP 2014). Projected intensification of the rainfall band of the SPCZ will increase wet season rainfall in Fiji (PCCSP 2014).

OBSERVED CHANGES	SHORT-TERM PROJECTIONS (2020–2039)	LONG- TERM PROJECTIONS (UP TO 2100)
SEA LEVEL	**SEA LEVEL**	**SEA LEVEL**
The rate of sea-level rise in Fiji is double the global average (6mm per year since 1993) (TNC 2020). The level of ocean acidification is slowly increasing (PCCSP 2014) and sea-surface temperatures are rising at 0.4°C/decade based on limited data (SNC, 2014).	Under a high emission scenario, the projected absolute changes in the annual mean sea level will be in the range 3–16cm by 2030 (PCCSP 2014). **Maximum sea level events will become ten times more likely** (going from a 100-year return level to a 10-year return level) by 2050 (SNC 2014).	**Mean sea level is expected to continue to rise** to 8–31cm by 2055 and 21–62cm by 2090 (PCCSP 2014), potentially exceeding 100cm by 2100 (World Bank 2017a). Ocean acidification will continue to increase (PCCSP 2014). Extreme sea level events will become 'normal' by 2100 (SNC 2014).
EXTREME EVENTS	**EXTREME EVENTS**	**EXTREME EVENTS**
Tropical cyclone intensity and frequency has been declining since the 1960s. (SNC 2014).	Short-term projections for cyclone frequency and intensity are not available, because of the single-event nature. Influences on cyclone activity are sea-surface temperature, sea-level rise, air temperature and several regional and global climate systems.	**The number of tropical cyclones is likely to continue decreasing in future, but events will be more intense** (TNC 2020); The average wind speed of cyclones is likely to increase by 2–11 per cent, while the rainfall intensity is likely to increase by about 20 per cent within 100km of the cyclone centre (PCCSP 2014). Maximum wind speeds exceeding 80 knots in Fiji are expected to become more frequent by 2100 (SNC 2014).
Historical trends on extreme rainfall are inclusive. Typically, these events are associated with tropical depressions and El Niño events (McGree *et al.* 2014).	Very extreme events of more than 200mm are projected to become less frequent in the near-term (SNC 2014). However, **extreme rainfall events with more than 50mm of rain will increase**, particularly in the coastal regions of Viti Levu during the wet season (WBCCKP 2020).	**The number of extreme rainfall days is likely to increase** in the future (WBCCKP 2020). There is little agreement on the magnitude of expected change. While rainfall events are expected to become more intense, the decreasing frequency of maximum daily rainfall of over 200mm is projected to continue up to 2100 (SNC 2014).

OBSERVED CHANGES	SHORT-TERM PROJECTIONS (2020–2039)	LONG- TERM PROJECTIONS (UP TO 2100)
EXTREME EVENTS	**EXTREME EVENTS**	**EXTREME EVENTS**
Hot days and extremely hot days primarily occur during the hot, wet season (Nov–April) and observations suggest a 2 per cent increase in frequency every ten years since 1951 (McGree *et al.* 2019).	**Hot days (over 35°C) will become twice as frequent already in the next twenty years** (SNC 2014). Under the high emission scenario (RCP 8.5) hot nights will increase by 45 days by 2039, especially during the dry season. The likelihood of heatwaves will increase by approximately 7–11 per cent (WBCCKP 2020). If global emissions remain high, Fiji may witness a drastic increase in the warm spell duration of 38 days by 2039 (WBCCKP 2020).	Temperatures exceeding 35°C will become a normal occurrence by 2100 (SNC 2014). Under the high global emission scenario, **there will be 199 more hot days per year by the end of the century** (WBCCKP 2020). The number of hot nights will increase by up to 144 days by the end of the century under a high emissions scenario (WBCCKP 2020). **Furthermore, warm spells may last up to 301 days by the end of the century** (WBCCKP 2020).

1.3. CLIMATIC VARIABILITY AND EXTREME WEATHER

While climate change may drive changes in a country's exposure to and the frequency of natural hazards, existing natural climate variability also affects weather and extreme events. **Fiji's climate varies considerably and is highly affected by ENSO conditions**, the position of the SPCZ and the south-easterly trade winds. These phenomena have a strong influence on rainfall, temperature and tropical cyclones in Fiji (SNC 2014). ENSO events occur every four years on average (SNC 2014). El Niño tends to bring drier and cooler conditions than normal, while La Niña events usually bring wetter than normal conditions over most parts of Fiji (SNC 2014; PCCSP 2014). El Niño and La Niña events will continue to occur in the future, but there is little consensus on whether these events will change in intensity or frequency (TNC, 2020).

- **Cyclones** typically occur during El Niño years at a rate of 1–2 times per wet season (November–April), although 4–5 events per season have been recorded, and some have also been observed in May and October (Government of Fiji 2014; PCCSP 2014; World Bank 2017a).
- River **flooding** occurs every wet season and is even observed in the dry season during La Niña events. However, large-scale flooding and coastal inundation are always associated with severe weather events like tropical depressions and cyclones with prolonged and high intensity rainfall (SNC 2014; PCCSP 2014).
- Meteorological **droughts** in Fiji have been associated with El Niño events. A moderate to strong El Niño event is usually associated with the reduction in 20–50 per cent of annual rainfall over most parts of the country, as observed during the droughts in 1982/83, 1986/87, 1992/93, 1997/98, 2003 and 2010. However, weak El Niño events have less influence on the country's total annual rainfall (SNC 2014). Climate projections suggest drought risk may decrease slightly in the long-term (TNC 2020),

though climate models differ in their projections because of insufficient data (World Bank 2017a). While the intensity and frequency of droughts may not change dramatically, the current risk level itself is significant, with a large impact area (World Bank 2017a); and, combined with heat spells, the impacts may worsen (TNC 2020).

SUMMARY: PAST CLIMATE TRENDS AND FUTURE CLIMATE PROJECTIONS

The impact of climate change through sea-level rise, ocean acidification and rising sea-surface temperatures will cause extensive damage to the marine and coastal ecosystems of Fiji. Rising sea-levels result in the higher exposure of low-lying coastal regions to storm surges, high tides and waves. Combined with ENSO dynamics, coral bleaching is a particular risk that may affect Fijians deeply. On the islands, temperatures will continue to rise, resulting in sharp increases in the number of hot days and nights already in the near-future. Rainfall trends are highly uncertain and strongly influenced by climatic variability. Nonetheless, extreme rainfall events will become more frequent and may worsen landslides on denuded forest hills, while higher temperatures may lead to more forest fires. Tropical cyclones are projected to be less frequent but more intense in the long-term. The risk of drought will continue and the impacts may worsen combined with higher peak temperatures.

RECOMMENDATIONS

1. **Raise awareness among communities, especially at-risk groups, on the main climate change stressors and shocks, especially in remote areas where there is less access to this information.**
2. **Explicitly integrate ENSO forecasts and weather warnings for droughts, high rainfall and high temperatures in operations, communications and planning.**
3. **Support communities to adapt water systems and water management techniques to the rising sea-levels, more frequent intense rainfall, higher temperatures and the continued risk of drought and landslides.**
4. **Support communities to seek nature-based solutions for natural hazards through the protection of coral reefs, mangroves, forests and other critical ecosystems and habitats to improve micro-climates.**

2. MOST AT-RISK POPULATIONS

2.1 COMMUNITIES IN LOW-LYING AREAS

While Fiji consists of many volcanic mountainous islands, 12 per cent of the urban and 6 per cent of the rural population resides in the coastal low-lying areas close to the coastline (World Bank 2017a). These households are particularly at risk from temporary flooding due to storm surges, cyclone impacts and flash floods, and permanent inundation due to sea-level rise (Gravelle and Mimura 2008). Ongoing urbanization and migration of people to peri-urban unplanned settlements, often with poorly constructed houses in the floodplain, is increasing the population at risk. Currently 20 per cent of the urban population (10 per cent of total population) lives in such unplanned informal settlements with limited access to potable water and electricity and frequent exposure to flooding (World Bank 2017a).

2.2 SUBSISTENCE FARMERS AND FISHERFOLK

Subsistence agriculture forms the mainstay of about half of the people living below the poverty line and about one-quarter of the people living above the poverty line (World Bank 2017a). Even minor agricultural shocks due to climate change can immediately deepen poverty. One assessment showed that a reduction of just one per cent in agricultural income can result in 1,000 additional people being pushed into poverty and increased stress for those already steeped in poverty (World Bank 2017a). Workers earn an income from a variety of natural resource-based livelihoods that includes farming, livestock rearing, fisheries and non-timber forest produce. Fisheries comprise a substantial proportion of fisherfolks'' income, in cash and in-kind, and is a key source of protein for them. Rising sea-level and reef damage as well as coastal floods and cyclones again affects this community deeply, leading to food insecurity, ill-health, loss of livelihoods and income. This makes adaptation all the more difficult for this vulnerable group.

2.3 LOW-INCOME HOUSEHOLDS

Both slow and rapid onset climate disasters strain households' resources. For poor or low-income households, studies indicate that recovery is slower and families may use more negative coping strategies compared to more affluent households, which may enforce a negative cycle of poverty (IPCC 2014; World Bank 2017a). For instance, a higher rate of poverty in 37 rural settlements around the Northern, Western and Southern Divisions of Fiji has resulted from 8,500 residents being affected by El Niño-related droughts, which reduced their resilience to face subsequent hazards (World Bank 2017a). Although Fiji has lower poverty rates

compared to other Pacific island states, 22 per cent of the general population, 16 per cent of the urban population and 29 per cent of the population in rural areas live below the national poverty line (HIES 2015). Furthermore, the World Bank (2017) predicts more frequent climate-related disasters may push an extra 32,400 people (3.8 per cent of the population) into poverty each year by 2050 as assets are damaged, work opportunities are lost and their health may be affected.

2.4 THE ELDERLY AND PEOPLE WITH DISABILITIES

Limited mobility and special needs can increase the vulnerability of individuals and their caregivers during disasters, and also affect their socioeconomic resilience to shocks. People with disabilities worldwide are two to four times more likely to die in a disaster (UNDP 2018). While their vulnerability to natural disasters is high, the elderly and people with disabilities tend to be underrepresented in planning and decision-making for disaster preparedness (World Bank 2017a). In Fiji, females with disabilities have also faced issues accessing sexual and reproductive health services in times of disaster (World Bank 2017a).

2.5 WOMEN

Women are among the most vulnerable groups with strong linkages between gender-based exclusion, climate change vulnerability, health and food insecurity and a deepening of the already high rates of violence against them. Women do much of the inshore work in subsistence fisheries, ensuring protein for their household; but this is unpaid, uncounted work in the 'i qoliqoli' or marine areas customarily owned by fishing communities (Vunisea 2017). In agriculture, women usually cultivate just one acre or less of land with hardly any access to financial or technical support, working as subsistence farmers and/or seasonal agricultural workers (Republic of Fiji 2019). This makes women highly vulnerable to climate shocks and they are primed to be pushed deeper into poverty with spin-off impacts on their health and welfare. In urban areas women mostly hold low-paid, informal jobs, largely employed as street vendors and as domestic workers (Republic of Fiji 2019) with no protection against the potential heat risk or floods. Given their informal employment, they also have very little recourse to social protection, which makes it almost impossible for women to invest in adapting to climate risks, including accessing available weather and climate information and resilience-building resources (Republic of Fiji 2019). Women have hardly any control over their income and spend at least four times the number of hours in household and care duties compared to men (FAO and SPC 2019). The prevalence of partner violence is among the highest in the world, especially in rural areas with little access to healthcare facilities or counselling (FAO and SPC 2019).

2.6 CHILDREN

Children have fewer assets than adults to decrease their vulnerability and address climate risks, and are dependent on caregivers for protection (UNICEF Pacific 2010). Particularly for children under five years old and girls at the onset of their reproductive years, adverse physical and mental health impacts can have lifelong implications (UNICEF Pacific 2010). The cumulative impacts of even minor disasters or slow-onset climatic changes may have lifelong implications for all children, for example, through missed school days, malnutrition and a slowing down of their development due to illness (Taylor 2016; World Bank 2017a).

SUMMARY: MOST AT-RISK POPULATIONS

Fijians live at the frontline of climate change impacts. Sea-level rise and increased flooding risk especially affect coastal communities (rural and urban) living in low-lying areas. A majority of the poor are dependent on farming and linked livelihoods, which are prone to climate shocks with the potential to push people deeper into poverty. Poverty limits the opportunities of households to recover from shocks and adapt to climate change, and may even enforce a negative feedback loop with implications for food security and health. Women are especially vulnerable due to gender-based barriers which make them more vulnerable to climate change risks with the potential of deepening the gender divide, including an increase in domestic violence. Children, people with disabilities and the elderly have limited capacity to deal with disasters and environmental change, and may be more vulnerable to associated health impacts. The intersection between vulnerability characteristics is a particular concern, such as poor or single women living with disabilities in remote atolls.

RECOMMENDATIONS

1. Develop, use and publicize localized data and maps on climate vulnerability, disaggregated by gender, age, ability, income sources, education, land tenure etc. to improve the understanding of localized risk in Fiji.
2. Amplify the voices of vulnerable groups in community assessments and in community-based health and livelihoods committees.
3. Ensure risk communication and outreach specifically target women, children and the elderly in remote locations.
4. Factor in intersectionality and the multiple vulnerabilities cutting across health and livelihoods to help at-risk community groups deal with climate shocks and climate projections.

3. HOW WILL LIVELIHOODS BE AFFECTED BY CLIMATE CHANGE?

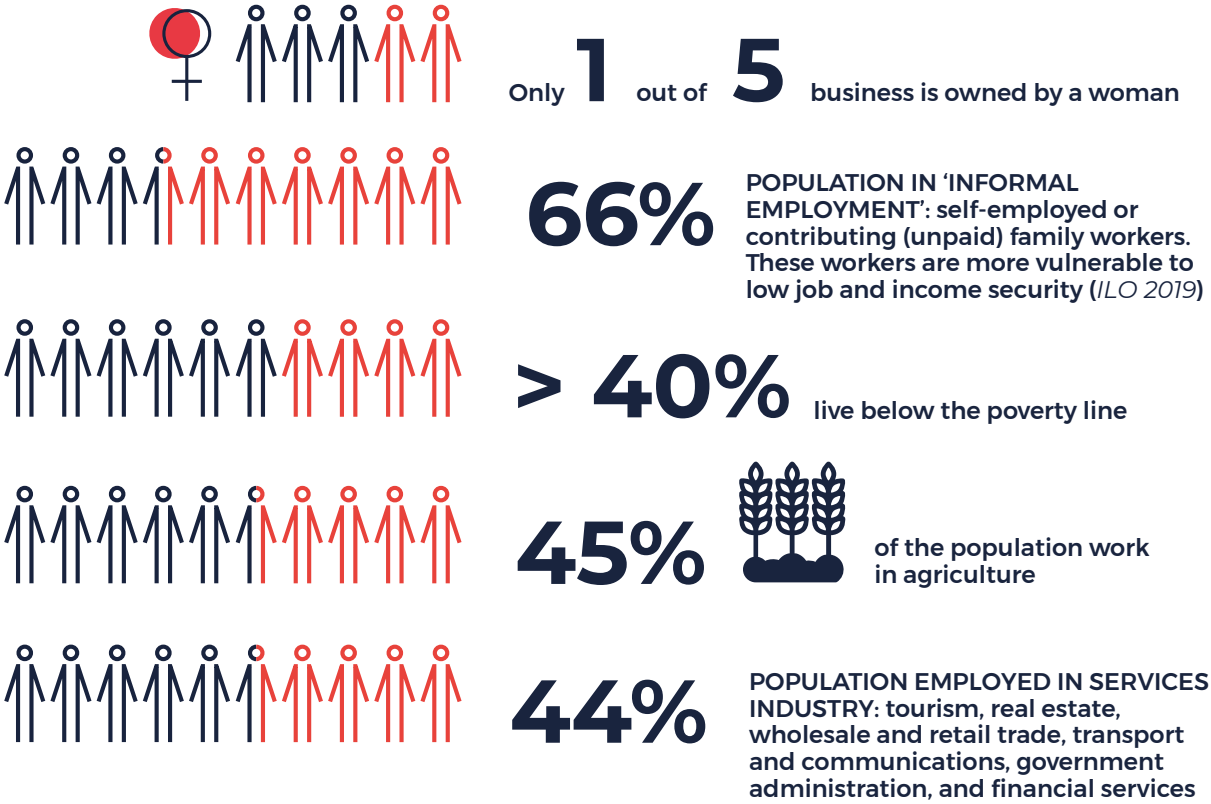
Livelihoods are the collection of "capabilities, assets and activities required for generating income and securing a means of living" (IFRC 2010). Livelihoods are dynamic and, depending on internal and external stressors, people may shift, adapt and transform their livelihoods. Some livelihoods, in particular, are more sensitive to a changing climate, such as rainfed agriculture, fisheries and the tourism sector in Fiji. According to the IPCC (2014), there is high confidence that climate change, climate variability and climate-related hazards exacerbate other stressors, worsen existing poverty, deepen inequalities, trigger new vulnerabilities and typically have negative outcomes on livelihoods. The following sections briefly outline the main livelihood strategies in Fiji as well as the country's particular vulnerabilities to climate change. A summary of the impacts of climate change on livelihoods in Fiji is shown in Annex B.

3.1. COUNTRY LIVELIHOODS PROFILE

Fiji is one of the most developed economies of the Pacific, primarily driven by a large tourism sector and its role as a regional trade-hub. As a result, its services (retail, wholesale, accommodation etc.) and manufacturing industries are the dominant sectors in terms of their contribution to GDP and employment (ADB 2015; World Bank 2017a; NAP 2018)[1]. Despite the relatively high GDP and developed economy, livelihood challenges remain. Poverty levels are high – nationally 22 per cent, of which 29 per cent of the rural population and 16 per cent of the urban population live in poverty (HIES 2015). In rural areas, subsistence agriculture and fishing are important sources of livelihoods and food security, yet there are few alternative livelihood options (WFP 2018). Traditional small-scale income-generation activities like mat-weaving by women require market support (Veitayaki *et al.* 2018). Women's employment is mostly informal, insecure and unregulated due to discrimination and the absence of protective legislation (WFP 2018).

1 Although the effects of the COVID-19 pandemic are beyond the scope of this climate-focused report, it should be noted that COVID-19 has deeply affected the region and diminished tourism influx (ILO 2020; IOM 2020).

Figure 2. Employment statistics. Source: ILO 2017



3.2. AGRICULTURE AND FISHERIES

The agricultural sector is an important livelihood source for almost 40 per cent of the Fijian population (ADB 2015). Over half of rural communities depend on subsistence farming and fishing (ADB 2015). Of those people living below the poverty line, half derive some income from agriculture (World Bank 2017a). The sector consists of five major sectors: crop production, sugarcane, livestock, fisheries and forestry (World Bank 2017b). In recent years, the share of agriculture to the nation's GDP has declined dramatically, due to both an increase in revenues in non-agricultural sectors (especially trade and tourism) and a decline in the important sugar production, driven by socioeconomic reasons (ADB 2015). Traditional crop and food production systems were relatively well-adapted to climatic variations. For instance, people planned their farming and fishing activities based on nature's cycle, tapping flora and fauna on land, rivers and mountains, which avoided putting pressure on one kind of natural resource. People also concurrently cultivated domestic and wild varieties, leading to a healthy cross-pollination and an emergence of diverse, hardy and adaptive landraces, which were preserved and improved through community seed banks (Shah *et al.*, 2018). However, traditional practices and knowledge are disappearing quickly – replaced by vulnerable commercial monoculture systems. These are also replacing people's traditionally rich diets with diverse nutrients, fibre and complex carbohydrates with more and more sugar, oil, sodium and refined starch from imported and packaged foods (Shah *et al.* 2018).

The **Fisheries sector** in Fiji is important for coastal livelihood security. Fish is an important export product and subsistence food source especially for protein; although consumption differs a lot per region in the country (ADB 2015). There is mixed information on the impact of climate change, as some projections suggest specific positive impacts (particularly on skipjack tuna – an economically important species), but the overall consensus is that the increasing climatic pressures on the coastal and marine ecosystems (mangroves, reefs and seas) will likely negatively affect fishing (World Bank 2017a). Fiji is already experiencing depleted fisheries stock (INDC 2015) and cyclones have been destroying reef ecosystems that act as a support for fisheries, with further decline expected due to higher sea-surface temperature, ocean acidification, sea-level rise and a drop in the availability of nutrients for marine life (TNC 2020). Traditional systems involved men and women engaging in the subsistence farming of marine resources on customary fishing right areas (called qoliqoli) with management and control exercised locally and through social pressures to abide by the rules and not exploit the resources (Veitayaki *et al.* 2018). However, increasing inroads by commercial/industrial fishing is putting unsustainable pressure on marine resources (Veitayaki *et al.* 2018). This is eroding customary rights and the livelihoods of traditional fishermen and women and also affecting their health by reducing their incomes and intake of fish protein. Recent initiatives in community-based marine resources management have shown success in reviving some traditional practices, registering customary fishing rights areas and enabling local communities to be the drivers of more sustainable, locally owned marine-based livelihood processes; even so these need strong national-level legal and policy support (Veitayaki *et al.* 2018). This is because the informal and the formal management systems continue to co-exist, with the latter being more exploitative of natural resources (Veitayaki *et al.* 2018).

Both commercial and home gardening and crop production are largely rainfall-dependent, and **changes in annual rainfall quantity, the timing of rainfall seasons and more frequent extreme rainfall** will affect these practices (WFP 2018). Of particular interest are El Niño-related droughts; which, if intensified, could reduce yields of crops such as cassava, taro and yams by 11–15% per cent and rainfed sugarcane production by 9 per cent by 2050 (ADB 2015). Besides drought and rainfall changes, riverine flooding – driven by rainfall and human floodplain management – is a particularly damaging hazard to the fertile cropland located in river plains (ADB 2015). There is also a risk of increased waterlogging, and favourable temperatures and conditions for pest proliferation, which can induce crop mortality and increase land erosion risk (World Bank 2017a; NAP 2018). For reef fisheries, there will be negative impacts from sediment washing onto reefs and pollution (World Bank 2017a). Other means of livelihoods that depend on natural resources include catching crabs in mangrove forests and aquaculture, especially the pearl industry which is dominated by women's groups in collecting pearl oyster and who are involved in small handicraft enterprises (ADB 2015; FAO and SPC 2019; Southgate *et al.* 2019). Women fish regularly, either full-time or part-time, to feed their families and/or to earn a living (ADB 2015).

Increases in mean and extremely high air temperatures primarily affect terrestrial agriculture, and heat will especially reduce the flowering and growth of mango, papaya and tomato (World Bank 2017a). Furthermore, the incidence of pests and diseases may increase across a range of crops and livestock. For Fijian livestock, the availability of feed (mostly imported) may be affected by the declining availability of animal feed globally, while locally heat-stress may affect the reproduction, growth and health of animals (World Bank 2017a).

The risk from cyclones may remain the same or decrease slightly, but a risk nevertheless remains. Cyclones affect crops as well as livestock. For example, Cyclone Tomas resulted in 25.4 million US dollars of agricultural damages in Fiji (ADB 2015). Recovering from cyclone damage can take up the majority of people's time and affect fishing activities too, as access is hampered or recovery efforts are prioritized (Thomas *et al.* 2019).

Continuing sea-level rise will affect the coastal low-lying regions of Fiji most, through a reduction of land area (permanent flooding), higher exposure to temporary floods and salinization of land and water resources. Much of Fiji's productive agricultural land is located in coastal areas (NAP 2018). For example, 5,000 hectares of sugarcane land is at risk of saline intrusion (World Bank 2017a). On the other hand, the area and productivity of some fisheries may increase (e.g. skipjack tuna), although increasing exposure to coastal flooding, storm surges and coastal erosion may cause damages to infrastructure and necessitate fishing communities to relocate (World Bank 2017a).

Ocean acidification and sea-surface temperature will continue to increase which will very likely cause extensive damage to fragile reefs through coral bleaching and ecosystem disruption. This will result in loss of fish habitat, changes in the migration and reproduction of key fish species, negative impacts on aquaculture (e.g. seaweed) area and productivity – although shrimp growth is projected to increase (World Bank 2017a).

3.3. TOURISM

Tourism is a major employment sector for both Fijians and migrants. Before the COVID-19 pandemic, tourism contributed 38 per cent of the national GDP, with over 750,000 to 1 million visitors per year (World Bank 2017a). Furthermore, approximately 12 per cent of people close to the poverty line and 6 per cent of people in poverty work in the tourism industry (World Bank 2017a). Fiji may lose 18 per cent of tourism revenues due to climate change by 2030, although these results should be interpreted with care (World Bank 2017a). The main drivers of these risks are: 1) the increased risk of climatic hazards due to sea-level rise and more intense rainfall events; 2) degradation of coastal ecosystems due to sea- and air-temperature changes, sea-level rise, and ocean acidification; 3) damage to transport infrastructure as a result of flooding, strong winds and rains; 4) perceived health risks from climate-sensitive diseases, such as Dengue Fever and diarrhoea (See Section 4); and 5) water stress both in terms of quality and quantity, seasonally and annually (IPCC 2014).

3.4 URBAN LIVELIHOODS

For the urban population (54 per cent in 2017), livelihoods are less dependent on natural resources and more on financial and knowledge capital. Here, income levels determine the capacity of households to adapt to climate shocks. For higher income groups, their vulnerability to, for example, changes in rainfall patterns is reduced, but for lower income groups this impacts their houses and assets, which may be in low-lying areas or in unprotected landscapes. Those working in the services industry, public administration, construction and retail in urban areas (both formally and informally) will be affected by climate impacts such as heat risk with its impact on water availability and the need for cooling environments. Damages to houses and workplaces incurred from urban flash flooding during heavy rainfall as well as coastal flooding along the sea, pose a major risk to livelihoods (World Bank 2017a).

3.5. FOOD SECURITY

According to the Committee on World Food Security (CFS) (2012), "food security is a situation that exists when all people, at all times, have physical, social, and economic access to sufficient, safe, and nutritious food that meets their dietary needs and food preferences for an active and healthy life." Both rapid and slow onset climatic hazards may affect food production domestically and globally, and subsequently the food supply chain, affecting livelihoods' sustainability and causing economic losses. Food insecurity is a leading cause of undernutrition. In Fiji, there may be a reduction of 7 per cent in calorie availability due to climate change in the year 2050 (ADB 2015). The health implications of malnutrition are discussed in Section 4.4.

Although only 2.5 per cent of the population lives below the food poverty line (the measure for extreme poverty in Fiji), estimates suggest that 34 per cent of the population live below the basic needs poverty line (World Bank 2017b), which leaves a large portion of the population vulnerable to food price spikes and food insecurity from climate impacts. Rural communities depend on natural resources and subsistence production for food security, while urban households rely more on imported market-bought foods (FAO 2008). Recently, there has been a shift away from traditional diets (indigenous grains, starchy roots, vegetables and fish) to a diet with a greater emphasis on processed foods such as canned fish or meat, bread and, particularly, white bread. In Fiji, this has led to an increased reliance on imported agricultural products. This import reliance increases the country's vulnerability to global climate change impacts and other factors that potentially affect global food prices and availability (ADB 2015; Taylor 2016). Price spikes are particularly challenging for the poor, who on average spend 29 per cent of their income on food (HIES 2015). The World Bank (2017a) estimates that an increase in food prices by 1 per cent – due to local production losses or global price increases – would push 1,000 extra Fijians below the poverty line. Alongside global food supply and disaster impacts, local food production challenges as a result of climate change may further jeopardize domestic food security, especially for rural communities who rely more on domestic subsistence.

3.6 PHYSICAL ASSETS (HOMES AND WORKPLACES)

Disasters such as cyclones, droughts, floods and landslides affect the majority of the Fijian population in some form, most frequently by damaging houses, workplaces and transportation as well as hydropower infrastructure (HIES 2015, TNC 2020). For example, up to 65 per cent of energy supply is through hydropower stations, which are affected by drought (TNC 2020). Even after social protection initiatives, households with limited financial buffers or borrowing options may be forced to recuperate losses by cutting spending on essential things such as food, education and healthcare – with negative impacts on health and future income (World Bank 2017a). An estimated 25,700 people are pushed into poverty each year due to climate-related disasters (World Bank 2017a). The World Bank (2017a) projects that damages and losses from climate-related natural hazards, especially low-intensity high-frequency events, may increase in the coming decades, driven by socioeconomic development and climate change, and will push 3.8 per cent of the population into poverty each year by 2050. The NAP (2018) emphasizes the need for more climate-resilient housing across the country and higher insurance coverage, as households currently have to rebuild homes with limited savings and debt.

SUMMARY: HOW WILL LIVELIHOODS BE AFFECTED BY CLIMATE CHANGE?

Traditional agriculture and fisheries are generally more resilient to climate impacts (especially droughts, heavy rainfall and high temperatures), but the transformation to monoculture farming and loss of productive farming land in coastal regions is threatening rural livelihoods and domestic subsistence food production in Fiji. The growing reliance on imported foods exposes Fiji to global climate impacts and disruptions as well. Communities in low-lying coastal regions (urban and rural) are already experiencing loss of homes, equipment and workplaces due to more frequent coastal flooding, greater exposure to high tides and intense rainfall, which forces households to use limited personal finance and loans to rebuild their assets. Women's livelihoods are dependent on mangrove forests and coastal products like pearl oysters which add to the family income.

RECOMMENDATIONS

1. Integrate climate-resilient construction, water management and home gardening into community-resilience work and education.
2. Ensure early warning systems reach the most vulnerable communities and remote locations, as these will suffer the greatest damages.
3. Promote community-based approaches and nature-based solutions to protect natural resources at the ecosystem-level via partnerships with local academic institutions and researchers. This includes helping to arrest coastal erosion and salinity ingress through coastal plantation, harnessing rainwater for drinking purposes and promoting climate-smart agricultural practices.
4. Wetland conservation and mangrove protection are essential for livelihood protection, DRR, and food security with health co-benefits.
5. Build on existing social protection programme coverage to ensure the most vulnerable households have access to emergency support and livelihood diversification options.

4. HOW WILL HEALTH BE AFFECTED BY CLIMATE CHANGE?

4.1. MORTALITY AND NONCOMMUNICABLE DISEASES

Mortality and injury. Fiji already faces flood risks, which can lead to the loss of life via drowning. Under climate change projections, storms with higher wind speeds and rainfall intensities, as well as a wetter rainy season (already when 70 per cent of rain typically falls), are likely to increase the number of flooding events across Fiji. Drowning from swimming whilst trying to cross flooded rivers or crossings is a major cause of death, especially for the elderly or people with disabilities who typically have lower mobility (World Bank 2017a).

Heat. Fiji is a hot country and even though it is facing a projected warming trend that is below the global average, 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., more 'hot' days and nights by 2100).

Noncommunicable diseases. The uncomfortable heat is likely to cause people to engage in less physical activity which increases the risk of noncommunicable diseases (NCDs). It is important to consider the link between climate impacts and NCDs, given 80 per cent of all deaths are due to NCDs in Fiji. A reduction in activity may lead to a rise in obesity, which is a risk factor for NCDs such as diabetes, cardio-vascular illnesses and cancers (endometrial, breast, rectal and colon) (World Bank 2017a; MoH 2018).

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) (WHO 2015). 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.

Dengue Fever is the main vector-borne disease of concern, but Zika Virus and Chikungunya are also present (Henderson *et al.* 2021). Eight major outbreaks of Dengue Fever have occurred in Fiji in the past 50 years, seven of which have occurred during periods of La Niña (wet conditions with flooding events) (McIver *et al.* 2012; MoH 2018). Both climatic conditions (higher day and night temperatures, humidity, rainfall) and human behaviour (water storage and vector control measures) influence

the frequency of Dengue Fever, and historical trends indicate that Dengue case numbers tend to peak a month after flooding events or during droughts when people store water in uncovered containers close to their homes (MoH 2018). With climate change, the risk of Dengue Fever may cease to be seasonal (i.e. occur at any time of the year) and no longer be focalized at certain hotspots (Western Division, Ba, Lautako). The resulting morbidity and mortality could "rise significantly" (MoH, 2018).

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

Improved drinking water access is generally high in Fiji (94–97 per cent), although access to piped drinking water is slightly lower in urban informal settlements and is limited in rural populations (GLASS 2015; World Bank 2017a; UN 2020). Communities, however, largely depend on singular water sources – in particular surface water from coastal areas. This makes the supply highly vulnerable to changes in rainfall and poses risks to the drinking water supply in Fiji from salinization, the higher risk of coastal flooding and permanent inundation (World Bank 2017a).

for every 1°C INCREASE IN TEMPERATURE,

there was a 3% INCREASE IN DIARRHEA CASES the month after

Singh et al., 2001

Sanitation

Basic sanitation coverage is slightly lower (87–95 per cent), and environmental contamination by both sewerage and waste is a problem in Fiji (World Bank 2017a; UN 2020). This is especially the case in rural areas in which infrastructure is vulnerable to climatic shocks, such as floods.

Water-borne diseases

- **Diarrhoea** remains a major challenge in Fiji – the high incidence contributes to morbidity, loss of work and malnutrition, and causes 3 per cent of total mortality. Diarrhoeal transmission is highly responsive to climatic conditions such as temperature and rainfall (especially when it results in flooding). For example, a study found that for every 1ºC increase in temperature, there was a 3 per cent increase in diarrhoea cases the month after (Singh *et al.* 2001). Extreme rainfall – both too much and too little – is also linked with increases in cases of diarrhoea (McIver *et al.* 2012; WHO 2015). Specifically, the likelihood of a diarrhoea outbreak one month after all floods is 3.5 times higher than all months without flooding (MoH 2018). By 2030, under high emission scenarios, mean annual temperatures are expected to further increase by 1ºC with the most warming being felt in the wet season when diarrhoeal diseases are already typically prevalent. Increases in minimum temperatures also pose a large risk, because this would remove the natural break on disease proliferation enabled by cooler conditions (Singh *et al.* 2001).

Other waterborne diseases with links to climate change:

- **Typhoid Fever** and **Leptospirosis** are endemic in Fiji and have largely the same determinants as diarrhoea, namely, poverty, poor sanitation and hygiene, and displacement and proximity in evacuation centres with compromised sanitary and hygiene facilities (MoH 2018). Outbreaks of Typhoid Fever tend to occur following floods and two months after cyclones, with evacuation centres identified as hotspots (MoH 2018). Leptospirosis risk is additionally linked to farming, whereby farmers (typically young males) come in contact with infected rodents or the urine of infected animals. This exposure may increase after floods as humans and animals are in closer proximity (Lau *et al.* 2016; MoH 2018).

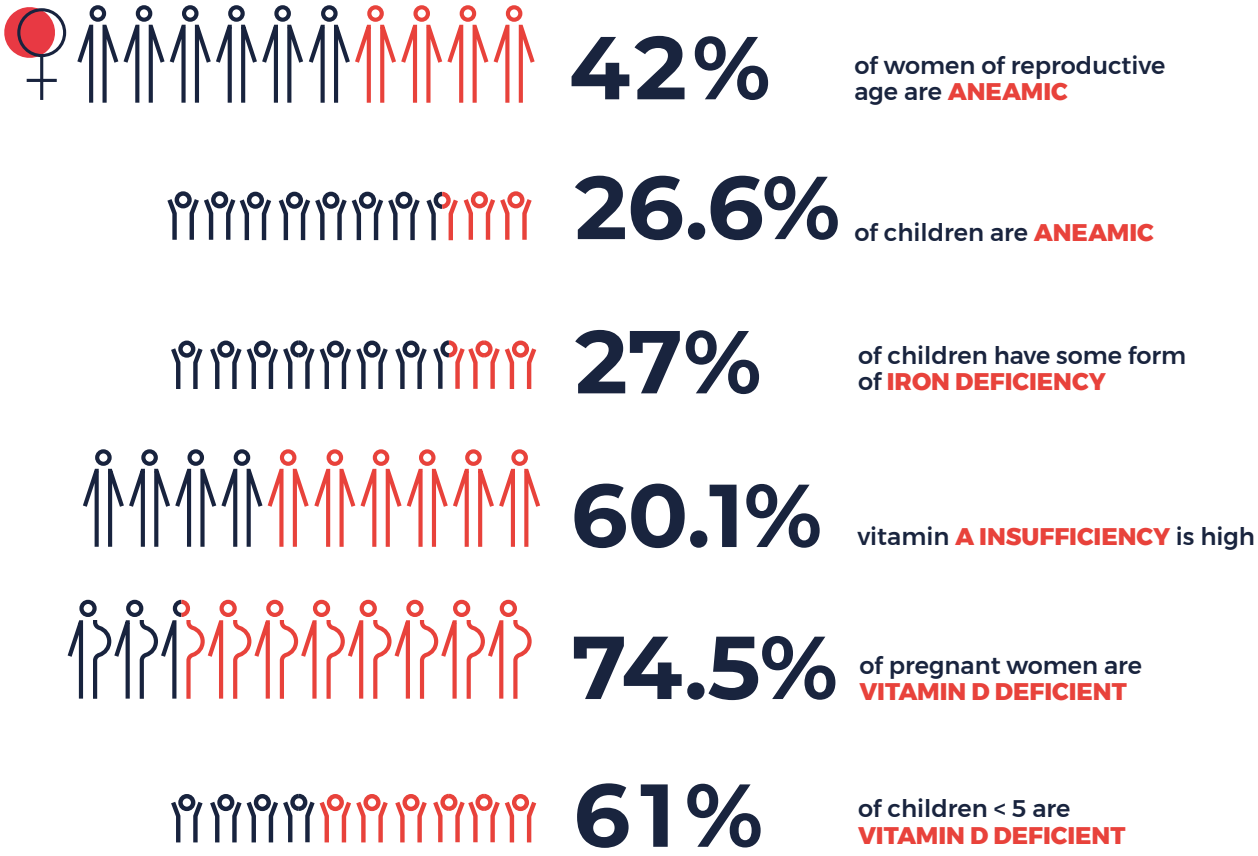
Solid waste management

In Suva City, waste collection services provided by the Suva City Council remove solid waste to a landfill site. However, the illegal dumping and burning of waste still occurs, which may pose a public health concern (ADB 2014).

4.4. MALNUTRITION

Fiji is not on course to meet the global nutrition targets. The increased likelihood of extreme weather events (the wet season becoming wetter, La Niña floods, more intense storms and cyclones, temperature increases, sea-surface temperature increases), which destroy crops and cause shortages of fresh fruit, vegetables and fish supplies, will further reduce nutrient availability and diversity, and may push households into the increased consumption of processed, high salt, high fat, nutritionally poor imported canned foods (MoH 2018). As such, there is both a worrying level of obesity in adults and children over five years old, as well as persistent undernutrition in children aged under five (MoH 2018; FAO *et al.* 2021; GNR 2021). Undernutrition is the leading cause of mortality in children under five years old in Fiji, even when the burden of stunting in children under five and wasting is relatively low (7.5 per cent and 6.3 per cent respectively) compared to the Oceania average (38.4 per cent) (GNR 2021). The projected reduction in agricultural and marine productivity as a result of climate change and the consequent reduction of calories available as well as food price spikes in the coming decades may exacerbate levels of undernutrition. At the same time as there are issues with macronutrient intake, micronutrient deficiencies (iron and iodine) are common across Fiji, and will likewise increase as households rely more on imported unhealthy canned or preserved foods (MoH 2018).

Figure 4: Source: NNS 2017 and Global Nutrition Report 2020



4.5. DISPLACEMENT AND MIGRATION

Temporary displacement to evacuation centres as a result of floods or cyclones is relatively common in Fiji. As flooding is projected to become more frequent and more severe, repeated temporary displacement may feature heavily in Fijian's lives without mitigation measures.

Faster than average sea-level rise claiming low-lying coastal land risks permanent displacement. As a result, the Government of Fiji has had to seriously consider planned relocation as a 'hard' adaptation measure and final resort once other options have been exhausted. These relocations would be voluntary and organized by the Government, but initiated by the affected communities and designed in close consultation with those communities. The objectives would be to support the emotional and social impact of the relocation, while making sure that no new vulnerabilities are created in the process and that the relocation is environmentally as well as economically feasible and improves the overall wellbeing and livelihoods of all affected people (MoFA, 2018).

4.6. MENTAL HEALTH

Climatic factors that put pressure on livelihoods and health, or create shocks leading to the loss of homes, family members and displacement from communities, loss of ancestral lands and burial grounds, and permanent dislocation from coastal areas which disrupt traditional ways of living can also lead to psychological stress, anxiety and depression (SNC 2014; MoFA 2018; MoH 2018). Given islanders' particular vulnerability to many impacts of climate change, it is likely that Fijians may be at high risk of mental health issues attributable to climate change (WHO 2015). In 2008, Fiji launched the World Health Organization's (WHO) mental health Gap Action Programme (mhGAP), recognizing the impact that mental health is likely to have on its population. Decentralized mental health cClinics became available in selected primary healthcare facilities. However, barriers related to transport to remote communities highlight that many people face access issues to home-based or outreach services and can easily be cut off from essential care in the event of extreme and disruptive weather (Charlson *et al.*, 2019).

4.7. CRITICAL INFRASTRUCTURE AND HEALTHCARE SYSTEMS

The proximity of critical infrastructure (roads as well as health facilities) to the coastline makes the health system vulnerable to the impacts of climate change, especially sea-level rise (World Bank 2017a). Historic extreme weather events (such as Cyclone Ami in 2003 and floods in 2012) caused direct physical damage to buildings and equipment from water and wind, and can cut access to healthcare facilities if roads become flooded or bridges are damaged (MoH 2018). Damage and disruption also extend to electricity and water cuts, which can affect and limit the operability of healthcare facilities. Furthermore, damage to drugs and medical records can disrupt treatment plans that has ramifications on wellbeing in the short- and long-term.

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. Key areas of concern from global studies have shown how a changing climate is altering the dynamics and risk of negative maternal health outcomes, forced child marriages, human trafficking, sexual exploitation and gender-based violence (Castañeda Carney *et al.* 2020; Women Deliver 2021). However, considerable gaps in research and evidence that link climate change and sexual and reproductive health rights exist both globally (Women Deliver 2021) and in Fiji.

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

- **Accessing sexual and reproductive healthcare services:** Extreme weather may cut women off from accessing services or supplies.
- **Menstrual hygiene:** Women and adolescent girls in urban areas of Fiji have reasonably good access to education and products (e.g. commercially available sanitary products) for menstrual hygiene management (IWDA, Burnet Institute, and WaterAid 2017). Women in rural and remote areas, especially those that are older or living with a disability, are more likely to rely on reusable cloths and have less access to information on menstrual hygiene management (*ibid*). Sanitary products can be expensive, therefore, when there are competing demands on a limited income (e.g., as a result of food price spikes) women may change them less regularly than they should or forgo them altogether (Plan 2020). As these are imported products, their supply may be disrupted due to disaster or extreme weather events (*ibid*). Furthermore, women and girls have reported having to wash in rivers or streams when water availability is reduced (*ibid*).

- **Sexual health:** In emergency settings (e.g., such as after cyclones or floods, which are likely to become more intense) there are a number of sexual health concerns. For example, unsafe sexual activities among adolescents in evacuation centres have been anecdotally reported by medical practitioners (MoH 2018), In addition, gender-based violence (which is already reported by 72 per cent of women, especially disabled women) and violence against children in emergency settings, such as after cyclones, has already been documented (World Bank 2017a). As climate change creates more extreme weather and more stressful conditions, the concern is that this gender-based violence may increase (World Bank 2017a).
- **Reproductive health:** Antenatal care coverage is high (95 per cent) (MoH 2018) but key micronutrient deficiencies of iron, resulting in anaemia, are prevalent in one in three women of reproductive age (GNR 2021).
- **Maternal health:** The risk of pregnant women experiencing dehydration, micronutrient deficiencies and infections (e.g., with Dengue Fever) is expected to be increased by climate change, increasing the chance of complications (e.g., preterm birth, eclampsia, low-weight births amongst others) (Women Deliver 2021). Women, who remain close to the house, may be in close proximity to water storage containers and thus at higher risk of Dengue Fever as the standing water acts as a breeding ground for the mosquitoes.
- **Newborn and child health:** Newborns and babies are vulnerable to climatic shocks as well as the stresses on their caregivers and micronutrient deficiencies are high as only 39.8 per cent of babies are exclusively breastfed in their first 0–5 months of life (GNR 2021).

SUMMARY: HOW WILL HEALTH BE AFFECTED BY CLIMATE CHANGE?

Climate change is likely to have wide-reaching ramifications on health in Fiji. The interactions of climate change may drive the growing burden of NCDs including obesity, diabetes and heart disease. For example, rising temperatures and uncomfortable heat may lead to a reduction in activity and a more sedentary life that can lead to a rise in obesity. Similarly, changing rainfall patterns, heat and extreme weather that damages crops could increase food insecurity and push people to rely on more processed, canned and preserved food as fresh produce is less available, also driving obesity, nutritional deficits, and NCD-related illnesses. Other key health issues indirectly caused by climate impacts and environmental changes include a high risk of vector-borne diseases (specifically Dengue Fever) and waterborne diseases (Diarrhoea, Dysentery, Typhoid), becoming year-round health issues rather than seasonal issues. Sea-level rise threatens coastal communities, driving some to relocate to higher altitudes as a last resort. The dislocation from traditional lifestyles as well as ancestral lands and burial grounds can contribute towards stress and anxiety. Given islander's particular exposure to the impacts of climate change, the following issues were also all identified as substantial risks: water insecurity, mental health problems, impacts on sexual and reproductive health rights and health system vulnerability.

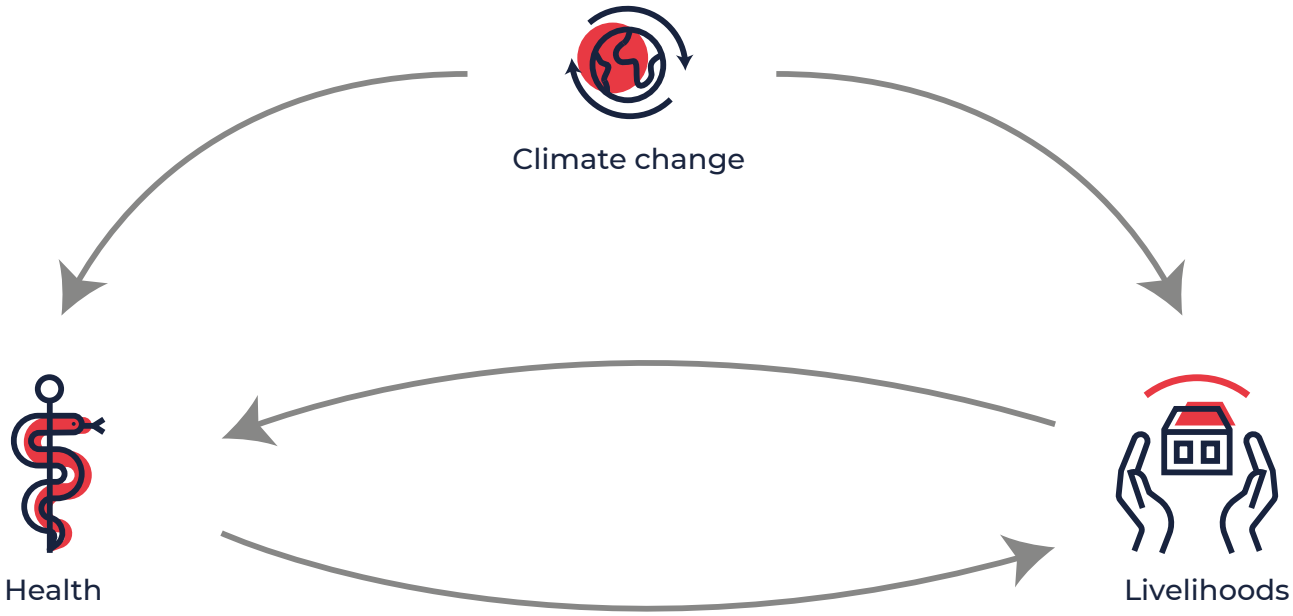
RECOMMENDATIONS

1. Emphasize nature-based heat management approaches that promote well-being and contribute towards tackling the burden of NCDs.
2. Improve and expand the surveillance systems for vector-borne diseases to potentially year-round surveillance, and ensure that water containers do not provide breeding grounds for mosquitoes.
3. Continue the emphasis on WASH awareness-raising with a focus on water conservation and avoiding contamination.
4. Prioritize working with women and local community groups to support home gardens for higher household consumption of fruits and vegetables to combat micronutrient deficiencies, and integrate knowledge packages on balanced, diversified healthy, locally grown meals for young children.
5. Help support the Government in mental health outreach in remote locations.

© IFRC

5. LINKAGE BETWEEN CLIMATE IMPACTS ON HEALTH AND LIVELIHOOD

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 is "*jaan hai to jahan hai*" – "the world exists when health exists".



The number of existing weather-related natural hazards, such as tropical cyclones, coastal inundation and flooding, are projected to increase due to climate change with potentially devastating impacts on people's livelihoods. In particular, the perceived risk of these natural hazards may deter tourists from visiting Fiji. The loss of tourism, as felt during the COVID-19 pandemic, would be a major blow to a significant proportion of the population and reduce national GDP substantially. Projected increases in extreme weather and natural hazard-related disasters may push an estimated 38,500 people (3.8 per cent of the population) into poverty each year, and may increase detrimental coping strategies such as cutting expenditure on food and healthcare. This may have long-term detrimental implications for health and well-being across society by increasing the already high burden of malnutrition among Fijians, many of whom may already postpone seeking treatment for noncommunicable diseases. Poor health will lead to lower productivity and will lead to a downward spiral, especially among poor people dependent on marine resources for their livelihoods.

Of major concern is the threat posed by higher than average sea-level rise, which is already making portions of the island uninhabitable from saltwater intrusion and coastal flooding. Maximum sea level events will become ten times more likely (going from a 100-year return level to a 10-year return level) by 2050. Land is being lost to the sea, reducing the limited agricultural land with potential implications for food security and malnutrition. Lost land is also necessitating relocation strategies – moving whole villages to elevated areas – which can impact mental health through stress, anxiety and the trauma of losing ancestral burial grounds, land and traditional livelihoods. Most urban activity is in coastal regions, and low-lying areas in urban centres tend to be densely populated placing these urban informal settlers at high risk of sea-level rise. Finally, communities largely depend on singular water sources, which face salt-water intrusion and permanent flooding and heighten the threat of water-borne diseases.

Warming temperatures will lead to more acute heatwaves as well as a new normal of chronically elevated temperatures. By 2040, hot days (over 35°C) will become twice as frequent; and, by the end of the century, warm spells may last up to 301 days per year. These warming trends, especially for those living in urban contexts experiencing the urban heat island effect, will contribute to heat-related morbidity largely via an increased burden of NCDs as people engage in less physical activity due to the uncomfortably hot outdoor temperatures. Pregnant and lactating women requiring cooler environments and fluids will become particularly vulnerable, especially if they belong to economically marginalized sections of society and cannot access adequate living spaces and healthcare facilities. The warming is likely to affect the ability to work outside, especially on farms, on the sea by fisherfolk and on seashores where much of the work is done by women. In urban areas, people working outdoors on vending, construction and services that require walking or cycling will be more at risk of a reduction of productivity and, consequently, income. It may also contribute to increased energy costs (e.g., for air conditioning) which could reduce households' money for other expenditures, including healthcare and food. Increasing temperatures will also affect the flowering and growth of certain plants, including mango, papaya and tomato, which are important sources of micronutrients. Shortages of fresh food typically prompts households to increase their consumption of processed unhealthy foods further contributing to the burden of obesity and noncommunicable diseases such as diabetes. This affects people's ability to put in hard work or long hours of work.

The warm wet season is likely to become both warmer and wetter, and extreme rainfall events will increase. The resulting floods can damage infrastructure and may displace people whose access to sanitation systems and clean water can be disrupted. This is problematic as warmer weather increases microbial growth in contaminated water sources and food, which could happen as a result of damage and displacement from flooding events. Furthermore, warmer temperatures year-round remove the natural break in bacterial proliferation offered by the cooler dry season, increasing the risk of waterborne diseases (Diarrhoea and Typhoid Fever)

year-round. A higher disease burden leads to loss of livelihoods and a downward spiral of poverty.

As wet seasons become wetter, especially during La Niña events, favourable conditions increase the transmission of vector-borne diseases, such as Dengue Fever. In a similar dynamic to diarrhoea risk extending year-round, cases of Dengue Fever may cease to be seasonal and instead occur at any time in the year. Real concern about the "significant increase" in Dengue Fever is not only limited to the health consequences, but also the impact on livelihoods and the sufferers' inability to work for weeks as a result of the painful fevers (MoH 2018).

Projections indicate that there will be fewer cyclones and storms, but they will be of higher intensity (in terms of wind speeds and rainfall). The heavy rains typically lead to flooding which, along with strong winds, can damage crops, rip up trees and damage or destroy buildings, assets and transportation networks, often leading to displacement as well as drowning and injury. As highlighted previously, a reduction of fresh food and a diverse food 'basket' pushes people to rely on unhealthy readily available processed foods, reducing their nutritional health. Damage to infrastructure leads to loss of livelihoods, increases the risk of waterborne disease transmission and breaks down sanitation facilities. Cyclonic shocks tend to have a huge impact on the Fijian population. For example, a tropical cyclone of the intensity of a 100-year event could force 5 per cent of the population into poverty and lose 6.5 per cent of GDP (World Bank 2017a). Community school buildings and healthcare facilities often cannot withstand the shocks from strong winds and floods and are frequently damaged, affecting child development and access to healthcare.

At the other extreme, the dry season is likely to become drier, though the projections surrounding drought (which is associated with moderate to strong El Niño events) are uncertain and may suggest a decrease in droughts over the long-term. Historic droughts have affected 25 per cent of the population; and, as agriculture is predominantly rainfed, it is crucial to monitor changes in rainfall patterns and the risks of dry periods, and to seek the most up to date climate change projections.

Water stress will affect livestock health and mortality and lead people to store water in containers which, if uncovered, can increase the risk of mosquito-borne diseases (e.g., Dengue Fever). Reduced flow in rivers due to droughts has also been leading to higher saline intrusion (World Bank 2017a). Worsening droughts will lead to further loss of coastal livelihoods. A few pilot projects on developing operational drought indices using historical drought data are under way (Deo 2011) and these need to be further promoted in collaboration with local stakeholders.

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

The impacts of climate change on water, sanitation and health (WASH) and livelihoods make a negative feedback loop as the effects of one aspect lead to detrimental results in other aspects of people's lives, especially those at-risk populations that already have enhanced vulnerabilities, are exposed to risks and have fewer capacities to deal with worsening rapid and slow-onset climate change-induced events. Exacerbating tropical cyclones, coastal inundation and flooding (also by intense rainfall), sea-level rise, heatwaves and drier dry seasons lead to loss of livelihoods and health impacts. Losses in crops and marine resources also lead to lower incomes and deteriorating household diets which, in turn, affect people's ability to work.

RECOMMENDATIONS

1. **Build awareness of the integral linkages between climate change impacts–health–WASH–livelihoods.**
2. **At-risk population groups are especially susceptible to cascading interlinked impacts and need to be prepared to deal with these based on anticipatory as well as adaptive action.**
3. **Advocate the use of social protection instruments to enhance people's adaptation capacities. For instance, distributing food coupons/medicines/etc. based on an early warning, before a flood strikes will enable people to stock up, safeguard their health and therefore be productive once the flood recedes.**
4. **Promote nature-based solutions to safeguard natural resources-based livelihoods and healthier food baskets.**

6. EXISTING CAPACITIES, STAKEHOLDERS AND PROGRAMMES

6.1. POLICY LANDSCAPE

Image A: Infographic of the National Climate Change Plan (2019) and the policy landscape in Fiji.

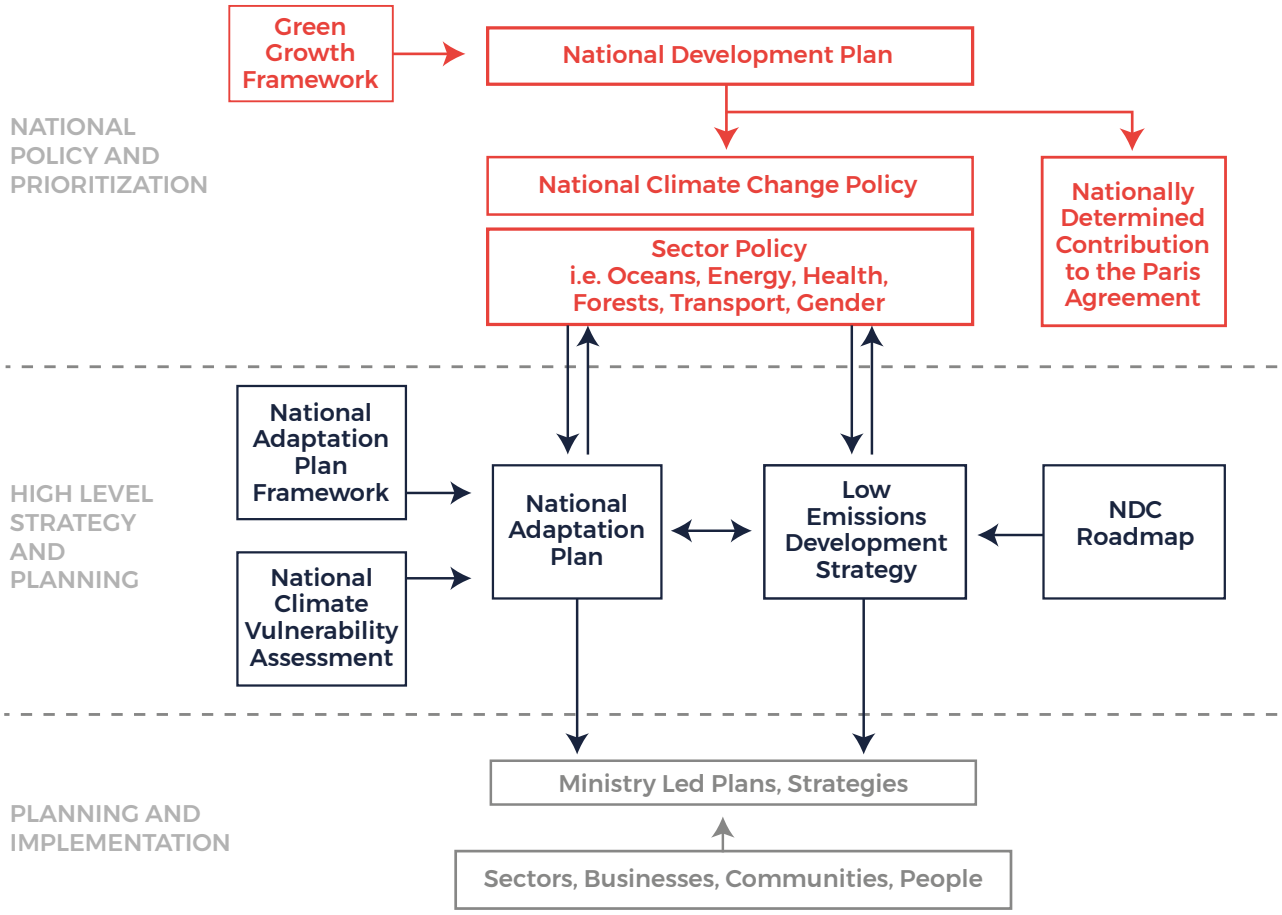


Image B: Infographic of the National Climate Change Plan (2019) and relevant organisations in Fiji.

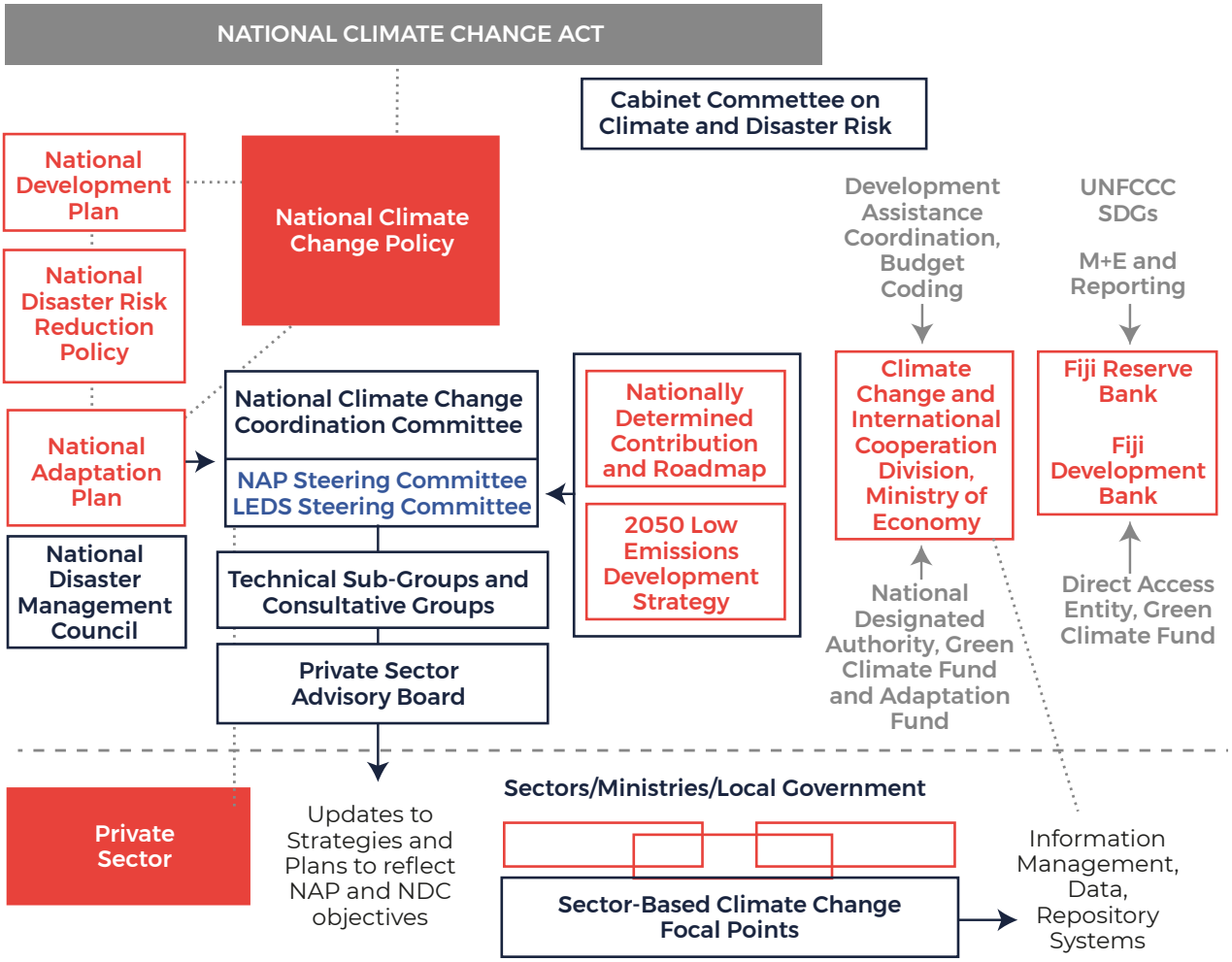


Table 2: National policies and plans

POLICY	DESCRIPTION OF CLIMATE–LIVELIHOODS–HEALTH FOCUS
Republic of Fiji National Climate Change Policy (2012)	The NCCP is the foundational policy document for climate change adaptation and mitigation. It defines the objectives and strategies for mainstreaming climate change issues into different sectors.
Fiji's Intended Nationally Determined Contribution (2015)	Defines the climate change adaptation and mitigation targets and contributions of Fiji. The document does not mention specific sectors for adaptation.

POLICY	DESCRIPTION OF CLIMATE–LIVELIHOODS–HEALTH FOCUS
Climate Change and Health Strategic Action Plan (CCHSAP) 2016–2020 (Ministry of Health 2015)	The CCHSAP is a key document that recognizes the impact of climate change on environmental determinants of health and healthcare delivery. Key priorities in the strategic plan are: • **Monitoring risks** connected with climate change and their influence on people's health is included for food, water, waste disposal and disease vectors such as mosquitoes and rodents for early warning. • The use of **environmental health impact assessment tools** will assist in the identification and monitoring of the parameters relevant to climate change health risks. • Using existing data or profiling to **identify communities most vulnerable to climate variability and change** and associated health risk exposures. • **Strengthening general health services delivery** and the management of environmental determinants of health where standard operating procedures for the health impact assessment.
5-Year and 20-Year National Development Plan (2017)	These two key National Development Plans explicitly recognize the threat of climate change to the development of Fiji and include priorities regarding health systems, improving, monitoring, disaster risk reduction and strengthening livelihoods resilience and diversification across the Fijian economy. The plan also explicitly recognizes the importance of gender-sensitive development and the integration of climate adaptation and preparedness in all future activities.
Republic of Fiji National Adaptation Plan (NAP) (2018)	The NAP guides the implementation of adaptation efforts discussed in the National Development Plan, the CVA (WB 2017) and the National Climate Change Policy (2012). Main sectors for action: food and nutrition security, health, human settlements, infrastructure, and biodiversity and the natural environment.
Fiji Low Emission Development Strategy 2018–2050 (2018)	Fiji aims to reach net-zero carbon emissions by 2050 across all sectors of its economy.
National Climate Change Policy 2018–2030 (2019)	A game-plan to achieve the Nationally Determined Contribution for Fiji and to integrate the national legislative landscape for climate change. Interestingly, the NCCP (2019) will primarily be evaluated through both health and livelihoods focused indicators. There is little explicit attention for health impacts, although it refers to the CCHSAP for health-specific plans.

POLICY	DESCRIPTION OF CLIMATE–LIVELIHOODS–HEALTH FOCUS
Third National Communication (TNC) (2020)	Outlines the results of the Climate Vulnerability Assessment (2017) and adaptation needs in Fiji. • Health: recognizes the need for strengthening health systems and monitoring climate-sensitive diseases • Livelihoods: discusses risks and opportunities in agriculture, tourism and infrastructure sectors. The TNC thereby addresses many of the important components of the climate–health–livelihoods nexus, yet does not recognize the linkages between these. A high-quality resource for further review. Proposed adaptation investments in transport are half of the total required investments, while agriculture is estimated to require the lowest investments to become more climate resilient.
Climate Risk Insurance Initiative for the Pacific launched (2020)	This is an initiative on Climate and Disaster Risk Financing (CDRF) that aims to develop a Climate and Disaster Risk Financing Framework (CDRFF) to complement existing disaster risk reduction policies and includes building stakeholder capacities with a focus on vulnerable communities and micro-, small- and medium-sized enterprises. The initiative is supported by several multilateral organizations including the United Nations Development Programme and is led by the Climate Change and International Cooperation Division of the Fiji Ministry of Economy (IRGP, 2020).

6.2. CAPACITIES

GOVERNMENT

STRENGTHS

- A strong advocate for global climate action.
- The clear commitment of the Government of Fiji to climate change adaptation and mitigation is evidenced by the multitude of policies, frameworks and action plans with attention to health and livelihoods.
- Relatively high coverage of social protection initiatives and recent work on disaster preparedness have increased the resilience of Fijian communities, demonstrated by the relatively quick recovery after Tropical Cyclone Winston in 2016.
- Strong social protection system.

CHALLENGES

- The finances required to ensure climate adaptation in Fiji are estimated to add up to 100 per cent of GDP in the next ten years (World Bank 2017a), posing an enormous financial challenge to the Government.
- Data gaps and limited monitoring hamper adaptation planning – especially on water resources (groundwater), coastal erosion, wave and sea-level variability/activity etc.
- Reaching the more remote communities with disaster preparedness information, climate adaptation measures, weather warnings etc. remains challenging (SNC 2014). Communication and dissemination of climate-related information to community level remains a challenge.
- Social protection system is not linked with climate change adaptation policy framework and action.

FIJI RED CROSS SOCIETY

STRENGTHS

- Sustained commitment to climate change adaptation and mitigation through different programmes.
- Large network of branches and volunteers that can build capacities to deal with climate change impacts at the local level.

CHALLENGES

- Accessing sufficient finances to implement resilience-building and awareness-raising activities is an ongoing challenge.
- Knowledge of and capacity in climate change within the branches and at local level can be expanded.
- Limited Early Warning Early Action work.

7. RECOMMENDATIONS AND OPPORTUNITIES

OVERARCHING RECOMMENDATIONS

RECOMMENDATION 1: Build community-based awareness and knowledge on climate change projections and their cross-sectoral impacts in rural and urban areas to enable communities to take early action and to engage with relevant local departments on adaptation measures.

Gap: There is information on the main climate projections and their impacts on people across different sectors but this does not reach the practitioners. The direct and linked impacts of climate change on health, WASH, livelihoods and DRR, especially on vulnerable groups of people, are also not part of the public discourse.

Opportunity for action: There are three key opportunities for action: 1) raising volunteers' and communities' awareness and knowledge of climate projections and climate change impacts on health, WASH, livelihoods and DRR through assessments, training, campaigns, research and interactions with Government departments working on sectors where adaptation is essential; 2) engaging with traditional leaders, provincial councils and frontline workers and officers from relevant departments that include health, agriculture and fisheries for a two-way exchange of knowledge and data and to share community-based best practices to help scale-up climate action; and 3) ensuring that weather and climate information reaches the 'last mile' and that local communities, relevant non-government actors and local government agencies have access to this information and are able to apply it to deal with the longer term impacts of climate change. This would include, for instance, community-based early warning mechanisms to forewarn fisherfolk, farmers and at-risk groups in urban areas of potential droughts, heat risk and extreme rainfall events to enable them to take early action. Achieving this would require collaboration with the national meteorological service and also with relevant Government departments and built capacities to disseminate impact-based forecasts (how forecasts will affect people and not just what the forecasts are).

RECOMMENDATION 2: Adopt and scale-up the multi-hazard community-based Early Warning Early Action approach, based on climate science projections to enable preventative health activities and safeguard livelihoods.

Gap: Relatively few Early Warning Early Action programmes are in place across Fiji, though the country's National Adaptation Plan 2018 provides for putting in place resources, technology and infrastructure for Early Warning Early Action to build community resilience. There is a disconnect between health-climate practitioners and a lack of expertise, research and financial capacity to develop early warning systems and responsive early action across sectors.

Opportunity for action: 1) introducing and scaling up climate-smart programmes and projects across sectors is possible by adopting a multi-hazard Early Warning Early Action approach, which systematically integrates medium- and long-term climate information to anticipate, prepare for and reduce the health and livelihoods impacts among high-risk groups and in high-risk areas. This includes forecast-based finance (FbF) and forecast-based actions (FbA) and working with the Government to synergize the social protection system to anticipatory action and adaptation measures. Toolkits and training materials on climate risk management, including climate-smart health programming and livelihoods-linked modules, are available in the Red Cross Red Crescent Climate Centre's Climate Training Kit. This also includes engaging with the Government on climate risk management for the use of financial risk mitigation instruments to ensure that communities are able to benefit from appropriate weather-based risk insurance measures. 2) continuously identifying specific drivers of vulnerability for health, social and economic impacts of environmental and climate change at the community level, within policy frameworks and engaging with other relevant organizations will help build stronger analytical capability for conducting integrated health and climate risk assessments using the multi-hazard approach to ensure that these drivers do not impact health, livelihoods, food and water security outcomes, especially in impoverished households. 3) programmes should increase the integration of DRR, livelihoods and public health work, and work with communities to holistically map these interactions in their environment to identify where health risks link with livelihoods and find community-based solutions to break the negative loop between climate change, health and livelihoods.

RECOMMENDATION 3: Focus on protecting and nurturing 'blue' and 'green' resources using nature-based solutions and especially involving at-risk community groups.

Gap: Agriculture, fisheries and tourism are the anchor for local communities to earn their livelihoods and safeguard their health. These sectors are dependent on healthy natural resources that are now under threat from increasing climate risk, even as community involvement in preserving these is also threatened by the increasing erosion of natural resources following the commercialization of these sectors.

Opportunity for action: 1) conservation of 'blue' and 'green' resources through the community-based resource management (CBRM) of wetlands, rainwater harvestin, mangrove protection and afforestation, which are key to ensuring the mitigation of climate shocks such as landslides, salination ingress and damage from cyclones, extreme rainfall events and droughts. There is an opportunity here to enhance the natural capital of communities in rural and urban areas through strategic collaboration with multiple stakeholders, including the enhanced use of weather and climate services in partnership with the national meteorological service, its network through the World Meteorological Organization and IFRC support on weather forecasts and climate projections. This opportunity also links with FRCS engagement with the Government on the National Adaptation Plan and other Government programmes and interventions to build the resilience of local communities and at-risk groups. There are several tools available within the Red Cross Red Crescent Climate Centre to begin pilot programmes and scale-up these community-based nature-friendly solutions through Government and stakeholder engagement.

RECOMMENDATION 4: Continue to foster cross-sector collaboration across programmes and with like-minded climate, humanitarian and development organizations.

Gap: No organization can tackle the increased risks posed by climate change alone nor alleviate the exacerbated risks of vulnerable populations.

Opportunity for action: 1) the FRCS is well placed to empower those most at-risk via capacity building and capability enhancing activities that take an inclusive and gender-sensitive approach. 2) FRCS should continue to foster and strengthen partnerships both within and outside the humanitarian and development sectors. There are opportunities to work closely with national agencies and donors to improve finance flows, strengthen infrastructure and facilitate access to technology-based solutions and innovations for climate adaptation and resilience as well as to support forecast-based financing mechanisms to scale-up anticipatory on the ground adaptation, especially in its engagement with the National Adaptation Plan (NAP). More internal integration is needed with the disaster management, communication and policy teams and, in tandem, closer collaboration with external collaborators such as the national meteorological service, private sector, academia and CSOs to implement early warning systems as well as access and disseminate information about immediate and potential disease outbreaks, adverse health outcomes and impending threats to livelihoods through damage to natural resources, especially for at-risk communities. 3) FRCS is well-positioned to showcase locally led adaptation actions; particularly the inclusive approaches of community voices addressing the risks and needs of the most vulnerable. FRCS is also well-positioned to broker collaborations to support policies and cross-sectoral planning processes, including contributing to the national ambitions for health within the Nationally Determined Contributions (NDCs) and the National Adaptation Plan (NAP).

PROGRAMMATIC AND PROJECT RECOMMENDATIONS

- Tackling unhealthy diets and NCDs by promoting the production of local, traditional, nutritious and resilient crops.
  (Gap: Changes in livelihood are transforming traditional diets into unhealthy, processed, low quality and high carbon-emitting modern diets that do not provide the nutrient diversity needed. Increasing the subsistence/home garden growing of fruit and vegetables and diversifying sustainable sources of protein, protecting coral reefs to increase diet quality are all recommended (Hidalgo et al. 2009), as are education campaigns on healthly eating and reducing the prestige of eating imported foods).

- Further research on rainfall differences across the islands
  (Gap: this report has taken a very national perspective, and it would be good to localize the risks and exposure across the different islands to make these findings more specific in terms of impacts on livelihoods and health).

- Surveillance periods for Dengue Fever have shifted and need to be investigated further.
  (Gap: there are strong seasonal influences that are changing as a result of climate change, knowing when surveillance absolutely needs to occur and whether it will become year-round will help prevent outbreaks of Dengue Fever).

- There is a role for FRCS to provide more mental health outreach support to remote or hard to access communities.
  (Gap: transportation to remote communities was found to be a big barrier to home-based or mental health outreach, which may become a significant concern due to islander's high exposure).

- Supporting efforts to climate-proof the health infrastructure.
  (Gap: critical infrastructure is exposed, and the MoH/WHO has identified the importance of ensuring facilities have back-up or renewable electricity, water (e.g., the installation of water tanks), sufficient drugs and supplies during natural disasters and undertaking regular repair and maintenance work).

- Identification of the most vulnerable, for example, through a registry of local poor and vulnerable households based on vulnerability and exposure (NAP 2018). Develop, use and publicize localized data and maps on climate vulnerability, disaggregating by gender, age, ability, income sources, education, land tenure etc. to improve the understanding of localized risk in Fiji.
  (Gap: The research team was not able to find localized livelihood zones, disaggregated data etc. so this may be a gap that FRCS can address. The NAP also highlights this a key gap in ensuring efforts go the "last mile").

- Climate-related information systems need to be strengthened.
  (Gap: Although the Fiji Meteorological Services and the NDMO issue early warnings, literature suggests that forecasting can be strengthened and specified).

- Coordinate with the local disaster management authorities to use the volunteering network of FRCS to support the communication and dissemination of climate-related information to community level.
  (Gap: Literature suggests that the communication of messages to remote communities is still challenging and vulnerable groups are not always reached because authorities do not know exactly where these groups are).

- Provide support to community-led natural resource management, particularly for native forests, coral reefs and mangroves to enhance ecosystem resilience. Promote nature-based solutions to protect natural resources at the community level. This includes helping to arrest coastal erosion and salinity ingress through coastal plantation, harnessing rainwater for drinking purposes and promoting climate-smart agricultural practices.
  (Gap: The FRCS website says it has been involved in mangrove planting and water management initiatives. To avoid further environmental degradation sound human (agricultural) practices are essential).

- Build on existing social protection programmes coverage to ensure the most vulnerable households have access to emergency support and livelihood diversification options.
  (Gap/note: these programmes are relatively well developed with a good coverage in Fiji according to the World Bank 2017a document, but there are still more opportunities to ensure the most vulnerable have access to these resources).

REFERENCES

Asian Development Bank (ADB) ADB (2014) *Solid Waste Management in the Pacific: Fiji Country Snapshot*. Asian Development Bank. Available at: https://www.adb.org/sites/default/files/publication/42672/solid-waste-management-fiji.pdf.

Asian Development Bank (ADB) (2015) 'Fiji Country Gender Assessment 2015', p. 110.

Atherton, J. *et al.* (2005) 'Watershed Assessment for Healthy Reefs and Fisheries', Wildlife Conservation Society, p. 42.

Castañeda Carney, I. *et al.* (2020) *Gender-based violence and environment linkages: The violence of inequality.* Edited by J. Wen. IUCN, International Union for Conservation of Nature. http://doi.org/10.2305/IUCN.CH.2020.03.en.

CFS (2012) *Global Strategic Framework for Food Security and Nutrition.* Committee on World Food Security (CFS). Available at: http://www.fao.org/3/ME498E/ME498E.pdf (Accessed: 21 May 2021).

Charlson, F. *et al.* (2019) 'Implementation of the mental health Gap Action Programme (mhGAP) within the Fijian Healthcare System: a mixed-methods evaluation', *International Journal of Mental Health Systems*, 13. http://doi.org/10.1186/s13033-019-0301-z.

Deo, R. C. (2011) 'On meteorological droughts in tropical Pacific Islands: time-series analysis of observed rainfall using Fiji as a case study', *Meteorological Applications*, 18(2), pp. 171–180. https://doi.org/10.1002/met.216.

FAO (2008) Climate Change and Food Security in Pacific Island Countries: Issues and Requirements. Food and Agriculture Organization of the United Nations (FAO). Available at: http://www.fao.org/tempref/docrep/fao/011/i0530e/i0530e01.pdf (Accessed: 12 February 2021).

FAO *et al.* (2021) *Asia and the Pacific Regional Overview of Food Security and Nutrition*. FAO. doi: 10.4060/cb2895en.

FAO and SPC (2019) 'Country gender assessment of agriculture and the rural sector in Fiji', p. 74.

Fiji (ed.) (2012) *Republic of Fiji national climate change policy.* Suva, Fiji: Sectretariat of the Pacific Community.

GLASS (2015) *Sanitation, drinking-water and hygiene status overview - Fiji.* UN-WAter Global Analysis and Assessment of Sanitation and Drinking Water. Available at: https://www.who.int/water_sanitation_health/glaas/2014/fiji-15-oct-2015.pdf?ua=1.

GNR (2021) *Global Nutrition Report Fiji Islands.* Global Nutrition Report. Available at: https://globalnutritionreport.org/resources/nutrition-profiles/oceania/melanesia/fiji/.

Government of Fiji (2014) *Second National Communication to the United Nations Framework Convention on Climate Change.* Suva, Fiji: Ministry of Foreign Affairs, Republic of Fiji. Available at: https://unfccc.int/Resource/Docs/Natc/Fjinc2.Pdf (Accessed: 29 March 2021).

Government of Fiji (2017) *5-Year and 20-Year National Development Plans.* Available at: https://www.climate-laws.org/geographies/fiji/policies/5-year-and-20-year-national-development-plan (Accessed: 29 March 2021).

Gravelle, G. and Mimura, N. (2008) 'Vulnerability assessment of sea-level rise in Viti Levu, Fiji Islands', *Sustainability Science*, 3, pp. 171–180. http://doi.org/10.1007/s11625-008-0052-2.

Henderson, A. D. *et al.* (2021) 'Interactions between timing and transmissibility explain diverse flavivirus dynamics in Fiji', *Nature Communications*, 12(1), p. 1671. http://doi.org/10.1038/s41467-021-21788-y.

IFRC (2010) *IFRC guidelines for livelihoods programming.* Geneva: International Federation of Red Cross and Red Crescent Societies, Geneva,. Available at: https://www.livelihoodscentre.org/documents/114097690/114438860/IFRC+Livelihoods+Guidelines_EN.PDF.pdf/73bdb19a-1a84-be09-f136-21232b13e3a0?t=1569430174761 (Accessed: 21 October 2020).

ILO (2020) *Impact of COVID19 on employment and business in the pacific.* Available at: https://www.ilo.org/wcmsp5/groups/public/---asia/---ro-bangkok/---ilo-suva/documents/publication/wcms_751883.pdf (Accessed: 10 March 2021).

INDC (2015) *Fiji's Intended Nationally Determined Contribution.* The Government of Fiji. Available at: http://fijiclimatechangeportal.gov.fj/sites/default/files/documents/FIJI_INDC.pdf (Accessed: 29 March 2021).

Intergovernmental Panel on Climate Change (ed.) (2014) 'Small Islands', in *Climate Change 2014 – Impacts, Adaptation and Vulnerability: Part B: Regional Aspects: Working Group II Contribution to the IPCC Fifth Assessment Report: Volume 2: Regional Aspects.* Cambridge: Cambridge University Press, pp. 1613–1654. http://doi.org/10.1017/CBO9781107415386.009.

IOM (2020) *Rapid Assessment of the Socioeconomic Impacts of COVID-19 on Labour Mobility in the Pacific Region.* Available at: https://publications.iom.int/books/rapid-assessment-socioeconomic-impacts-covid-19-labour-mobility-pacific-region (Accessed: 10 March 2021).

IWDA, Burnet Institute, and WaterAid (2017) *The Last Taboo: Research on menstrual hygiene management in the Pacific.* Fiji. Available at: https://www.dfat.gov.au/sites/default/files/the-last-taboo-research-menstrual-hygiene-management-pacific-fiji-report.pdf (Accessed: 15 March 2021).

L Olsson and *et al.* (2014) *Chapter 13 IPCC: Livelihoods and Poverty.* Geneva, Switzerland: IPCC, p. 40.

Lau, C. L. *et al.* (2016) 'Human Leptospirosis Infection in Fiji: An Eco-epidemiological Approach to Identifying Risk Factors and Environmental Drivers for Transmission', *PLOS Neglected Tropical Diseases*, 10(1), p. e0004405. http://doi.org/10.1371/journal.pntd.0004405.

McGree, S. *et al.* (2014) 'An updated assessment of trends and variability in total and extreme rainfall in the western Pacific', *International Journal of Climatology*, 34(8), pp. 2775–2791. https://doi.org/10.1002/joc.3874.

McGree, S. *et al.* (2019) 'Recent Changes in Mean and Extreme Temperature and Precipitation in the Western Pacific Islands', *Journal of Climate*, 32(16), pp. 4919–4941. http://doi.org/10.1175/JCLI-D-18-0748.1.

McIver, L. J. *et al.* (2012) 'Climate change and health in Fiji: environmental epidemiology of infectious diseases and potential for climate-based early warning systems', *Fiji Journal of Public Health*, 1, pp. 7–13.

Ministry of Health, G. (2015) *Health National Adaptation Plan (H-NAP). Climate Change Health Adaptation Strategies and Action Plans of Nepal (2016-2020).* Ministry of Health, GON. Available at: https://www.who.int/globalchange/resources/wash-toolkit/health-national-adaptation-plan-h-nap.pdf?ua=1.

MoE (2018) *Fiji Low Emission Development Strategy 2018-2030*. Ministry of Economy, Government of Republic of Fiji. Available at: https://www.climate-laws.org/geographies/fiji/policies/fiji-low-emission-development-strategy-2018-2050 (Accessed: 29 March 2021).

MoE (2019) *FIJI National Climate Change Policy (NCCP) 2018-2030.* Ministry of Economy, Government of Fiji. Available at: http://fijiclimatechangeportal.gov.fj/sites/default/files/documents/FIJI%20NCCP%202018-2030_0.pdf (Accessed: 26 March 2021).

MoFA (2018) *Planned Relocation Guidelines A framework to undertake climate change related relocation.* Ministry of Foreign Affairs, Republic of Fiji. Available at: https://www.refworld.org/pdfid/5b72a0c14.pdf.

MoH (2018) *Human Health Vulnerability to Climate Change in Fiji.* Suva: Ministry of Health, Government of Fiji. Available at: http://www.health.gov.fj/wp-content/uploads/2018/03/Human-Health-Vulnerability-to-Climate-Change-in-Fiji.pdf (Accessed: 12 February 2021).

NAP (2018) *Republic of Fiji National Adaptation Plan: A pathway towards climate resilience.* Suva, Fiji: Government of the Republic of Fiji. Available at: https://www4.unfccc.int/sites/NAPC/Documents/Parties/National%20Adaptation%20Plan_Fiji.pdf (Accessed: 26 March 2021).

PCCSP (2014) *Current and future climate of the Fiji Islands.* Pacific Climate Change Science Program (PCCSP). Available at: https://world.350.org/pacific/files/2014/01/1_PCCSP_Fiji_8pp.pdf (Accessed: 22 March 2021).

Plan (2020) *Periods in a Pandemic. Menstrual hygiene management in the time of COVID-19.* UK: Plan International.

Republic of Fiji (2019) *Beijing Declaration and Platform for Action*. Suva, Fiji. Available at: https://www.unwomen.org/-/media/headquarters/attachments/sections/csw/64/national-reviews/fiji.pdf?la=en&vs=4101 (Accessed: 17 May 2021).

Shah, S., Moroca, A. and Bhat, J. A. (2018) 'Neo-traditional approaches for ensuring food security in Fiji Islands', *Environmental Development*, 28, pp. 83–100. http://doi.org/10.1016/j.envdev.2018.11.001.

Singh, R. B. *et al.* (2001) 'The influence of climate variation and change on diarrheal disease in the Pacific Islands', *Environmental Health Perspectives*, 109(2), pp. 155–159. http://doi.org/10.1289/ehp.01109155.

Southgate, P. C. *et al.* (2019) 'Empowering women through pearl industry-based livelihoods in Fiji', *Women in Fisheries Information Bulletin*, 29, p. 6.

Taylor, M. (ed.) (2016) *Vulnerability of Pacific Island agriculture and forestry to climate change*. Noumea Cedex, New Caledonia: Pacific Community.

The Government of Fiji (2015) *Household Income and Expenditure Survey (HIES) Fiji 2014-2015*. Suva, Fiji.

The Government of Fiji (2020) *Third National Communication Report to the United Nations Framework Convention on Climate Change*. Available at: https://unfccc.int/sites/default/files/resource/Fiji_TNC%20Report.pdf (Accessed: 17 May 2021).

Thomas, A. S. *et al.* (2019) 'Impact of Tropical Cyclone Winston on women mud crab fishers in Fiji', *Climate and Development*, 11(8), pp. 699–709. http://doi.org/10.1080/17565529.2018.1547677.

UN (2020) *Report of the Special Rapporteur on the issue of human rights obligations relating to the enjoyment of a safe, clean, healthy and sustainable environment. United Nations General Assembly*. Available at: http://srenvironment.org/sites/default/files/Reports/2020/Fiji%20report%202020.pdf.

UNDP (2018) *Leaving no-one behind: Helping a billion people adapt to climate change*. Available at: https://www.preventionweb.net/go/62494 (Accessed: 16 December 2020).

UNICEF Pacific (2010) *Climate Change and Children in the Pacific Islands*. Available at: https://www.sprep.org/att/irc/ecopies/pacific_region/641.pdf (Accessed: 8 April 2021).

Veitayaki, J. *et al.* (2018) 'Future Use of Past Practices: Policy Implications of Insights from Two Community-Based Marine Resource Management Initiatives in Fiji', *Ocean Yearbook Online,* 32, pp. 376–405. http://doi.org/10.1163/22116001-03201015.

Vunisea (2017) *Entry Points for Gender*. Fiji: Women in Fisheries Network. Available at: http://aquaticcommons.org/21625/1/SAM_77_15_Entry%20Points%20for%20Gender.pdf (Accessed: 17 May 2021).

WBCCKP (2020) *Climate Change Knowledge Portal, For Development Practitioners.* World Bank Group (WBCCKP). Available at: https://climateknowledgeportal.worldbank.org/.

WFP (2018) *Food Security in Vulnerable Islands - A Regional Food Security Atlas of the Pacific.* Available at: https://www.wfp.org/publications/food-security-vulnerable-islands-regional-food-security-atlas-pacific-may-2018 (Accessed: 17 May 2021).

WHO (2015) *Human health and climate change in Pacific Island countries.* WHO Regional Office for the Western Pacific. Available at: http://iris.wpro.who.int/handle/10665.1/12399 (Accessed: 6 April 2021).

Women Deliver (2021) *The Link between Climate Change and Sexual and Reproductive Health and Rights*. Available at: https://womendeliver.org/wp-content/uploads/2021/02/Climate-Change-Report-1.pdf (Accessed: 19 March 2021).

World Bank (2017a) *Climate vulnerability assessment : making Fiji climate resilient.* Washington, D.C. Available at: http://documents1.worldbank.org/curated/en/163081509454340771/pdf/Climate-vulnerability-assessment-making-Fiji-climate-resilient.pdf (Accessed: 17 May 2021).

World Bank (2017b) *Systemartic Country Diagnostic 2017 Fiji.* 116491-FJ. Washington, DC.: The World Bank. Available at: http://documents1.worldbank.org/curated/en/529271512123603244/pdf/116491-revised-PUBLIC-ACS.pdf (Accessed: 10 March 2021).

ANNEX A
NEAR-TERM CLIMATE PROJECTIONS FOR FIJI (2020–2039)[1, 2]

Basic climatology. It is certain that temperatures will rise in the near future. For monthly average, minimum and maximum temperature, all models predict a slight increase of monthly temperature by 0.50–0.75°C, with the high global emissions scenario (RCP8.5) resulting in slightly higher monthly changes. Nonetheless, these changes are below the global average projected change. Rainfall trends are less certain, as climate models differ strongly. However, both under the low-emissions and high-emissions scenarios there is a small reduction (5–10 per cent) in wet season rainfall projected (particularly in January–March) while other months are likely to see little change. The SNC (2014) also underlines that 'the most likely projected change for Fiji centred around 2030, is for warmer temperatures and little change in rainfall with annual mean temperature increases of 0.7°C and negligible (-1 per cent) change in mean annual rainfall'.

Climatic extremes. The uncertain rainfall projections complicate estimates for extreme rainfall events. While general trends suggest more rainfall during intense rainfall events, and a higher frequency under high emission scenarios, there are large differences between regions and timescales.

As average, minimum and maximum temperatures are increasing in the next decades, the frequency and intensity of extreme temperature events will increase too. Nights will become increasingly warmer, especially during the dry season. Under the high emission scenario (RCP 8.5) hot nights will increase on average by 45 days by 2039, and up to 144 days by the end of the century. The heat index 35, which represents the change in the total count of days where the daily mean heat index rose above 35°C relative to the reference period (1986–2005), is expected to increase rapidly under RCP 8.5, by 7.8 days in the near-term and up to 199 days more by the end of the century. This change is less extreme under lower emission scenarios (e.g., RCP 2.6). The Second National Communication (2014) also underlines the increase in extreme temperature events, of which return periods in some locations are likely to halve already in the next twenty years, meaning these events will occur twice as often. In the near-term (up to 2039) the likelihood of heatwaves will increase by approximately

1 All data in this Annex are sourced from the World Bank Climate Portal, supplied under the Creative Commons 4.0 licence.

2 It should be noted that the islands of Fiji are small compared to the surrounding seas, and therefore downscaled GCM projections suffer from significant limitations.

7–11 per cent. If global emissions remain high in the business-as-usual scenario RCP8.5, Fiji may witness a drastic increase in the warm spell duration from 38 days by 2039 and 301 days by the end of the century.

Agricultural conditions. Drought conditions are not projected to change much (mean change of -0.08 to +0.03 SPEI for RCP 8.5 and RCP 2.6 respectively). This is in line with historical observations, and it is important to note that meteorological droughts in Fiji are largely determined by El Niño events (SNC, 2014).

SUMMARY OF KEY POINTS:

1. **Temperatures are rising, which may already result in drastic increases in extreme temperature events.**
2. **Rainfall trends in Fiji are highly uncertain and trends for the next 20 years are difficult to discern definitively.**

ANNEX B
SUMMARY TABLE OF CLIMATE CHANGE IMPACTS ON LIVELIHOODS

CLIMATE CHANGE TRENDS	PHYSICAL IMPACT	LIVELIHOODS IMPACTS
Increase in mean and extremely high air temperatures *(very high confidence)*	Number of hot days increases, more exposure to sun and heat	**Tourism:** loss of commercial value as a destination if the marine/coastal ecosystems degrade and lower attractiveness if disaster risk increases **Agriculture:** crops such as mango, papaya, and tomato can be adversely affected by high temperatures; the incidence of pests and diseases may increase across a range of crops and livestock; import availability of animal feed may decline; heat-stress on livestock **Urban and rural:** very hot days and nights impact all those working outside (vending, construction, fishing and farming) or in crowded indoor spaces, especially in factories and small workshops. This may impact work productivity and long-term health
Sea-level rise will continue *(very high confidence)*	Intensification of storm surge and coastal flooding and coastal inundation during high tide or storm surge events, and river flooding in tidal regions	**Tourism:** loss of commercial value as a destination if the marine/coastal ecosystems degrade and lower attractiveness if disaster risk increases **Agriculture:** "the land area available for agriculture may be reduced; e.g., the sugar industry has an estimated 5,000 ha of land that is under threat from saltwater intrusion" (WB 2017) **Fisheries:** area and productivity of some fisheries may increase; fisheries infrastructure and communities may be forced to relocate
	Threat of permanent coastal inundation of low-lying regions	**Loss of habitat** as an existential threat to the viability of livelihoods of affected communities

CLIMATE CHANGE TRENDS	PHYSICAL IMPACT	LIVELIHOODS IMPACTS
Ocean acidification and sea-surface temperature will continue to increase *(very high confidence)*	Coral reef damage and bleaching, fish stocks affected (change in distribution and species)	**Tourism:** the loss of commercial value as a destination if the marine/coastal ecosystems degrade **Fisheries:** coral bleaching may lead to loss of fish habitat; migration and spawning times may change for tuna and similar pelagic fish; fewer areas suitable for seaweed aquaculture; survival/growth of ornamental products, oyster spat, and sea cucumbers may be reduced; reduced productivity of invertebrates; growth rates for shrimp aquaculture may increase
The frequency and intensity of extreme rainfall will increase *(high confidence)*	Increase of flood risk, especially for low-magnitude, high-frequency floods and landslides	**Tourism:** loss of commercial value as a destination if disaster risk increases and flooding may damage natural resources like reefs **Agriculture:** heavy concentrated rainfall can cause waterlogging and pest proliferation which can induce crop damage; land erosion risk **Fisheries:** sediment covering of reefs; positive effect may be that there may be (temporary) larger areas for freshwater fish **Urban:** intense rainfall can cause urban flash flooding, which may damage houses, workplaces and infrastructure
Decrease in frequency of **cyclones**, but an increase in intensity	Flooding and wind damage may increase; higher landslide risk	Tropical cyclones and associated disaster impacts (flooding, strong winds, landslides) cause widespread damage, pushing people into poverty as their assets are damaged

ANNEX C
NATIONAL POLICIES AND PLANS RELATED TO CLIMATE CHANGE IN FIJI

1998	National Disaster Management Act
2005	First National Communication Under the Framework Convention on Climate Change (UNFCCC)
2011	Fiji REDD+ Policy
2012	Republic of Fiji National Climate Change Policy
2013	Second National Communication to the UNFCCC
2013	Health Emergency and Disaster Management Action Plan (HEADMAP)
2014	Green Growth Framework
2014	2020 Agriculture Sector Policy
2015	Fiji's Intended Nationally Determined Contribution submitted to the UNFCCC
2016	Climate Change and Health Strategic Action Plan (CCHSAP) 2016–2020
2017	National Development Plan
2017	Fiji's National Adaptation Plan Framework
2017	5-Year and 20-Year National Development Plan
2018	Fiji Low Emission Development Strategy 2018–2050
2018	Planned Relocation Guidelines: A framework to undertake climate change-related relocation
2018	Republic of Fiji National Adaptation Plan (NAP)
2019	National Climate Change Policy 2018–2030
2019	Climate Change Bill
2020	Third national communication to the UNFCCC

IFRC

Climate Centre