Myanmar

1. Country overview

Myanmar is the largest country in South-East Asia and has a population of 56 million people, of which two-thirds reside in rural areas (National Environmental Conservation Committee 2012). Although major political reforms have been established since the transition to a civilian government in 2011, the country remains heavily impacted by ongoing armed conflicts and unstable socioeconomic settings (United States Agency for International Development (USAID) 2017). Myanmar has great potential to acquire foreign investment and is rich with natural resources; however, this could be jeopardized by facing the highest economic vulnerability to climate change in South-East Asia (Central Intelligence Agency (CIA) 2020). It remains one of the poorest countries in the region, with one-quarter of the population living in poverty (CIA 2020), 70 per cent of which live in rural communities (Myint *et al.* 2016). Although industries and services are the main economic drivers, 70 per cent of the workforce rely on agriculture for income (Myint *et al.* 2016).

After 50 years of military rule, the civilian government faces significant peacebuilding challenges, which climate change is exacerbating (Internal Displacement Monitoring Centre (IDMC) 2020). Inter-communal tensions and violence amongst ethnic insurgent groups have created half-a-million Internally Displaced Persons (IDPs), with 80,000 new IDPs last year (2019) alone (IDMC 2020).
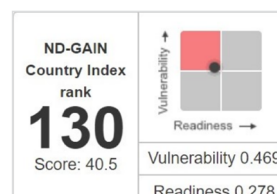

Figure 1: Map of Myanmar. (USAID,2017)

Figure 2: Myanmar's ND-GAIN Ranking (ND-GAIN 2021).

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1.1 Climate

Myanmar is a tropical country deriving its main climate processes from monsoon circulation (UN Habitat n.d.(b)). Its territory can be divided into three main agro ecological zones, which are subject to three seasons: a hot and dry inter-monsoon from mid-February to mid-May; a rainy south-east monsoon from mid-May to late October; and a cool and dry monsoon from late October to mid-February (World Bank Group n.d.).

The three agro ecological zones are: firstly, the central Dry Zone, which is home to 12 million people along the Ayeyarwady River basin and is an important agricultural production area (Herridge *et al.* 2019). Here, mean annual rainfall is the lowest across the country (800 millimetres (mm)), with 90 per cent generally occurring in May–September (UN Habitat, n.d.(b)). Temperature is very variable across seasons, from a maximum of 40°C (hot/dry season) to 10–15°C in the lowlands and 0°C in the highlands (cool/dry season).

The Coastal Zone receives the highest amount of rainfall (annual average between 2,500–5,500mm) and faces frequent tropical storms and cyclones in October–November, and in April–May (United Nations Framework Convention on Climate Change (UNFCCC) 2012). Finally, the Hilly Zone climate is defined by its topographic features: maximum elevation reaches 5,881 metres (m) in the north, where the populated Shan Plateau is located between 2,500–4,000m. With an annual average of 1,200mm, rainfall is the highest during July–August (UN Habitat n.d.(b)).

Summer monsoons (in May–October) account for 43 per cent of total rainfall over Myanmar and are associated with the movement of the Inter-Tropical Convergence Zone reaching north (Sein *et al.* 2015). Although both the Indian Ocean Dipole (known as the Indian Niño) and the El Niño Southern Oscillation (ENSO) are two important regional climatic drivers, inter-annual variability of precipitation and temperature is mostly due to the effects of the ENSO, with El Niño associated with dryer and hotter years (10 per cent drier on average) and La Niña with wetter years (4 per cent wetter on average) (Sein *et al.* 2015; Sutton *et al.* 2019).

Across Myanmar, the most severe weather events (in order) are: drought, extreme day temperatures, cyclones, extreme rainfall, and floods.

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1.2 Climate change

Historical Climate	Projected climate
Temperature	
Increase of annual temperature of 0.14°C per decade in coastal regions and 0.35°C per decade for inland regions (period of 1981–2010) (WWF 2017). Inland regions average maximum temperature increased by 0.57°C per decade, with a greater increase in the central Dry Zone (period of 1981–2010) (WWF, 2017).	Mean annual temperature could increase by 2.8–3.5°C by 2100 (Representative Concentration Pathway (RCP) 8.5), but could be limited to 1.1°C under a low emission scenario (RPC 2.6) (Herridge *et al.* 2019). The annual number of very hot days (over 35°C) could increase by 68 by 2100 (RPC 8.5) (Herridge *et al.* 2019).
Precipitation	
Increase of annual precipitation of 4.5 per cent per decade in coastal regions (up to 17 per cent per decade during dry season) and 2.5 per cent per decade in inland regions (period 1981–2010) (WWF 2017). South-east monsoon 20 days shorter (period of 1971–2000) (National Environmental Conservation Committee 2012). Increase of extreme rainfall events (National Environmental Conservation Committee 2012). Increase in the intensity and frequency of cyclones from one every three years (before 2000) to one every year (National Environmental Conservation Committee 2012). Increase of prevalence and severity of drought (period 1990–2002) (National Environmental Conservation Committee 2012).	Overall increase in annual precipitation ranging from 6–23 per cent, with the highest increase in the Rakhine coastal region (+1582mm per year) by 2070 (National Environmental Conservation Committee 2012; WWF 2017). Weakened monsoon and decreased cloud coverage is projected to exacerbate drought periods (National Environmental Conservation Committee 2012). Increased risk of flooding because of equivalent precipitation levels over a compressed monsoon season (National Environmental Conservation Committee 2012). Sea level rise of 0.4–0.8m by 2080 (WWF 2017); continuing increase in occurrence and intensity of extreme weather events such as cyclones, floods and storm surges, and intense rain (National Environmental Conservation Committee 2012).

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1.3 Climate vulnerability

With high vulnerability and low readiness, Myanmar is ranked as the second most vulnerable country to extreme weather events (Germanwatch 2020). The Notre Dame Global Adaptation Initiative (ND-Gain) index (36.1) identifies projected change in cereal yield, dam capacity, and health to be the most vulnerable components (ND-Gain 2020).

Important vulnerabilities include:

1. Livelihoods and national income highly depend on climate-sensitive sectors, such as agriculture and forestry (National Environmental Conservation Committee 2012).
2. Coastlines are projected to retreat by 10 kilometres (km) in the event of a 0.5m sea-level rise, which would further increase human density in regions that are already facing economic vulnerability due to cyclones and storm surges (National Environmental Conservation Committee 2012; WWF 2017).
3. Most vulnerable communities are located in high-risk areas where the key livelihoods, such as agriculture, are greatly susceptible to climate change impacts (National Environmental Conservation Committee 2012).
4. The World Health Organization (WHO) projects that by 2070 an annual average of 18 million people will be affected by seal level rise-induced floods (WHO 2016).

2.Humanitarian sectors and climate change

2.1 Water and habitat

Although Myanmar receives abundant precipitation, it is projected that climate-induced change to the temporal and spatial distribution of rainfall will likely exacerbate existing challenges related to water quality, quantity and accessibility (National Environmental Conservation Committee 2012). Further to a declining supply, rapid socioeconomic changes will increase stress on existing resources (World Bank Group n.d.).

It is projected that more water reservoirs in vulnerable areas (notably the central Dry Zone) will face seasonal and annual water shortages (UNFCCC 2012). In the central Dry Zone, annual evaporation is twice the annual precipitation and is likely to increase with a rise in temperature (Asian Development Bank (ASD) 2016). Further, as river flow declines and sea-level rises, groundwater is vulnerable to salt intrusion along the coasts and the Ayeyarwady River delta (UNFCCC 2012). Reliance on groundwater will accelerate the depletion of aquifers, where withdrawal rates already exceed recharge rates (UNFCCC 2012). Groundwater recharge will decrease as there is a reduction of extreme rainfall periods and an increase of evaporation due to higher than usual temperatures (UNFCCC 2012).

Climate-driven changes will exacerbate existing gaps and inequities in access to water. Currently, only 58 per cent of households in the central Dry Zone have stable access to protected safe drinking water. Due to the lack of improved sanitation, human faecal matter continues to be the main cause of water contamination (UN Habitat n.d.(b)).

Climate change will also continue to drive increased conflict and displacement related to water. Ongoing conflict and natural disasters are causing the widespread displacement and urbanization of vulnerable communities. IDPs are already forced into settings that lack adequate water and sanitation facilities (UNICEF 2018). Flooding and rainfall are likely to exacerbate contamination issues in IDP camps and in communities relying on communal ponds and wells; for example, 78 per cent of these sources of water were unsafe for drinking after the 2015 cyclone in Rakhine State (Plan International n.d.).

Myanmar's infrastructure is unprepared for climate-induced change to the hydrological cycle; most dams and reservoirs were not designed to respond to actual and projected river flows (National Environmental Conservation Committee 2012). Hydropower potential will continue to decrease as extreme rainfall accelerates the sedimentation of rivers and dams, and river flow becomes more unpredictable (National Environmental Conservation Committee 2012).

Increased tropical cyclone activity and extreme rainfall are projected to increase the incidence of significant flooding in urban infrastructure and water distribution systems, which are largely located in low-lying central Dry Zone and coastal areas (WWF 2017). If major water vulnerabilities are not addressed, the WHO projects that an annual average of 18 million people will be affected by seal level rise-induced floods by 2070 (WHO 2016).

2.2 Health

Human health in Myanmar is directly affected by climate-induced extreme weather, such as droughts or floods, and indirectly by the subsequent impacts on drinking water supply, vector-borne diseases, food insecurity, and increased mental health stressors (World Bank n.d.).

Decreasing availability of safe drinking water quantity and quality will exacerbate the spread of diarrhoeal disease (National Environmental Conservation Committee 2012). In addition, projected excess rainfall and increased temperature will amplify the spread of infectious diseases such as diarrhoea, cholera and influenza, as well as the transmission rate of vector-borne diseases including malaria and dengue fever (National Environmental Conservation Committee 2012). Parasites usually found in the lowlands will start to extend into mountainous areas (National Environmental Conservation Committee 2012). Under a high emission scenario, 46 million people would be at risk of malaria by 2070 (WHO 2016), compared to 31 million people today (WHO 2018).

Longer heatwaves and more frequent hot days are leading to a significant increase in health complications and heat-related deaths (WWF 2017). The number of extreme heat days is projected to be four to seven times higher by 2050, which could quadruple the heat-related morbidity of the older population by 2050 as well as severely affect outdoor workers and vulnerable populations lacking access to cooling locations (WHO 2016).

Vulnerable people are disproportionately more at risk of facing increased food insecurity due to climate change-induced crop failure and yield decreases (WHO 2016).

In addition to trauma stemming from extreme weather events, such as cyclones and floods, indirect impacts of climate change (i.e. poverty, discrimination and poor nutrition) will increase psychosocial stressors. This will further affect the mental health of a population that is already exposed to conflict-induced stress (Lee *et al.* 2018).

Finally, climate change will further burden an already over-stretched healthcare system, thereby jeopardizing access to, and quality of, healthcare for Myanmar citizens. Despite the government commitment to provide universal healthcare coverage by 2030, 0.5 million households suffered from catastrophic healthcare spending in 2015, averaging half their total capacity to pay (Ergo *et al.* 2019). Currently more than half of healthcare facilities face significant water, sanitation and hygiene challenges (UNICEF 2018). And a shortage of medical staff is identified as one of the country's greatest vulnerabilities to respond to climate change (ND-GAIN 2020) – staff capacity is under the WHO minimum requirement for the doctors:population ratio (Saw *et al.* 2019). Cumulatively, what this means is that the healthcare system is not equipped to respond to the additional stressors of projected water scarcity or of increased numbers of patients due to the factors outlined above.

2.3. Economic security

Myanmar's main economic drivers (agriculture, forestry and fisheries) are identified as highly vulnerable to projected climate change impacts such as increased temperature, precipitation variability and tropical storms (National Environmental Conservation Committee 2012). It is identified as the most economically vulnerable country to climate-induced change in South-East Asia (Tun Oo 2020). In rural areas, agriculture, livestock and fisheries constitute the main livelihoods for 75 per cent of the population (National Environmental Conservation Committee 2012), which is likely to face substantial food security and nutrition challenges (WWF 2017).

Extreme precipitation is affecting soil productivity and is likely to increase crop failures. Moreover, an increase in temperature will reduce the yield of critical staple crops such as rice, soybean, maize and wheat (World Bank Group n.d.). More frequent very hot days (35°C and over) during the flowering period of rice crops is leading to rice sterility and an incapacity to use rice seeds (World Bank Group n.d.). Across the central Dry Zone, farm households are expected to experience a loss of net crop revenue from 7–46 per cent by 2100 (Tun Oo 2020). Similarly, extreme weather events such as droughts, floods and very hot days are having significant impacts on livestock productivity and loss that are projected to continue to grow (WWF 2017).

Productive low-lying coastal and delta agricultural regions are facing salt intrusion in groundwater and more frequent flooding linked to sea-level rise, causing significant coastal retreat and loss of productive lands (National Environmental Conservation Committee 2012).

Along with sea-level rise and cyclones, climate-induced change, such as ocean acidification and sea temperature rise, will continue to increase pressure on fragile marine ecosystems, threatening the productivity of marine fisheries (Food and Agriculture Organization of the United Nations (FAO) 2020).

Ensuing negative impacts on food security and food systems are disproportionately affecting marginalized populations already living on lower productivity lands and could increase child malnutrition by 20 per cent by 2100 (National Environmental Conservation Committee 2012). With the loss of income-generating opportunities and restricted access to market, displaced populations will become even more susceptible to acute food insecurity and increase their reliance on external assistance (there are now more than 734,000 conflict-affected people in the Kachin, Kayin and Rakhine states) (USAID 2020).

In urban centres, the labour market remains highly informal; risks caused by natural hazards and health shocks (inclusive of climate-driven changes) are identified as key barriers keeping marginalized populations from accessing income-earning opportunities (World Bank 2019). Although the government has been implementing a policy to stimulate foreign investment, it is unlikely that significant development gains will derive from economic growth due to a high level of corruption (Myanmar ranks 130th out of 176 countries) (Internal Displacement Monitoring Centre (IDMC) 2020).

2.4. Protection

Armed conflicts between ethnic non-state armed groups and the government have been prevalent since the country's independence in 1948. Competition for territory, new industrial development and religious violence continue to be drivers of significant conflict-related displacement, despite a nationwide ceasefire signed in 2015 (IDMC 2020). Ongoing conflict in the Rakhine State alone has forced the displacement of more than 1 million people since 1970, and recent resurgent violence in 2017 triggered an additional 800,000 Rohingyas people to flee to Bangladesh (Tun Oo 2020).

Additionally, victims of conflict-based displacement in Myanmar often face significant systemic discrimination, loss or lack of legal status and restrictions on freedom of movement. This, in turn, limits access to humanitarian aid, healthcare services and livelihood opportunities (IDMC 2020). Most IDPs derive their livelihood from agriculture and fishing – two highly vulnerable sectors to climate change, which further exacerbates their vulnerability (Tun Oo 2020).

As climate change will impact the productivity of land (as outlined in Section 2.3), there are rising concerns that loss of land tenures linked to agriculture, logging and mining development projects will exacerbate IDPs' inability to return to their communities of origin (IDMC 2020). An illustration of this can already be found in Rakhine State, where the government imposed mobility restrictions on IDPs for a period of more than five years, prolonging their exposure to recurrent extreme weather events (Tun Oo 2020).

2.5. Policy

Over the last decade, Myanmar has worked to establish significant change in climate-related reforms. It announced a new National Environmental Policy of Myanmar and the Myanmar Climate Change Policy in 2019 to guide the country's vision to become a climate-resilient and low-carbon society that is prosperous and all-inclusive (The Republic of the Union of Myanmar 2019).

The National Adaptation Program of Action (NAPA) was released in 2012 and identified 32 priority adaptation projects to be developed, based on a review of the main impacts of climate variability on the country (agriculture, early warning systems and forests are identified as the three top priority sectors) (National Environmental Conservation Committee 2012). Myanmar has formulated several sectoral adaptation plans to integrate climate change adaptation across all national policy and budgets (United Nations Development Programme (UNDP) 2018).

In addition, Myanmar ratified the Paris Agreement and submitted its Intended Nationally Determined Contribution (INDC), which set out goals to mitigate emissions from the forestry and energy sectors that are currently causing major deforestation and contributing half of the country's greenhouse gas emissions (Climate Links 2017).

To reduce vulnerability to climate change, the Myanmar Climate Change Strategy (2018–2030) emphasizes the transition to climate-smart agriculture, fisheries and livestock for food security as among its top priorities (UNDP 2018). Identified challenges to successful implementation of the Myanmar Climate Change Strategy include: the inability to scale-up adaptation plans due to a limiting legal framework, lack of capacity to create pilot projects, and limited ability to integrate cost in national budgets (UNDP 2018).

These strategies are integrated under various goals of the Myanmar Sustainable Development Plan 2018–2030 (MSDP); which, in addition to climate change, acknowledged the need to implement a conflict-sensitive approach across all sectors (Myanmar Information Management Unit (MIMU) 2018). Myanmar's commitment to national reconciliation and good governance constitutes the first overarching goal of the MSDP, which aims to establish respect for human rights by mainstreaming conflict-sensitive socioeconomic development and services provision for marginalized groups (MIMU 2018). Goal 1 of MSDP recognizes the essential and reinforcing roles played by open, inclusive and well-governed institutions, adherence to the Rule of Law and respect for human rights, and the adoption of inclusive and conflict-sensitive approaches as a bridge towards trust, social cohesion and, ultimately, peace.

As demonstrated by the Myanmar Climate Change Alliance (2013–2019), international funds and expertise are still required, which provided key support in 2016 towards the creation of the Environmental Conservation Department of the Ministry of Natural Resources and Environmental Conservation in Myanmar (United Nations Environment Programme (UNEP) 2020).

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