

Disaster Risk Reduction in Myanmar

Status Report 2020



adpc Asian Disaster Preparedness Center



 **UNDRR**
UN Office for Disaster Risk Reduction

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About this report

The disaster risk reduction (DRR) status report provides a snapshot of the state of DRR in Myanmar under the four priorities of the Sendai Framework for Disaster Risk Reduction 2015-2030. It also highlights progress and challenges associated with ensuring coherence among the key global frameworks at the national level; and makes recommendations for strengthening overall disaster risk management (DRM) governance by government institutions and stakeholders at national and local levels.

As this report is based on information available as of the end of the year 2019, an update on the COVID-19 impact, response and recovery using a risk-informed approach by countries is provided at the beginning of this report. This report has been prepared by the Asian Disaster Preparedness Center (ADPC) on behalf of the United Nations Office for Disaster Risk Reduction (UNDRR) through country consultations and a desk review of key documents, including legal instruments and DRR policies, plans, strategies and frameworks, etc.

The report has benefited from inputs as well as review of the draft report by the Department of Disaster Management under the Ministry of Social Welfare, Relief and Resettlement. The international organizations including UN Agencies, Asian Development Bank, The World Bank (WB) Group, the United States Agency for International Development (USAID), and a number of non-government organizations were consulted. UNDRR and ADPC acknowledges the government, international organizations and stakeholder representatives who contributed their valuable input and feedback on this report.

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This report serves as a reference document for the implementation and monitoring of the Sendai Framework. The findings, interpretations, and conclusions expressed in this document are those of the author(s) and do not necessarily represent those of the United Nations, including UNDRR, or its Member States. The presentation of the material in this report concerning the legal status of any country or territory or of its authorities or concerning the delimitations of its frontiers or boundaries, as well as the text and the tables, is intended solely for statistical or analytical convenience and do not necessarily express a judgment about the stage reached by a particular country or area in the development process. While every effort has been made to ensure the accuracy of the information, the document remains open for any corrections in facts, figures and visuals

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UNDRR (2020). Disaster Risk Reduction in Myanmar: Status Report 2020. Bangkok, Thailand, United Nations Office for Disaster Risk Reduction (UNDRR), Regional Office for Asia and the Pacific

Myanmar's Response to COVID-19 and Disaster Risk Reduction

Myanmar confirmed its first two official cases of COVID-19 on 23 March 2020. On 31 March 2020, the National-level Central Committee for COVID-19 Prevention, Control and Treatment was formed with the Chairmanship of State Counsellor Daw Aung San Suu Kyi to slow the spread of COVID-19 in Myanmar. A second committee, the Coronavirus Disease 2019 (COVID-19) Control and Emergency Response Committee was setup on March 30 led by the Vice President 1 to help with stricter administrative measures to control the spread of the virus including quarantining migrant workers coming from neighbouring countries.

Myanmar has 127,582 confirmed COVID-19 cases (2,766 deaths and 110,809 discharged) as of January 5, 2021. Local transmissions have been rapidly increasing in Rakhine State and Yangon Region in August 2020. Semi lockdown with stay-at-home instruction was issued for entire Rakhine State starting August 27, and for all townships except the isolated Cocogyun Township (located on a far island) in Yangon Region starting September 21. Factories, especially in the garment sector, were instructed to close temporarily until October 21 which was relaxed on October 12 among all factories if they met Grade-A in preparation for virus prevention measures.

The Myanmar government has developed the COVID-19 Economic Relief Plan (CERP) consisting of seven goals, 10 strategies, 36 action plans and 76 actions that cover a range of emergency fiscal and monetary measures. The CERP seeks to mitigate the inevitable economic impact posed by COVID-19 while establishing a foundation to facilitate Myanmar's rapid economic recovery. Under the CERP, Department of Disaster Management (DDM) has built the long house for quarantine centers upon request of the local governments. The water storage concrete tanks are built and water is provided for the places where there is some water scarcity. DDM has also provided cash assistance to the households in IDP camps.

DDM has developed the Guidance Notes on COVID-19 and Disaster Management for local communities as well as for IDP Camps and also distributed them to local governments for the DRR interventions.

DDM has distributed hand sanitizers, soaps, steel basins for hand washing, disposable gloves, masks, face shields to the local communities as well as to the households at IDP camps. DDM also conducted the awareness raising activities such as distribution of posters, pamphlets, announcing the prevention and preparedness measures on COVID-19 at the communities using hand speakers.

1. Introduction

The Republic of the Union of Myanmar (henceforth, Myanmar) is a country located in Southeast Asia, sharing borders with Bangladesh, India, China, Laos and Thailand, facing the Andaman Sea and Bay of Bengal in the south and southwest. The country's total land area is 676,590 square kilometres, characterized by hilly and mountainous topography (FAO, 2011). The area is generally divided into five regions: the northern mountains, the western ranges, eastern plateau, the central basin and its lowlands as well as the low-lying coastal plains (Aung-Thwin, et al., 2019). In terms of climate, Myanmar is located in the tropical region, experiencing high temperatures, humidity and copious annual rainfall (depending on the monsoon conditions, altitude and location).

In terms of administration, Myanmar is divided into twenty-one sub-divisions, seven states (largely based on ethnicities), seven regions, one union territory, five self-administered zones and one self-administered division as per the constitution adopted in 2008. At the second level, district governments operate over the third, fourth and fifth levels, comprising townships, wards and villages, respectively. At the second level, there were 67 districts, further subdivided to 325 townships as of 2013 (The Asia Foundation, 2013). Legislative authority resides in a bicameral Assembly of the Union, represented by a 224-seat House of Nationalities and a 440-seat House of Representatives, three-fourths of which are directly elected to serve five-year terms (Aung-Thwin, et al., 2019).

With regards to its economy, Myanmar is a lower-middle income country with a Gross National Income per capita of US\$ 1,210 in 2017. Given its strong growth, poverty has reduced from 48 to 32 percent between 2005 and 2015 (World Bank, 2019). The country's annual Gross Domestic Product (GDP) growth in 2018 reached 6.20 percent, supported by major sectors such as services, various productive industries (oil, gas and minerals) alongside agriculture which contributes to 37.8 percent of the GDP and employs approximately 70 percent of the working-aged populations (FAO, 2019).

However, despite the country's relative success in sustained economic development, its people, infrastructure and the economy continue to be endangered by a plethora of hazards common to the Southeast Asian region. Myanmar experiences the impacts of frequent flooding, storms and landslides, and is sometimes affected by seismic activity. Droughts, epidemic and anthropogenic hazards (following urban expansion and industrial development) are contributing to the high risks as well. The country ranks 17th on the 2019 INFORM Risk Index, placing it into a high-risk category with a value of 6.3, where the highest risks arise from present hazards and exposure, followed by lack of coping capacities (INFORM, 2019).

1.1. Demographic Characteristics

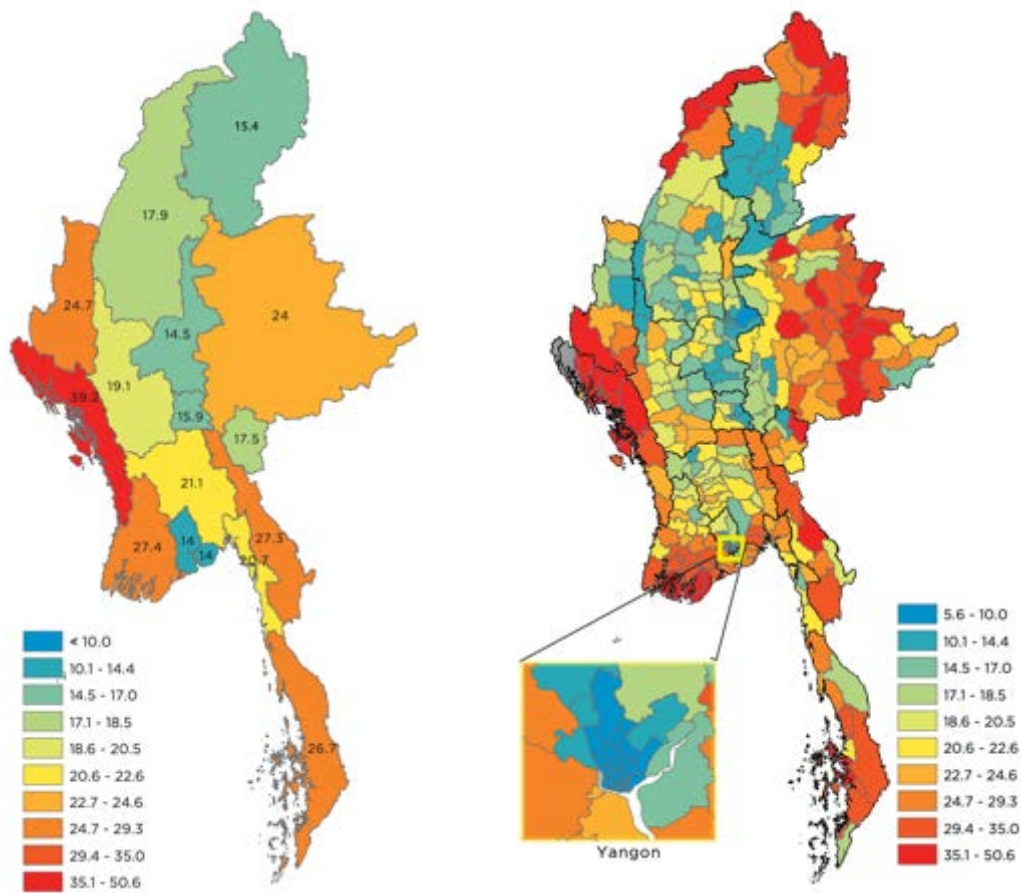
As of 2019, the Department of Population estimated the total population to have reached 54,457,024 people (Department of Population, 2019). As of 2014, approximately 30 percent of the people reside in urban regions according to the population census, with an average density of 76.1 people per square kilometre (Department of Population, 2015).

In terms of overall human development, the country ranks 145th among 189 measured countries and territories with a Human Development Index (HDI) Value of 0.584 (medium

human development category) (UNDP, 2019). Between 1990 and 2018, the country's HDI climbed by 67.2 percent due to increased life expectancy at birth by 10 years, mean years of schooling by 2.5 years and the expected years of schooling by 4.2 years, which illustrates relative success vis-à-vis targeted development efforts and investments made in human capital alongside the populations' wellbeing (UNDP, 2019). However, when accounting for inequalities within HDI, the country's HDI falls to 0.448, representing a loss of 23.3 percent due to high spatial variability of human development particularly in access to resources that support in improving standard of living (UNDP, 2019). The Multidimensional Welfare Report of 2018 published by the Department of Population and the World Bank illustrated how multiple disadvantages are substantial on the rural-urban continuum. It was found out that the Multidimensional Disadvantage Index (measuring disadvantage within the dimensions of education, employment, health, water and sanitation, housing and assets) was twice as high in the rural regions (Figure 1). Also, much remains to be done in terms of expanding access to education. According to the 2014 census, 4.4 million children between the ages of five and 18 do not, or have not attended school (Department of Population, 2015).

Myanmar will likely face challenges in achieving the demographic dividend, wherein the numbers of working age people (15 to 64) outweigh the numbers of dependent (children and the elderly), therefore requiring support from the public governance. By 2035, it is projected that 67 percent of the population will be of working age, which, if adequately supported by informed policy making and investments made in the bulging demographic of youth, may significantly boost the country's economy due to increased productivity and engagement (Htwe, 2019). However, by 2030, 3.7 million jobs are needed to even keep employment at current levels, and major investments in jobs, education and skills training are required now to achieve the country's immense potential (UNFPA Myanmar, 2017). Also, only half of the women in the country (50.5 percent) were employed in 2017, illustrating that significant efforts are required to increase women's participation in the labour market, not only to boost economic growth, but also to increase equity between men and women (UNFPA Myanmar, 2017).

Figure 1. Multidimensional Disadvantage Index at the State/Region Level (left) and Township-level (right) (Department of Population & World Bank Group, 2018).



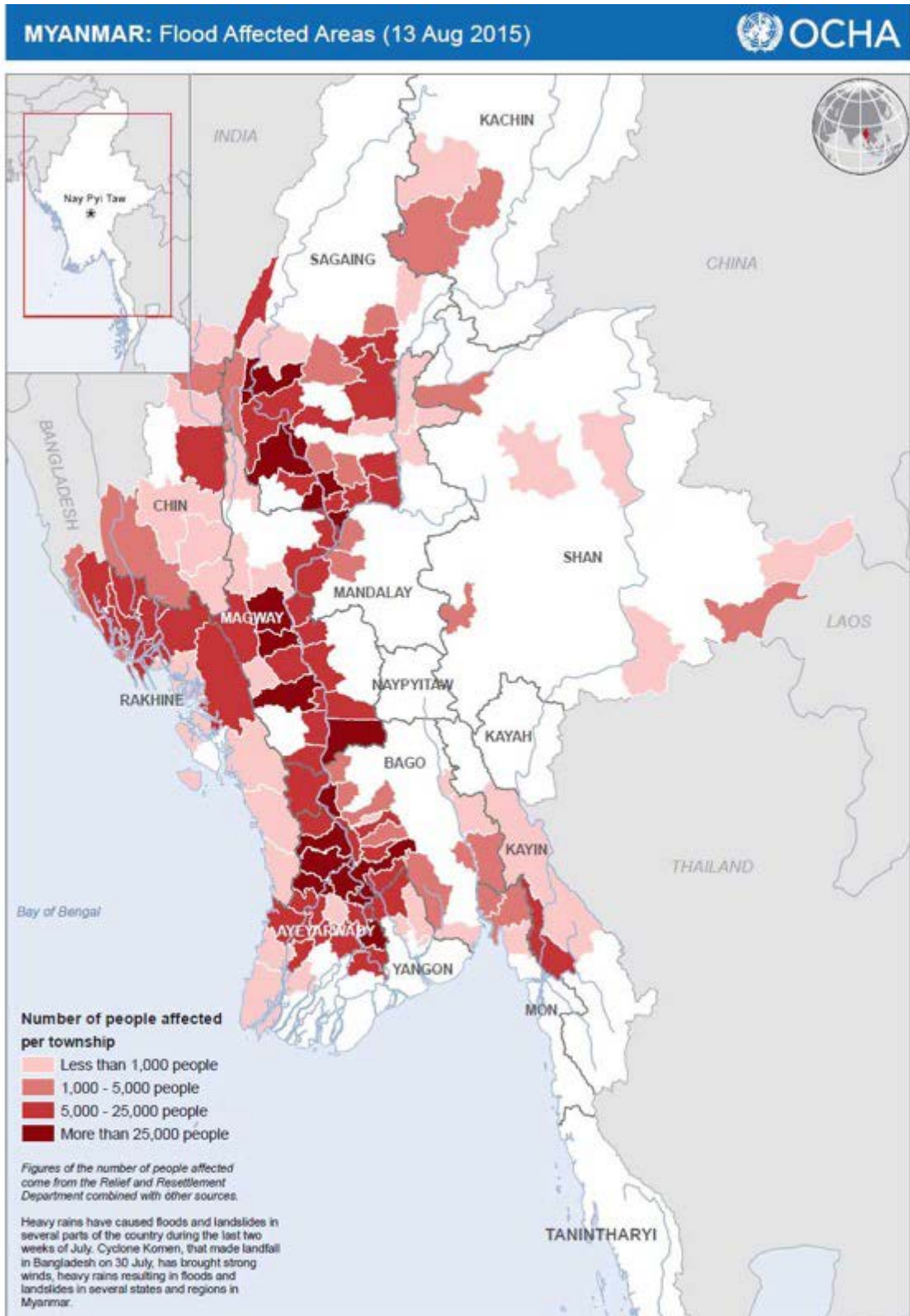
1.2 Economic Impact of Disasters

Disasters, or conversely, impacts of frequent and disruptive hazards, may severely compromise economic development due to prolonged financial needs arising from reconstruction and recovery, or because their impact may severely hinder economic activities following loss of livelihoods, assets and infrastructure. The UNDRR's Asia-Pacific Disaster Report of 2012 estimated that the average annual economic loss due to disasters in Myanmar nears 0.9 percent of the country's GDP, which was the highest in Southeast Asia (UNDRR & UNESCAP, 2012). For example, the Cyclone Nargis in 2008 alone had an impact of US\$ 4.02 billion, over half of which occurred in the productive sector due to heavy damages and losses, followed by the social sector with sustained losses exceeding US\$ 968 million (UNDRR & UNESCAP, 2012). The cyclone was also feared to affect rice production, especially crops already harvested and stored, which could have had a significant impact on exports, revenue and domestic food security given the high reliance on the crops (FAO, 2008). Given the scale of impacts and disruptions to the rice plantations, it was said that the economic impacts could exceed (and persist longer) than those of the Indian Ocean Tsunami of 2004 (ReliefWeb, 2008).

In 2015, similar impacts were witnessed following severe flooding and landslides which affected 2,952,753 hectares of rice cultivations (20.4 percent of the total production area) (Government of Myanmar, 2015). Over 17 million people were affected in the country (Figure 2), and the total economic value of losses and damages exceed US\$ 1.51 billion according to the post-disaster needs assessment, representing an equivalent of 3.1 percent of the annual GDP in 2014/2015 (Government of Myanmar, 2015). Agriculture, livestock and fisheries were the most severely affected (37 percent of all economic impacts), followed by housing (28 percent) and industry (25 percent). Also, while these impacts had a major effect on the exports reducing the economic growth slightly, at the micro-levels the consequences were worse to many. Local food prices increased massively (with 25 percent increase witnessed in the price of rice), which also strains household economies and local markets (MacGregor, 2015), not to mention the loss of household assets needed for income-generation which may provide important support in times of adversity (such as fishing boats and cattle).

Such disasters illustrate the pervasive impacts which they may have to macro and micro-scale economies, and further highlights the need to invest in proactive disaster and climate risk reduction measures given that when left unmitigated, these mounting costs may compromise not only economic growth, but human development.

Figure 2. Map of the flooded areas by August 13, 2015 (OCHA, 2015).



1.3 Social Impact of Disasters

Alongside the economy, disasters also affect people to a varying degree due to compromised health, psychosocial wellbeing, or lost household assets which affect one's quality of life. In the case of cyclone Nargis, causing more than 140,000 fatalities, also resulted in significant trauma and reduced social capital among those affected due to deceased family members and friends, or lost livelihoods, homes and routines of life (ASEAN Secretariat, 2010). The disaster also increased inequality within regions by worsening localized pockets of poverty, wherein expenditures of poorer households was reduced significantly (Warr & Aung, 2019). More than 2.4 million people in the townships of Labutta, Bogale, Pyinsalu, Yangon and others were affected, leaving hundreds of thousands without livelihoods, home and access to healthcare (Lateef, 2009).

In the 2015 floods, more than 1.6 million people were temporarily displaced (GFDRR, 2019), which is also a significant concern in post-disaster phases, given that displaced populations often suffer from lack of access to sanitation and infrastructure, and may face disruptions in accessing education. Although schools officially reopened on August 10, 2015 in the aftermath of the flood, many did not return to schooling for several months due to damaged or destroyed school facilities, facilities, schools were converted into temporary shelters, or due to trauma experienced by children (Save the Children, 2016). Income is often prioritized ahead of education while those living in geographically rural locations may face challenges in commuting to schools, further limiting their access to education (Laung, 2013). Considerations for guaranteeing the contingency of education despite disasters is indeed important given that education and poverty are interlinked not only in Myanmar, but globally. Those living in poverty in Myanmar are likely to come from rural households with no education, and a primary income dependent on agriculture (World Bank & Ministry of Planning and Finance, 2017), disruptions of which may constitute to the formation of trans-generational cycles of poverty which may be impossible to overcome.

When it comes to human health and wellbeing, disasters and hazards may also disrupt healthcare provisions due or damaged facilities, and critical infrastructure such as roads and electric grids. While access and utilization of health services in some regions of Myanmar is inadequate due to geographical, financial and cultural barriers, healthcare provision suffered even more in the aftermath of the 2015 flooding and landslides which resulted in more than 200 partially destroyed facilities and infrastructure in the most affected areas (Government of Myanmar, 2015). On the other hand, while healthcare contingency may suffer, the prevalence of diseases may rapidly increase in the aftermath of disasters. Flooding, may wash up waste in areas where access to sanitation is low, which then increases the occurrence of diarrheal diseases including cholera, typhoid and E. coli. Such diseases may impose severe stress on already hindered healthcare infrastructure during times of adversity.

2. Disaster Risk Profile

2.1 Hazards and Climate Change

Myanmar is exposed and vulnerable to a myriad of natural and anthropogenic hazards depending on the location, regional weather and geological conditions and topography, among other factors. These spatial characteristics can be seen in Figure 3. Approximately half of total number of disasters in the country are caused by flooding, followed by storms (23 percent), earthquakes (15 percent) and mass soil movement (12 percent) (JICA, 2015). Increased risks of flash flooding must also be acknowledged. Occurring as a consequence of rapid rainfall and impermeable surfaces and/or low soil's absorption capacity, such events may rapidly endanger large numbers of people and infrastructure. Other hazards include droughts, wildfires, potential for tsunamis, as well as major epidemics and technological disasters originating from industrial or transport accidents.

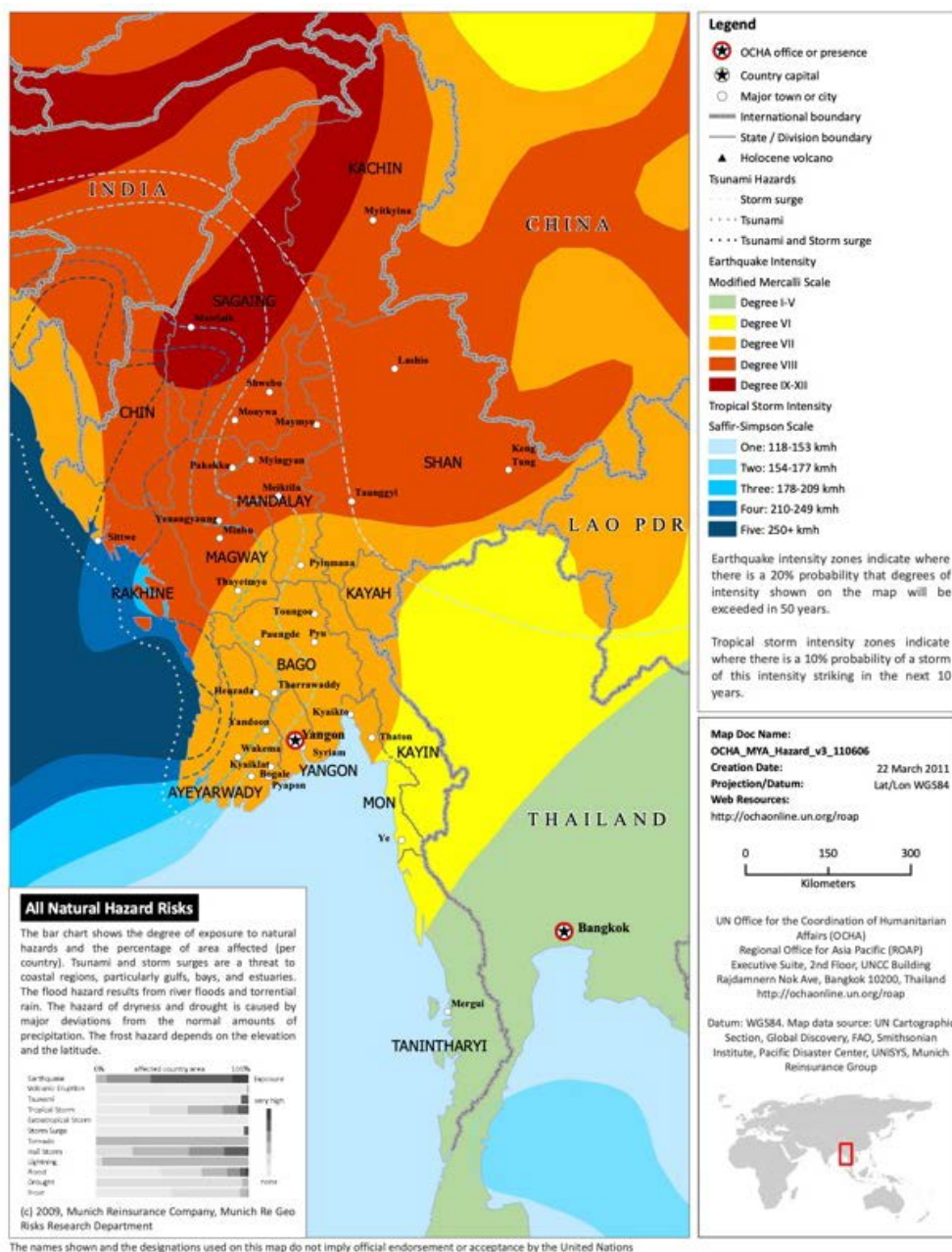
Cyclone hazards also affect the country, usually originating over the Bay of Bengal on the western coasts. The average lifetime of a cyclone is about four to five days depending on the cyclone season. Pre-monsoon months from mid-April to mid-May, followed by the post monsoon months of October to November may generate cyclones and storms with a varying intensity (Department of Meteorology and Hydrology, 2019). Such events may also generate storm surges and cause inundation in the coastal regions, which adds to the coastal flood risks. Tropical storm risks are indeed highest in the Rakhine State, Ayeyarwaddy region, and other coastal states which may be affected by events measuring as high as five on the Saffir-Simpson storm intensity scale, as seen in Figure 3 (OCHA, 2011).

Water scarcity and droughts are common in Myanmar as well, often made worse by limited availability of water to household consumption in the more rural areas, as they often rely on shallow wells or rainwater collection ponds vulnerable to drying (RIMES, Adaptation Fund & UNDP, 2017). Often occurring in association with high temperatures, dry conditions and low precipitation, wildfires also occur in Myanmar, mostly in the form of low-intensity surface fires (Department of Meteorology and Hydrology, 2009). Yet, they still threaten woodland areas, pose a threat to watersheds and wildlife alongside the economy and people. Also, often generated as a result of high precipitation or seismic activity, landslides are a concern for a country characterized by hilly topography. The conditions are often worsened by unplanned expansion of cultivations and settlement, slope cutting, erosion and changes in the hydrological cycles. When it comes to seismic risks, Myanmar is located in the southern ranges Himalaya, and faces the Indian Ocean to the east, thus being exposed to earthquakes caused by the Himalayan orogeny or by the subduction of the Indian Plate pushing underneath the Burma Platelet (a part of the Eurasian Plate) (Department of Meteorology and Hydrology, 2009). Five seismic risk zones from I to V have been identified, the most dangerous of which are located in the northern and central regions of the country.

Climate change is also a severe concern to a country frequently affected by hydrometeorological hazards. It is likely to exacerbate the impacts of flooding, storms and associated storm surges, and contributes to prolonged periods of droughts. Furthermore, loss of biodiversity and damaged ecological systems may have severe consequences to livelihoods and wellbeing of millions given the high dependency on activities, including fishing and subsistence agriculture, which depend on the stability of the environment. Changes in regional weather patterns is likely to endanger agricultural activities, for example, and higher

temperatures may reduce yields of rice, wheat, maize, soybean and groundnut significantly (World Bank, 2019). The coastal regions will be affected by increased impacts of flooding and storms, but also by sea level rise, coastal erosion and salinization of otherwise fertile soil, which is detrimental for highly productive and economically important deltaic and low/lying crop cultivation areas (World Bank, 2019). These impacts will also affect coastal settlements, their population and critical infrastructure. Increasing temperatures and humidity will affect the prevalence of diseases as well, and will cause myriad of health impacts due to worsened heat-stress, especially in the urban regions. Due to more prolific breeding conditions for mosquitoes, vector-borne diseases such as dengue and malaria are likely to increase, and an increase in non-potable fresh water sources will result in communities without access to safe water, thus exacerbating diarrheal diseases and dehydration (Ministry of Information, 2019).

Figure 3. Myanmar natural hazard risks, issued March 22, 2011 (OCHA, 2011).



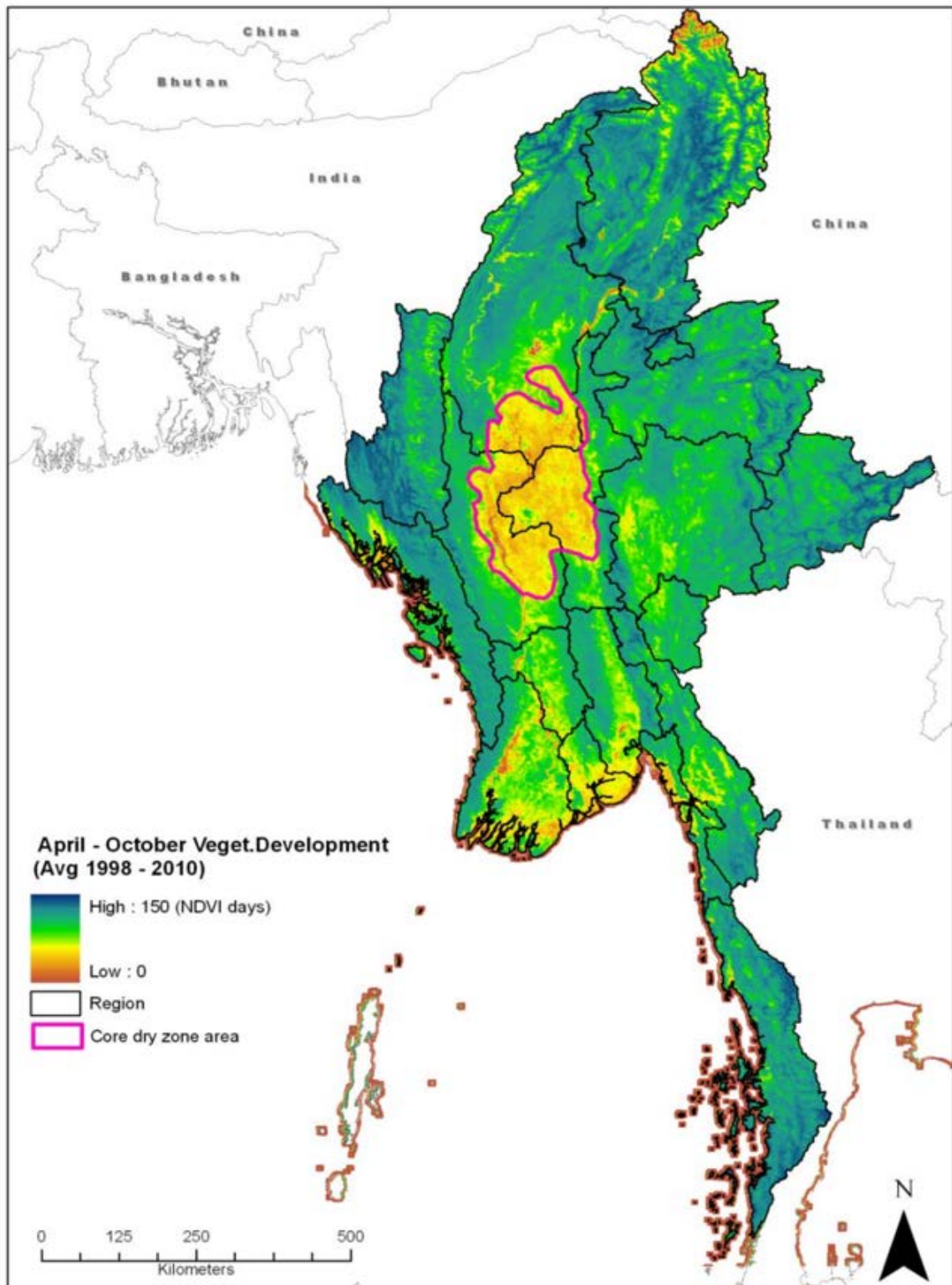
2.2 Exposure

As briefly discussed above, disasters and hazards do not affect the country equally. Their impacts and prevalence depend on regional weather conditions, exposure to bodies of water, soil conditions, and topography alongside plethora of other factors. For example, few major cities and urban centers are located in the vicinity of the active Sagaing Fault, which makes seismic risks highly localized. It extends throughout south of Putao and Katha through Sagaing, and continues alongside the eastern parts of Bago Yomas and Bago with a total length of approximately 1,500 kilometers (Department of Meteorology and Hydrology, 2009). Landslides are also localized to hilly and mountainous areas, especially in the northern regions. Geomorphologically, Myanmar has two mountainous provinces: The Western Ranges and Eastern Highlands, within which risks are high due to steep slopes and unstable soil conditions worsened by heavy monsoonal precipitation (Department of Meteorology and Hydrology, 2009).

Quite uniquely, impacts of droughts have also demonstrated high spatial variability in the past. Most of central Myanmar is considered as the 'Dry Zone', covering an area of 67,700 square kilometres (10 percent of the total area), characterized by intense heat, low rainfall (April to May) and degraded soil conditions (Department of Meteorology and Hydrology, 2015), which is usually worst affected by extreme heat and prolonged drought conditions. The Dry Zone covers 3 regions in total, comprising 54 townships under 13 districts, and also affects 35 percent of all cultivable land in the country (Department of Meteorology and Hydrology, 2015), as seen in Figure 4.

Similarly, flooding exposure is largely determined by the prevalence of flood plains and bodies of water. For example, there are approximately 60 major rivers in the country, including the Ayeyarwaddy, Chindwin, Sittaung and Thalwin, most of which flow to the Bay of Bengal from North to South given the topography of the country (Aung, et al., 2017). They are also incredibly fertile regions, thus attracting large numbers of people due to their lucrative potential for agricultural activities and fishing. According to Myanmar Unified platform for Disaster Risk Application (MUDRA) developed by Department of Disaster Management with the technical support of ADB, it is estimated that more than 1 million people are exposed to riverine flood and storm surges in Myanmar and one third of the population exposed lives in Ayeyarwaddy Region.

Figure 4. Average vegetation index of Myanmar between 1998 and 2010, revealing the Dry Zone at the centre of the country (WFP, 2011).



2.3 Socio-Economic Vulnerability

Exposure also correlates with socio-economic vulnerabilities, given that people rarely choose to inhabit dangerous sites. Rather, they are forced to expand their housing or income-generation (such as cultivations) to hazard-prone areas out of necessity to escape poverty, or due to lack of available or affordable land. These activities often negatively impact hazard risks, given that development on unstable hillsides, for example, further contributes to land degradation, vegetation loss and soil cutting, thus exacerbating the risks of mass movements.

Poverty is indeed an important element of vulnerability, as the poorest of any given society are often the hardest hit by disasters. Mortality rates are typically highest among low-income groups, and they tend to reside in hazard-prone areas where land is cheap or readily available (such as organic expansion of urban slums), and the poor are also disproportionately affected by lost assets including farms, livestock, or equipment such as fishing boats (Deraniyagala, 2012). Given that 57.3 percent of the country's poor were involved in agriculture, forestry and fishing in 2013 (UNDP, 2013), addressing the socio-economic vulnerability of those dependent on climate and disaster-sensitive activities in Myanmar is elemental to mitigate the worst impacts of disaster events to those with the least means to shelter themselves from damages and losses. In the urban regions, those most affected by flooding are also the poorest, living on highly exposed land with no legal tenure, in poorly-constructed houses which creates socio-economic boundaries to disaster impacts occurring in cities of Myanmar (Kawasaki, et al., 2019).

Disasters also affect demographic groups differently depending on their status in any given society. The impacts of catastrophic events are often distributed following not only economic, but social and cultural boundaries as well, wherein women, children, the elderly, disabled and other vulnerable groups are affected to a differing degree based on their ability to access services and support that is determined by contextual social hierarchies. A status of marginalization may negatively affect one's social capital, access to employment opportunities or income-generation, the ability to own land or inherit property, all of which translate to lower levels of resilience and high vulnerability. For example, there were an estimated of 318,000 disabled children younger than 15 in the country, of whom are expected to face significant troubles in the aftermath of disasters especially in their ability to access schooling (ADPC, 2015; Save the Children, 2016).

Gender is another important dimension of social vulnerability, originating from social systems which inadvertently or indirectly discriminate women and girls limiting their access to schooling, opportunities, employment, healthcare and ownership opportunities. In Myanmar, significant inequalities between women and men exist, especially in rural regions where distinct gender roles for women in management of households limit their ability to uptake employment (IFRC, 2017). It was also reported that women affected by the cyclone Nargis were also exposed to heightened risks of experiencing gender-based violence and sexual abuse in the aftermath of the disaster (IFRC, 2017). Yet, it must be acknowledged here that 'women', are not a homogenous group. Rather, the intersectionality of gender, race, religion and sexual orientation also creates levels of vulnerability among women, who are affected to a differing degree depending on their perceived status within a society.

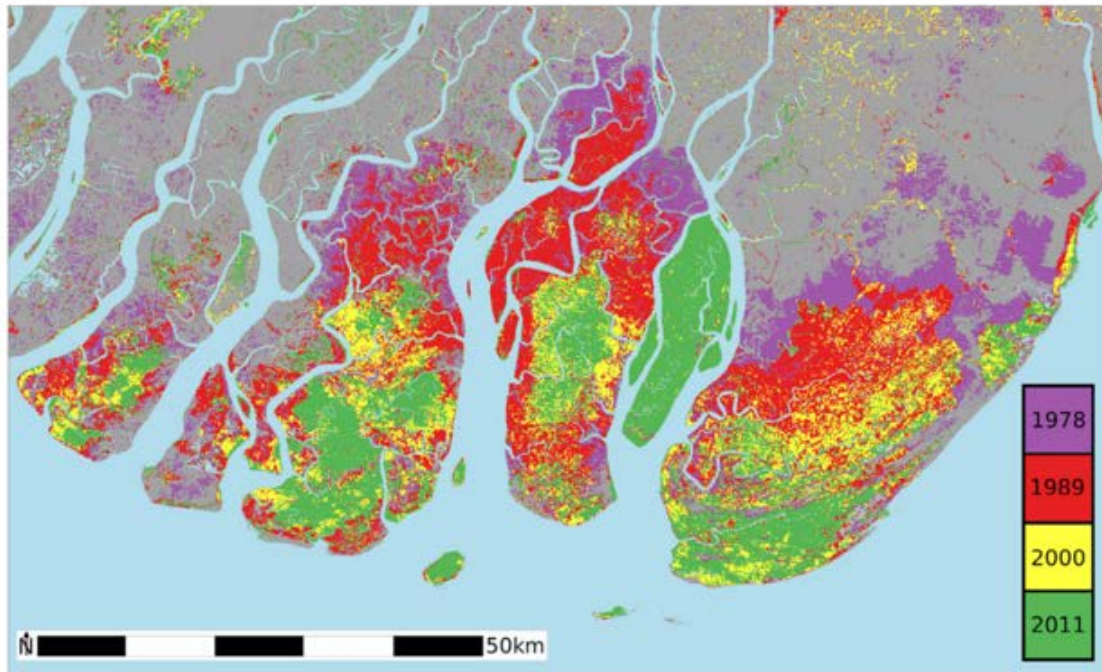
2.4 Physical Vulnerability

As is evident in urban slums across the world, low-income households tend to construct housing which is of poor quality, does not integrate necessary considerations for improving resiliency, and is often highly prone to damages during earthquakes, storms or flooding. In Yangon alone, skyrocketing housing prices and continuing income stratification among people continues to marginalize low-income city-dwellers and rural-to-urban migrants seeking new opportunities, forcing them to inhabit land without legal claims, having no access to basic urban services and constructing their houses with highly flammable, or otherwise poor quality building materials which increases physical vulnerability (Forbes, 2016). This inequality may undermine all the benefits brought by urbanization as it worsens social divisions, contributes to rising crime and violence (World Bank, 2019), and accentuates disparities in disaster risks following socio-economic boundaries. Similarly, as most of the people still reside in rural areas, settlements in more remote regions have high seismic vulnerabilities due to the prevalence of non-engineered and traditional structures and housing (Department of Meteorology and Hydrology, 2009). Approximately 82 percent of all households in the country utilize bamboo or wood for walls, and when combined with poor building techniques or roofing materials, they may heighten vulnerability significantly (HARP-F & MIMU, 2018). Dirt floors are also carriers of contaminants causing diarrhea, skin diseases or respiratory illnesses, and also require more effort to maintain in good condition.

Physical vulnerabilities are also apparent in the wider infrastructure where investment considerations are not just important from the perspective of development, they are also an indicator of resilience. Underfinanced and underdevelopment infrastructure rarely integrates necessary considerations for disaster and climate risk reduction measures, which are the cornerstones in building resilient and sustainable cities vis-à-vis the contemporary challenges of the 21st century. Myanmar infrastructure index was categorized as high risk, signifying the importance to strengthen efforts targeted towards building resilient infrastructure. (INFORM, 2017)

Organic growth of cities and unplanned (or inadequately managed) development also contributes significantly to environmental degradation, which is another dimension of vulnerability as loss of natural spaces may exacerbate impacts of hazards. Between 1990 and 2015, the forest cover of Myanmar has been declining at an average rate of 1.2 percent annually, and the rates of mangrove forest loss are highest in Southeast Asia, as seen in Figure 5 (World Bank, 2019). This translates to increasing flood risks in coastal zones given that mangrove forests act as important buffer zones against inundation and storm surges. Similarly, water and air pollution effluents are escalating due to high growth, which further compromises the availability of safe water and healthy environment for the population (ADB, 2015), and saline intrusion following frequent storm surges and the sea-level rise further compromise coastal regions, especially. Facing the ongoing challenges of climate change and worsened impacts of disasters, sheltering the country from loss of these critical resources is elemental to increase the resiliency of the population against adverse impacts of disasters.

Figure 5. Change in mangrove forest cover between 1978 and 2011 on the Ayeyarwady Delta (HARP-F & MIMU, 2018).



2.5 Future Disaster and Climate Risks

As briefly noted, climate change is likely to exacerbate the impacts of hydrometeorological hazards by increasing monsoonal precipitation (and thus, flooding), and by contributing to prolonged extreme temperatures and droughts. Similarly, the rising sea levels will severely hinder economic activities, lives and livelihoods along the coasts of Myanmar due to submerged or damaged infrastructure, increasingly salinized soil and water resources, and worsened tides or storm inundation. The risks are indeed high, as Myanmar was placed as the third among countries on the 2019 Climate Risk Index assessing most affected nations between 1998 and 2017 (Germanwatch, 2019).

Average annual surface temperature has already increased by 0.25 degrees Celcius between 1981 and 2010 and the average rainfall has increased as well (WWF, 2017). In the future, temperatures are expected to increase by 1.3 to 2.7 degrees Celcius by mid-century, the number of extreme days of heat per month could increase by 4 up to 17, and the sea level rise could exceed 41 cm by 2050 under current climate change projections (WWF, 2017). These changes will have tangible impacts on fragile biodiversity (especially range-restricted and slow-moving species), on coastal zones, human health and wellbeing, on agriculture (and livelihoods) alongside infrastructure and urban areas (WWF, 2017). Safe water availability may also dwindle depending on the region, which has a significant potential to reduce agricultural output and endanger human health.

However, these impacts will not affect the country equally. Some regions, such as the central dry zone, are more vulnerable and susceptible to the rise in temperature, while the southern coastal regions are most likely to be heavily affected by the increasing prevalence of storms and cyclones (Figure 6). All ecological zones host vulnerable communities and

ecosystems, mainly in the Hilly, Dry and Coastal Zones (Table 1). Compounding factors from the vulnerability of livelihoods, location, exposure to hydrometeorological hazards, levels of poverty as well as the local capacities to adapt and prepare for climate change impacts affect the distribution of impacts to the populace of Myanmar within the vulnerable regions (Department of Meteorology and Hydrology, Ministry of Transport & UNEP, 2012). Also, given the high importance of hydropower output and industry to the wider economy, fluctuations in the regional weather patterns (mainly rainfall and temperature) may have deleterious impacts to the economic development in the future. Similarly, climate extremes affecting the health, food security and industrial productivity may endanger growth due to vulnerable workforce.

Figure 6. (a) Vulnerability of areas and Regions/States to climate change-related increases in intensity and severity of extreme weather events; and (b) the vulnerability of the main socio-economic sectors in Myanmar to extreme weather events as well as a range of other predicted climate change impacts (Department of Meteorology and Hydrology, Ministry of Transport & UNEP, 2012).

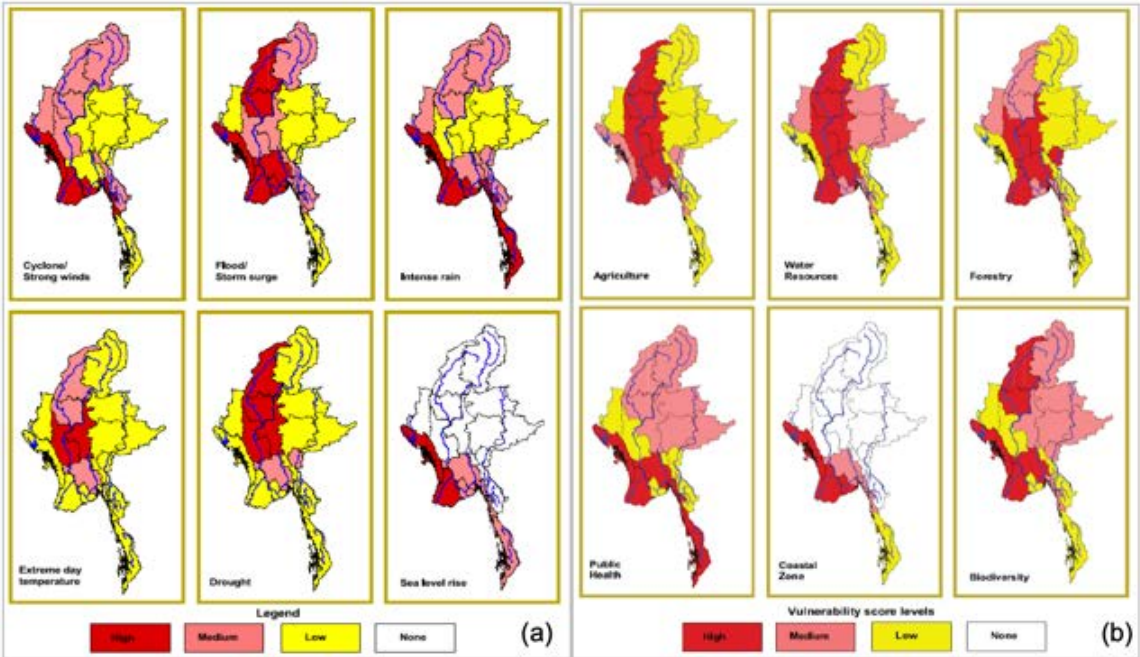


Table 1. Areas, Regions and States that are most vulnerable to climate-change related impacts of hydrometeorological hazards as identified in the National Adaptation Programme of Action (Department of Meteorology and Hydrology, Ministry of Transport & UNEP, 2012).

HAZARD	VULNERABLE AREAS, REGIONS AND STATES
DROUGHT	Central Dry Zone – Sagaing, Mandalay and Magway, especially agricultural production occurring within these regions
CYCLONE AND STRONG WINDS	Coastal Regions from Rakhine, Ayeyarwady and Yangon
HEAVY RAIN	Tanintharyi, Yangon, Rakhine, Ayeyarwady and Mon, which have the longest exposure to the south-west monsoon flows
STORM SURGES	All low-lying regions alongside river basins and floodplains, especially those nearing Ayeyarwady, Chindwin, Sittaung and Thanlwin river systems and coastal areas
EXTREME TEMPERATURE	Low-lying regions in the Central Dry Zone
SEA-LEVEL RISE	Coastal zones such as the Ayeyarwady Delta, which may face permanent inundation

3. Disaster and Climate Action Interventions

As evidenced by the previous chapters, managing DRR and climate change adaptation (CCA) in Myanmar is a mountainous task, not to mention the efforts to reduce poverty, increase resilience, and to improve the management of resources. However, efforts are in place to improve disaster and CRM in the country, and concrete steps have been taken to further integrate the post-2015 Development Agenda into policymaking and efforts on the ground. The following chapters provide an overview of the country's process vis-à-vis the mandates of international agreements and frameworks (the Sendai Framework for Disaster Risk Reduction, Sustainable Development Goals and the Paris Climate Agreement), highlights some of the key issues and provides suggestions for improving the further implementation of DRR, CCA and sustainable growth.

Priority 1. Understanding Disaster Risk Analyzing, collecting and managing disaster and climate risk-related data is the cornerstone for achieving comprehensive understanding of disasters. Data is required in the processes of conducting risk and vulnerability assessments, used in prioritizing investments for resilient development and in supporting sustainable and risk-informed land use planning. Data should also be categorized as well as appropriately disaggregated to facilitate disaster trend projections and identification of impacts to different demographics, and all the information should be accessible to the public and authorities at all levels, stored within well-managed disaster information management systems.

In Myanmar, risk assessments are available at local and national levels, based on hazard data and vulnerability information, including targeted initiatives for key sectors of development (CFE-DM, 2017). Most recently, such assessments have been drafted by the Ministry of Social Welfare, Relief and Resettlement, with complementing guidelines for drafting them at sub-national levels (Taw, 2018). The most important tool for assessing disaster losses and damages, utilized for trend projection and compiling available information about past disasters is the Myanmar Disaster Loss and Damage Database hosted by the Department of Disaster Management in partnership with the UNDP (Department of Disaster management, 2019). It was established in 2014 with the intention to pool all available disaster-related data from the range of government departments, by focusing on improving the national capacities for decision-making by enhancing the talents required for monitoring and analysing prevalent risks and vulnerabilities to support further DRR, mitigation, preparedness, response and recovery efforts (UNDP, 2014). In addition, the development of Myanmar Unified platform for Disaster Risk Application (MUDRA) helps improve understanding and awareness of various stakeholders about existing risks and future risks associated with climate change. Also, the non-governmental Myanmar Information Management Unit under UNOCHA collects, analyses and disseminates information and data related to emergency and disaster management by maintaining them in a public domain, thus enabling and supporting risk-informed decision making (Orozco, 2017).

Numerous ongoing initiatives exist also for improving the coverage of disaster and climate information. They include applications of Space and Geospatial (GIS) technology, such as flood hazard mapping conducted in Ayeyarwady region, and the hazard/risk mapping utilizing similar technology in numerous cities, including Hpa-an. However, lack of technologies, government budgets ineffective systems for monitoring disasters and related-data, and lack of cooperation between relevant stakeholders limit the availability of data, and constitute in shortcomings witnessed in maintaining the current databases (Than, 2014).

Priority 2. Strengthening Disaster risk Governance to Manage Disaster Risk DRM in Myanmar is founded into the 2013 Disaster Management Law and the 2015 Disaster Management Rules detailing the tangible implementation of the aforementioned law. It includes considerations for all phases of the disaster management cycle from preparedness, prevention, mitigation, response to recovery, identifies the roles and responsibilities of relevant stakeholders at various levels of government, and integrates DRR as a key concern for authorities to consider before disasters (Ministry of Social Welfare, Relief and Resettlement, 2014). In 2019, efforts were being made to review DM law with the intention to integrate climate change and other emerging issues. In terms of operationalizing interventions in the country, the Myanmar Disaster Preparedness Agency (MDPA) was established as the main focal point for organizing and coordinating disaster preparedness initiatives, but was later replaced by the establishment of the National Disaster Management Committee led by the Vice President of Myanmar and membered by Cabinet Ministers and Chief Ministers for all States and Regions. NDMC serves as the supreme body in terms of policy formulation, decision making and overall management before, during and after disasters.

Existing laws are supported by robust plans intended to improve preparedness and DRR, including the Myanmar Action Plan for Disaster Risk Reduction (MAPDRR) for 2009-2015. It intended to improve national resilience against national hazards across all development sectors, but does not consider private sector as essential stakeholders nor partners to include in DRR activities (Orozco, 2017). These gaps were addressed in the Myanmar Action Plan on Disaster Risk Reduction of 2017, in which the private sectors' role was recognized important in supporting national operations (National Disaster Management Committee, 2017). The MAPDRR of 2017 also recognized the importance of achieving policy and operational coherence between disasters, CCA, mitigation and sustainable development (National Disaster Management Committee, 2017), which illustrates a good level of understanding of the interlinkages between these aspirations. The plan also mentions the need to identify, implement, monitor and evaluate priority actions that will be inclusive, in efforts to address special needs of disproportionately vulnerable populations including women, children, people with disabilities and those elderly.

For responding to concerns related to climate change, Myanmar's National Adaptation Programme of Action (NAPA) has been established in 2012. It outlines the adaptation activities at relevant sectors from agriculture, industries and local communities that are required to improve the resilience and adaptive capacity of most vulnerable aspects of the country. Considerations have also been given on safeguarding the biodiversity, ecological systems and water resources in areas that are at high risk (Department of Meteorology and Hydrology, Ministry of Transport & UNEP, 2012). Under the NAPA, adaptation priorities have been divided into four classes; first investment priority (agriculture, early warning systems and forests); second priority (public health and water resources); third priority (coastal zones); and the fourth priority (energy, industry and biodiversity). Mandated by the NAPA, the Nationally Determined Contribution, as well as the recently established Climate Change Policy, make up Myanmar's strategic adaptation goals further strengthened by the establishment of the Myanmar Climate Change Strategy for 2018-2030. The Strategy intends to transform Myanmar into a climate-resilient, sustainable and low-carbon society, equipped with necessary capabilities and resources to adapt and respond to the future challenges in consideration of the Paris Climate Agreement and wider post-2015 development agenda (Ministry of Natural Resources and Environmental Conservation, 2019). Under the lead of the Environmental Conservation Department – responsible over the coordination of the implementation – the strategy seeks to achieve inclusive, resource-efficient and integrated development, and increase Myanmar's adaptive capacity in key priority action

areas (similar to the NAPA). These areas include policy (improving CCA initiatives at sectoral policies and plans); institutions; finance (building financial mechanisms for the effective allocation of resources); capacity and technology (improving the technology across sectors for deliver climate-responses); improving local awareness (all levels of society); as well as improving multi-stakeholder partnerships for coordinated climate action (Ministry of Natural Resources and Environmental Conservation, 2019). It is hoped that these targeted endeavours endeavors will help in improving the resiliency of agriculture, fisheries, and livestock, alongside natural resources, industry and energy as well as communities, townships and cities.

Table 2. Myanmar's legislative plans and policies intended to improve DRR and CR

IMPLEMENTATION	PLAN/POLICY	SCOPE	PURPOSE
NATIONAL DISASTER MANAGEMENT COMMITTEE	Disaster Management Law (2013)	National, States and Regions, Districts, Townships, Wards and Villages	Intended to reduce disaster risks by enforcing the systematic implementation of disaster management programs and by protecting, conserving and restoring ecological systems and livelihoods. Comprises provisions for vulnerability reduction by focusing on health and education initiatives as well.
MINISTRY OF SOCIAL WELFARE, RELIEF AND RESETTLEMENT	Disaster Management Rules (2015)	National, States and Regions, Districts, Townships, Wards and Villages	Enforces the implementation of the 2013 Disaster Management Law in consideration of all phases of the disaster management cycle.
NATIONAL DISASTER MANAGEMENT COMMITTEE, RELEVANT STAKEHOLDERS	Action Plan on Disaster Risk Reduction 2017	Whole-of-society	Outlines a strategy for disaster and climate risk reduction in consideration of all types of hazards and climate-risks in Myanmar.
NATIONAL COMMISSION FOR ENVIRONMENTAL AFFAIRS, RELEVANT STAKEHOLDERS	National Adaptation Programme of Action (2012)	Whole-of-society	Outlines strategic priorities for sectoral adaptation, including budget allocations
ENVIRONMENTAL CONSERVATION DEPARTMENT	Myanmar Climate Change Strategy (2018-2030)	Whole-of-society	Strategic vision for guiding Myanmar towards climate-resilient, sustainable and low-carbon development in consideration of the post-2015 development agenda

Priority 3. Investing in Disaster Risk Reduction for Resilience Disasters have wide implications to the social and economic development of a country due to their potentially widespread impacts as well as the funding required in post-disaster recovery. Disaster financing provides various options from the government (and private sector) to avoid losses and impacts to lives and livelihoods in the form of investments in infrastructure, training, insurance schemes, preparedness and response, data management, and so on. In Myanmar, the Natural Disaster Management Law details the establishment of the National Disaster Management Fund to support in managing and spending of which is further detailed in the 2015 Financial Regulations. As per DM law, disaster management funds at the subnational levels are also set up for effective relief, response and recovery interventions.

However, major and frequent disasters continue to drain the government's resources and it is estimated that the country experiences an average loss of 0.9 percent of its GDP annually (World Bank, 2017). In order to address the financial gaps and increase financial capabilities, the Ministry of Planning, Finance and Industry has been drafting the National Risk Financing Strategy in close collaboration with the Ministry of Social Welfare, Relief and Resettlement, ADB and World Bank. The Strategy will explore the existing financial instruments including government contributions, insurance and microfinance tools that can strengthen government and people's financial capacities to respond to and recover from disasters. There are also private companies that are working on life, cattle and crop insurance to widen the availability of risk transfer mechanisms. However, this still requires more outreach and community engagement.

Furthermore, there are numerous initiatives, intended to increase disaster and climate resilience by investing in sectoral projects and programs. Among them, the government has implemented a Safe School program in 2015 to inform the post-flooding school reconstruction phases to Improve design and quality of facilities (Save the Children, 2016). The Ministry of Education with the support of the Government of Switzerland, has been conducting rollout activities across the country to implement the program at various levels.

Priority 4. Enhancing Disaster Preparedness for Effective Response to “Build Back Better” in Recovery, Rehabilitation and Reconstruction Preparedness for disaster response is elemental to guarantee effective, coordinated and collaborative functioning of the government and relevant authorities in the aftermath of disasters. In Myanmar, the focal point for Disaster Preparedness and Response is the Department of Disaster Management of the Ministry of Social Welfare, Relief and Resettlement, which seeks to maintain a systematic, inclusive and well-coordinated approach over response initiatives, and organizes the mobilization of resources (OCHA, 2019). In times of national level disasters (Level 1), the Vice President led National Disaster Management Committee oversees all operations, management and coordination to ensure timely and effective response with the activation of Emergency Operation Centre.

Ever since the impacts of Cyclone Nargis, early warning systems and disaster response mechanisms have been consistently improved. In early 2015, Myanmar received a US\$ 40 million funding from the Government of Japan to establish three-weather radar stations in Yangon, Mandalay and Kyaukpyu, alongside 30 automated weather observation stations across the country by 2017 (Australian Broadcasting Corporation, 2015). Myanmar has also implemented a specialized system for agro-meteorological early warning (SESAME) system, intended to disseminate location-specific weather information to farmers to help them in avoiding significant crop losses due to hydrometeorological events (JICA, 2017). The Department of Meteorology and Hydrology established the National Multi-hazard

Early Warning Centre (NMHEWC) in July 2006, as the focal point of the government for issuing early warnings for all public, authorities and stakeholders for the full spectrum of hazards affecting the country (Australian Broadcasting Corporation, 2015). Despite these initiatives, guaranteeing the delivery of warnings to the 'last mile' is still a persistent concern due to the geographical remoteness and about 100 different languages spoken in the country. However, given the increased coverage of communication networks and social media influence, early warning information has the potential to be disseminated more efficiently than ever before.

Build back better is a key component of priority four, focused on improving human systems, infrastructure and resiliency of institutions at all levels. There are lessons learnt from Cyclone Nargis Recovery that should be integrated with future risk reduction and building resilience in the affected areas. In the aftermath of the 2015 floods, the Asian Development Bank highlighted the need to build back better to reduce the risk of monsoon rains and associated flooding to avoid catastrophic damages in the future (Win, 2015). In recognition of these needs, the Government of Myanmar has founded a Coordination Group on Rapid Recovery of Disaster Affected Areas in 2018 with the aim of improving coordination, resource mobilization and rapid implementation of rehabilitation and reconstruction at disaster hit areas. The group is jointly chaired by the Union Minister for Social Welfare, Relief and Resettlement and Union Minister for Agriculture, Livestock and Irrigation with the membership of Line Ministries and the Chief Ministers of affected Regions and States.

4. Coherence with Sustainable Development Goals and the Paris Climate Agreement

Harmonizing the synergies among policy pieces and legislative frameworks to achieve holistic DRR, CCA and sustainable development, integrated into all sectors, is increasingly necessary due to the fact that all these efforts share overlapping characteristics, objectives and targets. By identifying synergies among major international agreements, it is possible to reduce overlapping responsibilities and doubled efforts at the country levels through informed and intelligent policymaking. However, due to the rapidly evolving nature of “best practice” and country needs, policies are often formed on an ad-hoc basis which leaves gaps among these three dimensions. This section intends to identify some of these gaps (or strengths) in policy and legislation in Myanmar’s disaster governance.

Disasters and climate-related issues as well as potential threats are also recognized in the national development plan. Given the particular vulnerability of Myanmar climate change risks increasing impacts of hazards, it is stated that the country’s development strategy must be sensitive to said vulnerabilities and disparities in social, economic and cultural development to minimize their potential to derail sustainable and resilient growth for all (Ministry of Planning and Finance, 2018). Similarly, the MAPDRR of 2017 integrates DRR, CCA and aspects of sustainable development, intended to transform national development towards building environmentally sustainable and resilient cities. It identifies relevant SDG targets vis-à-vis their linkages to DRR (Goals 1, 2, 11 and 13), and draws a connection to the Paris Agreement on climate change which requires further mainstreaming of climate interventions in the form of research, investments to infrastructure, environmental protection and improving the resilience of communities and their livelihoods (National Disaster Management Committee, 2017).

For climate change concerns, the Myanmar Climate Change Alliance was launched in 2013 to mainstream climate change into policy development and the reform-agenda of Myanmar in recognition of its high vulnerability and exposure. The Ministry of Natural Resource and Environmental Conservation has endorsed Myanmar’s Climate Change Strategy and Action Plan (MCCSAP) in 2016 outlining its vision of a climate-resilient, inclusive nation that can address climate risks and harness the benefits of low-carbon development. To implement the strategy, the plan prioritizes six key areas: policy, institutions, finance, capacity and technology, awareness, and partnerships through the implementation in six sectors: including agriculture, fisheries and livestock sector; natural resource management; energy, transport and industrial systems; towns and cities; disasters, risks and health impacts; as well as education, awareness and technological systems.

Table 3. Some of the synergies between international agreements and different policies and commitments of Myanmar in various sectors.

Sectoral Aim	Policies/programs with potential links to Sendai Framework for Disaster Risk Reduction	Policies/programs with potential links to Sustainable Development Goals	Policies/programs with potential links to the Paris Climate Agreement or Environment
National Development	Climate Change Strategy (2018-2030) Action Plan on Disaster Risk Reduction (2017)	Climate Change Strategy (2018-2030) Myanmar Sustainable Development Plan (2018-2030)	Climate Change Strategy (2018-2030) Action Plan on Disaster Risk Reduction (2017)
Agriculture and Resource Management	Action Plan on Disaster Risk Reduction (2017)	Myanmar Sustainable Development Plan (2018-2030)	Climate Change Strategy (2018-2030) National Adaptation Programme of Action (2012)
Disaster and Climate Risk Reduction	Disaster Management Rules (2015) Action Plan on Disaster Risk Reduction (2017)	Action Plan on Disaster Risk Reduction (2017)	Climate Change Strategy (2018-2030) National Adaptation Programme of Action (2012)
Vulnerability Reduction	Action Plan on Disaster Risk Reduction (2017)	Myanmar Sustainable Development Plan (2018-2030)	National Adaptation Programme of Action (2012)
Urban Development	National Urban Policy Framework	National Urban Policy Framework Myanmar Sustainable Development Plan (2018-2030)	National Urban Policy Framework Climate Change Strategy (2018-2030)

5. Issues in the Implementation of Disaster Risk Reduction and Climate Policy

Like many other countries, Myanmar also faces some challenges in terms of resource mobilization, coordination and technical capacity in translating climate change and DRR strategies and plans into actions. To be able to pursue a whole-of-government approach, it is necessary to enhance collaboration amongst government agencies, international organizations, local civil society organizations and private sector in a systematic and coordinated manner. Technical transfer and capacity building play an important role in sustaining and upscaling activities and implementation for reducing disaster and climate change risks both at the national and local levels. In order to support policymaking and implementation in the country, the local capacities from senior civil servants to state/regional executive staff must have the ability and understanding of the policy issues as envisaged at the national level (The Asia Foundation, 2016). Their capability to improve policy implementation can be enhanced significantly through regular consultations, training and coordination across important sources of information outside the government (including national experts and research institutions). When conducted effectively, consultations with various agencies and sectors can improve not only policymaking towards a direction that can fully integrate sectoral DRR and CCA concerns (informed by local knowledge), but also support their implementation at the grassroots level.

In this context, bridging the gap between policy and people is a key concern. Information should flow in two-directions: from the government to its people, but also by expanding policymaking by consulting local communities and wider public to ensure that all plans represent the interest of the public as well. The efficacy for implementation of adaptation and resilience-building activities often relies on the ability and willingness of the people to adhere and commit to them, which makes this negotiation between the government and the public elemental for achieving intended policy objectives and targets. However, consultation can be time-consuming and costly, which must be considered to mitigate potential pitfalls and negative side effects.

Yet, it is increasingly important to integrate local knowledge and capacities into risk-informed policymaking given the high spatial variability of hazards and climate change impacts. People's needs for adaptation and resilience-building differ vastly depending on the region for example, central dry zones must be equipped with capacities and resources to protect agricultural output from droughts, whereas the coastal regions must prepare for the eventual sea-level rise and worsened storms. In such a diverse setting, a so-called 'blanket approach' are likely to be impeded if regional differences are not considered as part of policymaking and resilience-building processes. This reinforces the argument of strengthening whole-of-society approaches in Myanmar to achieve tangible implementation of DRR and CCA policies.

6. Stakeholder Analysis

At the state and regional level, there are numerous important partner organizations involved in conducting disaster management activities. They include the Department of Disaster Management, Fire Services, General Administration Department, Police Force, Department of Public Health, Irrigation and Water Resource Utilization Management Department, Myanmar Airways and Myanmar Red Cross Society, among others (Than, 2014). Similarly, Myanmar Information Management Unit and the Disaster Risk Reduction Working Group are important non-governmental institutions contributing to risk management and monitoring in the country (Orozco, 2017).

To support national efforts, multilateral and bilateral partnerships are also important in achieving the overall development aspirations, but also in the phases of disaster response. For example, donor assistance has been crucial to the country given the financial burden caused by disasters and climate change. Between 1990 and 2010, commitments for disaster financing totalled US\$ 723 million, of which 96 percent was used for the purposes of emergency response (World Bank, 2017). Agencies including Asian Disaster Preparedness Center, numerous United Nations branches, CARE Myanmar, Red Cross Movement, Oxfam and Plan International (among a plethora of others) have provided their important contributions into DRM and development efforts in Myanmar.

The private sector is also an important contributor to disaster and climate risk reduction not only in Myanmar, but globally as well. For improving coordination, the government has initiated the Myanmar Private Sector Disaster Management Network (MPD-Network) to strengthen the capacity of businesses and business associations in Myanmar and increase its resilience to return to normalcy as soon as possible after disasters. Still, there are areas of cooperation to improve private sector engagement in DRR and mitigation measures.

Communities should also be considered as important stakeholders in disaster management efforts, given that the success of any localized intervention depends on the ability and willingness of communities and households to integrate necessary changes, to adapt or to support activities intended to improve their resilience. Decentralization of DRR should be extended through schools and community linkages in coordination with relevant organizations which could contribute to community-based disaster risk management. Myanmar's government adopted the Myanmar National Framework for Community Disaster Resilience which details Government led community-based programs and activities through which DRR can be integrated. This framework highlights possible entry points for incorporating DRR measures into different sectoral implementations efforts.

7. Future Priorities

7.1 Challenges

Limited data availability hindering the efficacy of risk and vulnerability assessments is a significant concern in Myanmar. Due to lack of resources, technical and human capacities, collecting and analysing data is inadequate, especially at the sub-national levels. The latter is especially important given that when adequately equipped to collect and compile data, contextualized hazard and risk information originating from the local levels could increase the accuracy of national level assessment efforts considerably given the local authorities' contextual knowledge.

Indeed, technical assistance is required for further mainstreaming of DRR and CCA which should be reinforced at all levels to support planning and financing. Moreover stronger cooperation is required between different sectors to create national harmony an effort to increase sustainability and resilience (Relief and Resettlement Department, 2013).

Significant funding gaps contribute to challenges in managing disasters in Myanmar. Even the current emergency response costs of flooding far outweigh the available resources, which indicates a severe short-term funding gap for relief and response (World Bank, 2017). Financial provisions to conduct assessment on reconstruction gaps are not currently available, but as previous disasters have indicated (such as the Cyclone Nargis in 2008), sustaining long-term financing for recovery is also an immense challenge now and for the upcoming decades (World Bank, 2017). Financial assistance is also required for further integration of DRR and CCA into critical infrastructure (especially hospitals and schools) (Relief and Resettlement Department, 2013).

The hierarchical and top-down process of policymaking also hinders the country's disaster and CRM activities. Due to opaque systems and low involvement of lower-level departments and relevant authorities, disparities exist within the government due to oversight on localized or technical issues arising from lack of consultative processes (The Asia Foundation, 2016). Thus, expanding the scope of democracy by increasing the number of institutions involved in informed policymaking is necessary, alongside strengthening the consultative approaches. This is related to the larger process of democratization across the country, which has been claimed to remain incomplete (Brennan, 2017), but significant progress has been made to date.

7.2 Priority Issues

Firstly, increasing the availability, quality and accessibility of risk information covering localized impacts of hazards and climate change is crucial to prioritize interventions vis-à-vis limited budgets and human resources. Lack of accurate and adequately disaggregated data from states and territories hinders the estimation of climate and disaster impacts, thus rendering much of the risk and vulnerability assessments imprecise. This is also required to fully nationalize risk assessment efforts which are currently highly reliant on external stakeholder efforts. However, this also requires targeted interventions to improve local capacities in managing, storing and analysing data to make sure that all information is cross-platform compatible and stored in a manner which can be effortlessly combined.

Secondly, managing economic growth and urbanization in a sustainable and resilient manner should be rapidly enforced, especially in the context of expanding urban slums. Unplanned and unsafe land-use tends to exacerbate disaster and climate risks, and worsens environmental degradation due to increased pollution and erosion. Avoiding further loss of biodiversity, natural space and clean environment is a crucial concern given that people rely on stable environments keeping in view both health and economic implications, for example the agriculture which relies on natural buffers such as coral reefs and mangrove forests. In this context, regional disparities must be taken into account. Given the high spatial variability of hazard impacts and the disparities in accessing services, education, health and infrastructure between rural and urban regions, targeted interventions are required to guarantee equitable development for all. Managing growth and urbanization must be conducted in consideration of poverty reduction. While this is integrated into the wider development agenda, implementing the envisaged changes at the grass-root levels requires support, research and investments especially in the more unstable regions. As of today, Shan and Ayeyarwady have the largest populations of vulnerable persons due to their size and relative vulnerability and exposure to hydrometeorological hazards and climate change (HARP-F & MIMU, 2018).

It has also been suggested that the financing of disaster and climate risk management requires strengthening, alongside established policy priorities for financing, establishing post-disaster resource pool, and having extensive social protection systems targeted to relieve the financial burdens of affected communities (World Bank, 2017). Currently, these investment priorities have been outlined in the Myanmar Sustainable Development Plan (2018-2030), and in the Climate Change Strategy, latter of which highlights the need to assess the financial needs in terms of building technological capacity and to support human resources through trainings to achieve successful implementation of wider CCA aspirations. While the exact costs associated with climate-resilient and low-carbon investments have not been calculated, it is estimated that the achieving these development targets requires a five to ten percent increase in GDP and annual capital investment increase of up to 28 percent over the two upcoming decades (Ministry of Natural Resources and Environmental Conservation, 2019). Thus, achieving resilient and sustainable development is also interlinked with green growth that can support the needs of the population, and can increase the reach of social safety nets, infrastructure and employment opportunities.

Finally, some consultative interviews have revealed that despite the efforts to decentralize DRR in the country, the central government is still in the leading position within the government's networks, and the powers of state and non-state actors remain founded on an asymmetrical platform wherein power is utilized with a top-down approach (Srikandini, et al., 2018). Furthermore, much of the efforts are still largely demand-driven as opposed to being proactive to support DRR and CCA, which limits the efficacy of numerous interventions (Srikandini, et al., 2018). Expanding the collaborative, coordinated approach to disaster and climate risk management at all levels of government is necessary to reduce inefficiencies arising from hierarchical, opaque and inflexible governance.

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