

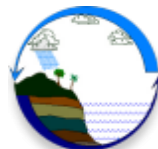


MYANMAR CHILD-CENTRED RISK ASSESSMENT



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Second Edition
2017



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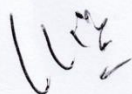
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FOREWORD

In the years since the first version of the Child-Centered Risk Assessment was released in 2015, Myanmar has continued to face natural disasters and severe weather that cause considerable harm to the lives, livelihoods, and economy of Myanmar. The country's unique situation and exposure to a variety of natural hazards and conflict situations mandates close consideration of risk. With the history of Cyclone Nargis in 2008 and the even more recent 2015 severe flooding displaying the stakes of natural disasters on Myanmar's population, understanding how these risks affect children- over a third of the population- is clearly essential.

Recent updates to Myanmar's disaster-related legislation work to increase capacities to understand, respond to, and boost resilience to hazards. The forthcoming update to the Myanmar Action Plan for Disaster Risk Reduction (MAPDRR) will adhere to the worldwide agreement of Sendai Framework for Disaster Risk Reduction as well as support progress towards reaching the Sustainable Development Goals. The 2017 MAPDRR has a vision of "protected lives, economy, heritage and environment, through inclusive approach, towards sustainable development in Myanmar".

This second edition of the CCRA complements the 2017 MAPDRR's prioritization of inclusive disaster risk reduction and better understanding of vulnerability throughout Myanmar. Updated data and maps show where children's vulnerability is greatest by combining natural and human-caused hazards. This edition of the CCRA also updates risk maps and analysis based on 2014 census data, using more precise information on risks facing children allowing for insight at the township level rather than the previous analysis at a State/Region level presented in the first edition. The visual representation of risk can support identification of where to prioritize interventions and capacity building to reduce the risk to children and their communities.



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ACRONYMS

ACLED	Armed Conflict Location and Event Database
CCA	Climate Change Adaptation
CCRA	Child-Centred Risk Assessment
CSO	Central Statistical Organization
DHS	Demographic and Health Survey
DMH	Department of Meteorology and Hydrology
DRR	Disaster Risk Reduction
DRRWG	Disaster Risk Reduction Working Group
DSW	Department of Social Welfare
ECD	Early Childhood Development
GoM	Government of Myanmar
HCT	Humanitarian Country Team
HFA	Hyogo Framework for Action
IASC	Inter-Agency Standing Committee
MAPDRR	Myanmar Action Plan on Disaster Risk Reduction
M&E	Monitoring and Evaluation
MEC	Myanmar Earthquake Committee
MES	Myanmar Engineering Society
MICS	Multiple Indicator Cluster Survey
MIMU	Myanmar Information Management Unit
MRCS	Myanmar Red Cross Society
NAPA	National Adaptation Programme of Action
NASA	United States National Aeronautics and Space Administration
NGO	Non-Governmental Organization
DDM	Department of Disaster Management
UNDAF	United Nations Development Assistance Framework
UNDP	United Nations Development Programme
UN-HABITAT	United Nations Human Settlements Programme
UNHCR	United Nations High Commission on Refugees
UNICEF	United Nations Children's Fund
UNISDR	United Nations International Strategy for Disaster Reduction
UNOCHA	United Nations Office for the Coordination of Humanitarian Affairs
WB	World Bank
WFP	World Food Programme

PURPOSE OF THE REPORT

Disaster Risk Reduction (DRR) recognises that disasters are driven both by environmental and human-created hazards, and are mediated by the socio-economic characteristics of individual locations; therefore, resilience to natural and human-induced hazards is an integral part of the concept of sustainable development. The Child Centred Risk Assessment (CCRA) provides a detailed and extensive view of risk across the country and serves as a decision-support tool for the Government of Myanmar (GoM) and its partners.

The CCRA analysis explicitly places children at the centre of a national risk assessment to understand where children, and therefore the country, experience the greatest risk. Spatial risk assessments integrate various data sources into a single metric as a means for operationalizing disaster risk, and therefore provide an essential tool for risk-informed planning and ultimately risk-informed programming. In order to assess relative levels of risk within specific geographic areas, risk assessments overlay hazard risk information, population exposure, climate change vulnerability, socio-economic vulnerability, and local capacity to absorb, and recover from, disaster. The CCRA demonstrates the utility of using indicators related to children's development and welfare as the key measures of vulnerability in the larger population.

The outcome of the analysis is a child-centred risk index ranking the 325 townships of Myanmar compiled using 32 indicators. The CCRA additionally serves as an in-depth planning document supporting UNICEF's child-centred work and enables more risk- and climate-sensitive programming. It also provides a tool for development partners and civil society organisations interested in visualising and addressing risk and its implications on children and other vulnerable groups in Myanmar.

The patterns of child-centred risk that emerge from the CCRA take into account the importance of integrating all elements of the risk equation—exposure, socio-economic vulnerability, capacity, hazard risk, and climate change—for a comprehensive understanding and to build effective disaster risk mitigation and reduction approaches. According to their specific mandates, different agencies may focus on individual elements of the risk equation for their decision-making; yet all efforts to reduce the drivers of risk ultimately contribute to fostering child-centred resilience.

Child-Centred Risk Map

UNICEF Myanmar, March 2017

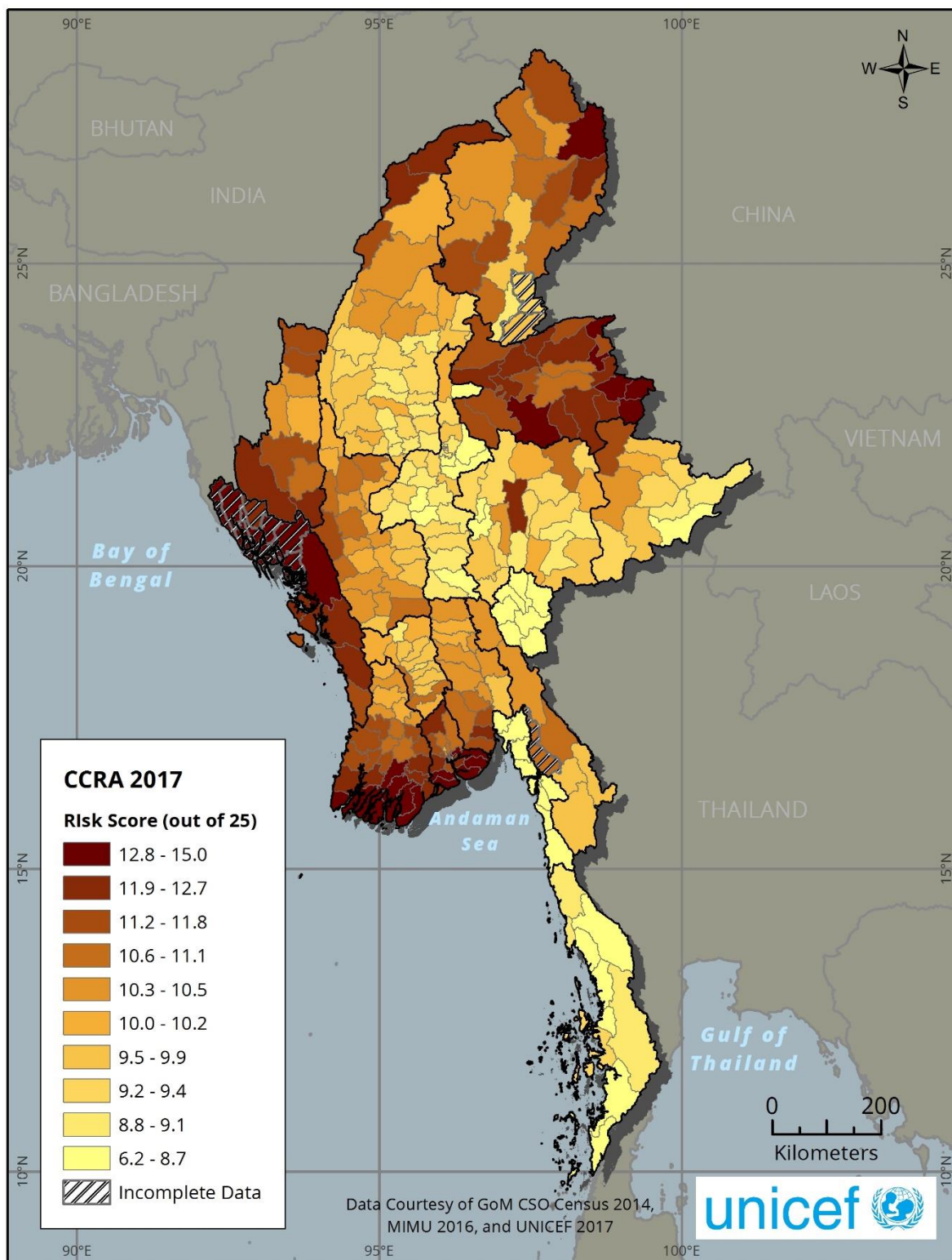


Figure 1. Child-Centred Risk Map at the Township Level.

BACKGROUND

Disaster Risk Reduction

Increasingly, a disaster is recognised as the product of a “shock” or “stress event” combined with the capacity of an area to absorb the impact of the event/shock. These stressors are often environmental (e.g. flood, drought, cyclone, epidemics, etc.) that result in crises (e.g. food shortages, illnesses, loss of livelihoods, etc.). Viewing a disaster as a combination of a physical event and the capacity to absorb that event recognizes the intervention of stakeholders and emphasizes opportunities to proactively identify, prevent and reduce disaster risks.

Disaster Risk is the potential loss of life, injury, or destroyed or damaged assets which could occur to a system, society or a community in a specific period of time, determined probabilistically as a function of hazard, exposure, vulnerability and capacity¹. Disaster Risk Reduction (DRR) is aimed at preventing new, and reducing existing, disaster risk and managing residual risk, all of which contribute to strengthening resilience and therefore to the achievement of sustainable development. DRR is also recognised as a key climate change adaptation (CCA) strategy. Likewise, as climate change is increasing the frequency and strength of many natural hazards and exerting a multiplier effect on disaster risk, CCA is recognised as a key DRR strategy. Based on the increasingly aligned goals of DRR and CCA, the CCRA uses the following disaster risk equation:

$$\text{Disaster Risk} = \frac{(\text{Hazard}) \times (\text{Vulnerability}) \times (\text{Exposure}) \times (\text{Climate Change})}{(\text{Capacity})}$$

Methodology

Data comprising the 32 indicators were compiled into an excel spreadsheet. Each indicator was normalized between 0 to 1 to make the data comparable. Normalization equally spreads a range of values between 0 and 1, independent of the size of the range or magnitude of the values, highlighting the relative importance of high and low values for comparison between townships. For each of the five components—Exposure, Hazard, Vulnerability, Adaptive Capacity, Climate Change—the constituent indicators were added together and then scaled between values of 1 and 5 to assign an equal weight for each component. Scaling is required because each component has a different number of indicators—for example Vulnerability has 12, Exposure has 1 and Capacity has 6. Scaling them to a max value of five allows of direct, equal comparison of each component. These components were then integrated according to the CCRA formula to produce the overall CCRA Score. The individual data, the components, and the overall CCRA Scores were brought into a Geodatabase using ArcGIS software, where they were combined with spatial township boundary data which were then used to generate the final project maps included in this document.

The Case for Putting Children at the Centre of the Risk Equation

The impacts of disaster on children affect development for generations to come. The CCRA is broadly applicable, not just for advancing child welfare, but for a wide range of development partners and planners. Focusing on child-centred risk is a practical approach for several reasons:

- **Children represent over one third of the population:** Children represent 34% of the population in Myanmar², making them a priority demographic for planning and programming.
- **Children are disproportionately affected by disaster:** Disasters can unequally affect children and women by exacerbating their pre-existing vulnerabilities and inequalities. DRR aims to support those most in need; prioritizing children in risk management planning is an equitable and responsible approach to sound programming.
- **Children’s vulnerabilities are indicative of larger development challenges:** Children often suffer the first consequences of shocks and stresses. Monitoring children’s health, nutrition, education and protection status therefore can provide insight into emerging vulnerabilities in the larger population and provide warnings for future challenges.
- **Children have the right to be integrated in planning:** Children have basic rights to survival, development, education and protection. Respecting these rights requires incorporating children’s

¹ <http://www.unisdr.org/we/inform/terminology> 2017

² The 2014 Myanmar Population and Housing Census Report

issues into the DRR process and including children in decision-making, especially as this generation of children will likely experience more disasters than their parents.

UNICEF and DRR in Myanmar 2017

Working in Myanmar since 1950 and in 190 countries globally, the United Nations Children's Fund (UNICEF) works with others to realise the rights of every child, especially the most disadvantaged. Since disasters affect children, youth and women disproportionately, UNICEF promotes child-centred DRR in order to strengthen the resilience of children, families and communities to shocks and stresses relating to natural hazards, climate change, violent conflicts and epidemics. UNICEF is also embarking on a multi-sectoral examination of barriers and bottlenecks in the provision of social services to help the Government build more adaptive and flexible systems.

UNICEF completed a Multi-Year Work Plan (2016-2017) with the Department of Disaster Management (DDM) of the Ministry of Social Welfare, Relief and Resettlement, which aimed to increase capacity at national and sub-national levels to incorporate child sensitive elements into DRR and resilience platforms and actions. Through close engagement with the Government's MAPDRR Task Force and three technical working groups, UNICEF supported the updating of the Myanmar Action Plan on Disaster Risk Reduction endorsed in 2017. UNICEF, together with Oxfam International, Plan International, Handicap International, Help Age and the BRACED Myanmar Alliance organized a MAPDRR Thematic workshop on people most at risk: "Leaving No One Behind" in order to highlight the needs of children, youth, women, elderly people and people with disability within the revised MAPDRR. UNICEF is an active member of the Steering Committee of the DRR WG and a member of its Policy Task Force. In 2016, UNICEF received Government commendation for supporting preparedness actions during Cyclone Roanu.

Together with technical partners Handicap International and HelpAge, UNICEF created and delivered Inclusive Disaster Risk Management training as part of the Myanmar Consortium on Capacity Development on Disaster Management in support of the Disaster Management Training Centre of Myanmar. The training sought to build the capacity of officials across Government ministries as well as civil society representatives.

Recognising the need for enhanced disaster mitigation and the intrinsic linkages of DRR, climate change mitigation and adaptation, and environmental sustainability, UNICEF is co-chair of the 'People' and partner of the 'Planet' working groups on the development of the first Myanmar United Nations Development Assistance Framework (UNDAF). UNICEF provided significant input into the youth component of the Myanmar Climate Change Strategy & Action Plan as well as the National Environmental Policy Strategic Plan. UNICEF will produce a Myanmar Climate Landscape Analysis for Children in 2017.

Disaster Risk in Myanmar

Myanmar experiences a wide range of natural hazards including cyclones, seasonal flooding, landslides, droughts, fires and earthquakes. Over the past two decades, Myanmar has had more disaster-related deaths per capita than any country³. In the past ten years, Myanmar has faced:

- Two major cyclones (Nargis 2008, Giri 2010) which devastated coastal communities--particularly children and women;
- Cyclone Mora in 2017 affected Rakhine state damaging over 26,750 water and sanitation facilities, collapse of almost 4,800 houses and damage to an additional 13,500 houses and 140 temporary learning facilities either sustained damage or collapsed.
- Flooding that displaced 1.6 million people in 2015 and reduced GDP by an estimated 3.3 percent;⁴
- Landslides caused by flooding and seismic activity that severely damaged hill areas;
- A series of earthquakes in the country's northern and central areas along the Sagaing Fault, including a 6.8 magnitude Richter-scale event in 2016 that damaged the famed Bagan historical site; and
- Fires routinely destructive of homes and infrastructure in communities countrywide.

Civil conflicts and intercommunal tension compound vulnerability to Myanmar's natural hazards in several areas of the country—principally Rakhine, Kachin and Shan States. This interplay between natural hazards and human-induced hazards exacerbates existing vulnerabilities among women,

³ GermanWatch, Global Climate Risk Index, 2016, p. 6

⁴ WorldBank - Myanmar - Post-disaster needs assessment of floods and landslides: July - September 2015

children and youth, negatively affecting their socio-economic status, their physical and mental well-being and development and their access to basic social services such as education and healthcare. To address some of the underlying drivers of disproportionate vulnerability between groups and areas, the second edition of the Myanmar Action Plan for DRR highlights inclusivity in its vision and recognises the urgent need for commitment to risk-informed disaster management. The Government of Myanmar is committed to developing countrywide capacity to recover from devastating events as well as to addressing the underlying issues of widespread poverty⁵. Due to Myanmar's physical exposure, high vulnerability, limited capacity and high incidences of man-made and natural disaster risks, it ranks as the "most at-risk country" in Asia and the 12th most at-risk country in the world by INFORM⁶. When looking solely at natural disasters, Myanmar is ranked as 42nd most at-risk country by the World Risk Report of the United Nations University.⁷

The accumulating effects of natural hazards in recent years highlight the importance of taking concrete actions to reduce the loss of lives and livelihoods. The Government of Myanmar and the international community have increased disaster management efforts significantly over the past decade, focusing primarily on humanitarian preparedness and response capacity. An effective DRR strategy for Myanmar will require further research, investment and risk-informed programming in preparedness, mitigation and prevention as well as resilient response and development programming aimed to minimise the potential impact of future disasters.

CHILD-CENTRED RISK ASSESSMENT

The CCRA highlights the multiple dimensions of disaster by exploring the individual components of risk, providing a comprehensive view of disaster. By centring the assessment on children's risk, the CCRA explores how disasters affect one of the largest, most under-represented and most disproportionately affected groups. Children's vulnerabilities are good indicators of larger development challenges, therefore, focusing on children's vulnerabilities provides insight into national vulnerability to disasters.

UNICEF's CCRA methodology, developed through six previous applications in countries across the Asia-Pacific region⁸, is customised to fit local context through coordination with the Government of Myanmar and members of the DRR WG. By integrating information on hazard risk, child population exposure, socio-economic vulnerability, local capacity to manage risk and climate change, the CCRA produces a comprehensive measure of the disaster risk of children across 325 townships in Myanmar.

The CCRA's spatial risk assessments allow for intuitive visual comparison of risk across Myanmar. The CCRA maps contribute to prioritisation by identifying both the location and magnitude of at-risk areas which are helpful for risk-informed planning and programming. The CCRA enables key stakeholders, government ministries and NGO partners to visualise children's risk in the current context of Myanmar. By factoring in exposure (given as population of children) and climate change, the CCRA gives an overview of how underlying drivers manifest and translate into risks for children across Myanmar.

The CCRA Second Edition draws upon 32 township-level indicators to assess the five core components of risk: Exposure, Hazard, Vulnerability, Capacity and Climate Change. Village tracts are the lowest administrative unit in Myanmar; however townships are the lowest administrative unit for which comprehensive data exists. Township-resolution data thus provides the highest degree of detail available and allows for more precise programme planning. These five components combine to calculate the child-centred risk score for each township (Figure 1). The results show Rakhine as the most at-risk state with five of the 10 most at-risk townships (Table 2). Although the highest risk is concentrated along the coastal areas in Rakhine, Ayeyarwady and Yangon, the analysis also shows risk hotspots within Shan, Chin and Kachin States. The improved detail of township-level Census data also reveals that states previously marked as moderate risk, specifically Chin, contain several very high risk townships along with several townships of lower risk.

In addition to the composite Child-Centred Risk Map (Figure 1), this report also presents a Child Exposure Map (Figure 2), a Multi-Hazard Map (Figure 3), a Child-Centred Vulnerability Map (Figure 4),

⁵ SDC & ADPC (2012), "A Situational Analysis of Disaster Risk Management Policy and Practice in Myanmar"

⁶ INFORM Global Risk Index 2017 <<http://www.inform-index.org/Results/Country-profiles?iso3=MMR>>

⁷ https://reliefweb.int/sites/reliefweb.int/files/resources/WRR_2017_E2.pdf

⁸ Child-centred risk assessments is a UNICEF-tool developed to risk-inform country programmes as part of the broader resilience agenda. Since 2012, child-centred risk assessments have been developed for Pakistan, India, Nepal, Lao PDR, Indonesia and Solomon Islands. For further details please see: http://www.preventionweb.net/files/36688_36688rosaccriskassessmentfeb2014.pdf

a Capacity Map (Figure 5), and a Climate Change Map (Figure 6). The CCRA process additionally generated a comprehensive dataset that can serve as a baseline metric for future analysis.

Advancements in the Second Edition

The first edition of the CCRA assessed the levels of children's risk between Myanmar's 14 states and regions. With the release of the GoM Central Statistical Organisation's (CSO) 2014 Census data, the second edition now evaluates children's risk across Myanmar's 325 townships. The second edition also increases in breadth to incorporate 32 indicators, expanding upon the 24 indicators used in the first edition. This increase in information and level of detail provides a more nuanced picture of children's risk allowing for more specific targeting of programming priorities.

The previous iteration also employed a weighting scheme in developing the Multi-Hazard Map, whereby earthquakes and cyclones—which occur infrequently but with severe effect—were weighed more heavily than hazards such as fires which occur frequently with severe but highly localised effect. Although weighting hazards holds much promise, due to a lack of a clear and defined methodology for generating the hazard weights, this analysis uses an equal weighting scheme. Similarly, the previous CCRA used a weighting scheme for integrating the five components, emphasising the importance of hazards and vulnerability and de-emphasising the effect of capacity, exposure and climate change. The second edition applies an equal weighting scheme in calculating risk to reflect all of the components transparently that inform the CCRA.

Limitations and Opportunities

Limitations: The CCRA Second Edition relies on Census data for the exposure and at-risk population figures, which represents a leap forward in providing detailed township level data for the whole country. However, this data is incomplete due to both lack of access to populations in areas of active conflict in Kachin and Shan States/Regions and undercounting of populations in 13 townships in northern Rakhine, Kachin and Kayin States/Regions⁹. The CCRA would be more robust with the inclusion of independently verified data sources to compliment and verify the Census data and account for previously excluded populations. Furthermore, the statistical analysis of data was completed prior to August 2017. While this report explores the spatial relationships between risk and its underlying characteristics, additional work is needed to verify the robustness and sensitivity of this indicator and to demonstrate the causative relationship between included variables and child-centred risk.

The CCRA develops a composite indicator to present a single measure that quantifies children's risk and provides a clear metric for comparing risk between locations. However, as the study relies upon pre-existing datasets, data availability affected the choice of included inputs and required the incorporation of some proxy data. For example, as no direct measure of poverty or impact on social economy is available at the township level, the number of children per household serves as a proxy to capture the demands on a household's resources. Additionally, integrating 32 datasets into a single metric limits the amount any individual variable can affect the overall score. This may present situations where, for example, an area facing extremely high risk from only a single hazard ranks as less risky than an area with medium risk from multiple hazards. Any attempt to distil a complex issue into a single metric necessarily simplifies some important factors. The CCRA therefore forgoes some accuracy by simplifying assumptions in order to present a comprehensive, extensive metric. The next edition of the CCRA should consider, if possible, township-level data on reported child abuse, climate change and fires, which are only currently available on the countrywide and state levels.

Capacity is often a highly localised and time-bound characteristic and is not easily represented in nationwide datasets. Previous efforts to measure capacity considered where DRR efforts have focused and assumed that these programs were successful in establishing capacity. The CCRA Second Edition attempts to measure capacity based on in-place infrastructure (e.g. roads, schools, mobile phones, electrification and emergency response warehouse locations etc.) however does not account for the variability of children depending on age. The inclusion of social caseworkers begins to incorporate social capacity, better metrics and methods to quantify capacity are needed.

Opportunities: The CCRA can inform studies as a data resource, a baseline for monitoring and evaluating progress, or as a high-level programming guide. Moreover, the CCRA can be used to assist partners and implementers with the identification of gaps relevant to their mandates and opportunities to conduct other relevant assessments. Focuses could include:

⁹ The 2014 Myanmar Population and Housing Census Report Volume 2-B, The Union Report: Occupation and Industry. See section: 1.2. Areas of non- and/or under- enumeration
http://reliefweb.int/sites/reliefweb.int/files/resources/2B_Occupation_and_Industry_EN.pdf

- Child-centred indicators for underage workers;
- Children in irregular settlements;
- Environmental and social impact assessments focused on children;
- Children in hazardous livelihood zones;
- Human resource DRR capacity;
- Health care workers with emergency training; and
- Regular surveillance of water shortages.
- The incidents of thunderstorms

Child-Centred Exposure

Exposure is defined by UNISDR as “The situation of people, infrastructure, housing, production capacities and other tangible human assets located in hazard-prone areas.” The CCRA identifies exposure as the total number of children population aged 0 through 17 residing in conventional households and institutions within each township (Figure 2). The 2014 Census counted 17,004,562 children across Myanmar with 5.4 million (31%) children under 5 and 11.6 million (69%) children between 5 and 18. The population of children varied widely from 203,567 in Hlaingtharya Township in Yangon to less than 1,000 children living in Sumprabum and Injangyang Townships in Kachin. As exposure data is taken directly from the Census, it inherits the same limitations of the Census, specifically the exclusion of some vulnerable populations such as those living in informal settlements, homeless or stigmatised children and undercounted areas in northern Rakhine, Kayin and Kachin States.

Gender and Inclusivity

The impacts of disaster manifest differently for boys, girls, men, women, elderly and disabled. Inclusive disaster management applies both gender and disability lenses to focus on specific capacities and vulnerabilities. Due to data limitations for variables that reflect gender-disparate risks and capacities as well as a lack of appropriate disability figures, these lenses have not been applied through the CCRA analysis. To more comprehensively analyse areas of the greatest risk due to gender and disability, a gender ratio and disability ratio calculated at the township level is required, however variables for each are not currently available. Selecting gender- and disability-specific variables would strengthen future CCRA and allow targeted programmes to address disaster risks specific to traditionally vulnerable and marginalised groups.



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Child-Centred Exposure Map

UNICEF Myanmar, March 2017

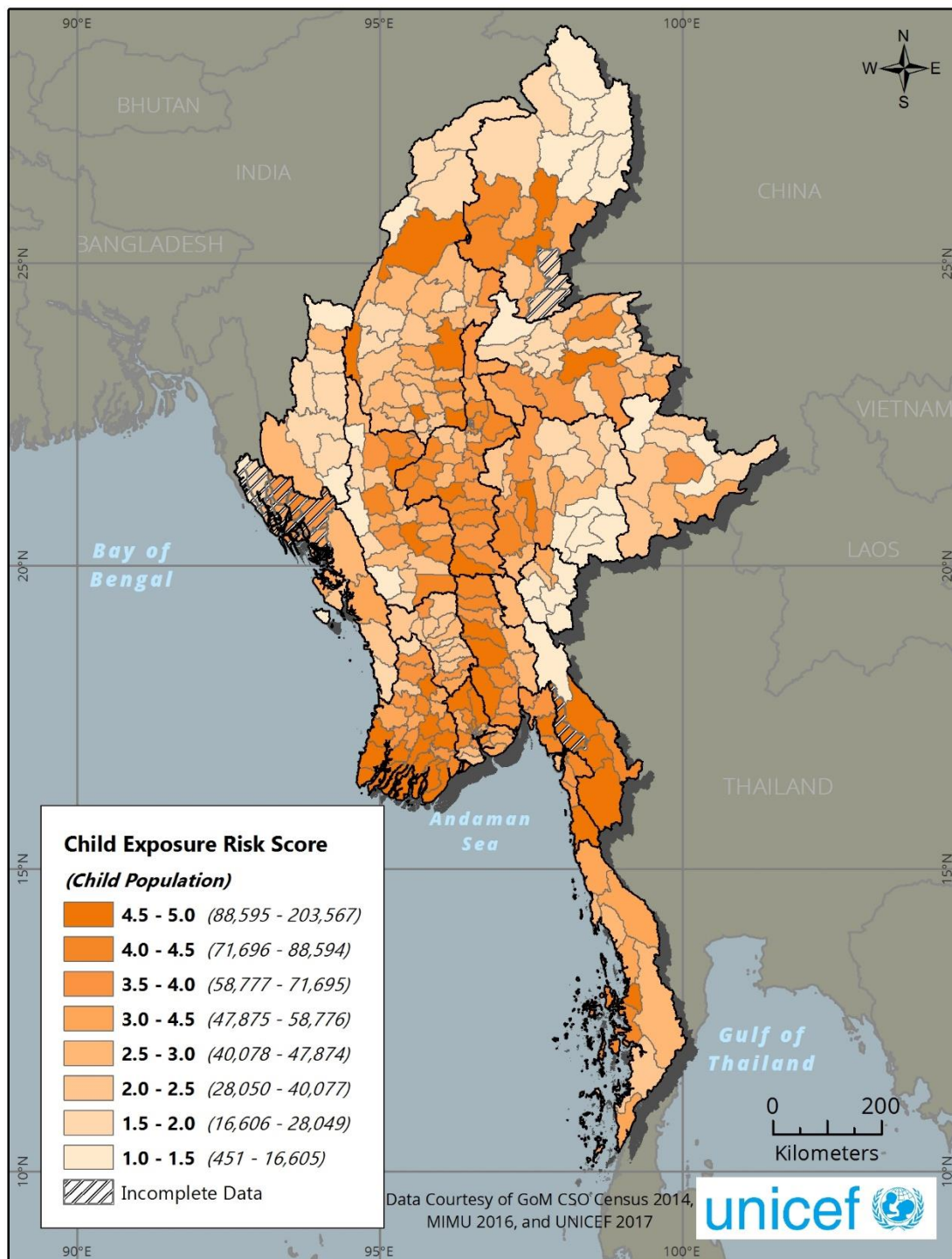


Figure. Exposure Map - Child Population per Township

Hazards

Because of its diverse geography, Myanmar faces varied and complex hazards and different combinations of threats throughout the country. The Multi-Hazard Risk Map (Figure 3) presents an integrated view of the eight primary hazards that threaten Myanmar. All data sources and links are provided in Annex 2. To assess hazard risk, every township is given a value for each hazard ranging from 0 for low hazard risk to 1 for high hazard risk. The values for all eight hazards are then summed and normalised, giving each township a multi-hazard score ranging from 1 (lowest risk) to 5 (highest risk). The indicators used to develop the Multi-Hazard map, in order of frequency as provided by the Department of Meteorology and Hydrology (DMH), are *Urban Fires*, *Flooding*, *Cyclone*, *Tsunamis/Storm Surge*, *Earthquake*, *Landslide*, *Drought* and *Conflict and civil unrest*.

Urban Fires, while limited in terms of loss of life, are the most common hazard in Myanmar and can cause severe loss and damage in localised areas. Urban fire hazard is calculated as the number of fires that occurred between 1993 and 2008 for each state and region as recorded by the Fire Services Department. More recent data was not available at the township-level as was used for other hazards; the state urban fire hazard values at the township level are assumed to be the same as state/region.

Flooding threatens a large number of people, cities and agricultural lands. While "heavy rain" is the main cause of large flooding, Myanmar is also subject to "brief torrential rain" which generates flash floods. Flooded areas are identified by a Dartmouth Flood Observatory dataset identifying all areas susceptible to flooding determined through combined analysis of satellite imagery and topographic data as well as historical flooding data. The CCRA assesses risk as the extent of a township's land within the flood risk area.

Cyclone data is derived from the OCHA Natural Hazard Risks Map¹⁰ that identifies the intensity of storms likely to impact coastal areas over the next decade. Cyclone risk decreases with distance from the coastline. Cyclones in Myanmar have had periodic but devastating impacts. Cyclone Nargis in 2008 led to the deaths of 138,000 people and incurred over \$10 billion USD in damage¹¹.

Tsunamis/Storm Surge are often the most damaging components of earthquakes and cyclones. Risk for tsunamis and storm surges is a function of elevation as acquired from NASA's Shuttle Radar Topographic Mission—land lying below 5m is categorized as *high risk*, land between 5m and 10m is categorized as *low risk*, and land above 10m is categorized as *no risk*. The 10m threshold is a standard for determining risk and is used to situate evacuation points¹². Using this physical variable for measuring risk more accurately estimates future risk than probability models based only on historical data.

Earthquake risk is determined using the Probabilistic Seismic Hazard Assessment Map of Myanmar developed by the Myanmar Geo-Science Society (2012). All townships are assigned a risk value based on the amount of township land within the high, medium, and low risk zones. Earthquakes pose a serious threat to Myanmar and 16 major earthquakes (magnitude > 7.0) have occurred in the last 175 years¹³.

Landslide potential is taken from a NASA Socioeconomic Data and Applications Centre global dataset of landslide risk that ranks landslide potential from low to very high. The highest value within the township is used for its landslide risk as it represents the highest level for which a township needs to prepare. Landslides present both a direct threat to human lives and indirect risks stemming from extended periods of disrupted accessibility.

Drought data provided by the UN Environmental Programme identifies the impact of droughts between 1981 and 2010 using the Standard Precipitation Index and Global Population Grid. Drought is defined as any area that has received less than 50% of its baseline precipitation for three consecutive months. The highest risk areas are those that have experienced the greatest drought impacts on the largest number of people. These are identified as most at-risk to droughts potentially impacting food and water availability and potentially livelihoods.

Conflict and civil unrest continues to affect Myanmar citizens, and disproportionately so in border areas. Humans drive conflict and civil unrest, which makes it the least predictable of the hazards and gives limited warning for when and where it might erupt. However, because it is controlled by human decision-making, it is also the most controllable and potentially can be completely eradicated. Conflict in the

¹⁰ <http://www.unocha.org/roap>

¹¹ Swiss Re, SIGMA Report 2009: Natural catastrophes and man-made disasters in 2008.

¹² Theilen-Willige and Pararas-Carayannis, 2009

¹³ ADPC Hazard Profile of Myanmar 2009

CCRA is measured as all violent incidences, including protests, riots and armed conflict, recorded during 2015 and 2016 by Armed Conflict Location and Event Database (ACLED)¹⁴.



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The Multi-Hazard Map

Combining data of the eight primary hazards affecting Myanmar children produces the Multi-Hazard Risk Map (Figure 3). The map displays high exposure to hazards along the northern part of coastal and delta areas, and along the central corridor; areas of medium exposure to hazards across the western states/regions; and low exposure to hazards in the southern and south-eastern areas.

The most hazardous townships are identified as Mawlamyinegyun Township in Ayeyarwady and Pauktaw Township in Rakhine as those areas experienced both high and medium risk to multiple hazards. The 30 most hazardous townships reside in just three states—Rakhine, Ayeyarwady and Yangon—primarily due to the high prevalence of cyclones, storm surge and flooding in coastal areas (Annex 3).

Earthquake risk is most severe along the north-south running Sagaing fault and is the hazard responsible for the moderate overall hazard risk identified in Sagaing, Mandalay and southern Kachin. Landslide risk most affects steeper-sloped areas with poorly consolidated soils, conditions mostly found along the north and west borders, predominantly in Chin State, as well as several border townships in Sagaing and Kachin. Water shortages cause the greatest disruption within the dry zones stretching from Sagaing through Magway and Mandalay and reaching down into the northern delta areas. Urban fire mainly affects states with larger cities such as Mandalay and Yangon and poses moderate risk for Sagaing, Magway, Bago and Mon States.

For conflict and civil unrest, the most intense fighting occurred in northern Shan, Kachin, and northern Rakhine, however conflict occurred in other states/regions in 2015 and 2016. The integrated multi-hazard hazard map shows the risk of a physical event occurring in any given location; it does not explore the specific impacts of those events such as loss of life, loss of livelihoods, food insecurity, poverty prevalence or other causes or effects of underlying vulnerability.

¹⁴ <http://www.acleddata.com/>

The INFORM Index calculates the overall Risk for Myanmar as 6.7 including a Hazard and Exposure value of 7.5, Vulnerability of 6.0 and Lack of Coping Capacity of 6.6. Hazard and Exposure includes a natural hazard risk of 8.0 and risk of manmade hazards of 7.0.¹⁵

Multi-Hazard Risk Map

UNICEF Myanmar, March 2017

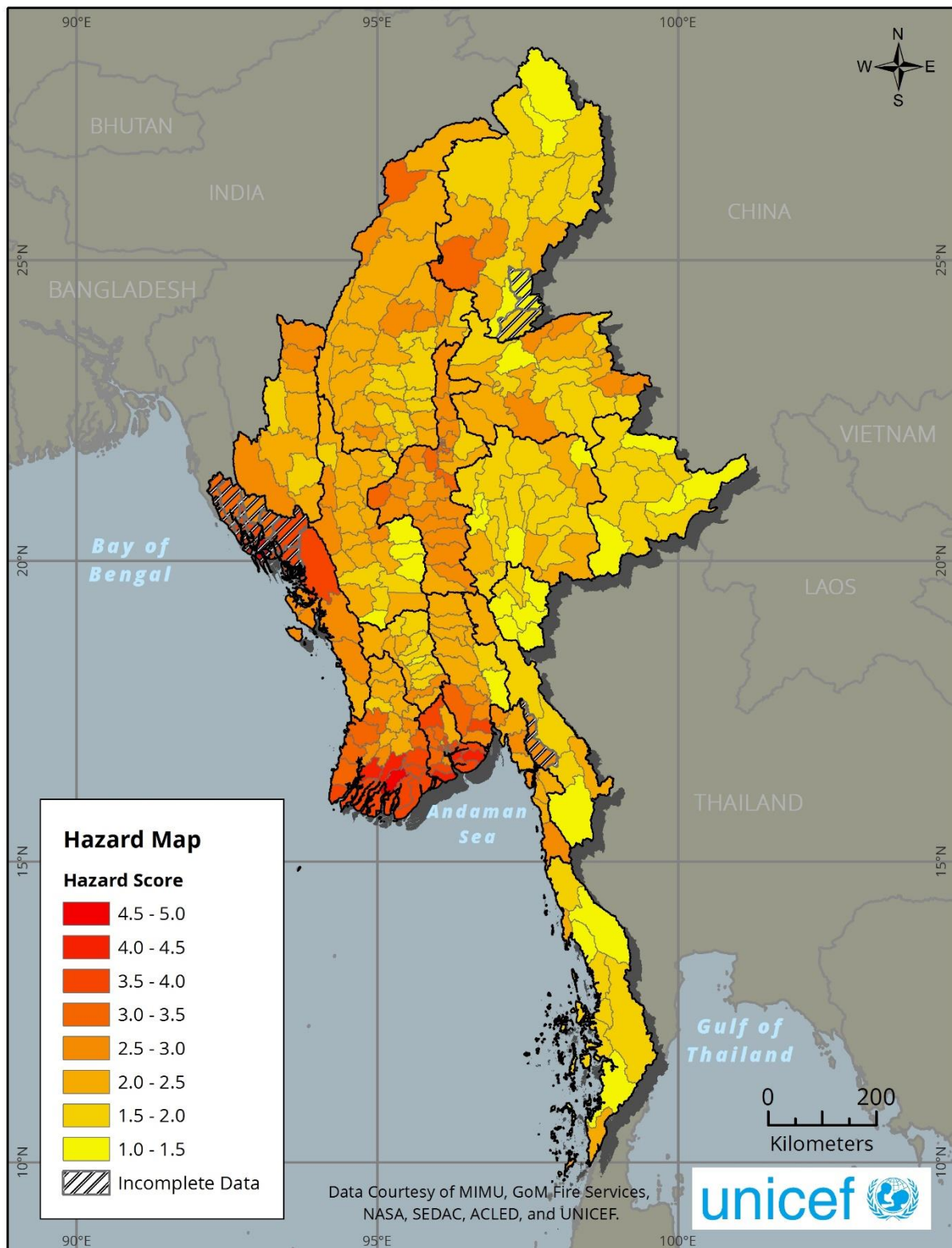


Figure 2. Multi-Hazard Risk Map.

¹⁵ Index for Risk Management - <http://www.inform-index.org/Portals/0/InfoRM/2017/INFORM%20Concept%20and%20Methodology%20Version%202017%20Pdf%20FINAL.pdf?v=2017-07-11-104935-783>

Vulnerability

UNISDR defines vulnerability as “The conditions determined by physical, social, economic and environmental factors or processes which increase the susceptibility of an individual, a community, assets or systems to the impacts of hazards”. The CCRA measures child vulnerability with eleven indicators representing the key sectors of education, health, water, sanitation, nutrition and child protection, which provide a broad and comprehensive overview of vulnerability across the country. These measures aim to capture all children under 18 years, ensuring representation of the entire child’s lifecycle from birth through adolescence. These indicators are Malnourished Children, Primary School Completion, Secondary School Completion, Poverty (number of children by household), Housing Resilience (roof materials), Cooking Fuel Source, Improved Sanitation, Improved Water, Pentavalent-3 Immunization Rate, Children in Monastic Institutions and Internally Displaced Peoples.

Within the Education sector, *Primary and Secondary School Completion Rates* provide insight into the educational attainment levels of young children and adolescents, useful in understanding township-level vulnerability of different aged children. Completion rates are obtained from the 2014 Census data. These metrics replace Early Childhood Development (ECD) Centre Attendance used in the CCRA First Edition.

The Health sector is represented with *Immunisation Rates* of Pentavalent 3 Vaccine reported by the Ministry of Health and Sports. Additional health metrics include *Cooking Fuel Source*—as the use of solid cooking fuels (charcoal, wood, grasses, etc.) increases respiratory problems in children—and *Resilient Housing Materials*, which identifies natural roofing materials as a source of vulnerability. Both Cooking Fuels and Housing Material indicators are captured by Census data. Hospital infrastructure data, such as beds per 1,000 people, was unavailable for this analysis but its inclusion would further the understanding of vulnerability and capacity in the health sector.

The Water and Sanitation sector includes Census-measured access to *Improved Water* and *Improved Sanitation* to show where clean water and sanitation are more prevalent and where improvement is needed. Improved WASH facilities reduces vulnerability to disasters. Within Myanmar, challenges associated with measuring improved water need to be considered as limitations. Household rainwater harvesting which is considered improved is sometimes confused with pond rainwater harvesting which is considered unimproved. Similarly, piped water supply is considered improved regardless of origins, and within Myanmar, origins are frequently untreated water sources. These challenges have the potential to misrepresent actual access and over/under estimate improved water sources for some townships.

The Nutrition sector reflects information on *Chronic Severe Malnutrition for Children under Five* as captured by the 2015 Demographic and Health Survey. State/Region values projected to the township level provide coarse estimates of child malnutrition, with higher rates of malnutrition equating to higher vulnerability. General poverty indicators also affect access to nutrition. In the CCRA, *number of children per household* is used as a proxy for poverty.

To assess Child Protection, three variables are included: *Child Trafficking*, *Children in Institutions* and *Children with Disabilities*. These children lack the protection of parents or family caregivers or require additional support and are thus more vulnerable to disasters. State-level trafficking data is provided by the anti-trafficking division of the Myanmar Police Force, state-level disability data is provided by UNICEF Situation Assessment (except for Chin State, where Census data was supplemented in its place), and the *Children in Institutions* data is provided at the township level from the Census.

The Child Vulnerability Map

The Government of Myanmar identified Rakhine and Chin as the least developed States in the Union. However, the CCRA reveals a distinct pattern of child vulnerability across Myanmar with the highest levels concentrated on the peripheries of the country, especially in Rakhine and Shan States. These locations, among the least accessible areas in Myanmar, contain 36 of the 40 most vulnerable townships. The other four most vulnerable townships are identified as border townships in Sagaing and Kachin (Annex 4). Overall, *lack of sanitation* and *not completing primary school* were the most reliable indicators of overall *vulnerability* with a correlation of 78% and 76% respectively.

Sector-specific vulnerabilities also show clear geographic patterns. Within the Education sector, Shan State and northern Sagaing have the lowest completion rates for primary school as well as low secondary school completion rates in all non-urban areas. For Health, reported immunisation rates are generally high but with notable exceptions in townships in northern Sagaing, Kachin and Shan States. Cooking fuels and housing materials are often chosen from available surrounding materials, leading to greater solid cooking fuel use in remote regions, increasing vulnerability in the more rural townships.

Houses built with natural roofs—and thus increased vulnerability—are most common in Rakhine, northern Sagaing and Kachin.

For Water and Sanitation, access to sanitation varies greatly by township—the lowest and highest sanitation-rated townships are located next to each other in Magway. Lack of improved drinking water is most problematic within the northern-most townships of Kachin and Sagaing, Shan, northern Rakhine and the delta regions. The 2015 Demographic Health Survey identifies Rakhine as the region facing the most significant nutrition challenges, with 13.9% of children experiencing global acute malnutrition before age five. Poverty as indicated by household size is a challenge in the northern areas of Kachin and Sagaing, north and east Shan, and throughout Chin¹⁶. Within Child Protection, the highest rate of reported children with disabilities is found in Shan and child trafficking poses its greatest threat in Rakhine and Yangon according to 2016 annual report on combatting human trafficking in Myanmar.

The Child Vulnerability Map (Figure 4) presents a comprehensive overview of where children are vulnerable to the social and economic factors that influence their susceptibility to hazards and their ability to absorb shocks and stressors linked to long-term implications for healthy development. The analysis does not reveal causal relationships between individual variables and overall vulnerability.



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¹⁶ [https://www.unicef.org/myanmar/Social_impact_study_version_2_\(Fianl_Draft\).pdf](https://www.unicef.org/myanmar/Social_impact_study_version_2_(Fianl_Draft).pdf)

Child Vulnerability Map

UNICEF Myanmar, March 2017

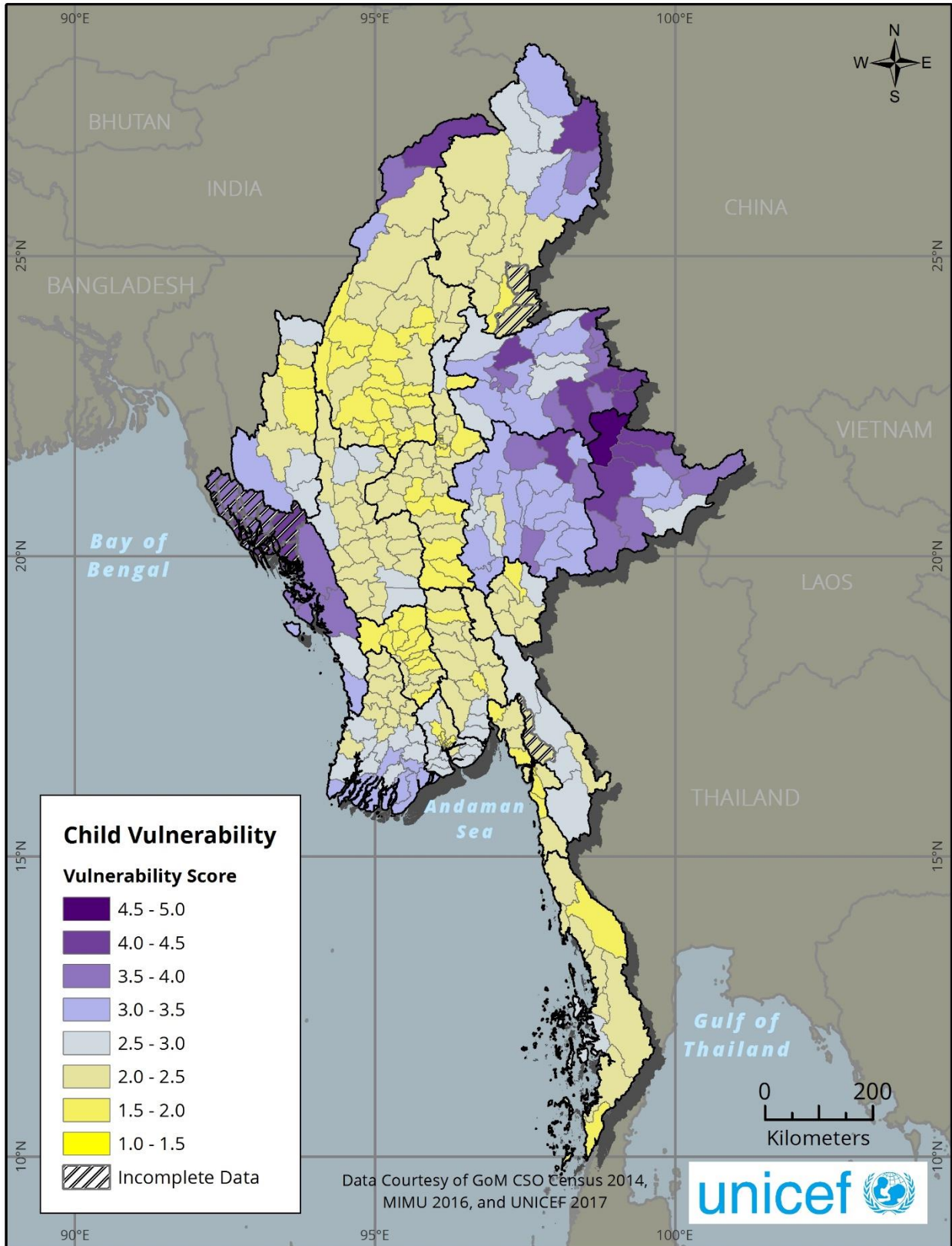


Figure 3. Child Vulnerability Map.

Capacity

Capacity is a highly localised and often time-bound characteristic and is developed in response to local conditions, which makes it a challenging component to measure and map. Furthermore, adequate capacity often results in limited disaster impacts and cannot be quantified or captured through current disaster reporting metrics. To assess capacity, the CCRA looked at in-place infrastructure that may facilitate enhanced response and recovery, or limit the damages from disasters. There are six indicators used to identify the coping capacity: Mobile Phones per Household, Electrified Households, Emergency Response Warehouses by government departments and development agencies, Social Case Worker Presence, Accessibility (Roads) and Number of Children per School.

The next CCRA can strengthen these indicators by including data on health care workers with emergency training, health facilities resourced for emergency care and emergency evacuations centre locations rather than schools.

Mobile Phones per household is included as a proxy for access to emergency information. More connectivity allows easier and quicker access to Early Warning Systems or similar emergency information. Mobile Phones per Household data is captured in the CSO 2014 Census, but these numbers are out-dated due to the high rate of mobile phone uptake.

Electrified Households, captured in the Census, provides similar insight on the townships with high rates of electrification, and therefore likely improved methods of disaster communication.

Emergency Response Warehouses provide the basis for relief distribution to both the townships in which they are located and surrounding townships. Using locations of warehouses operated by the Department of Disaster Management (DDM), the World Food Program, United Nations High Commission for Refugees, Myanmar Red Cross Society and UNICEF, each township is assigned a value if they have warehouses within their township (high capacity), if there is a warehouse in a neighbouring township (low capacity) or if there are no nearby warehouses (no capacity).

Social Case Workers Presence helps communities prepare for and recover from disasters. Many communities have dedicated social workers trained by the Department of Social Welfare (DSW), UNICEF or partner organisations. If a township has a social caseworker, it is understood to have a higher capacity than if it does not.

Accessibility (Road Density) allows emergency consignments of food and movement of resources to respond quickly to disasters and/or for evacuation purposes. Accessibility is measured by the township's road density: the total length of primary and secondary roads within a township divided by the total area of a township. Higher density means more potential routes to any given area, resulting in a higher capacity score.

Schools often serve as community centres and gathering points, and in several townships they also serve as community shelters. Areas with more schools, and more developed infrastructure in general, are likely to have increased capacity for dealing with disasters. Here, schools stand as a proxy for potential emergency infrastructure capacity; however, UNICEF does not condone schools as planned evacuation sites since this can impede early return to education. Schools in this report are measured as the number of children per school, measured in the Education Management Information System. From this data, townships with a lower number of students per school are rated with a higher capacity score.

The Capacity Map

Capacity is the most difficult component to measure as it manifests in different ways depending upon potential threats. Population distribution also factors into investment and allocation as interventions tend to focus on areas where they will make the greatest impact for the largest number of people, often defaulting to urban centres. Across Myanmar, capacity varies widely; the predominant trend is that townships with larger urban areas generally display more capacity than rural areas. In the Capacity Map (Figure 5), areas of high capacity correspond with local capitals and major cities (Annex 5). This pattern is reinforced through several variables used to capture capacity such as trained social workers, emergency response warehouses and road density. Other variables that comprise capacity—mobile phones per household, children per school, and percent of electrified households—are irregularly patterned.

Capacity Map

UNICEF Myanmar, March 2017

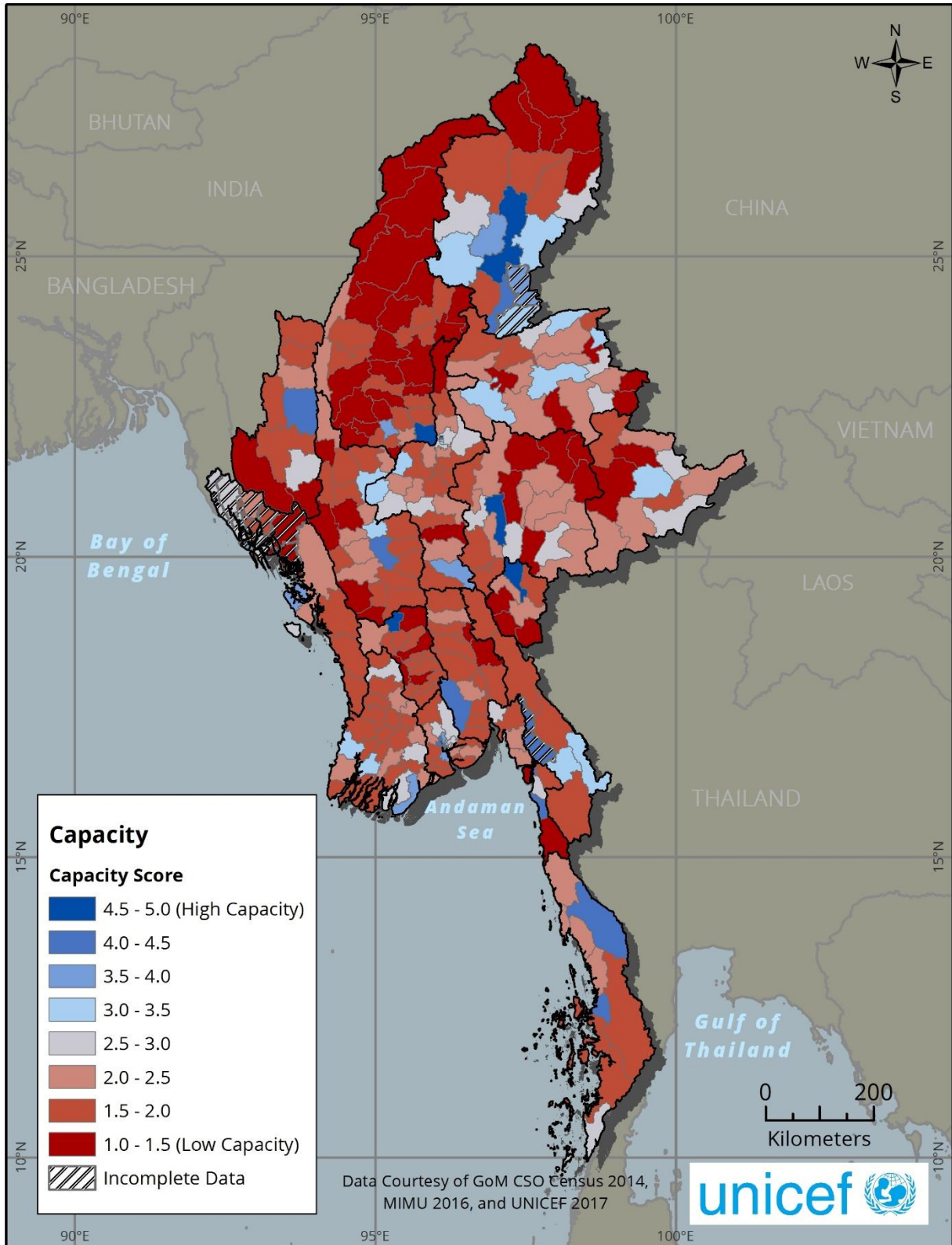


Figure 4. Capacity Map

Climate Change

Myanmar is exposed to various climate hazards such as cyclones, heavy rains, floods, extreme temperatures, and drought which are increasing in intensity and frequency. Observed changes in the Southeast Asia climate include: increased temperatures, variable precipitation, a rise in sea level and increased frequency and magnitude of extreme weather events (Hijioka et al. 2014).

The Department of Meteorology and Hydrology (DMH) under the Ministry of Transportation and Communication analysed hydro-meteorological indicators and conclude that Myanmar's climate is changing. Observable trends over last six decades include:

- Mean temperature has risen by around 0.08°C each decade;
- Overall rainfall has increased throughout the majority of the country—with decreases in some areas;
- Late onset and early termination of southwest monsoon;
- More extreme weather events; and
- Rising sea levels.

Changing climate patterns are becoming more prominent and data collected by the DMH shows evidence of a shortening of the monsoons and overall increases in heat and drought indices. Climate change has the potential to undermine all development efforts if not considered as part of risk-informed planning processes and is therefore included as a fundamental determinant of child-centred risk in Myanmar.

The climate change data UNICEF used for this analysis—provided by DMH—are the mean temperature and precipitation change for each state through mid-century is based on global climate model projects from the Intergovernmental Panel on Climate Change 5th Assessment (IPCC, 2015) using Representative Pathway Concentration (RCP) 8.5. Full DMH data is available in Annex 2.

The RCP (4.5 & 8.5) models for both temperature and precipitation are generally able to capture the broad distribution of observed climatology in Myanmar. The RCP (4.5 & 8.5) scenario-based projections of future climate should be used for impact and vulnerability assessment as well as adaptation planning.

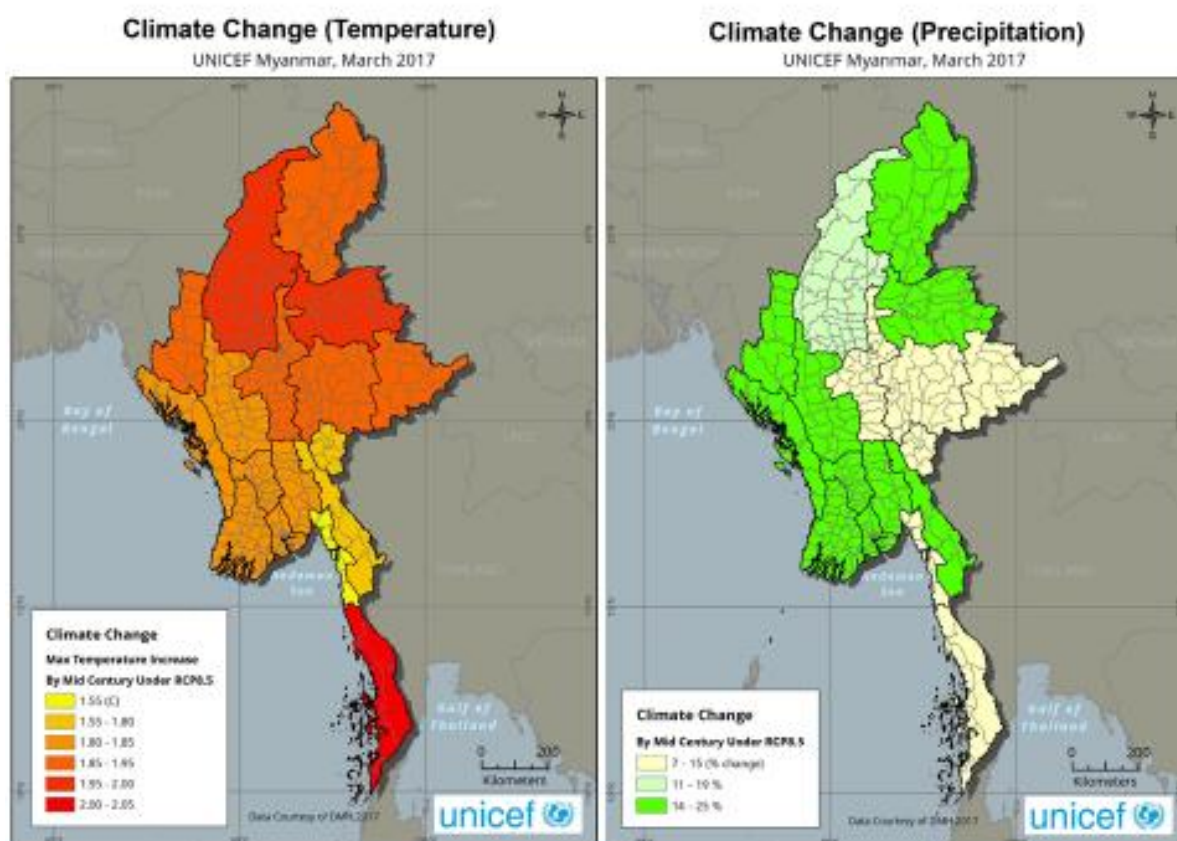


Figure 5. Climate Change by Mid-Century Maps showing projected temperature increases (left) and precipitation increases (right) by mid-century.

Child-Centred Risk

To calculate child-centred risk using equal weights for each of the five components, the disaster risk formula is adapted to the following:

$$\text{Child Centered Risk} = (\text{Hazard}) + (\text{Vulnerability}) + (\text{Exposure}) + (\text{Climate Change}) + \left(\frac{1}{\text{Capacity}}\right)$$

Child-Centred Risk Map

Child-Centred Risk Map

UNICEF Myanmar, March 2017

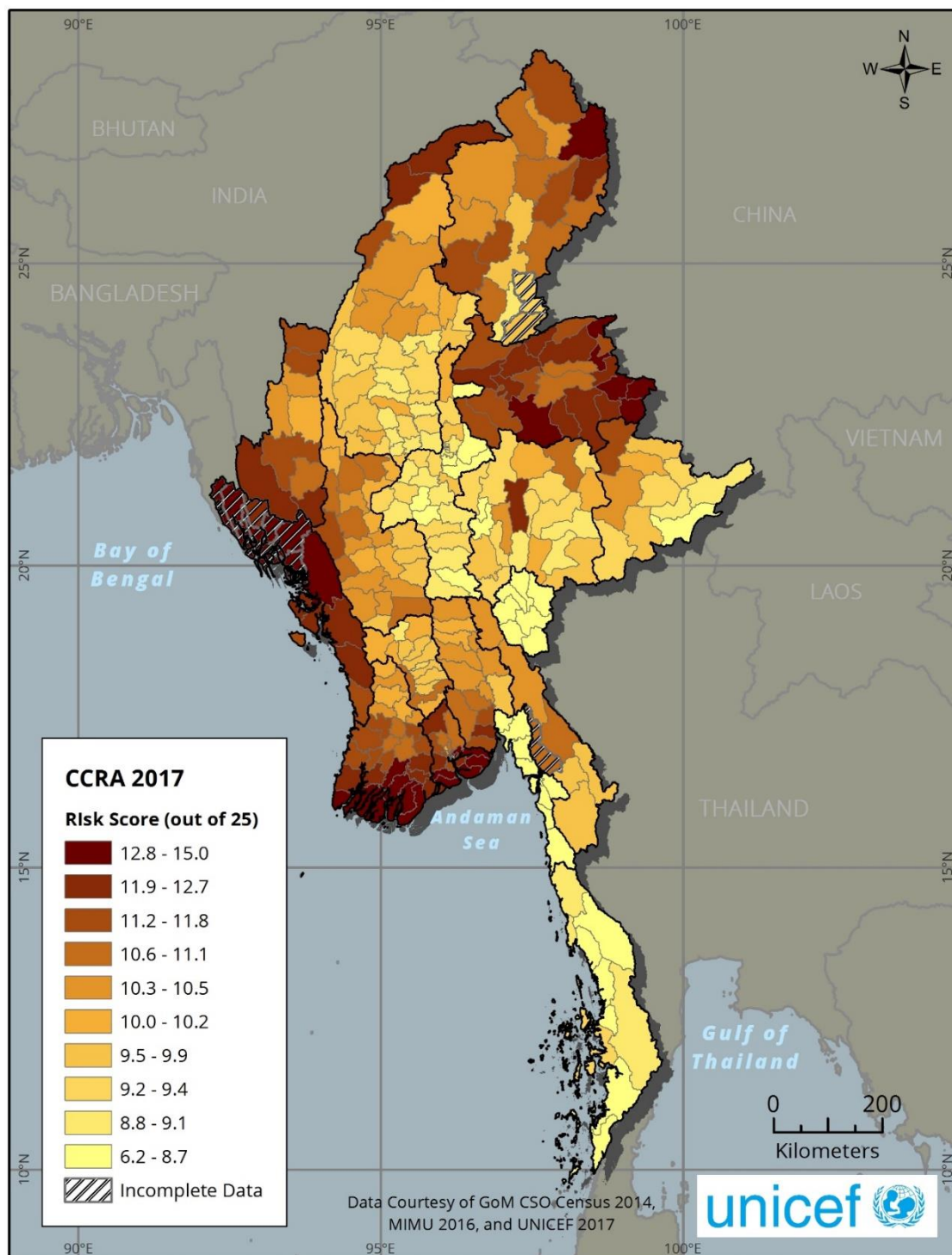


Figure 6. Child-Centred Risk Assessment Map

Combining the five components of child-centred risk with an equal weighing scheme reveals concentrations of risk in the peripheral areas of Myanmar (Figure 7). At the state level, Rakhine displays the highest level of child-centred risk followed by Northern Shan, Ayeyarwady, Yangon, Chin and Kachin (Table 2). At the township level, Rakhine has five of the ten highest risk townships as well as the single highest risk township. Furthermore, Rakhine's high risk score may be an under-estimate, as the exposure component is based on Census data likely undercounting the child population in northern Rakhine. The delta region—Ayeyarwady and Yangon—also received high scores due to medium-high degrees of coastal hazard, vulnerability and predicted climate change impacts.

Shan State significantly diverges in child risk between the north, south and east regions with the north displaying very high risk levels compared to low to medium risk in the others (with the exception of Hopong Township). Most of Shan exhibits high vulnerability and medium hazard risk. The sharp divide, however, is driven by DHM climate change projections that classify northern Shan's climate risk as severe and the rest of the state as moderate. Additionally, the high risk score in Hopong is likely related to its location on the outskirts of the city Taunggyi where it may receive increased population without corresponding resources, leading to a high risk score. The capacity and exposure components produce more localised competing effects with mixed results, lowering the score for more urbanised townships but raising the score for higher densities of children.

Rank	State/Region	CCRA Score
1	Rakhine	12.99
2	Shan (North)	12.18
3	Ayeyarwady	11.59
4	Yangon	11.21
5	Chin	11.12
6	Kachin	10.74
7	Bago East	10.61
8	Magway	10.30
9	Kayin	10.13
10	Bago West	9.78
11	Sagaing	9.66
12	Shan (East)	9.62
13	Shan (South)	9.53
14	Mandalay	8.94
15	Tanintharyi	8.59
16	Kayah	7.30
17	Mon	6.87

Table 1. State/Region aggregated mean CCRA values.

In this analysis, Chin emerges as a state with medium-high risk. However, township level analysis shows high risk in the southern- and northern-most townships with medium risk townships surrounding Hakha. This example illustrates the utility of a township-level analysis that delineates high-risk and low-risk areas within single regions.

In viewing the Child-Centred Risk Map, the dark brown townships represent those with the highest combined risk (hazards x climate change x exposure x vulnerability/capacity). There may be two townships of the same colour where one has high climate change risk and the other high vulnerability risk. The purpose of this report is to underline *combined* risk factors as this recognises the intrinsic linkages and multiplying factors of risks. The lighter the shade of yellow, the lower combined risk factor for that township. While risk is considered low in these areas, there may be individual children within that township who are at very high risk. Furthermore, as noted previously, an area facing extremely high risk from only a single hazard is ranked as less risky than an area with medium risk to multiple hazards.

Risk Rank	State/Region	Township	Exposure Score	Hazard Score	Vulnerability Score	Capacity Score	Climate Change Score	CCRA Score
1	Rakhine	Pauktaw	1.0	4.9	4.3	2.7	4.4	14.9
2	Yangon	Dagon Myothit (North)	5.0	3.6	1.3	3.3	4.4	14.6
3	Rakhine	Myebon	1.0	3.9	4.0	1.1	4.4	14.2
4	Shan (North)	Pangwaun	1.0	2.9	4.4	1.5	5.0	14.0
5	Yangon	Thongwa	1.8	4.4	2.9	2.0	4.4	14.0
6	Rakhine	Ponnagyun	1.0	4.0	4.0	1.6	4.4	14.0
7	Ayeyarwady	Mawlamyinegyun	1.0	5.0	2.8	1.6	4.4	13.8
8	Rakhine	Minbya	1.0	3.5	4.1	1.5	4.4	13.7
9	Rakhine	Rathedaung	1.0	3.7	4.1	2.5	4.4	13.6
10	Rakhine	Sittwe	1.0	4.5	3.2	3.8	4.4	13.4
11	Shan (North)	Mongmao	1.0	2.5	4.2	2.1	5.0	13.3
12	Rakhine	Ann	1.0	3.6	3.8	2.4	4.4	13.2
13	Ayeyarwady	Wakema	1.0	4.5	2.8	2.1	4.4	13.2
14	Rakhine	Mrauk-U	1.0	3.3	4.0	2.0	4.4	13.1
15	Yangon	Dagon Myothit (South)	2.9	3.7	1.8	2.7	4.4	13.1
16	Yangon	Dagon Myothit (East)	2.6	3.9	1.8	2.7	4.4	13.1
17	Shan (North)	Namphan	1.0	2.0	4.1	1.0	5.0	13.0
18	Shan (North)	Konkyan	1.0	1.9	4.4	1.5	5.0	13.0
19	Ayeyarwady	Labutta	1.0	3.9	3.0	1.6	4.4	12.9
20	Shan (North)	Kunlong	1.0	2.4	3.8	1.4	5.0	12.9

Table 2. List of the CCRA 20 most at-risk townships.

USE OF CHILD-CENTRED RISK ASSESSMENT

Findings of the CCRA identify key opportunities for risk-informed, climate-sensitive programming for government ministries and national and international non-governmental organisations in order to build resilience among children, families and their communities.

Township Risk Profiling

The CCRA map provides a quick overview of child-centred risks across the country, allowing easy identification of high and low risk townships. Using the hazard, vulnerability, exposure and capacity maps allows users to understand the drivers of risk within a given township. Furthermore, by consulting

the CCRA dataset, users can understand the factors that lead to underlying component scores (e.g. conflict driving a high hazard score). Users can then begin to assemble a township profile that provides the risk score as well as the drivers of that risk score to gain a more nuanced understanding of the challenges facing any given township.

Depending on programming objectives, the CCRA may be operationalised in various manners. For example, when focusing on prevention and mitigation measures—to a larger extent than preparedness and response—individual hazards will come to the fore as these measures need to be hazard specific.

Advocacy on Child-Centred Resilience

Children are incredibly resilient and active agents for change that can, and have the right to, meaningfully contribute to disaster risk management and other resilience-building processes. Children are also the most vulnerable group to the negative impacts of disaster, including physical and mental health effects and disruption to education, environment, protective structures and well-being. UNICEF advocates for child-centred resilience programming that ensures an equitable approach that does not marginalise those most-at-risk and promotes Do No Harm principles¹⁷.

The CCRA demonstrates that all states and regions have areas where children are exposed to moderate or high risk. Myanmar is at a critical stage in defining its development path related to the Sustainable Development Goals, State/Region Development Plans, sectoral strategies and policies and significant international investment in development. The CCRA provides a tool for planners and decision-makers to design comprehensive initiatives aimed at building community resilience. As child well-being is an indicator of family well-being—which in turn supports community prosperity—the CCRA provides a strategic vantage point from which to identify, target, and resolve challenges before they become crises. Additionally, using the CCRA as a programming guide brings children into the national agenda and further highlights the need for effective DRR, climate change mitigation and adaptation, environmental sustainability measures, comprehensive education, adaptive health, nutrition and WASH service provision, national coverage of adaptive child protection services and integrated social protection programmes.

Quantitative ranking of children's risk for each township allows for targeting of priority areas and provides robust rationale for allocating resources. Not only does the CCRA identify at-risk areas, but it also quantifies the magnitude of risk, facilitating intra- and inter-state comparisons.

This analysis and dataset serves as a resource for other development partners. The UN Strategic Framework in Myanmar defines as one of its four Strategic Priorities to “reduce vulnerability to natural disasters and climate change”, focusing on national policies and relevant public sectors, strengthening community resilience and improving information systems. The findings of the CCRA support this broader UN priority and emphasise the need for continued resilience and risk-informed programming in the next Myanmar UNDAF. Furthermore, the CCRA demonstrates the importance of mainstreaming DRR in development processes and encourages the government to continue making it a national and local priority. Sharing this analysis with development partners helps to inform the national agenda and may influence allocation of resources towards more sustainable and risk-sensitive programming in high-risk areas of Myanmar.

Multi-Sectoral Interventions

The multi-faceted nature of disasters means that efforts to strengthen resilience require multi-sectoral approaches. UNICEF's comparative advantage lies in its reach across social sectors - such as education, health, nutrition, child protection, social protection and water and sanitation - and prioritises its cross-sectoral programme effectiveness goals; comprising DRR/CCA; Core Commitments to Children in Humanitarian Action¹⁸; communication for development; advocacy, policy and communication; public financial management and government engagement at national and subnational levels. UNICEF places specific value on its government, UN, NGO and civil society partnerships to achieve results for children.

The Government of Myanmar also outlines an inter-ministerial and multi-sectoral approach noted in the Disaster Management Law (2013), Disaster Management Rules (2015) and Myanmar Action Plan on Disaster Risk Reduction (2017).

¹⁷ For more information on “Do No Harm” Principles please see https://www.unicef.org/lac/CCCs_EN_070110.pdf

¹⁸ https://www.unicef.org/publications/files/CCC_042010.pdf

Risk-Informed Country Programming

In order to achieve priorities laid out by the Sustainable Development Goals, Sendai Framework for Disaster Risk Reduction, Paris Climate Agreement and World Humanitarian Summit, it is critical that Government of Myanmar and development partners align systems, policies and strategic frameworks across its ministries and for programmes to be risk-informed.

In addition to an overall risk assessment, the CCRA provides the first comprehensive child-centred township-level spatial assessments of multi-hazard risk, vulnerability and capacity for Myanmar. The breakdown of the components that contribute to children's risk provides better understanding of risk drivers and allows programming to target specific factors particular to each location.

The second version of the Myanmar Action Plan for Disaster Risk Reduction recognises that risk information on multi-hazards needs to be combined with vulnerability, exposure and capacity assessments in order to develop the necessary risk assessment across the nation and down to local levels for its inclusive vision to be achieved. Risk-informed programming and systems should allow for adaptive social service provision that can be timely and flexibly modified for specific contexts, trends, and acute situations in a manner that reduces negative consequences and develops resilience of the most at-risk members of the community.

In closing, UNICEF advocates that where appropriate, disaster risk should not be considered in isolation of other risks, including the impact of climate change, social/political conflict, economic shocks and/or health-related crises; and that DRR is part of an integrated approach to building resilience. Multi-sectoral, risk-informed interventions need to ensure that emergency planning is less shock-driven and more vulnerability-centred; while development planning requires integrated disaster risk and climate change mitigation and adaptation measures.



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BIBLIOGRAPHY AND REFERENCES

Policies and frameworks

Sendai Framework for Disaster Risk Reduction

In 2015, the Sendai Framework for DRR 2015-2030 replaced The Hyogo Framework for Action (HFA) 2005-2015. The Hyogo agreement was the first 10-year plan developed to make the world safer from disasters. It was endorsed by the UN General Assembly in the [Resolution A/RES/60/195](#) following the 2005 World Disaster Reduction Conference, and adopted by many Governments, including the Government of Myanmar thereafter. The Sendai Framework for DRR, adopted in March 2015, is the continuation of these efforts adopting specific targets for reducing mortality and impacts of future disasters. The HFA can be accessed online at: <http://www.unisdr.org/we/inform/publications/1037>, and Sendai Agreement can be accessed online at: http://www.preventionweb.net/files/43291_sendai_frameworkfordrren.pdf

Myanmar Action Plan on DRR (MAPDRR)

The Myanmar Action Plan on Disaster Risk Reduction was first published in 2009 with the goal 'To make Myanmar Safer and more Resilient against Natural Hazards, thus Protecting Lives, Livelihood and Developmental Gains'. The Government of Myanmar fully endorsed an updated version in 2012, thereby providing greater impetus for DRR work and paving the way for a forthcoming 2017 update. MAPDRR aligns with the ASEAN Agreement on Disaster Management and Emergency Response and the Hyogo Framework for Action. It is accessible online at: <http://reliefweb.int/report/myanmar/myanmar-action-plan-disaster-risk-reduction-mapdr>

ASEAN Agreement on Disaster Management and Emergency Response (AADMER)

The ASEAN Agreement on Disaster Management and Emergency Response was ratified by all ten Member States and entered into force on 24 December 2009. The AADMER is a proactive regional framework for cooperation, coordination, technical assistance and resource mobilisation in all aspects of disaster management. It also affirms ASEAN's commitment to the Hyogo Framework of Action (HFA) and is the first legally binding HFA-related instrument in the world. It is accessible online at: <http://www.asean.org/resources/publications/asean-publications/item/asean-agreement-on-disaster-management-and-emergency-responce-work-programme-for-2010-2015>

National Adaptation Programme of Action (NAPA)

Myanmar's National Adaptation Programme of Action (NAPA) was adopted in 2012 following the guidelines outlined by the United Nations Framework Convention on Climate Change (UNFCCC) Least Developed Countries Expert Group; and identifies 32 priority activities to address Myanmar's urgent needs for adaptation to climate change. The NAPA is accessible online at: <http://unfccc.int/resource/docs/napa/mmr01.pdf>

Terminology on Disaster Risk Reduction

Terminology and definitions of DRR terms included in the report are taken from UNISDR's "Terminology on Disaster Risk Reduction", accessible online at: <http://www.unisdr.org/we/inform/terminology>

Risk Management Platforms and Indexes

INFORM

INFORM Risk Index is a global, open source risk assessment providing a risk ranking as well as country risk profiles for 191 countries. Myanmar's country risk profile can be viewed at: <http://www.inform-index.org/Results/Country-profiles?iso3=MMR>

Surveys referenced in the document

The 2014 CSO Population and Housing Census

The 2014 Myanmar Population and Housing Census Report Volume 2-B The Union Report: Occupation and Industry, organized by the Government of Myanmar and executed by the Centre Statistical Organisation (CSO), provides detailed township level data for the entire country. Released in 2016, various portions of the data were processed and aggregated by UNICEF and the Myanmar Information Management Unit (MIMU) <http://www.themimu.info/census-data>.

Demographic and Health Survey (DHS)

Supported by USAID, demographic and Health Surveys (DHS) are nationally-representative household surveys that provide data for a wide range of monitoring and impact evaluation indicators in the areas

of population, health and nutrition. In Myanmar, DHS data collection started in 2015 and data became available in 2016. See more details at: <http://dhsprogram.com/What-We-Do/Survey-Types/DHS.cfm>

Key stakeholders referenced in the document

Environmental Conservation Department (ECD)

The Environmental Conservation Department, within the Ministry of Environmental Conservation and Forestry, operates as the main land management agency within Myanmar. Additionally, in fulfillment of its role as the chief agency for organising and facilitating environmental information and data dissemination, the ECD released the Myanmar Environment Portal (2014), available here: <http://mya.gms-eoc.org/>.

Department of Social Welfare (DSW)

The Department of Social Welfare, under the Ministry of Social Welfare, Relief and Resettlement, is a primary implementer of the National Social Protection Strategy (2014) and is tasked with developing programs aimed at preventing, protecting, and rehabilitating children, women and families. More information is available at: <http://www.dsw.gov.mm/en>

Department of Disaster Management (DDM)

The Department of Disaster Management, under the Ministry of Social Welfare, Relief and Resettlement, is Myanmar's National Disaster Management Authority and has the dual objective to

- (a) Provide emergency assistance for the victims of natural disasters for ensuring immediate relief and
- (b) Conduct preventive measures to reduce the loss of lives and properties due to disasters. Detailed information on the activities and publications of the RRD can be accessed online at: <http://www.rrdmyanmar.gov.mm/>

Department of Meteorology and Hydrology (DMH)

The Department of Meteorology and Hydrology, under the Ministry of Transport and Communication, performs key roles relating to weather forecasting and early warning for natural hazards. One of DMH's specific objective is to take precautionary measures against and minimise the effects of natural disasters. More information on DMH's activities can be accessed online at: <http://www.dmh.gov.mm/>

DRR Working Group Myanmar

The Disaster Risk Reduction Working Group (DRR WG) was formed in 2008 during the early recovery phase of Cyclone Nargis to support the Government and communities to promote disaster resilience in Myanmar. Since then, the DRR WG has evolved as one of the most diverse and dynamic networks in the country, currently comprising of over 60 agencies including the UN, international NGOs, local NGOs and professional organisations working for DRR. UNICEF is a member of the Steering Committee and the Policy Task Force. Information and publications of the DRR WG can be accessed online at: <http://www.themimu.info/sector/disaster-risk-reduction>

UNICEF Myanmar

UNICEF is the world's leading child rights organisation. For more than 60 years, UNICEF has been working to positively change the lives of Myanmar's children. Through its strong working relationship with the Government of Myanmar over the decades and significant engagement with other stakeholders, UNICEF is positioning itself to continue to strengthen its efforts to improve children's lives. More information on UNICEF's activities in Myanmar can accessed online at: <http://www.unicef.org/myanmar/>

Myanmar Information Management Unit (MIMU)

The Myanmar Information Management Unit / MIMU is a service to the UN Country Team and Humanitarian Country Team, under the management of the UN Resident and Humanitarian Coordinator. Its purpose is to improve the capacity for analysis and decision making by a wide variety of stakeholders - including the United Nations, the Humanitarian Country Team, non-governmental organisations, donors and other actors, both inside and outside of Myanmar, through strengthening the coordination, collection, processing, analysis and dissemination of information. All MIMU products can be accessed online at: <http://www.themimu.info/>

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Annex 1: Data List and Sources

<u>Exposure</u>	<u>Source</u>	<u>Data Access</u>
Children 0-17	GoM CSO Census 2014	http://www.themimu.info/census-data
Boys 0-17	GoM CSO Census 2014	http://www.themimu.info/census-data
Girls 0-17	GoM CSO Census 2014	http://www.themimu.info/census-data
Adolescents (10-17)	GoM CSO Census 2014	http://www.themimu.info/census-data

<u>Hazards</u>	<u>Source</u>	<u>Data Access</u>
Earthquake	Seismic Zone Map of Myanmar, PSHA Map, MGS, 2012	https://www.researchgate.net/publication/292845235_Seismic_Zone_Map_of_Myanmar
Cyclones	OCHA Multi-hazard map & Hazard Profile	http://www.preventionweb.net/english/professional/maps/v.php?id=4164
Tsunamis	NASA SRTM	https://search.earthdata.nasa.gov/
Flood	Dartmouth Flood Observatory and River Courses	http://www.dartmouth.edu/~floods/Dataaccess.htm
Drought	UNEP Population Exposure to Drought	http://preview.grid.unep.ch/index.php?preview=data&events=droughts&evcat=4&lang=eng
Fires	GoM - Fire Services	Personal Communication
Landslides	SEDAC	http://sedac.ciesin.columbia.edu/data/set/ndh-landslide-hazard-distribution/data-download
Conflict	ACLED Database	http://www.acleddata.com/asia-data/

<u>Capacity</u>	<u>Source</u>	<u>Data Access</u>
Mobile Phones per household	Census 2014/Neilson Survey 2015	http://www.themimu.info/census-data
Electrified households	GoM CSO Census 2014	http://www.themimu.info/census-data
Emergency Response Warehouses	(DDM, WFP, MRCS, etc.)	Personal Communication
Social Case Workers Presence	UNICEF	UNICEF
Accessibility (Roads km/km ²)	MIMU Road layer	http://themimu.info/gis-resources-agency-maps
Students per School	GoM MoE EMIS Dataset	Education Management Information System

<u>Vulnerability</u>	<u>Source</u>	<u>Data Access</u>
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Chronic Severe Malnutrition	DHS Survey 2015	http://dhsprogram.com/what-we-do/survey/survey-display-454.cfm
Improved Sanitation	GoM CSO Census 2014	UNICEF
Improved Water	GoM CSO Census 2014	UNICEF
Primary School Completion	GoM CSO Census 2014	http://www.themimu.info/census-data
Secondary School Completion	GoM CSO Census 2014	http://www.themimu.info/census-data
Poverty (Number of Children/hh)	GoM CSO Census 2014	http://www.themimu.info/census-data
Penatvalent 3 Immunised Rate	Min Health & Sports	Ministry of Health and Sports
Cooking fuel source	GoM CSO Census 2014	http://www.themimu.info/census-data
Housing Resilience (roofing)	GoM CSO Census 2014	http://www.themimu.info/census-data
Child Trafficking	Myanmar Police Force	Myanmar Police Force 2016 annual report
Children in Institutions	GoM CSO Census 2014	UNICEF
Children with Disabilities	UNICEF Situation Analysis	https://www.unicef.org/myanmar/Full_report_in_English.pdf

<u>Climate Change</u>	<u>Source</u>	<u>Data Access</u>
Climate Change Precipitation	DMH – IPCC 5AR 2015	DMH - Personal Communication
Climate Change Temperature	DMH – IPCC 5AR 2015	DMH - Personal Communication

Annex 2: Department of Meteorology and Hydrology Climate Change Data

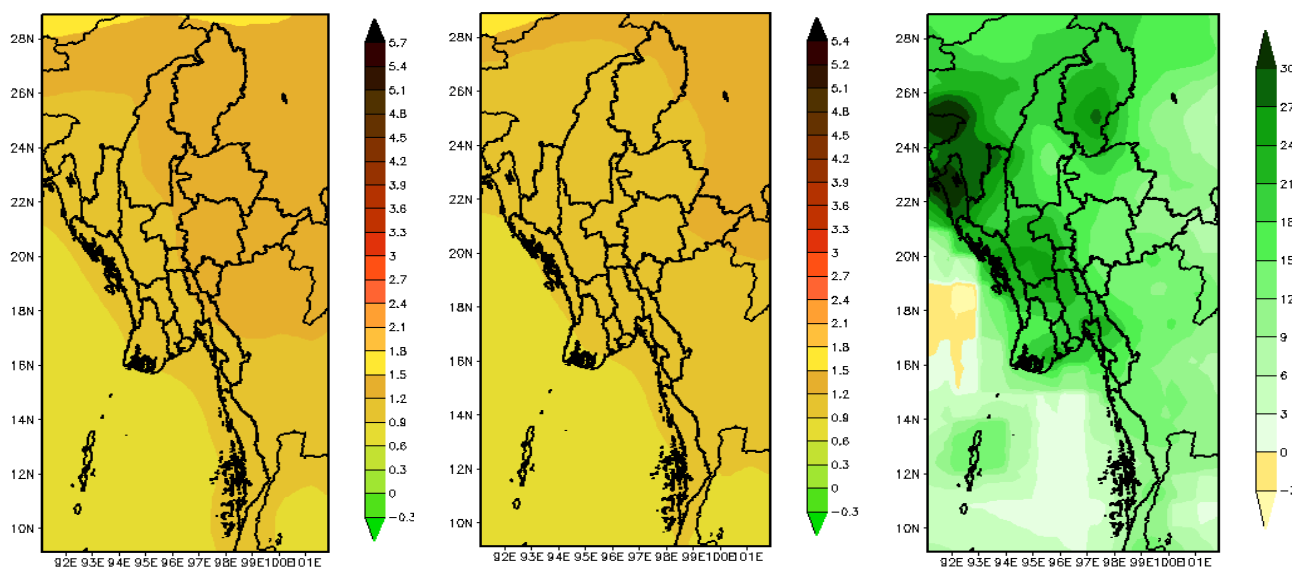
Climate Change Projections for Myanmar, based on RCP 8.5

version 11 January 2017												
Climate Change Projections for Myanmar, based on RCP 8.5												
States/ Regions	Annual Maximum Temperature Increases (Celcius)				Annual Minumum Temperature Increases (Celcius)				Rainfall Departure (%)			
	2021-2040	2041-2060	2061-2081	2081-2100	2021-2040	2041-2060	2061-2081	2081-2100	2021-2040	2041-2060	2061-2081	2081-2100
Ayeyarwaddy	0.9-1.2	1.6-2.1	2.3-3.0	3.2-4.0	0.8-1.3	1.7-2.3	2.2-3.2	3.1-4.1	6-13	14-25	12-44	10-31
Bago	0.9-1.3	1.6-2.1	2.4-3.1	3.3-4.1	0.9-1.4	1.8-2.4	2.5-3.4	3.4-4.4	6-13	14-25	12-44	10-31
Chin	0.6-1.3	1.5-2.4	2.0-3.3	2.2-4.4	1.0-1.4	2.0-2.7	2.6-3.7	3.7-5.0	6-13	14-25	12-44	10-31
Eastern Shan	1.0-1.3	1.6-2.3	2.5-3.3	3.4-4.3	1.0-1.6	2.0-2.7	2.7-3.6	3.7-4.8	-7 to 7	7 -15	3-25	10-31
Kachin	0.9-1.5	1.5-2.4	2.6-3.6	3.5-5.0	0.9-1.3	1.9-2.6	2.5-3.6	3.6-4.9	6-13	14-25	12-44	10-31
Kayah	0.9-1.4	1.5-2.1	2.5-3.2	3.4-4.3	1.0-1.5	2.0-2.7	2.6-3.6	3.7-4.8	-7 to 7	7 -15	12-44	10-31
Kayin	0.9-1.2	1.5-2.1	2.3-3.1	3.3-4.2	0.9-1.4	1.8-2.4	2.4-3.4	3.4-4.5	-7 to 7	14-25	12-44	10-31
Lower Sagaing	0.8-1.4	1.5-2.4	2.5-3.4	3.5-4.8	1.0-1.6	2.0-2.8	2.8-3.9	3.8-5.2	-7 to 7	7 -15	12-44	16-54
Magway	0.8-1.3	1.5-2.2	2.3-3.2	3.4-4.5	0.9-1.4	1.9-2.6	2.5-3.6	3.5-4.8	6-13	14-25	12-44	10-31
Mandalay	0.8-1.4	1.6-2.3	2.4-3.3	3.5-4.6	1.0-1.6	2.1-2.8	2.7-3.8	3.8-5.1	-7 to 7	7 -15	3-25	10-31
Mon	0.7-1.0	1.2-1.9	1.5-2.2	1.7-2.2	0.8-1.3	1.7-2.3	2.2-3.2	3.1-4.2	-7 to 7	7 -15	12-44	10-31
Northern Shan	1.0-1.5	1.6-2.4	2.6-3.4	3.4-4.5	1.0-1.5	2.1-2.8	2.7-3.7	3.8-5.0	-7 to 7	14-25	12-44	10-31
Rakhine	0.7-1.1	1.5-2.2	2.3-3.1	3.1-4.1	0.8-1.3	1.6-2.3	2.2-3.1	3.1-4.2	6-13	14-25	12-44	10-31
Southern Shan	1.0-1.3	1.6-2.3	2.5-3.2	3.4-4.4	1.0-1.5	2.0-2.7	2.6-3.7	3.7-4.8	-7 to 7	7 -15	3-25	10-31
Tanintharyi	0.9-1.4	1.6-2.5	2.4-3.5	3.4-4.7	0.9-1.4	1.7-2.2	2.2-3.2	3.1-4.3	-7 to 7	7 -15	3-25	10-31
Upper Sagaing	0.7-1.4	1.7-2.4	2.4-3.5	3.7-5.0	1.0-1.6	1.9-2.6	2.5-3.6	3.5-5.0	6-13	14-25	12-44	16-54
Yangon	1.0-1.3	1.6-2.1	2.4-3.1	3.3-4.1	0.9-1.4	1.8-2.4	2.5-3.4	3.4-4.3	6-13	14-25	12-44	10-31

Minimum Temperature

Maximum Temperature

Precipitation % Departure



Climate Change by Mid Century (2021-2040) based on Representative Pathway Concentration (RCP) 8.5

Annex 3: State Level Comparison of Results CCRA 1st Edition and 2nd Edition

The following tables from the 2017 and 2015 CCRA underline how, with additional data, differing results emerge. As the 2015 was weighted and the 2017 was of equal weight, these tables cannot be compared to determine change in risk levels of states/regions. It is hoped that as data becomes more robust in the coming years, equal values and indicators will be used so that trend analysis can be reflected.

2017 Rank	State/Region	CCRA Score
1	Rakhine	12.99
2	Ayeyarwady	11.59
3	Yangon	11.21
4	Chin	11.12
5	Kachin	10.74
6	Shan	10.44
7	Magway	10.30
8	Bago	10.20
9	Kayin	10.13
10	Sagaing	9.66
11	Mandalay	8.94
12	Tanintharyi	8.59
13	Kayah	7.30
14	Mon	6.87

2015 Rank	State/Region	CCRA Score
1	Ayeryawaddy	2.59
2	Bago	2.06
3	Mandalay	1.47
4	Sagaing	1.06
5	Yangon	1.04
6	Rakhine	1.04
7	Magway	0.83
8	Shan	0.41
9	Mon	0.31
10	Tanintharyi	0.22
11	Kayin	0.20
12	Kachin	0.13
13	Chin	0.06
14	Kayah	0.05

Annex 4: Township Hazard Rankings (Top 40)

Rank	Township	State/Region	Hazard Score
1	Mawlamyinegyun	Ayeyarwady	5.00
2	Pauktaw	Rakhine	4.90
3	Wakema	Ayeyarwady	4.50
4	Sittwe	Rakhine	4.48
5	Seikgyikanaungto	Yangon	4.41
6	Thanlyin	Yangon	4.37
7	Thongwa	Yangon	4.36
8	Kungyangon	Yangon	4.09
9	Myaungmya	Ayeyarwady	4.05
10	Kayan	Yangon	4.00
11	Pyapon	Ayeyarwady	3.97
12	Kyauktan	Yangon	3.97
13	Ponnagyun	Rakhine	3.95
14	Dagon Myothit (East)	Yangon	3.95
15	Bogale	Ayeyarwady	3.94
16	Myebon	Rakhine	3.92
17	Labutta	Ayeyarwady	3.91
18	Kawhmu	Yangon	3.81
19	Thanatpin	Bago East	3.79
20	Dagon Myothit (Seikkan)	Yangon	3.72
21	Taikkyi	Yangon	3.71
22	Rathedaung	Rakhine	3.70
23	Bahan	Yangon	3.69
24	Dagon Myothit (South)	Yangon	3.69
25	Ann	Rakhine	3.65
26	Kyaiklat	Ayeyarwady	3.64
27	Dedaye	Ayeyarwady	3.63
28	Thaketa	Yangon	3.61
29	Kyeemyindaing	Yangon	3.60
30	Dagon Myothit (North)	Yangon	3.59
31	Hlaingtharya	Yangon	3.58
32	Mahaangmyay	Mandalay	3.56
33	Maubin	Ayeyarwady	3.55
34	North Okkalapa	Yangon	3.53
35	Mingaladon	Yangon	3.53
36	Minbya	Rakhine	3.51
37	Ngapudaw	Ayeyarwady	3.47
38	Chanayethazan	Mandalay	3.47
39	Mohnyin	Kachin	3.46
40	Bago	Bago East	3.44

Annex 5: Township Child Vulnerability Rankings (Top 40)

These rank as the forty townships with the highest degree of **child vulnerability** to disaster.

Rank	Township	State/Region	Vulnerability Score
1	Matman	Shan (East)	5.00
2	Konkyan	Shan (North)	4.41
3	Pangwaun	Shan (North)	4.37
4	Mongping	Shan (East)	4.33
5	Pauktaw	Rakhine	4.27
6	Tangyan	Shan (North)	4.24
7	Mongmao	Shan (North)	4.23
8	Manton	Shan (North)	4.21
9	Mongkhet	Shan (East)	4.19
10	Rathedaung	Rakhine	4.13
11	Kyethi	Shan (South)	4.11
12	Minbya	Rakhine	4.11
13	Mongyang	Shan (East)	4.10
14	Namphan	Shan (North)	4.08
15	Nanyun	Sagaing	4.02
16	Mongton	Shan (East)	4.00
17	Khaunglanhpu	Kachin	4.00
18	Ponnagyun	Rakhine	3.99
19	Mongkaung	Shan (South)	3.99
20	Myebon	Rakhine	3.97
21	Mrauk-U	Rakhine	3.96
22	Pangsang	Shan (North)	3.90
23	Kyauktaw	Rakhine	3.90
24	Mongyai	Shan (North)	3.86
25	Tsawlaw	Kachin	3.85
26	Kunlong	Shan (North)	3.85
27	Buthidaung	Rakhine	3.82
28	Lahe	Sagaing	3.82
29	Ann	Rakhine	3.80
30	Monghsat	Shan (East)	3.79
31	Laukkaing	Shan (North)	3.76
32	Kyaukpyu	Rakhine	3.75
33	Mawkmai	Shan (South)	3.68
34	Ramree	Rakhine	3.63
35	Kunhing	Shan (South)	3.63
36	Mongla	Shan (East)	3.62
37	Mongyawng	Shan (East)	3.60
38	Hopang	Shan (North)	3.58
39	Namhsan	Shan (North)	3.56
40	Toungup	Rakhine	3.55

Annex 6: Township Capacity Rankings (Lowest 40)

These rank as the forty townships with the lowest **capacity** for handing disasters.

Rank	Township	State/Region	Capacity Score
1	Nanyun	Sagaing	1.00
2	Namphan	Shan (North)	1.04
3	Khaunglanhpu	Kachin	1.07
4	Myebon	Rakhine	1.09
5	Paungbyin	Sagaing	1.10
6	Banmauk	Sagaing	1.11
7	Lahe	Sagaing	1.12
8	Tsawlaw	Kachin	1.15
9	Homalin	Sagaing	1.16
10	Kani	Sagaing	1.20
11	Monghsu	Shan (South)	1.20
12	Pinlebu	Sagaing	1.20
13	Kyethi	Shan (South)	1.20
14	Putta-O	Kachin	1.21
15	Mongkaung	Shan (South)	1.22
16	Mese	Kayah	1.22
17	Thabeikkyin	Mandalay	1.24
18	Mongyai	Shan (North)	1.24
19	Monyo	Bago West	1.24
20	Kanpetlet	Chin	1.25
21	Tabayin	Sagaing	1.27
22	Nawngmun	Kachin	1.29
23	Lay Shi	Sagaing	1.29
24	Kamma	Magway	1.31
25	Mongping	Shan (East)	1.31
26	Mawkmai	Shan (South)	1.32
27	Mongkhet	Shan (East)	1.32
28	Sidoktaya	Magway	1.33
29	Mindon	Magway	1.33
30	Khin-U	Sagaing	1.34
31	Machanbaw	Kachin	1.34
32	Hpasawng	Kayah	1.35
33	Kyaukkyi	Bago East	1.35
34	Taze	Sagaing	1.36
35	Yinmabin	Sagaing	1.37
36	Hpruso	Kayah	1.37
37	Pale	Sagaing	1.38
38	Yamethin	Mandalay	1.38
39	Namhsan	Shan (North)	1.39
40	Paletwa	Chin	1.41

Annex 7: CCRA All Indicators (Top 100)

Blue indicates Top 40 in that indicator (in the case of Capacity, bottom 40)

	State/Region	Township	Exposure	Hazard	Vulnerability	Capacity	Climate Change	CCRA
1	Rakhine	Pauktaw	1.0	4.9	4.3	2.7	4.4	14.9
2	Yangon	Dagon Myothit (North)	5.0	3.6	1.3	3.3	4.4	14.6
3	Rakhine	Myebon	1.0	3.9	4.0	1.1	4.4	14.2
4	Shan (North)	Pangwaun	1.0	2.9	4.4	1.5	5.0	14.0
5	Yangon	Thongwa	1.8	4.4	2.9	2.0	4.4	14.0
6	Rakhine	Ponnagyun	1.0	4.0	4.0	1.6	4.4	14.0
7	Ayeyarwady	Mawlamyinegyun	1.0	5.0	2.8	1.6	4.4	13.8
8	Rakhine	Minbya	1.0	3.5	4.1	1.5	4.4	13.7
9	Rakhine	Rathedaung	1.0	3.7	4.1	2.5	4.4	13.6
10	Rakhine	Sittwe	1.0	4.5	3.2	3.8	4.4	13.4
11	Shan (North)	Mongmao	1.0	2.5	4.2	2.1	5.0	13.3
12	Rakhine	Ann	1.0	3.6	3.8	2.4	4.4	13.2
13	Ayeyarwady	Wakema	1.0	4.5	2.8	2.1	4.4	13.2
14	Rakhine	Mrauk-U	1.0	3.3	4.0	2.0	4.4	13.1
15	Yangon	Dagon Myothit (South)	2.9	3.7	1.8	2.7	4.4	13.1
16	Yangon	Dagon Myothit (East)	2.6	3.9	1.8	2.7	4.4	13.1
17	Shan (North)	Namphan	1.0	2.0	4.1	1.0	5.0	13.0
18	Shan (North)	Konkyan	1.0	1.9	4.4	1.5	5.0	13.0
19	Ayeyarwady	Labutta	1.0	3.9	3.0	1.6	4.4	12.9
20	Shan (North)	Kunlong	1.0	2.4	3.8	1.4	5.0	12.9
21	Yangon	Kyeemyindaing	2.9	3.6	1.7	3.4	4.4	12.9
22	Rakhine	Buthidaung	1.0	3.3	3.8	2.6	4.4	12.9
23	Yangon	Kayan	1.0	4.0	2.8	1.6	4.4	12.8
24	Ayeyarwady	Bogale	1.0	3.9	3.1	2.9	4.4	12.8
25	Yangon	Kungyangon	1.0	4.1	2.7	1.7	4.4	12.8
26	Yangon	Sanchaung	3.7	3.4	1.0	4.4	4.4	12.7
27	Yangon	Kyauktan	1.1	4.0	2.8	1.9	4.4	12.7
28	Kachin	Khaunglanhpu	1.0	2.0	4.0	1.1	4.8	12.7
29	Shan (North)	Hsipaw	1.0	2.7	3.4	2.1	5.0	12.7
30	Ayeyarwady	Pyapon	1.0	4.0	3.0	3.8	4.4	12.7
31	Yangon	Kawhmu	1.0	3.8	2.8	1.6	4.4	12.6
32	Rakhine	Maungdaw	1.0	3.4	3.5	2.8	4.4	12.6
33	Shan (North)	Mongyai	1.0	1.9	3.9	1.2	5.0	12.6
34	Yangon	Seikgyikanaungto	1.0	4.4	2.5	2.9	4.4	12.6
35	Rakhine	Kyauktaw	1.0	2.8	3.9	2.4	4.4	12.5
36	Sagaing	Lahe	1.0	3.1	3.8	1.1	3.7	12.5
37	Ayeyarwady	Kyaiklat	1.0	3.6	2.9	1.7	4.4	12.5
38	Chin	Paletwa	1.0	2.7	3.3	1.4	4.8	12.5
39	Ayeyarwady	Myaungmya	1.0	4.1	2.7	3.0	4.4	12.5
40	Rakhine	Toungup	1.0	3.0	3.6	1.8	4.4	12.5
41	Kachin	Tsawlaw	1.0	1.9	3.9	1.1	4.8	12.4
42	Ayeyarwady	Dedaye	1.0	3.6	3.0	2.5	4.4	12.4

43	Yangon	Thanlyin	1.0	4.4	2.2	2.3	4.4	12.4
44	Shan (North)	Namhkan	1.0	2.8	3.2	2.8	5.0	12.3
45	Yangon	Taikkyi	1.1	3.7	2.6	1.8	4.4	12.3
46	Bago East	Thanatpin	1.0	3.8	2.5	1.7	4.4	12.3
47	Shan (North)	Hopang	1.0	2.3	3.6	2.6	5.0	12.3
48	Rakhine	Kyaukpyu	1.0	2.9	3.7	3.9	4.4	12.3
49	Rakhine	Ramree	1.0	2.9	3.6	2.4	4.4	12.3
50	Shan (North)	Tangyan	1.0	1.6	4.2	2.3	5.0	12.2
51	Shan (South)	Hopong	4.1	1.5	3.2	1.5	2.7	12.1
52	Shan (North)	Pangsang	1.0	1.8	3.9	2.5	5.0	12.1
53	Shan (North)	Manton	1.0	1.3	4.2	1.6	5.0	12.1
54	Ayeyarwady	Ngapudaw	1.0	3.5	2.8	2.4	4.4	12.1
55	Shan (North)	Kutkai	1.0	2.2	3.4	2.4	5.0	12.1
56	Yangon	Twantay	1.0	3.3	2.8	1.7	4.4	12.0
57	Ayeyarwady	Maubin	1.0	3.5	2.7	2.6	4.4	12.0
58	Chin	Kanpetlet	1.0	2.3	3.0	1.3	4.8	11.9
59	Yangon	Mayangone	2.7	3.3	1.3	4.2	4.4	11.9
60	Sagaing	Nanyun	1.0	2.1	4.0	1.0	3.7	11.8
61	Shan (North)	Kyaukme	1.0	2.4	3.2	3.4	5.0	11.8
62	Rakhine	Thandwe	1.0	2.9	3.0	1.6	4.4	11.8
63	Shan (North)	Mongmit	1.0	2.1	3.3	2.2	5.0	11.8
64	Rakhine	Munaung	1.0	2.8	3.3	2.5	4.4	11.8
65	Shan (North)	Namhsan	1.0	1.5	3.6	1.4	5.0	11.8
66	Ayeyarwady	Thabaung	1.0	3.3	2.5	1.7	4.4	11.8
67	Shan (North)	Laukkaing	1.0	1.7	3.8	3.3	5.0	11.7
68	Yangon	Thaketa	2.0	3.6	1.5	3.5	4.4	11.7
69	Shan (North)	Namtu	1.0	2.1	3.2	2.1	5.0	11.7
70	Yangon	Dagon Myothit (Seikkan)	1.1	3.7	2.0	2.3	4.4	11.6
71	Yangon	Htantabin	1.0	3.0	2.7	2.1	4.4	11.6
72	Shan (North)	Muse	1.0	2.6	2.6	3.3	5.0	11.6
73	Chin	Tonzang	1.0	2.6	2.5	1.7	4.8	11.5
74	Kachin	Mohnyin	1.0	3.5	2.0	3.5	4.8	11.5
75	Bago East	Kawa	1.0	3.0	2.5	1.6	4.4	11.5
76	Rakhine	Gwa	1.0	2.4	3.1	1.8	4.4	11.4
77	Shan (North)	Nawngkhio	1.0	2.0	3.0	2.5	5.0	11.4
78	Magway	Sidoktaya	1.0	2.8	2.5	1.3	4.4	11.4
79	Ayeyarwady	Yegyi	1.0	3.2	2.3	1.9	4.4	11.4
80	Yangon	Dala	1.0	3.0	2.7	3.7	4.4	11.4
81	Chin	Tiddim	1.0	2.9	2.1	1.9	4.8	11.4
82	Ayeyarwady	Kangyidaunt	1.0	2.8	2.6	1.7	4.4	11.3
83	Kachin	Nawngmun	1.0	1.3	3.5	1.3	4.8	11.3
84	Yangon	North Okkalapa	1.5	3.5	1.6	3.2	4.4	11.3
85	Shan (North)	Mabein	1.0	1.9	2.9	1.9	5.0	11.3
86	Ayeyarwady	Einme	1.0	2.7	2.6	1.7	4.4	11.3
87	Ayeyarwady	Nyaungdon	1.0	3.0	2.4	2.3	4.4	11.3
88	Shan (East)	Matman	1.0	2.0	5.0	1.6	2.7	11.3

89	Ayeyarwady	Pathein	1.0	3.3	2.3	3.3	4.4	11.3
90	Kachin	Injyangyang	1.0	1.5	3.3	1.7	4.8	11.2
91	Bago East	Waw	1.0	2.8	2.5	1.8	4.4	11.2
92	Sagaing	Lay Shi	1.0	2.6	3.1	1.3	3.7	11.2
93	Chin	Madupi	1.0	2.5	2.3	1.6	4.8	11.1
94	Shan (North)	Hseni	1.0	1.7	3.0	2.3	5.0	11.1
95	Kachin	Mogaung	1.0	3.0	2.1	3.6	4.8	11.1
96	Kachin	Sumprabum	1.0	1.8	3.0	1.9	4.8	11.1
97	Yangon	Hlaingtharya	1.0	3.6	1.9	4.4	4.4	11.1
98	Shan (North)	Lashio	1.0	1.9	2.8	3.5	5.0	11.0
99	Magway	Saw	1.0	2.6	2.4	1.5	4.4	10.9
100	Kachin	Putta-O	1.0	1.7	2.7	1.2	4.8	10.9