

MYANMAR CHILD-CENTERED RISK ASSESSMENT



First Edition - 2015



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FOREWORD

Due to its geographical location, the Republic of the Union of Myanmar is exposed to a wide range of natural disasters such as fires, floods, strong winds, storms, landslides, earthquakes, tsunamis, droughts and thunder storms. The worst disaster in the country's history, cyclone Nargis hit the coastal areas of Myanmar in May of 2008, affecting 2.4 million people and leaving 138,373 people dead in its wake. The total damage and losses were estimated at 11.7 trillion Myanmar Kyats with the most devastating consequences for children, older people and women.

The Republic of the Union of Myanmar accelerated its efforts on disaster risk management through the development of MAPDRR (Myanmar Action Plan on Disaster Risk Reduction) in 2012, aligned with the Hyogo Framework for Action (HFA) and the ASEAN Agreement on Disaster Management and Emergency Response (AADMER). In addition, a Disaster Management Law was introduced in 2013 and assorted Rules and Regulations.

MAPDRR has 7 components, of which component 2 focuses on hazard, vulnerability and risk assessment. The Disaster Management Law, Chapter VI section 13 sub-section (b) states that anyone with responsibility under the Law "shall give priority and protect infants, the elderly, the disabled and women (especially pregnant and lactating women) in carrying out (their) functions" including preparedness, prevention, response and rehabilitation.

The Child-Centred Risk Assessment provides a visual representation of child-centred risk in different development programmes and in different State/Regions. Organizations working in Disaster Risk Management will find this Child-Centred Risk Assessment useful in complementing the goal of MAPDRR 'To make Myanmar Safer and more Resilient against Natural Hazards, thus Protecting Lives, Livelihood and Developmental Gains'. Furthermore, it is believed to support the protection of Myanmar's future, its children.



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ACKNOWLEDGMENTS

The child-centred risk assessment (CCRA) was developed with the support of key counterparts from the Government of the Republic of the Union of Myanmar, who provided data and suggestions throughout the process, in particular the Relief and Resettlement Department, the Department of Meteorology and Hydrology and the Fire Services Department. The CCRA was conducted in close collaboration with the Disaster Risk Reduction Working Group (DRR WG) of Myanmar who contributed to the contextualisation of the regional methodology and indicators. Members of the DRR WG, in particular UN-Habitat, the Myanmar Earthquake Society, the Myanmar Engineering Society and the Myanmar Geo-Science Society, provided both data and technical expertise in support of the exercise. Inputs from the Regional Multi-Hazard Early Warning System (RIMES) were critical in assessing tsunami risk in Myanmar. UNICEF Myanmar thereby extends its gratitude to all the agencies and individuals that supported the CCRA process.

The development, printing and dissemination of this report was made possible thanks to the generous support of the United Kingdom's Department for International Development (DFID).



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ACRONYMS

CCA	Climate Change Adaptation
CCRA	Child-Centred Risk Assessment
DHS	Demographic and Health Survey
DMH	Department of Meteorology and Hydrology
DRR	Disaster Risk Reduction
DRR WG	Disaster Risk Reduction Working Group
HCT	Humanitarian Country Team
HFA	Hyogo Framework for Action
IASC	Inter-Agency Standing Committee
IHLCA	Integrated Households Living Condition Assessment
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
MGS	Myanmar Geo-Science Society
NAPA	National Adaptation Programme of Action
RIMES	Regional Integrated Multi-Hazard Early Warning System
RRD	Relief and Resettlement Department
UNDAF	United Nations Development Assistance Framework
UNDP	United Nations Development Programme
UN-HABITAT	United Nations Human Settlements Programme
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 AND INTENDED AUDIENCE

As disasters are increasingly recognized as the outcome of poor development choices, resilience to natural and human-induced hazards is becoming an integral part of the concept of sustainable development.

A quantitative and spatial risk assessment helps to better understand and operationalize disaster risk, and is therefore an essential tool for risk-informed planning and ultimately risk-informed development programming. Risk assessments normally overlay hazard risk information, population exposure, climate change vulnerability, some measure of socio-economic vulnerability and measures of local capacity to manage risk and disasters in order to assess relative levels of risk specific geographic areas. This analysis was conducted specifically to demonstrate the merit of putting children at the centre of a national risk assessment, and 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 14 states and regions of Myanmar. Although findings were limited in some cases by insufficient and/or out-dated data, the CCRA has informed internal decision-making around UNICEF's Country Programme, enabling more risk and climate-sensitive programming. The real value of this exercise however, was to demonstrate the significance of such an analysis for key stakeholders, such as Government, development partners and civil society organizations, that are interested in visualizing and addressing factors of risk and their implications on children and other vulnerable groups in Myanmar. Specifically, it is hoped that this analysis will inform the Ministry of Social Welfare, Relief and Resettlement's choices on approach and methodology for the development of the national hazard and vulnerability atlas, which is a key planned output under the Myanmar's Action Plan for Disaster Risk Reduction.

Through this process, the importance of interpreting hazard risk, child vulnerability and child-centred maps alongside each other was confirmed. Different agencies may decide to focus on different elements of the risk equation for their decision making - hazard risk management, capacity development or child vulnerability reduction - according to their specific mandate and areas of technical expertise; yet all investments that purposefully contribute to reducing factors of risk will ultimately contribute to fostering child-centred resilience.

BACKGROUND

Disaster Risk Reduction

Disasters are no longer understood as ‘natural disasters’ that take place outside the realm of development. Increasingly, disasters are perceived as the outcome of poor development choices or gross capacity gaps to implement sound policies— typically related to land-use, building practices, environmental preservation, communicable disease prevention, poverty eradication, sustainable rural development and management of migration trends/patterns (e.g. urbanization). This new understanding represents an optimistic shift in perspectives, since it emphasizes opportunities to proactively identify, prevent and reduce disaster risks.

The United Nations Office for Disaster Risk Reduction (UNISDR) defines disaster risk as “the potential loss expressed in lives, health status, livelihoods, assets and services, which could occur to a particular community or a society due to the impact of a natural hazard”¹. Disaster risk reduction (DRR) is a systematic approach to identifying, assessing and reducing disaster risk. Specifically, the purpose of DRR is to enhance capacities and minimize vulnerabilities throughout a society in order to avoid (prevent) or to limit (mitigate and prepare for) the adverse impacts of natural hazards. Further, DRR is widely recognized as a climate change adaptation (CCA) strategy and a component of the broader resilience debate. Disaster risk is commonly understood as a function of hazards, vulnerability, exposure and capacity. The basic risk formula that guides DRR looks like this:

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

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

The CCRA has wide application, not just for child right’s advocates, but for a wide range of development partners and planners. Putting children at the centre of a risk analysis makes sense for several reasons:

- **Children represent almost half the population:** From a demographic perspective, the child population matters for planning. Children constitute between one third and one half of the population in most countries in Asia and the Pacific and 34% of the population in Myanmar.
- **Children’s vulnerabilities are good indicators of larger development challenges:** Often children are the first to manifest the negative impact of shocks and stresses. Indicators that measure their health, nutrition, education and protection status are therefore very sensitive and can warn of emerging vulnerabilities in the larger population.
- **Children are also disproportionately affected when disaster strikes:** Evidence shows that disasters disproportionately affect children and women, exacerbate pre-existing vulnerabilities and inequalities and affect approximately 100 million children and young people around the world every year.² Considering them in risk management strategies therefore, is a responsible approach.
- **Children have the right to be integrated in planning:** Child-centred DRR also reflects the understanding that disasters threaten children’s basic rights to survival, development, education and protection. Not only do children have the right to be considered in planning that will affect their lives, but they have the right to participate in decision-making, especially considering that this generation of children will experience more disaster impacts than their parents.

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

² UNGA, ‘Implementation of the International Strategy for Disaster Reduction: Report of the Secretary General.’ A/67/335. 27 August 2012. p.9

Disaster Risk in Myanmar

Myanmar is prone to a range of high impact natural hazards, including cyclones, seasonal flooding, landslides, droughts, fires and earthquakes.³ In recent years, two major cyclones (Nargis 2008, Giri 2010) have hit the coastal parts of the country with devastating impact on children and women; since 2002 flooding has affected over 500,000 people,⁴ inflicting the greatest damage in the coastal and hill areas; landslides due to flooding and seismic activity have occurred in hill areas; a series of earthquakes have affected the country's northern and eastern parts, most significantly in eastern Shan in early 2011 (6.8 on the Richter scale); and fires have destroyed homes and infrastructure in communities across the country.

In Myanmar, natural hazards have been compounded by civil and communal conflicts across the country. This interplay of natural hazards and human-induced risks has drastically exacerbated existing vulnerabilities among women and children - both in terms of their socio-economic status, and their access to basic social services such as education and primary healthcare. Widespread poverty and poor infrastructures are at the heart of the country's relatively low capability to recover from a significant event⁵. It is this combination of high hazard vulnerability and low capacity which makes Myanmar the "most at-risk country" in Asia-Pacific according to the INFORM risk model⁶.

The recurrence of natural hazards over recent years has alerted the Government of Myanmar and the international community of the importance to take concrete actions to reduce the losses to lives, livelihoods, and other humanitarian and development consequences of potential disasters. The effort made by the Government so far - intensified since Cyclone Nargis in 2008 - has primarily focused on improving readiness to offer timely emergency assistance, while a systematic approach to reduce underlying vulnerabilities has received less attention⁷.

UNICEF and DRR in Myanmar

Working in 190 countries around the world and in Myanmar since 1950, UNICEF is the United Nations Agency created with a distinct purpose in mind: to work with others to realise the rights of every child, especially the most disadvantaged. Since disasters affect children 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 has, since Cyclone Nargis, provided a range of interventions to mitigate the impact of future disasters primarily in the areas affected by Cyclone Nargis in 2008. These include - but are not limited to - the construction of child friendly schools in the Delta townships, which now serve as models for safe schools, able to withstand as shelters the impact of another cyclone of Nargis' scale; the introduction of DRR in the life skills curricula offered to all primary school children across the country providing them with a basic need-to-know information in the event of a disaster; the establishment of a nutrition surveillance system in selected high-risk areas to timely alert actors of increasing malnutrition rates amongst young children (and thereby trigger an intervention to avert widespread malnutrition).

Building on these experiences, UNICEF Myanmar strives to more systematically address DRR, by helping the government and implementing partner agencies in prioritizing children in their disaster mitigation strategies, as well as in preparedness and response. This child-centred risk assessment is a critical first step in achieving more resilient outcomes for children.

³ According to the 2015 INFORM global risk management platform, which attempts to classify and categorize countries according to their vulnerability to disasters, Myanmar ranks 10th globally and first in Asia-Pacific in relation to disaster Risk.

⁴ UNOCHA. 'Myanmar: Natural Disasters 2002-2012.'

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

⁶ <http://www.inform-index.org/Results/Country-profiles?iso3=MMR>

⁷ Government of Myanmar, HFA Progress reports (2009-2011 and 2011-2013)

CHILD-CENTERED RISK ASSESSMENT

A quantitative and spatial risk assessment helps to better understand and operationalize risk. It is an essential tool for risk-informed planning and ultimately risk-informed programming. Based on previous assessments done by UNICEF in various country offices in the Asia-Pacific region⁸ and in close coordination with the DRR WG, the child-centred risk assessment combined information on hazard risk, exposure of the child population, vulnerability of socio-economic assets to climate change, child vulnerability and local capacity to manage risk, to give a relative measure of the disaster risk of children in 14 states and regions in the country. Although the township level (lowest administrative unit in Myanmar) would provide the best reference for program planning, this assessment used the state/region level due to lack of data for the township level. The scope of the assessment will be expanded gradually as and when data becomes available.

The main purpose of the CCRA is to enable key stakeholders to visualize and address factors of risk and their implications on children in the current context of Myanmar. As highlighted by UNISDR, the main underlying risk drivers in the first half of the 21st Century are poor urban governance, vulnerable rural livelihoods and declining eco-systems. By factoring in exposure (population) and climate change vulnerability, the CCRA gives an overview of how these underlying risk drivers manifest themselves and translate into risks for children in different states and regions of Myanmar. The main findings of the CCRA- the multi-hazard risk map, the child vulnerability map and the child-centred risk map- should be interpreted alongside each other for informed decision-making. Agencies may decide to focus interventions on mitigating overall risk levels, for which the child-centred risk map will provide critical information; or may choose to emphasize one components of the risk equation- hazard risk management, capacity development or child vulnerability reduction – depending on their mandates and areas of technical expertise.

Limitations and Opportunities

Although substantial progress has been made in recent years, Myanmar continues to suffer from a chronic lack of data affecting all sectors of public life. This is particularly true when looking at sub-national levels of administration where limited data is available at state/region level and almost no data at township level. Where data is available, it is generally not disaggregated by sex, age and locality. This exercise was constrained by the lack of data but alternative ways of assessing the different components of risk were identified.

Since the purpose of this exercise was to demonstrate the utility of a risk assessment methodology that puts children of the centre of the analysis, it is recommended that national risk assessments maximise the use of new evidence that will emerge in the coming two years. A number of initiatives are underway, which will have a direct impact on the quantity and quality of data available in Myanmar such as the publication of the final results of the 2014 Myanmar census, expected at the beginning of 2015; poverty surveys to be conducted by the World Bank and UNDP in 2015; DHS survey expected to take place in 2015; ongoing food security and poverty estimation surveys by WFP, etc. In addition, several members of the DRR WG are working on hazard risk assessments at different levels and discussions have been initiated between the DRR WG and the Government on the production of a hazard and vulnerability atlas, in line with the Myanmar Action Plan on DRR. It is critical therefore that the national Atlas of Hazards and Vulnerabilities becomes a living document that is updated as new, reliable and precise data becomes available.

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

Multi-Hazard Mapping

The multi-hazard mapping presented in this paper includes both natural and human-made hazards and focuses on the hazards that are of highest significance in relation to both likelihood and severity of impact on the population. As a result, hazards such as landslides, hail storms, lightning storms are not included in the risk calculations. The detailed calculations can be found in the annexed CCRA matrix. Given that no multi-hazard risk mapping is available for the different states and regions of Myanmar and very limited single-hazard risk mapping (fire and earthquake and cyclones derived from national risk maps), different sources of information were compiled for different hazards, as detailed below:

Earthquake: the earthquake index was developed by earthquake experts from the Myanmar Geo-Science Society and UN-Habitat, based on state/region probabilistic seismic maps currently being developed by these two agencies, and which are derived from the national probabilistic seismic map that can be found at the end of the report (Figure 2).

Tropical storm/cyclone: data on cyclone/tropical storm is derived from the OCHA multi-hazard map of Myanmar (see Figure 1). The map uses the Saffir-Simpson scale and defines intensity zones, ranging from 1 to 5. Intensity zones indicate where there is a 10% probability of a storm of this intensity striking in the next 10 years. Intensity zones for each state and region were converted on a scale of 1 to 10 in the calculation sheet to enable data comparison.

Tsunamis: the tsunami risk ranking used in the CCRA was developed by the Regional Integrated Multi-Hazard Early Warning System (RIMES) based on 3 likely scenario. The process through which the ranking was defined is summarized at the end of the report (Figure 5), and the ranking developed by RIMES was reversed and converted on a scale of 1 to 10 for data comparison purposes.

Floods: flood information was derived from a map developed by Ithaca/WFP based on a historical seasonal analysis of population exposed to floods in different districts of Myanmar between 2001 and 2010 (see Figure 3). Although the map already contains exposure information, this map presents the most reliable and precise picture of flood risk available. Population exposure (eight levels) were combined at state and region level and converted on a scale of 1 to 10 to enable data comparison.

Droughts: information on droughts is a translation of the Hazard Profile in numerical values where 10 indicates that the region/state is prone to drought and 1 indicates the region isn't. In spite of extensive efforts and consultations with a number of stakeholders, it was not possible to find a more accurate representation of drought risk in Myanmar.

Fires: although they have limited impact in terms of loss of life, fires are by far the most common hazard in Myanmar and can cause localized loss and damage. The index included in the CCRA was created based on all incidences of fires recorded by the Fire Services Department between 1993 and 2008 per state and region; converted on a scale of 1 to 10.

Conflict: conflict and civil unrest have affected Myanmar since its independence but more so even than for natural hazards, conflict risk is rapidly evolving, mobile and thus difficult to map. The values included in the CCRA matrix are extracted from the Conflict Barometer developed by the Heidelberg Institute for International Conflict Research for Myanmar in 2013⁹. Where a conflict affects a particular state/region, the conflict intensity value is extrapolated to the whole state and region. Where several conflicts are present, the highest intensity value was retained. This however is a partial representation of conflict risk as it only considers conflicts that were active in 2013 and does not account for latent conflict risk. The conflict barometer is converted into a scale of 1 to 10 in the calculation sheet to enable data comparison.

The second step of the multi-hazard mapping was to allocate weights to the different hazards based on their likelihood and potential impact on the population. This is to avoid an analysis that would be overly

⁹ The Heidelberg conflict barometer has 5 intensity levels, corresponding to the following: 5 = war; 4 = limited war; 3 = violent crisis; 2 = non-violent crisis; 1 = dispute. Refer to pages 97 and 98 for information on conflict in Myanmar.

biased towards low impact hazards such as fires. Here, the CCRA uses the risk matrix developed by the Myanmar Inter-Agency Standing Committee (Humanitarian Country Team), which can be found in the Myanmar Emergency Response Preparedness Plan 2014: tropical storm (2), conflict (1.6), earthquake (1.5), flood (1.5), tsunami (1), fire (0.9) and drought (0.4)¹⁰. It is important to note that this table does not provide a scientifically-sound measure of risk but is based on the assessment of an inter-agency expert panel, taking into account the disaster history of Myanmar and available records of losses and damage. Other methods for to evaluate the likelihood and impact of hazards can be considered for the national Atlas of Hazards and Vulnerabilities, which should also benefit from updated data to support a more systematic way of weighting different types of risks¹¹.

Impact	5. Critical		Storm Surge and Tsunami	Earthquake	Cyclone	
	4. Severe				Conflict and Civil Unrest	
	3. Moderate			Fire		Floods
	2. Minor	Pandemics	Drought and Landslides			
	1. Negligible		Forest Fire			
		1. Very Unlikely	2. Unlikely	3. Moderately Likely	4. Likely	5. Very likely
		Likelihood				
Likelihood : 1=Very unlikely (up to 20% chance of the event happening) 2 = Unlikely (20-40%) 3 = Moderately likely (40-60%) 4 = Likely (60-80%) 5 = Very likely (over 80%)			Impact : 1 = Negligible (minimal impact on overall population) 2 = Minor (minor impact on overall population) 3 = Moderate (moderate impact on overall population) 4 = Severe (severe impact on overall population) 5 = Critical (major impact on overall population)			

Emergency Response Preparedness Plan, Myanmar HCT, 2014

Multi-hazard map

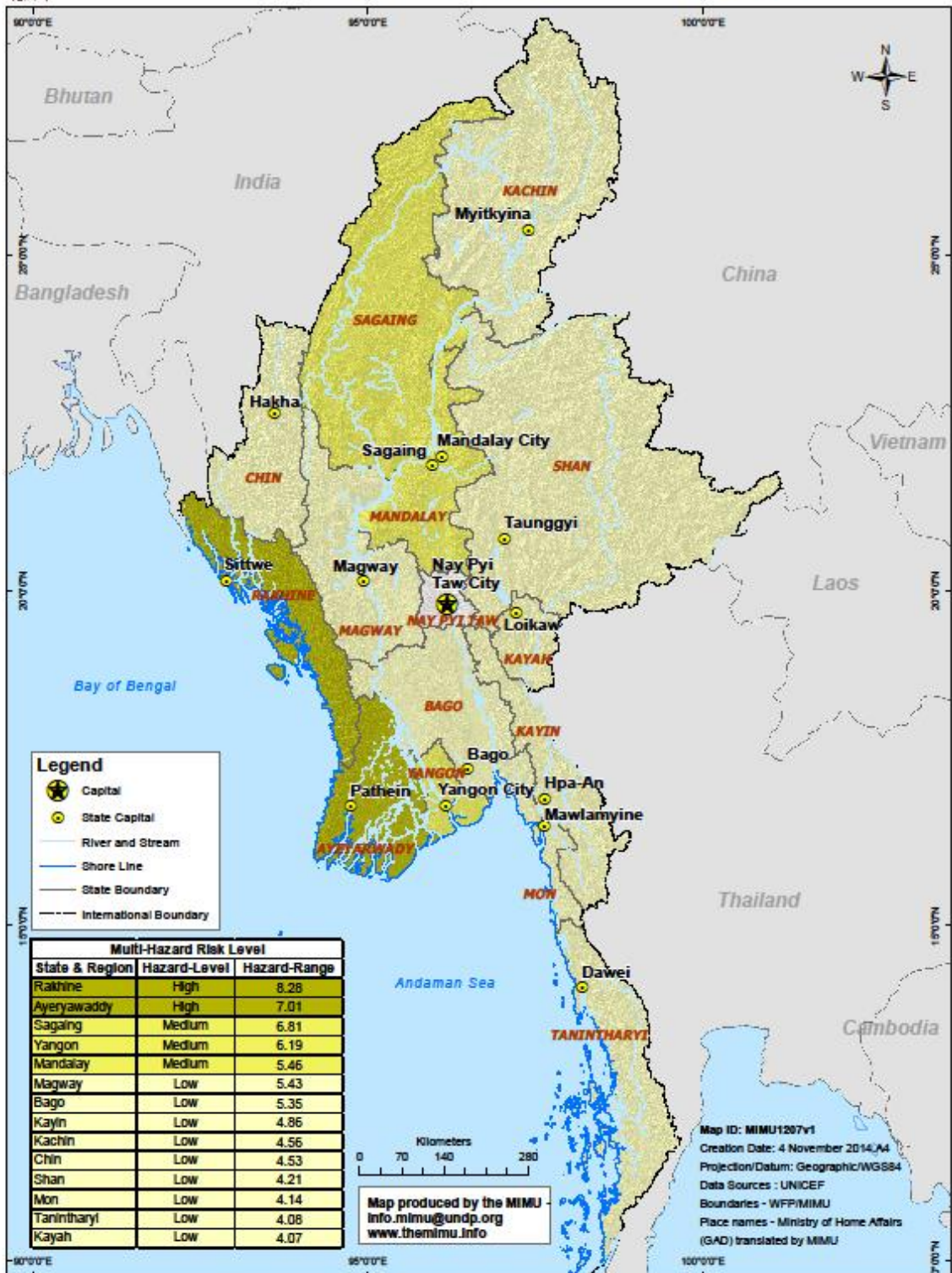
The multi-hazard map presented below confirms the high hazard vulnerability of Rakhine state and Ayeryawady region, stemming from their extreme exposure to cyclone, flood and tsunami risk and compounded, in the case of Rakhine, by inter-community violence and conflict. Sagaing, Yangon and Mandalay, three of the most populated and urbanized regions of Myanmar, also rank high in terms of hazard risk due to their location on or close to an active seismic fault line, and their exposure to droughts (Sagaing and Mandalay) and tropical storms (Yangon). Magway and Bago regions display medium levels of hazard risk with their vulnerability to earthquakes, floods (Bago) and droughts (Magway). The other states and regions of the country Kayin, Kachin, Chin, Shan, Mon, Tanintharyi and Kayah all have comparable levels of hazard risk, which are substantially lower than those of Rakhine and Ayeryawady.

¹⁰ The overall scoring of the HCT's ERP Plan was divided by 10 for ease of calculation.

¹¹ UNDP and UN-Habitat are currently supporting the Relief and Resettlement Department to roll-out a Loss and Damage Database based on Desinventar methodology.



Myanmar Information Management Unit
Multi-Hazard Map
 UNICEF-Myanmar, November 2014



Legend

- Capital
- State Capital
- River and Stream
- Shore Line
- State Boundary
- International Boundary

Multi-Hazard Risk Level		
State & Region	Hazard-Level	Hazard-Range
Rakhine	High	8.28
Ayeyawaddy	High	7.01
Sagaing	Medium	6.81
Yangon	Medium	6.19
Mandalay	Medium	5.46
Magway	Low	5.43
Bago	Low	5.35
Kayin	Low	4.86
Kachin	Low	4.56
Chin	Low	4.53
Shan	Low	4.21
Mon	Low	4.14
Tanintharyi	Low	4.08
Kayah	Low	4.07

Map produced by the MIMU
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Map ID: MIMU1207v1
 Creation Date: 4 November 2014_A4
 Projection/Datum: Geographic/WGS84
 Data Sources: UNICEF
 Boundaries: WFP/MIMU
 Place names: Ministry of Home Affairs (GAD) translated by MIMU

Disclaimer: The names shown and the boundaries used on this map do not imply official endorsement or acceptance by the United Nations.

Climate Change

Since most disasters are triggered by weather phenomena, climate change exacerbates the frequency and intensity of hydro-meteorological hazards. Since 1977, the Department of Meteorology and Hydrology (DMH) of Myanmar has been collecting meteorological and hydrological data and has documented concerning changes in patterns in recent years such as the shortening and intensification of the monsoons; an increase in sea surface temperature and an overall increase in heat and drought indices¹². The Global Adaptation Institute ranks Myanmar 167 out of 176 countries; a ranking which is as much a reflection of Myanmar's exposure to climate change as it is of the country's low capacity to manage climate risks¹³. Climate change vulnerability was therefore included in this paper in recognition of its direct impact on hazard risk and allocated a weight of 10% in the overall risk equation that underpins the assessment.

The Myanmar National Adaptation Program of Action (NAPA) includes two climate change vulnerability index maps (see Figure 6), one which reflects states/regions' vulnerability to climate change in relation to exposure of key socio-economic sectors (the index includes 5 risk categories) and one which reflects states/regions' vulnerability to climate change in relation to population exposure, measured by population density (the index identifies low, medium and high areas of risk). In this exercise, only the first index was considered as population exposure is already factored in.

Exposure

Exposure is defined as "people, property, systems, or other elements present in hazard zones that are thereby subject to potential losses" (UNISDR, 2009). In this paper, exposure is measured by the size of the total child population aged 0 to 18 in each state and region. Overall population estimates per region and state are based on the preliminary results of the 2014 census; these results however did not include age disaggregated data. As a result, the child population was calculated by applying a ratio of 35.08% to the overall population, which corresponds to the population projection included in the Statistical Year Book published by the Myanmar Central Statistics organization. The data will be updated as the final results of the census become available in the course of 2015.

The child population ranged from 86,021 in Kayah state to 2,206,523 in Yangon region, pointing out to substantial differences in levels of exposure. In order to enable data comparison, child population exposure was converted on a scale of 1 to 10 in the calculation sheet.

Vulnerability Mapping

UNISDR defines the term vulnerability as "the characteristics and circumstances of a community, system or asset that make it susceptible to the damaging effects of a hazard" (UNISDR, 2009). There are many aspects of vulnerability, arising from various physical, social, economic, and environmental factors. Considering that children are often the first to manifest the negative impact of shocks and stresses, using indicators that measure children's health and wellbeing can be very useful for analysis.

Learning from regional experiences, this assessment measures child vulnerability based on an equal weighting of 9 indicators in a composite index covering key sectors such as health, nutrition, water and sanitation, education and child protection. The indicators, detailed below, were selected based on relevance to the concept of vulnerability in the Myanmar context and with a concern to avoid indicators that would cancel each other out. Data was derived from the 2009-2010 Multiple Indicator Cluster Survey (MICS) led by the Ministry of National Planning and Economic Development with financial and technical assistance from UNICEF and the 2009-10 Integrated Household Living Conditions Survey (IHLCA) jointly led by UNDP

¹² Department of Hydrology and Meteorology, Tin Yi, Assistant Director (2012), "Climate Change Adaptation in Myanmar", http://www.uncece.org/fileadmin/DAM/env/documents/2012/wat/workshops/Transboundary_adaptation_april/presentations/6_Tin_Yi_Myanmar_Final_.pdf

¹³ Global Adaptation Institute (2013), "Gain Index", <http://index.gain.org/ranking>

and the Ministry of National Planning and Economic Development¹⁴. As no specific child protection indicators are available in the afore-mentioned surveys, the vulnerability index also includes the number of children in institutions (such as residential child care centres) per state and region, obtained from the Department of Social Welfare. Given the low figures, the number of children in institutions in each state and region was magnified by 10 to ensure the significance of the indicator within the overall index.

Myanmar Child Vulnerability Index

	Indicator	Source
1	Underweight Prevalence in children under-5	MICS
2	Poverty Incidence	IHLCA
3	Birth not registered (reversed indicator)	MICS
4	No access to improved sanitation (reversed indicator)	MICS
5	No skilled attendance at delivery (reversed indicator)	MICS
6	Children not attending Early Childhood Development (reversed indicator)	MICS
7	Children not completing primary school on time (reversed indicator)	MICS
8	No comprehensive knowledge of mother to child HIV transmission among women (reversed indicator)	MICS
9	Percentage of 1-year-olds not immunized against measles	IHLCA
10	Children in institutions	Department of Social Welfare

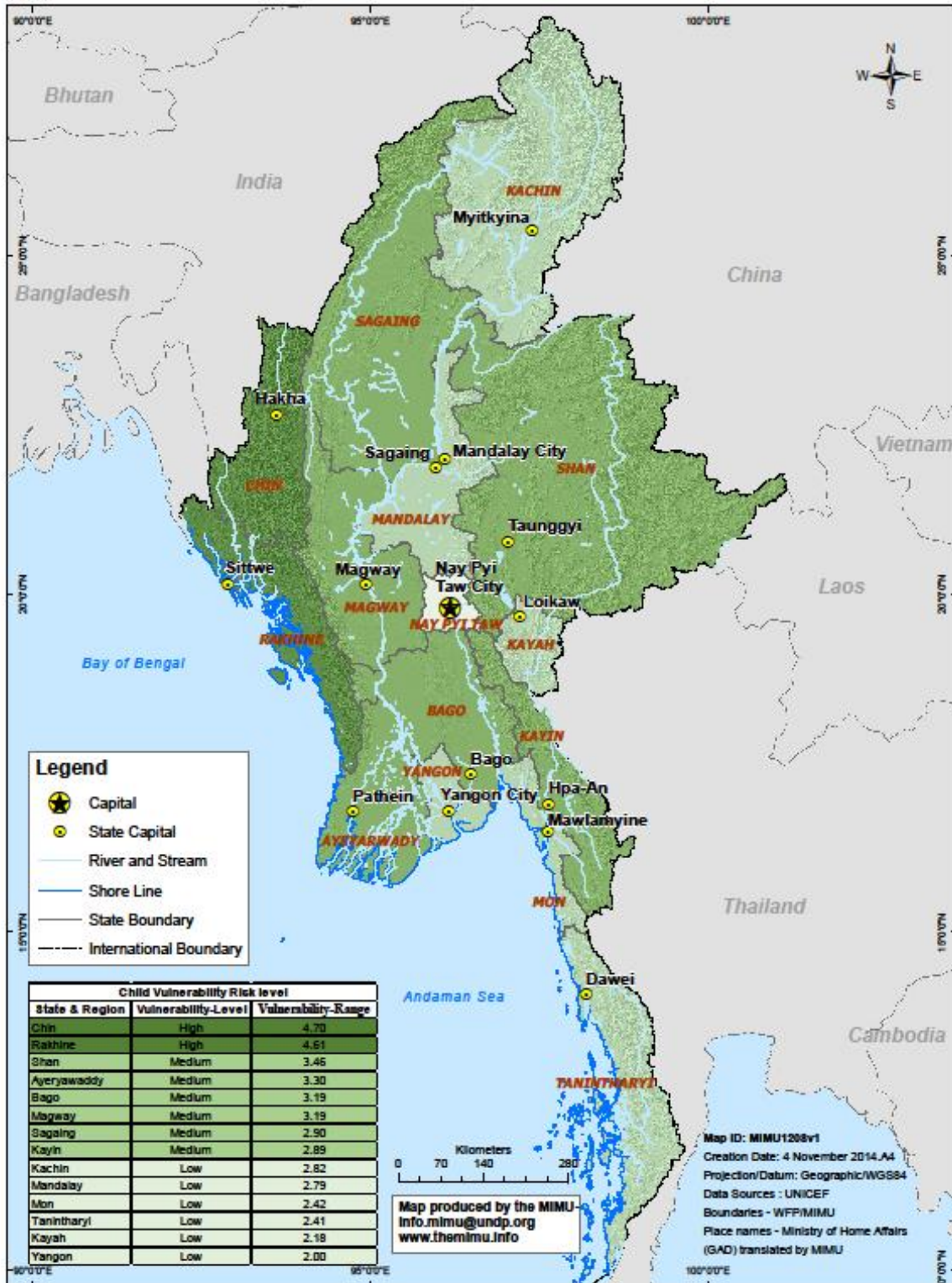
Child Vulnerability Map

The child vulnerability map presented below confirms that Chin and Rakhine states are the two regions in Myanmar where children are the most likely to be deprived of their basic rights. These two states stand out in all existing data as the poorest, with the highest levels of malnutrition and food insecurity in the country. In the medium range of child vulnerability, Shan and Kayin states and Ayeryawady, Bago, Magway and Sagaing regions score higher than Chin and Rakhine but remain areas where children are likely to be vulnerable and to face limitations in accessing basic services in an equitable manner. With the lowest scores, Kachin, Kayah and Mon states, and Mandalay, Tanintharyi and Yangon regions, perform better than the rest of the country in delivering services and guaranteeing access to basic rights for children. Kayah state and Yangon region in particular stand out as the two regions with the lowest levels of child vulnerability.

¹⁴ At the time of writing, the revised poverty data published by the World Bank had not been approved by the Government and was therefore not used for the calculations.



Myanmar Information Management Unit
Child Vulnerability Map
 UNICEF Myanmar, November 2014



Disclaimer: The names shown and the boundaries used on this map do not imply official endorsement or acceptance by the United Nations.

Capacity

Capacity in relation to DRR at state/region level was assessed through a series of proxy indicators which look primarily at the institutional capacity of local Governments but also factor in the capacity of civil society actors and communities. These indicators were defined during a brainstorming session with interested members of the DRR WG and in consultation with the Relief and Resettlement Department (RRD).

Specifically, local DRR capacity was assessed through four indicators:

- Presence and outreach of RRD in the state/region. RRD has a presence in all states and regions but is also present in selected districts, thereby contributing substantially to increased local readiness levels. RRD's presence at state/region level is marked by a score of 5; 1 point is added where RRD covers between 1 and 24% of the district of a particular region/state; 2 points where coverage is between 25 and 50% and 3 points where RRD's coverage is above 50%. The maximum score here is 8 in recognition of the fact that RRD's lack of presence at township level, the lowest administrative unit, is a capacity gap in relation to DRR locally.
- RRD state/region warehousing capacity is measured by the number of households that can be assisted through locally available emergency supplies in the event of a disaster in a particular state/region. Central warehouses were excluded from the calculations as they could be used for any of the state/region. The numbers of beneficiaries were converted on a scale of 1 to 10 for data consistency. It would be important to understand and factor in the extent to which the decentralised warehouses of RRD are structurally sound enough to withstand the impacts of common hazards in the areas where they are located. This information was not available at the time of developing this report but will be updated in later versions of the document.
- Number of DRR-related trainings benefitting local authorities per state and region: RRD maintains a record of all DRR-related trainings benefitting local authorities in states/regions and using the officially-recognized Disaster Management Course curriculum. The number of officials trained in the last 2 years was used in the CCRA as a proxy indicator of local authorities' awareness of DRR and were converted on a scale of 1 to 10.
- Number of agencies implementing or having implemented DRR projects per state/region: the coverage of DRR agency was used as an indicator of local level capacity. The number includes all types of DRR projects (CBDRR, awareness, school-based DRR, etc.) and completed as well as ongoing projects as of 2014 and is based on the database maintained by the Myanmar Information Management Unit (MIMU). The CBDRR task force of the DRR WG is currently developing a detailed mapping of past and ongoing CBDRR initiatives in the country. When available, the data will allow for the refining of this indicator, looking specifically at what type of services the communities are equipped to deliver in the event of a disaster (first aid, search and rescue, psychosocial, etc.).

Child-Centred Risk Mapping

In line with institutional guidance from the regional level¹⁵ and following other child-centred risk assessments undertaken in the region, the following weight-distribution was used when overlaying natural hazard, climate change, child vulnerability, exposure and capacity data:

Natural and human-made hazards	40%
Climate change	10%
Vulnerability	30%
Exposure	10%
Capacity	10%

Child-centred risk is then calculated using the following formula:

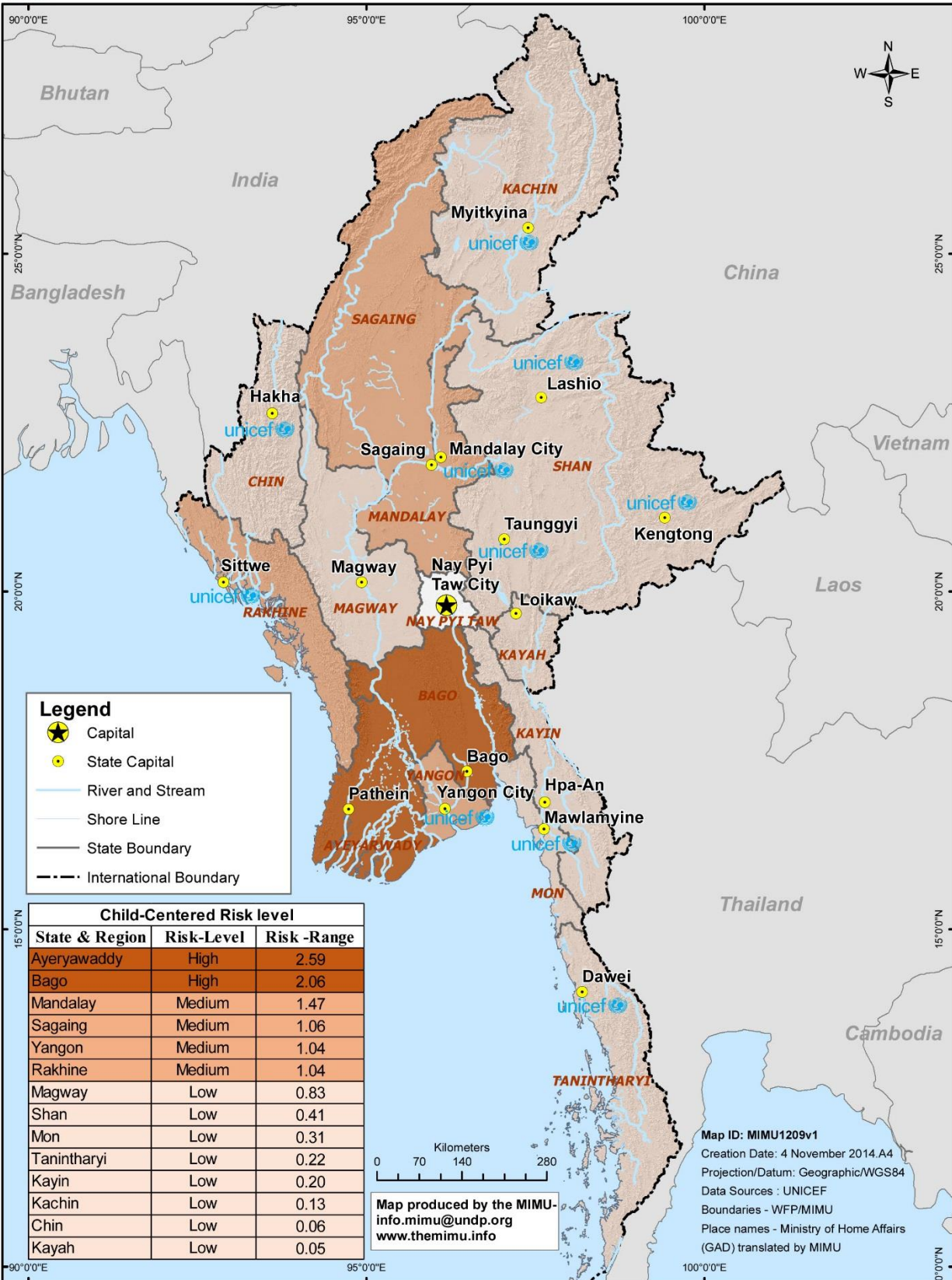
$$\text{Child Centred Risk} = \frac{(\text{Hazard} \times 0.4) \times (\text{Climate Change} \times 0.1) \times (\text{Vulnerability} \times 0.3) \times (\text{Exposure} \times 0.1)}{(\text{Capacity} \times 0.1)}$$

Child-centred Risk Map

As shown in the child-centred risk map below, the five states and regions that display the highest levels of child-centred risk are also the most densely populated, rapidly urbanizing and with the highest concentration of economic and social assets. Ayeryawady and Bago regions have the highest levels of risk when combining hazard risk, impacts of climate change, child vulnerability and population exposure. The two regions host some of the largest cities in the country and concentrate significant proportions of the population. They are also some of the most developed economically, which in turn makes them particularly vulnerable to climate change, measured in this paper as vulnerability of socio-economic assets to the impacts of climate change. Also relatively highly populated and urbanised areas, Yangon, Mandalay and Sagaing regions display medium levels of child-centred risk. Although Rakhine state scored high in relation to both hazard risk and child vulnerability, the overall child-centred risk comes out as medium due mostly to limited population exposure (relatively low population density). Kayah, Chin, Kachin, Kayin and Mon states, as well as Tanintharyi and Magway regions, have relatively low levels of child-centred risk.



Child-Centered Risk Map UNICEF Myanmar, November 2014



USE OF CHILD-CENTERED RISK ASSESSMENT

Findings of a child-centered risk assessment can be utilized to make development programmes risk-informed and climate sensitive, as well as to advocate for increased investments in programmes that foster the resilience of children, their families and communities.

Advocacy on Child-Centred Resilience

The findings of the CCRA and the process followed have value for Government partners, UN agencies, the DRR WG and other key stakeholders.

Firstly, the CCRA process has highlighted the lack of adequate multi-hazard risk mapping information at national and sub-national level that would enable the Government, development partners and NGOs to effectively target their programs and to address the multi-dimensional vulnerabilities that people in Myanmar face. Given its high disaster vulnerability, Myanmar needs to be able to support its plans and protect its investments through risk-informed programming, for which accurate and precise risk information is a pre-requisite. The update of Myanmar's Hazard Profile and generation of multi-hazard risk mapping for all administrative levels down to township level is therefore a critical first step.

The CCRA has highlighted that many areas of the country present high levels of child-centred risks. The country is at a critical stage in terms of defining its development path with the 5-year Comprehensive Plan due to be produced in 2015, regional level development plans under development, and a plethora of key sectoral policies (social protection, education, water and sanitation, etc.) currently being reviewed, developed or enacted. The CCRA can enable Government counterparts to protect and further development gains through risk-informed strategies and the incorporation of resilience in all development processes, as well as of bringing children onto the national agenda as a way to effectively tackle vulnerabilities. In particular, effective strategies to reduce child vulnerability to disasters and climate change such as child-centered DRR should be systematically promoted; along with a focus on addressing child vulnerability in a more holistic manner through comprehensive education and integrated social protection programs.

Finally, this analysis has value 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. By sharing the findings of the CCRA with UN agencies, it is hoped that resilience and risk-informed programming will continue to feature prominently in the next Myanmar UNDAF and that concerted UN efforts to support the Government in mainstreaming DRR in development processes will become a national and local priority. Sharing this analysis with major bilateral and multilateral development partners may also help to influence the national agenda and leverage resources towards more sustainable and risk-sensitive programming in high-risk areas of Myanmar.

Multi-sectoral Interventions

Disaster risks are multifaceted and efforts to strengthen resilience calls for multi-sectoral approaches. A child-centred risk assessment provides an opportunity to advance multi-sectoral approaches in both development and humanitarian action. Interventions across multiple sectors are often the most effective way to reduce vulnerabilities since their impact can be greater than actions undertaken individually.

One such approach is advocacy for safe infrastructures to reduce risk and adapt to climate change. If natural hazards are not considered in site selection and building design, critical infrastructure may fail during natural events and amplify a disaster. Past disasters such as the earthquake in Kashmir in 2005 and in Sichuan, China in 2008 had dramatic effects on schools, teachers and students. Making child infrastructure (e.g. health facilities, cold chains, child protection centres and schools) safe is not only a cost-effective investment, but also a social, moral and ethical imperative. The Comprehensive School Safety Framework,

in which 'safe learning facilities' is one of the three pillars, aims at building the resilience of children at school as well as in communities¹⁶.

Another rapidly emerging area that requires broad partnerships is social protection. While DRR focuses on children's vulnerabilities to hazards, social protection helps to enhance economic and social capacities. Global experience shows that incorporating disaster and climate risks into social protection systems and programmes does not just help children and their families better manage risks but can also build long-term resilience to shocks and stresses while helping break the cycle of poverty. Social protection interventions therefore have the potential to act as a buffer against all types of risks – including disaster risk – and aims at building resilience.

Capacity development in DRR, CCA, conflict sensitivity, and resilience is another multi-sectoral strategy. Indeed it is the second strategic goal of the *Hyogo Framework for Action* aimed at strengthening resilience to hazards. Targeted capacity development of both rights-holders and duty-bearers reduces underlying vulnerabilities, increases resilience to disasters, and contributes to enhanced emergency preparedness, response and early recovery.

Risk-informed Country Programming

In order to safeguard development gains and protect development investments, it is critical that planning and programming tools used by the Government, development partners and civil society organizations be risk-informed. When operationalizing the child-centred risk assessment, it is important to analyse individual hazards and vulnerabilities in specific locations. This is because prevention and mitigation measures – to a larger extent than preparedness and response – are hazard-specific.

Targeting geographical districts with high levels of child risk is one but not the only way of contributing to DRR, resilience and adaptation. Users of the CCRA would need to consider what they can do differently in terms of:

- **Geography** → Relocating to provinces/districts with high child risks.
- **Beneficiaries** → Focusing on the most vulnerable people, who have least livelihood options when exposed to disaster risk / climate change.
- **Timing** → Accelerate certain types of interventions in certain areas in order to contribute to risk reduction / climate change adaptation.
- **Approach** → Consider new types of interventions.
- **Outreach** → Specific interventions to reach out to often overlooked population groups (e.g. socially excluded groups in terms of gender, caste, ethnicity, disability, household structure, and children/adolescents not enrolled in schools).

¹⁶ The Global Alliance for Disaster Risk Reduction and Resilience in the Education Sector, *Comprehensive School Safety Framework*, 2014; http://www.preventionweb.net/files/31059_31059comprehensiveschoolsafetyframe.pdf

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Policies and frameworks

Hyogo Framework for Action (HFA)

The Hyogo Framework for Action (HFA) 2005-2015 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 HFA can be accessed online at: <http://www.unisdr.org/we/inform/publications/1037>

Its successor, the Sendai Framework for DRR was adopted in March 2015 and can be accessed online at: http://www.preventionweb.net/files/43291_sendaiframeworkfordrr.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'. After going through an update, it was formally endorsed by the Government of Myanmar in 2012, thereby providing greater impetus for DRR work. It is aligned 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 has been 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 were 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 which provides a risk ranking as well as country risk profiles for 191 countries, accessible online at: <http://www.inform-index.org/>

Myanmar's country risk profile can be viewed at: <http://www.inform-index.org/Results/Country-profiles?iso3=MMR>

Heidelberg Conflict Barometer

The Conflict Barometer has been published since 1992 and is an annual analysis of the global conflict events. Non-violent and violent crises, wars, coup d'états as well as peace negotiations are observed in it. See more details online at: <http://www.hiik.de/en/konfliktbarometer/>

Notre-Dame-GAIN Index

The ND-GAIN Country Index, a project of the [University of Notre Dame Global Adaptation Index \(ND-GAIN\)](#), summarizes a country's vulnerability to climate change and other global challenges in combination with its readiness to improve resilience. Details are accessible online at: <http://index.gain.org/>

DesInventar

DesInventar is a conceptual and methodological tool for the generation of National Disaster Inventories and the construction of databases of damage, losses and in general the effects of disasters. It helps to analyze the disaster trends and their impacts in a systematic manner and can be accessed online at:

http://www.desinventar.net/index_www.html

Surveys referenced in the document

Multiple Indicator Cluster Survey (MICS)

The MICS methodology was developed by UNICEF to support countries in collecting and analyzing data in order to fill data gaps for monitoring the situation of children and women; as well as to monitor progress against MDGs at a higher frequency. In Myanmar, a MICS survey was conducted in 2009-10 by the Ministry of National Planning and Economic Development and the Ministry of Health with support from UNICEF. The report is accessible online at: http://www.unicef.org/myanmar/MICS_Myanmar_Report_2009-10.pdf

Integrated Household Living Conditions Assessment (IHLCA)

In cooperation with the Ministry of National Planning and Economic Development and UNICEF, UNDP conducted two rounds of Household Living Conditions survey. The latest round from 2011 resulted in several reports that can be accessed online at:

<http://www.mm.undp.org/content/myanmar/en/home/library/poverty/povertydynamic-ihlca-ii.html>

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 should be available in 2016. See more details at: <http://dhsprogram.com/What-We-Do/Survey-Types/DHS.cfm>

Key stakeholders referenced in the document

Relief and resettlement Department (RRD)

The Relief and Resettlement Department, 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, 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 minimize the effects of natural disasters. More information on DMH's activities can be accessed online at: <http://www.dmh.gov.mm/>

Regional Integrated Multi-Hazard Early Warning System (RIMES)

Based in Bangkok, the Regional Integrated Multi-Hazard Early Warning System for Africa and Asia (RIMES) is an international and intergovernmental institution, owned and managed by its Member States, for the generation and application of early warning information. More information on RIMES' activities can be accessed online at: <http://www.rimes.int/>

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 organizations working for DRR. 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 organization. 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 and strengthen its efforts to improve children's lives. More information on UNICEF's activities in Myanmar can be accessed online at: <http://www.unicef.org/myanmar/>

World Food Programme/Ithaca

The ITHACA Institute of the Politechnic of Turin is one of the top-level academic institutions who are helping WFP to take advantage of recent advances in science and technology. With ITHACA's help, WFP can rapidly access satellite imagery of disaster areas and so build highly detailed maps that will guide and inform its humanitarian operations: <http://www.wfp.org/videos/mapping-emergencies>

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 organizations, 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/>

UN-Habitat Myanmar

UN-Habitat established a presence in Myanmar in the early 1990's during which time the agency pioneered the "People's Process" by establishing the first community led projects in the Dry Zone, Shan State and the Delta. The agency also extended substantive assistance for the design of the Human Development Initiative (HDI) for UNDP and has partnered in implementation of HDI 1, HDI 2 and HDI 3. More information on UN-Habitat's activities in Myanmar can be accessed at: <http://unhabitat.org/myanmar/>

UNDP Myanmar

The United Nations Development Programme (UNDP) is the UN's global development network, working in 177 countries and territories. In Myanmar, UNDP provides support to the national political and socio-economic reforms that underpin the country's transition. UNDP's support is channeled through a programme that seeks to strengthen institutions of democratic and local governance, support the environment and disaster risk management, and support government efforts for poverty reduction. More information on UNDP's activities in Myanmar can be accessed online at: <http://www.mm.undp.org/>

UNOCHA

OCHA is the part of the United Nations Secretariat responsible for bringing together humanitarian actors to ensure a coherent response to emergencies. OCHA also ensures there is a framework within which each actor can contribute to the overall response effort. More information on OCHA's activities in Myanmar can be accessed at: <http://www.unocha.org/myanmar>

Asian Disaster Preparedness Centre (ADPC)

As the most hazard prone region in the world, Asia-Pacific must proactively manage its disaster risk. For nearly 30 years, Asian Disaster Preparedness Center (ADPC) has been contributing in making Asia-Pacific safer by strengthening disaster resilience at all levels. More information on ADPC's activities can be accessed online at: <http://www.adpc.net/igo/Default.asp#>

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Figure 1: Myanmar: Natural Hazard Risks, OCHA, 2011

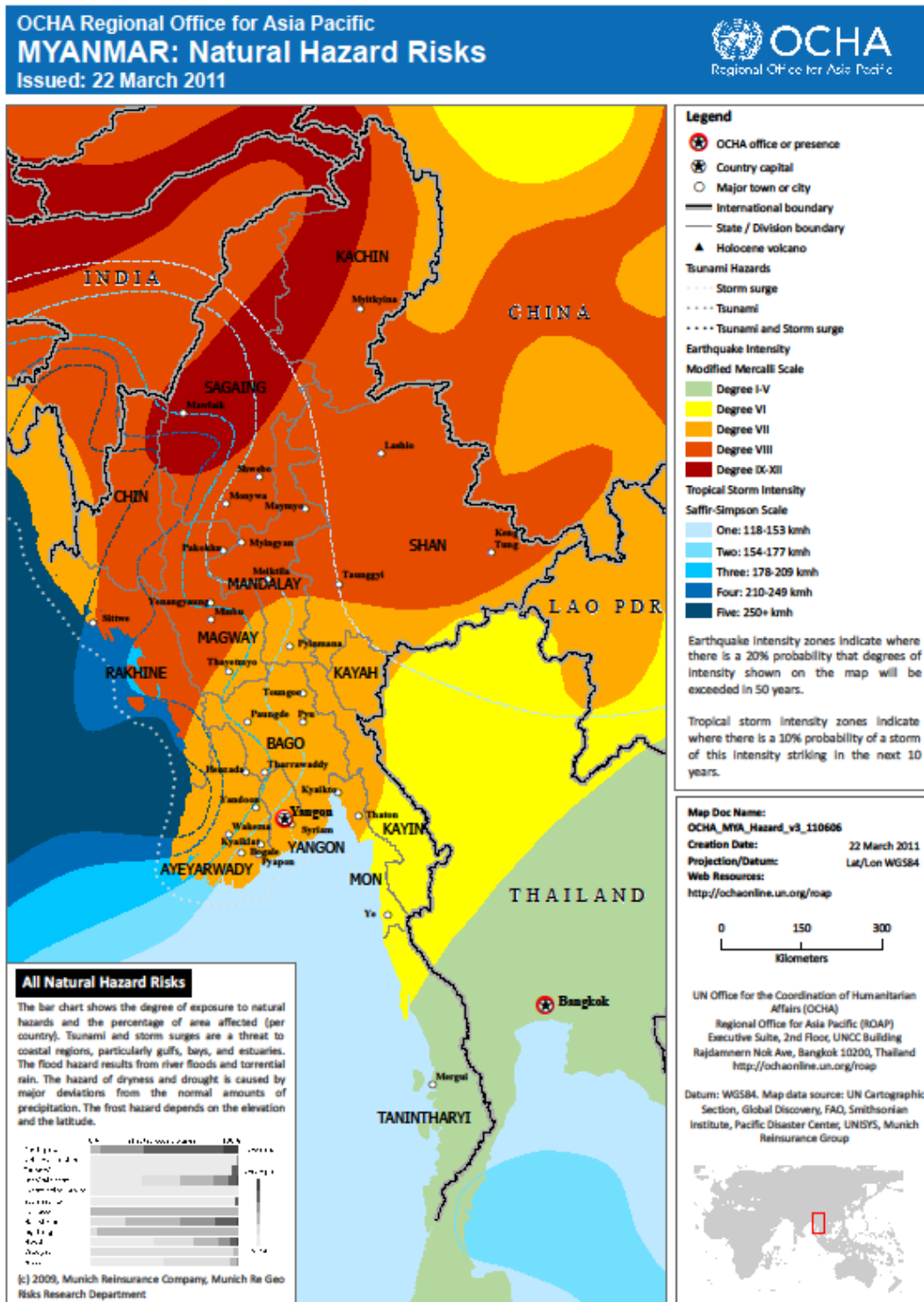


Figure 2: Seismic Zone Map of Myanmar, PSHA Map, MGS, 2012

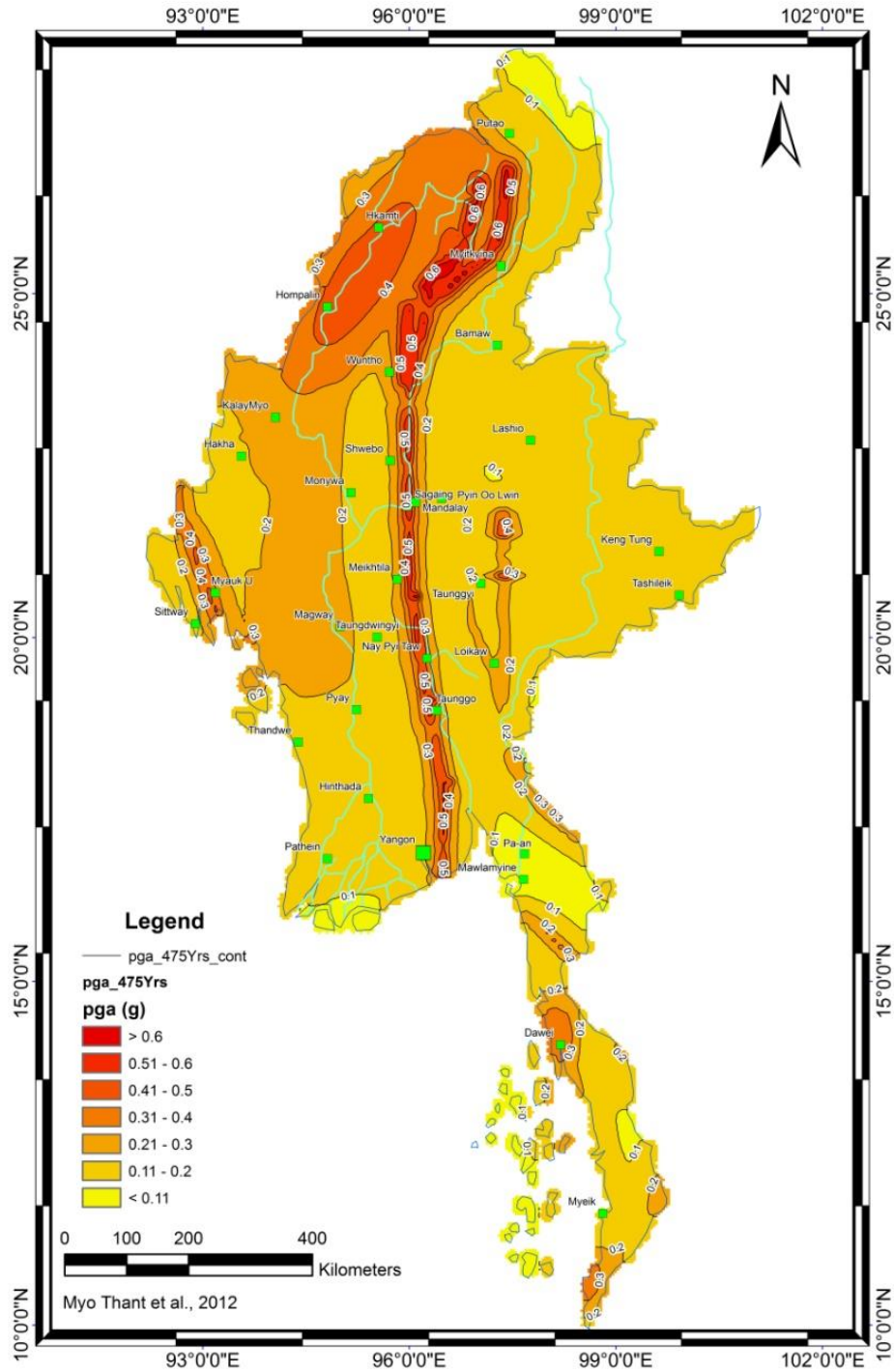


Figure 3: Myanmar Historical Seasonal Analysis: Population exposed to floods by year during the monsoon between 2000 and 2010, Ithaca/WFP, 2011

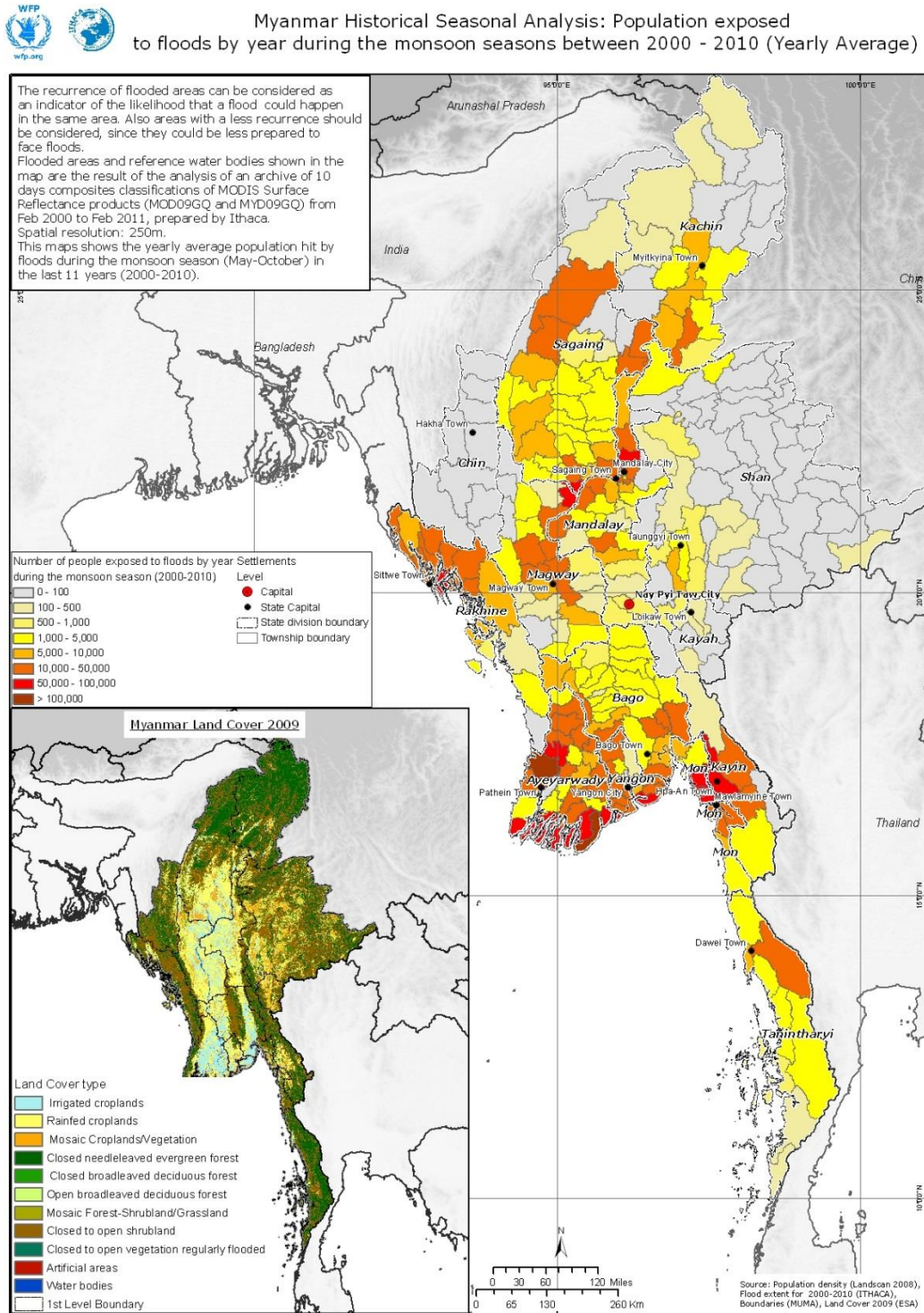


Figure 4: Fire Risk Map, Myanmar Hazard Profile, Government of Myanmar, 2009

Figure 15 Fire Risk Map (Based on Fire Cases from 1983 to 2007)

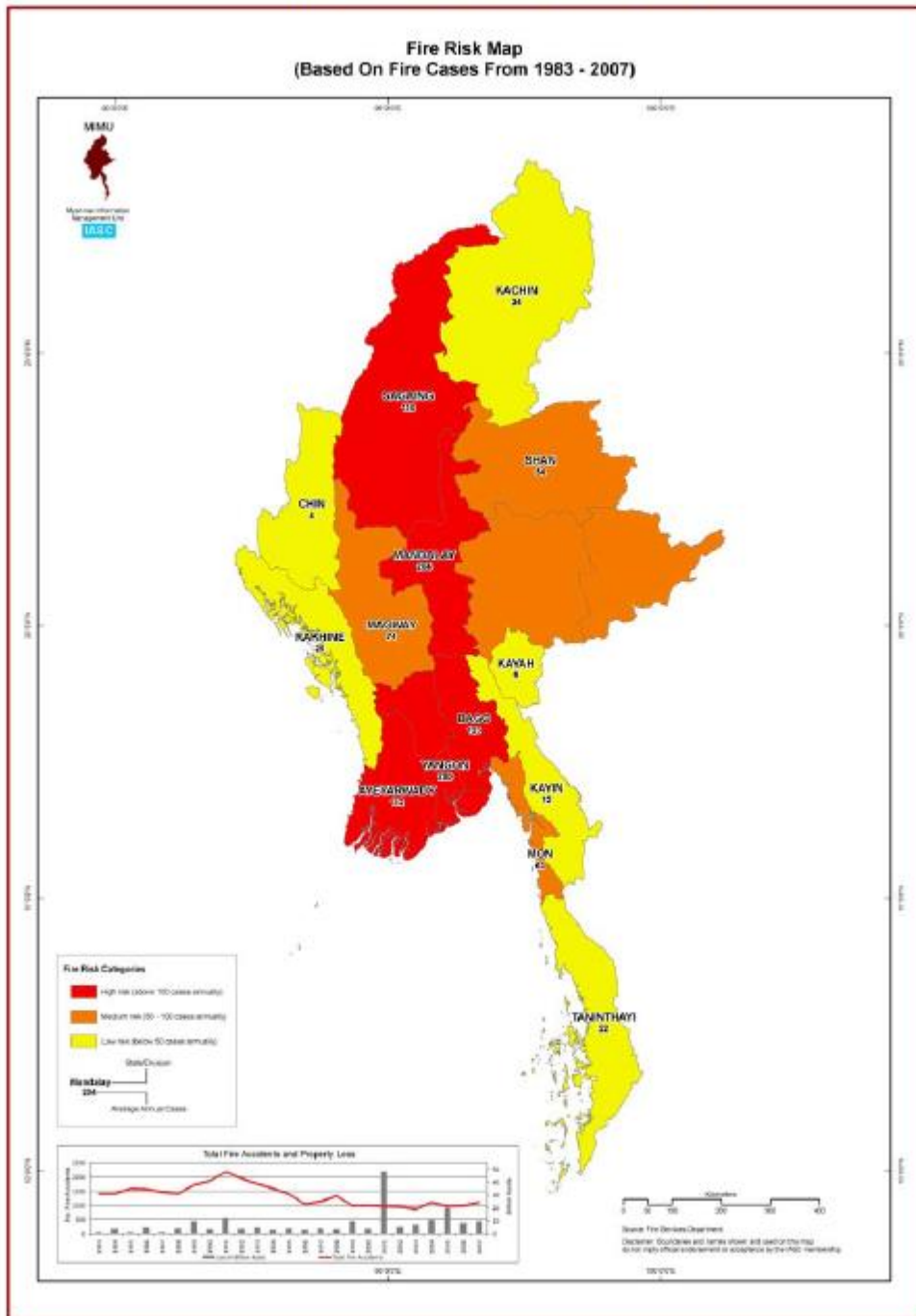


Figure 5: Technical Opinion, Ranking of Potential Tsunami Hazard in Myanmar, RIMES, 2014



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TECHNICAL OPINION
Ranking of Potential Tsunami Hazard in Myanmar

To evaluate the potential tsunami hazard in Myanmar, hydrodynamic simulation of the tsunami wave generated from the selected subduction earthquake scenarios are performed. It is necessary to stress that the case studies described herein are by definition worst-case scenarios; in particular, they do not necessarily represent the next large earthquake in each of the relevant subduction zones. The actual earthquake could be smaller than envisioned in this document. In addition, the potential tsunami hazard is actually varied within the same state, base on the location and near-shore bathymetry and topography.

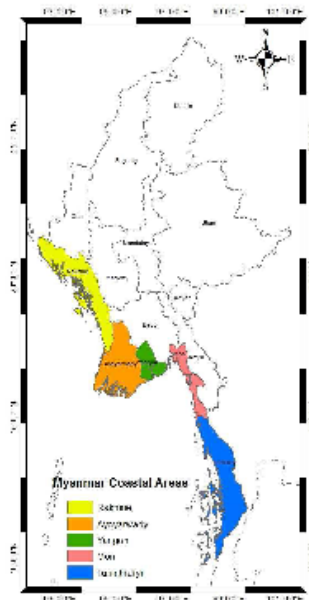


Fig. 1 Myanmar Coastal State



Fig. 2 Earthquake Scenarios for the evaluation

From hydrodynamics simulation, potential of maximum tsunami amplitudes are estimated along five Myanmar coastal states namely, Rakhine, Ayeyawade, Yangon, Mon and Tanintharyi.

Three earthquake scenarios are included:

- 1) Sumatra-Andaman 2004 event
- 2) Myanmar- Andaman, Leftover of 2004 event
- 3) Arakan , Bangladesh-Myanmar coast

Fault parameters representing scenario 1 are referred to the study by Suppasri et al. (2008) for Comparison among the proposed source models for the 2004 Indian Ocean tsunami whereas the hypothetical scenarios 2 and 3 are referred to the study on Far-field tsunami hazard from mega-thrust earthquakes in the Indian Ocean (Okal and Synolakis, 2008)

Table 1 Ranking of potential tsunami hazard in Myanmar

Scenario	State				
	Rakhine	Ayeyawade	Yangon	Mon	Tanintharyi
1	3	1*	4	5	2*
2	3*	1*	4	5	2*
3	1*	2*	4	5	3*

Remark: * with potential significant impact (tsunami wave height greater than 1 ft.)
 1 is the highest rank in term of potential tsunami hazard

Figure 6: Climate Change Vulnerability Index, NAPA, Government of Myanmar, 2012

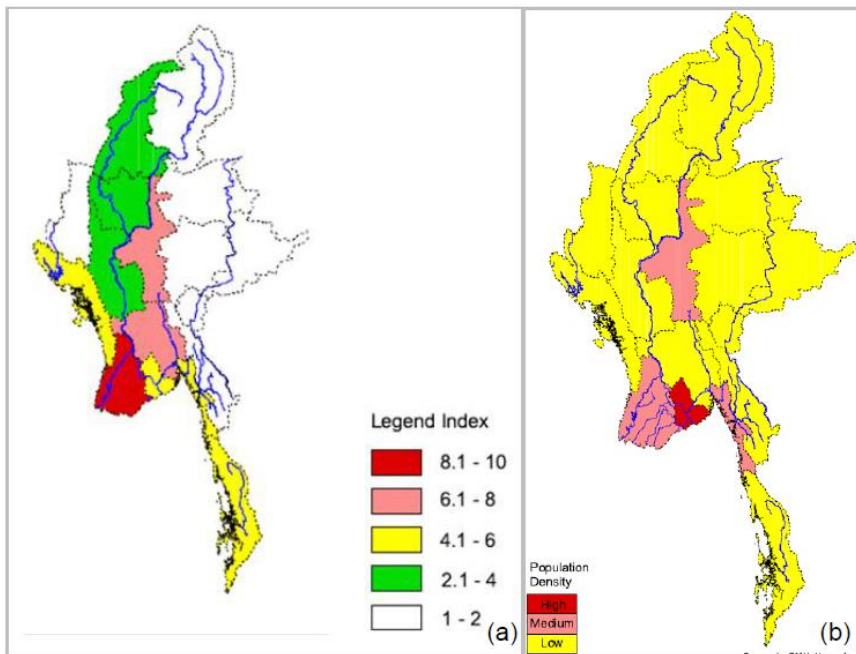


Figure 12. (a) Myanmar's overall climate change vulnerability index (taking into account areas and socio-economic sectors most at risk); and (b) climate change vulnerability index for Myanmar considering population density.

Figure 7: RRD's Warehousing Capacity

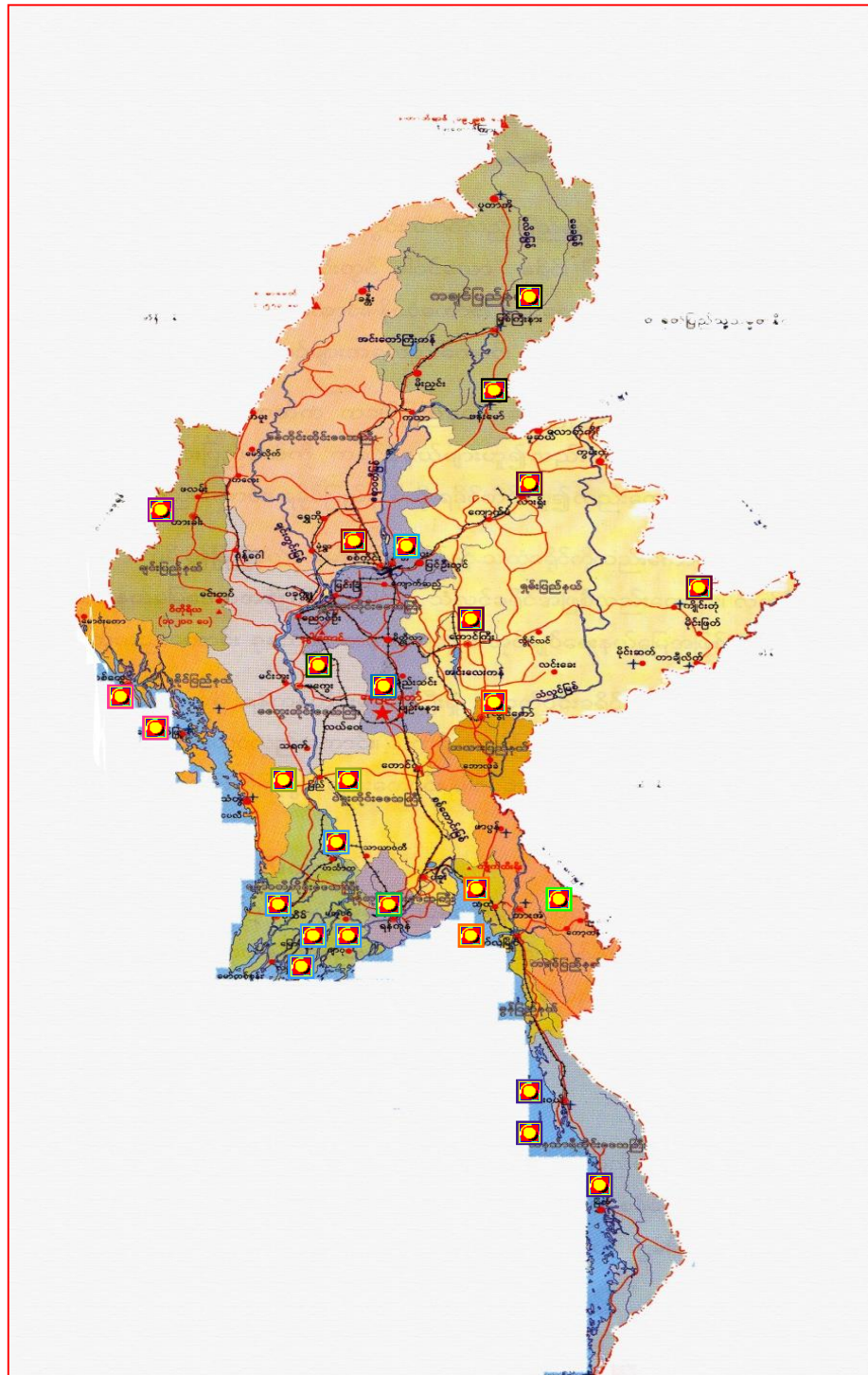


Figure 8: DRR Agencies' Coverage per state/region, MIMU, January 2014

