Climate, Environmental Degradation and Disaster Risk in Myanmar

IMN Meeting, May 2023

themimu.info

→ *Climate, Environmental Degradation and Disaster Risk in Myanmar (MIMU, 2022)*

MIMU's Analytical Brief

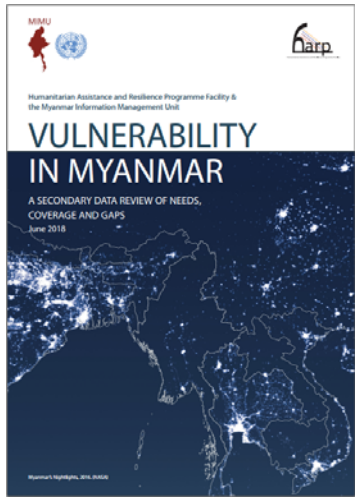
Further exploring findings of the MIMU/HARP-F vulnerability study on the influence of climate change and environmental degradation on disaster risk in Myanmar.

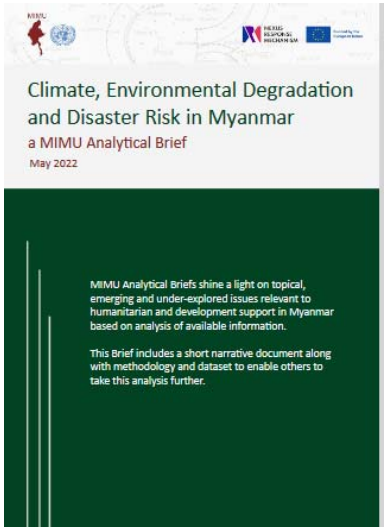
Climate change is increasing the impact of natural disasters globally...

- 11,000 extreme weather events between 2000 and 2019
  - 475,000 deaths, losses of USD 3.54 trillion globally

- Looking forward, expecting costs to increase
  - By 2030 – USD 300 billion per year
  - By 2050 - USD 500 billion per year.

Myanmar is ranked as one of the countries most affected by natural disasters in recent years, and among the most vulnerable to new disasters in the years to come





Methodology

❑ Desk Review

- Available research and recent modelling of hazard risk
- Vulnerability tools based in earlier work by MIMU and HARP-F
- Technical inputs from the Wildlife Conservation Society – Myanmar and UNDP

❑ Use of Publicly Available Data

- Areas at risk – drawn from recent estimates
  - Floods - SERVIR-Mekong Historical Flood Analysis Tool
  - Cyclones - Global Risk Data Platform
  - Drought – Various data sources (meteorological, agricultural, etc.)
  - Landslides - NASA Socioeconomic Data and Applications Center (SEDAC)
- Potentially exposed population – 2021 projections from 2014 Housing & Population Census, adjusted with 2019 Intercensal Survey results
- Vulnerability – measured using MIMU/HARP-F Vulnerability Index
  - Census data (2014, 2019)
  - Data from ACLED (conflict events), HRP (displacement)

Limitations of this Analysis

❑ Hazards

- Uses TS/district level estimates of exposed/vulnerable population - not by actual affected areas. This enables comparison but may over-estimate overall exposed population
- Lack of Cyclone data; calculated on the pixel values

❑ Vulnerability

- Vulnerable population is likely under-estimated due to Census gaps, i.e. some areas, populations under-represented
  - *2014 Census* – Gaps in Rakhine (1.09 million persons not enumerated), Kachin (46,600 persons from 97 villages not enumerated), and Kayin (69,753 persons not fully enumerated).
  - *2019 Intercensal Survey* – Sampling approach. Gaps in coverage of self-administered zones and some districts (Maungdaw, Mrauk-U in Rakhine; Hopang, Matman in Shan)
- Lack of data on new displacement in 2021
- Some info from 2014 Census not included in the 2019 ICS

Myanmar's Changing Climate

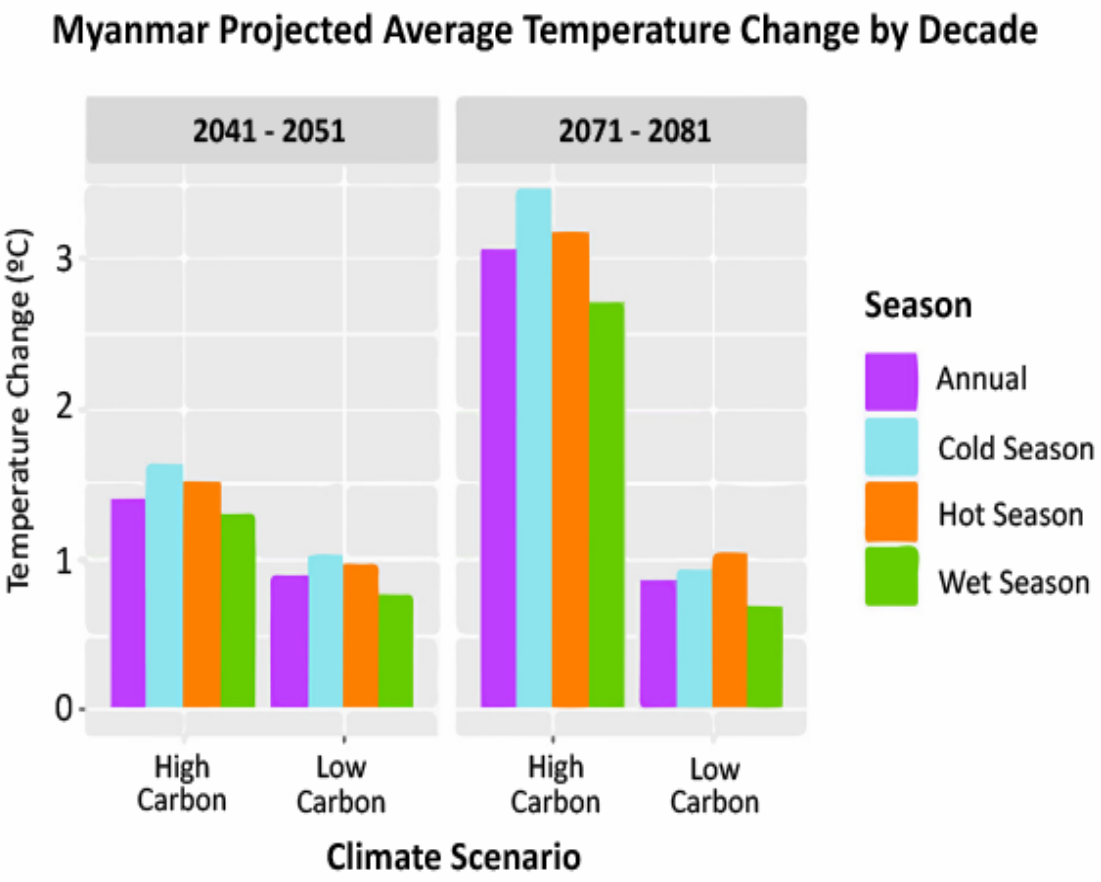
❑ Climate Change

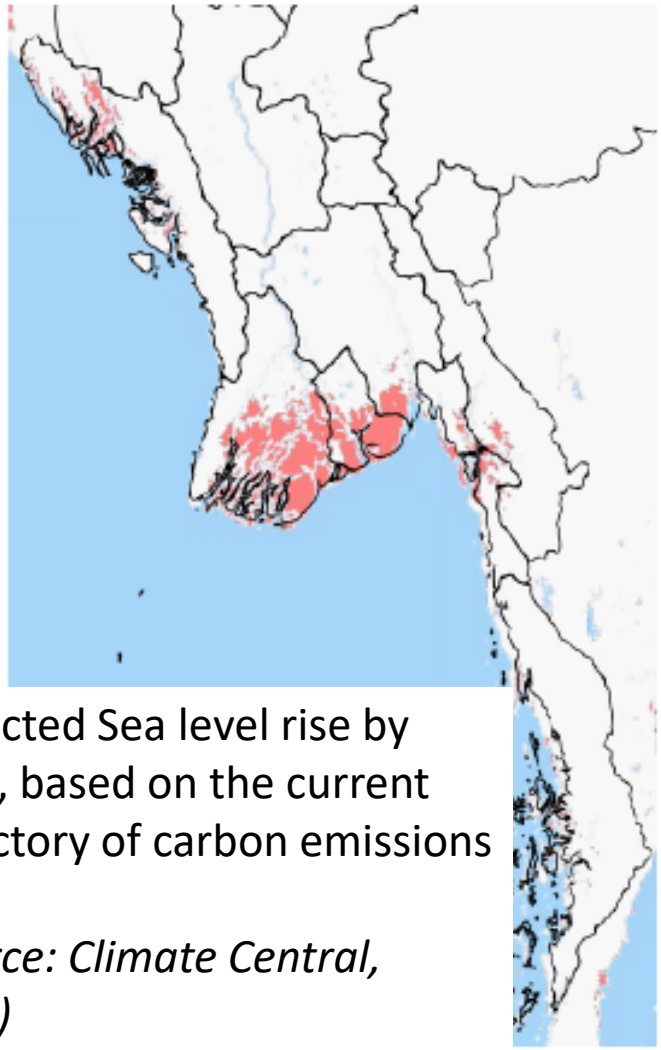
- o Rising average annual temperatures for several decades – expected to continue
  - 0.25°C increase per decade in daily average temperatures between 1981 and 2010
  - 0.4°C increase per decade in daily maximum temperature
  - Most optimistic - 1°C increase in next 50 years, more impact inland, hottest and coolest seasons

- o More intense rainfall, more damaging over the past 40 years
  - Increasing annual rainfall - 4.5% per decade between 1981 and 2010
  - Slightly higher increase in coastal areas

- o Anticipated sea-level increases
  - low lying areas in Rakhine, Mon, Ayeyarwady, Yangon most at risk
  - Risk of some areas permanently under water in the next 10 years with predicted sea level rises

Projected av temp change in Myanmar by season under high and low carbon climate change scenarios
(Intergovernmental Panel on Climate Change)





Projected Sea level rise by 2050, based on the current trajectory of carbon emissions

(Source: Climate Central, 2022)

Myanmar's Changing Landscape

❑ Deforestation

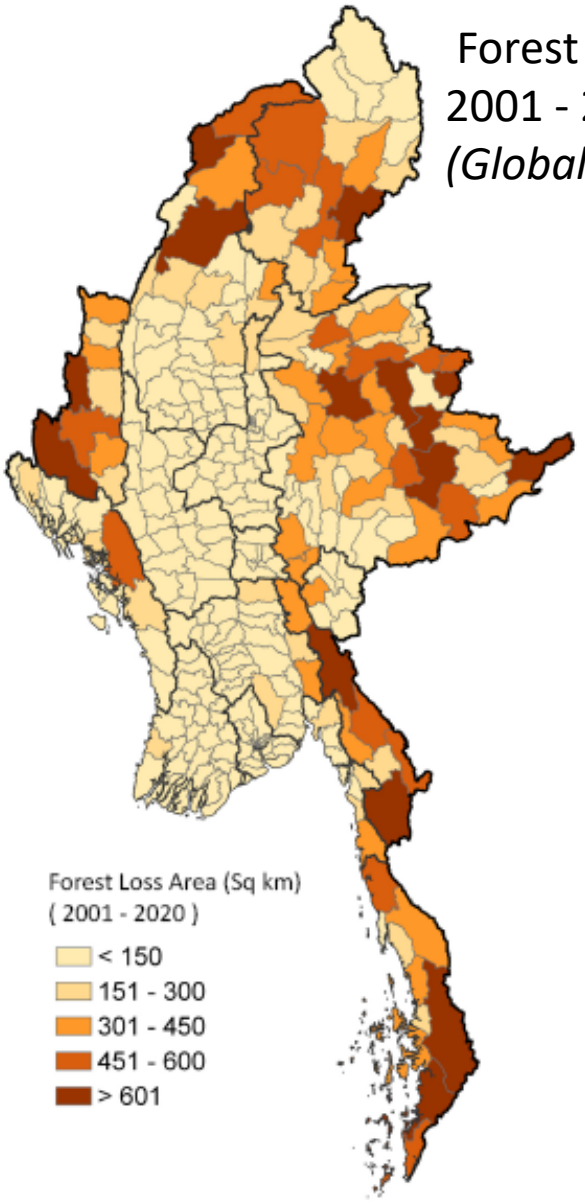
- Myanmar has the most forest cover remaining among countries in Southeast Asia, *BUT ALSO* one of the highest rates of deforestation
  - 33% of forest cover lost 1948 - 2015 (from 77% to 44%)
  - 1%-2.5% lost from 2000 to 2020 – among top ten countries globally for deforestation
  - Mainly in Shan, Kachin, Sagaing, Chin and Kayin
  - Forest removal as well as forest degradation
    - gradually compromising ecosystems, increasing immediate disaster risks
    - Increasing risk of contamination of drinking water, esp in Rakhine (many people dependent on groundwater) as well as less populated Chin and Kachin states

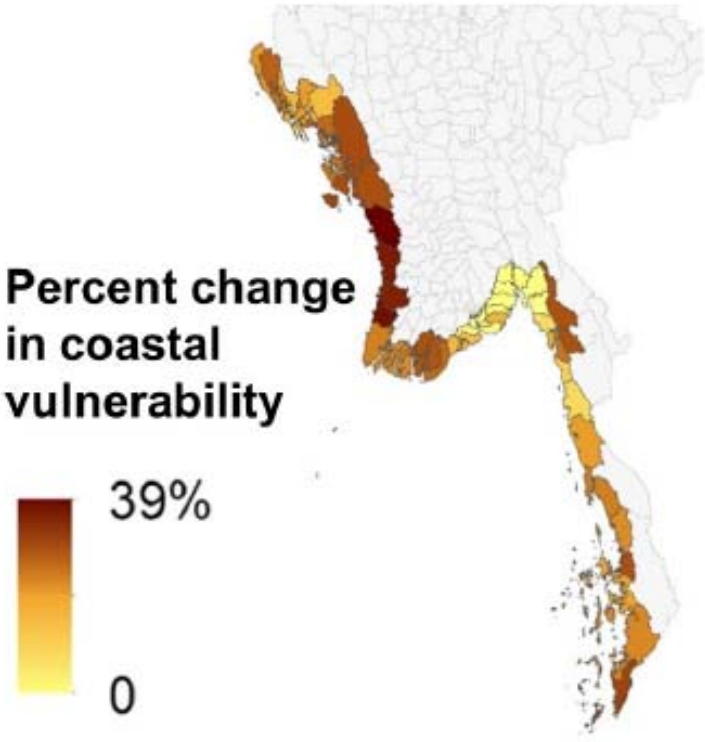
- Mangroves being lost even more rapidly than other types of forests for at least 25 years – greatest impact on storm surges moving inland

❑ Water Resource Conservation and Management

- Expanding freshwater ecosystems over the past 15 years (includes paddy and aquaculture).
- Large but unpredictable effects of existing and planned dams on Myanmar's water resources.

Forest loss area in square km
2001 - 2020
(Global Forest Watch)





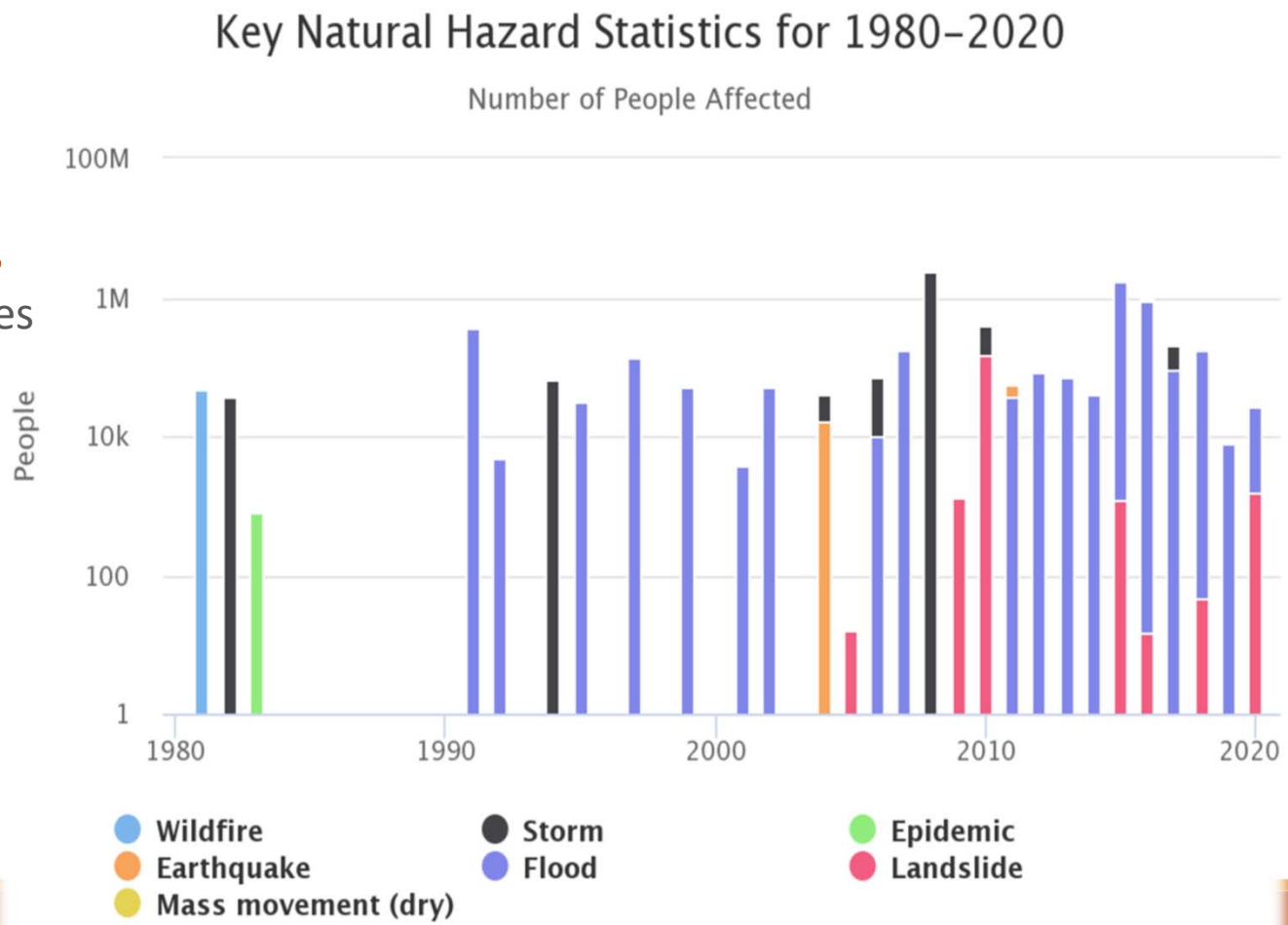
Coastal TS susceptibility to loss of ecosystem services from loss of natural vegetation *(Mandle, L. et al)*

Analysis of Natural Hazards affecting Myanmar

- Disaster Risk - a combination of
  - Hazards
  - Exposure
  - Vulnerability

- Four high impact natural hazards influenced by environmental changes
  - Floods
  - Storms
  - Drought and extreme heat
  - Landslides.

Climate change, environmental degradation are adding to these risks



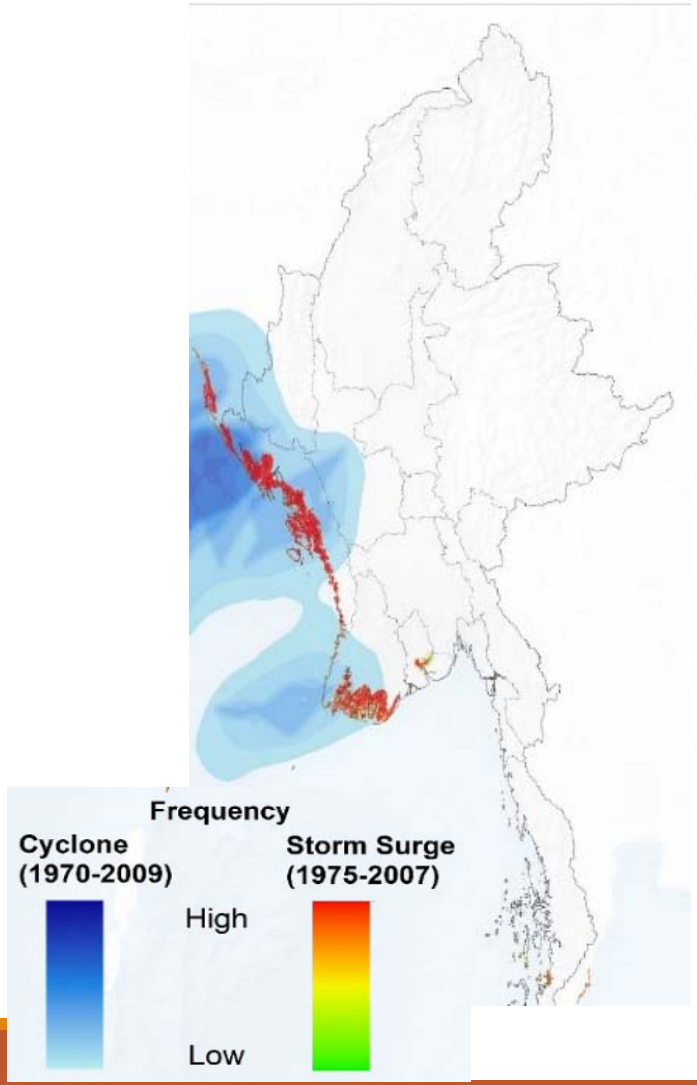
Increasing frequency, severity in Myanmar

→ climate issues, deforestation, farmland expansion

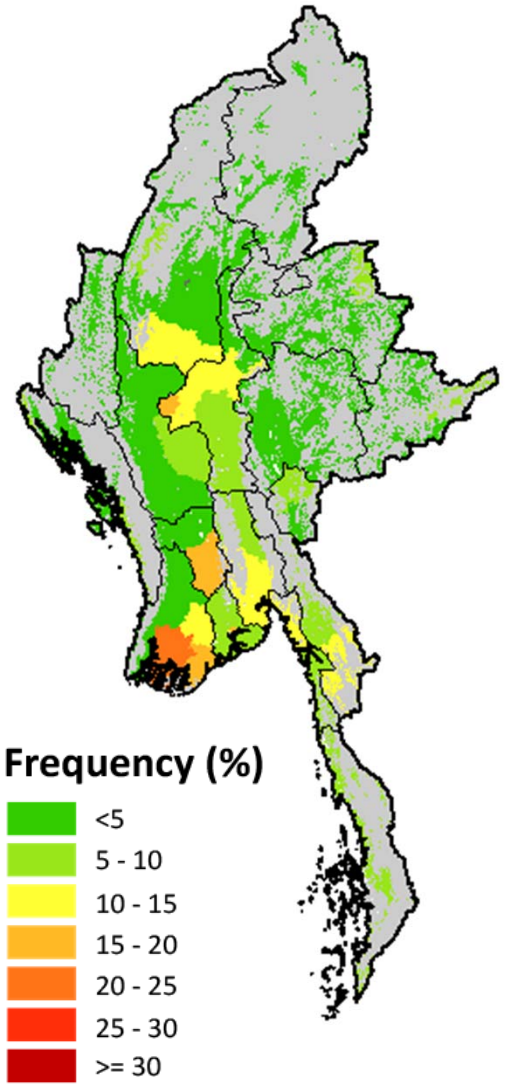
Among the recorded natural disasters affecting 100+ persons 1970-2015

- Floods – 51%
  - More frequent, extreme flooding over last 10-15 years
  - Yangon, Ayeyarwady, Mandalay districts – highest risk
- Storms – 18%
  - Differing risks of wind vs storm surge – Rakhine, Ayeyarwady, Yangon
  - Expected to become more intense with rising ocean temperatures. Mangroves are important in resilience – but have mostly been lost
- Landslides – 12%
  - Localised but loss of lives, infrastructure - esp transport
  - Mainly mountainous areas – Chin, Sagaing, Rakhine higher risk
- Drought - moderate every 10-14 mths; severe every 2-3 years

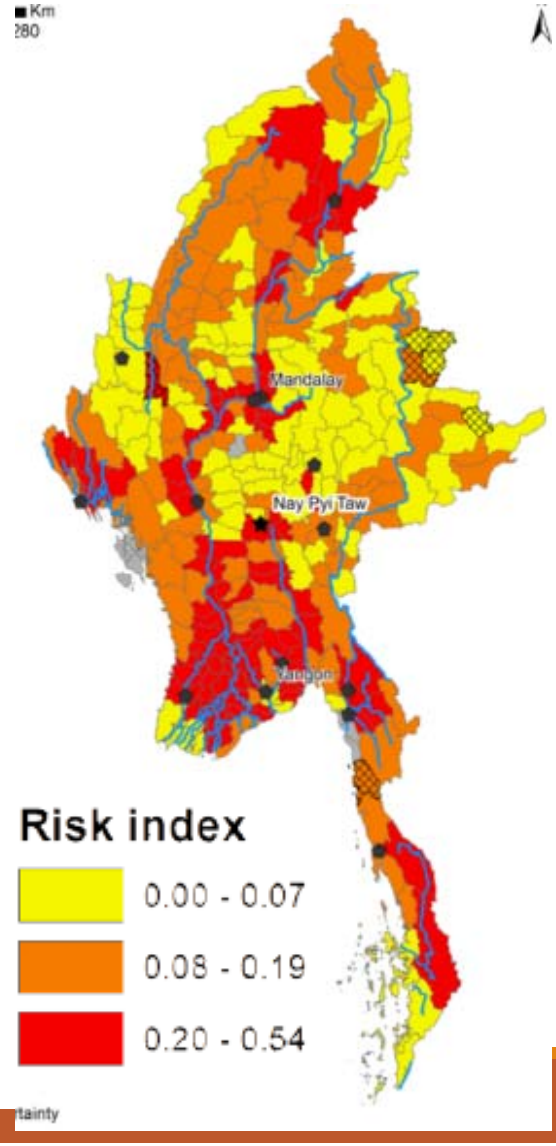
Areas at risk



Cropland affected by drought 1984-2020 (FAO)



Township Flood risk
(Hnin Wuit Yee Kyaw, Alexandra Dudley)



Vulnerability is an important factor in Disaster Risk

Extreme weather events do not become disasters on their own...
-- the level of impact is influenced by the vulnerability of the affected community

MIMU/HARP-F Vulnerability Study (2018)

❑ Vulnerability has no single defining trait

- A diverse range of characteristics
- Individuals, groups - different vulnerabilities at different times
- Differs among districts, even in a state/region
- Need information at the lowest possible level to understand who is affected

❑ Overlapping factors limit equitable development and resilience

- Exposure to Climate and Hazard risks
- Conflict
- Under-investment, under-development and lack of strong social protection

Eight township typologies 2014-2017

Type 1: Extreme outliers in terms of development needs and/or exposure to conflict

Type 2: Conflict-affected areas with poor human development

Type 3: Hubs in conflict-affected areas

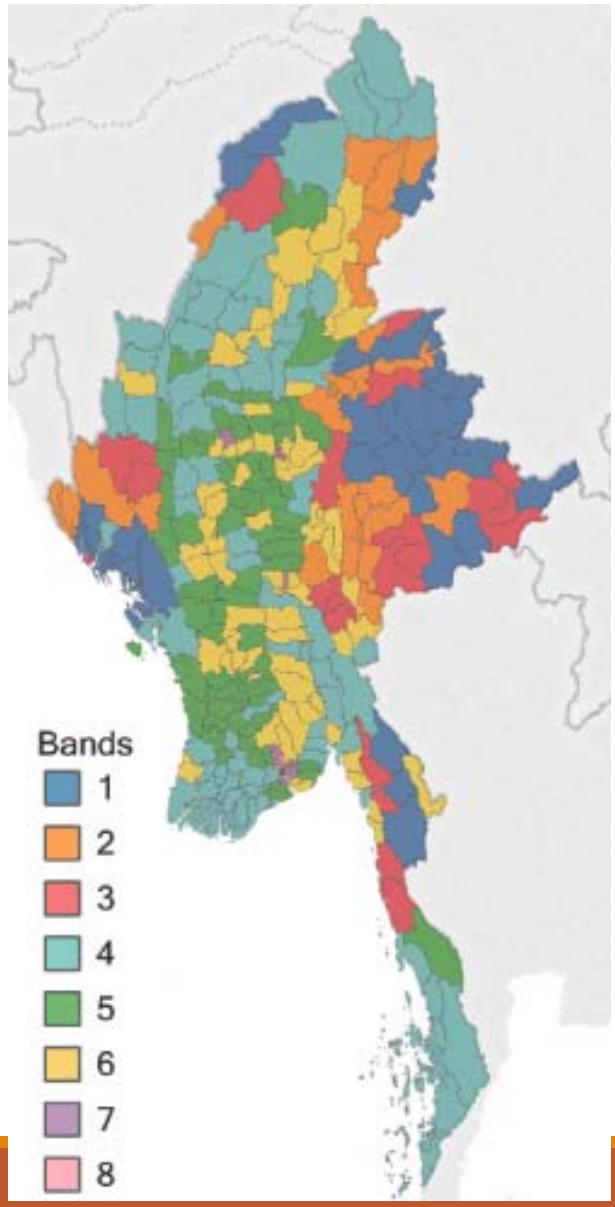
Type 4: Very low access to basic services, infrastructure

Type 5: Agricultural townships with highest profits per capita

Type 6: Agricultural areas with secondary cities and towns

Type 7: Up-and-coming peri-urban, urban areas

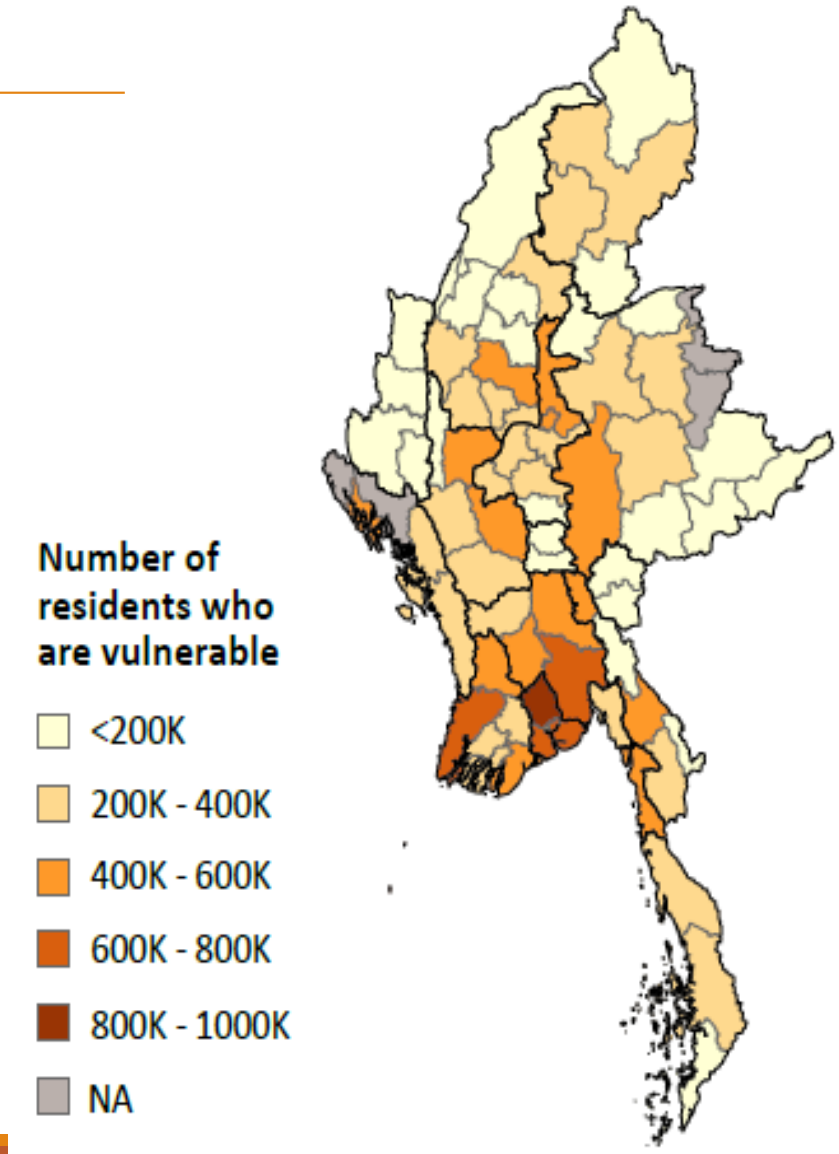
Type 8: Affluent, densely populated city centres



Estimate of Vulnerability by District 2021

21.2 million persons with some level of vulnerability in terms of:

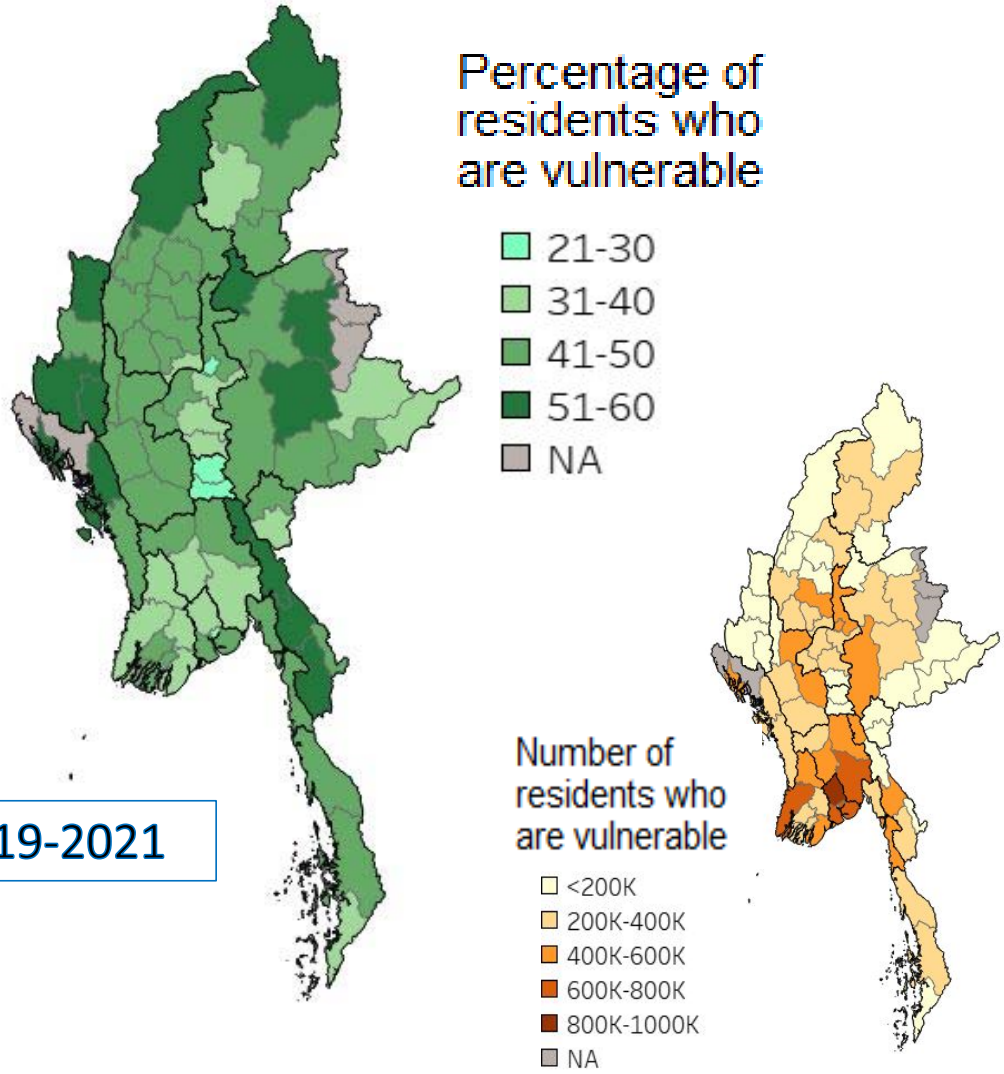
- ❑ Living standards – 2019 ICS, 2014 Census
  - Quality of housing materials (roof/wall materials)
  - Education/educational attainment (female literacy, middle school completion)
  - Safe sanitation, drinking water, electricity
  - Child dependency, unpaid family workers, ID cards
- ❑ Direct exposure to conflict 2019-2021 - ACLED
  - Incidents of clashes/battles, conflict fatalities, displacement and violence against civilians - underestimates displaced persons who are not located in formally recognized camps



Vulnerability by District

- Changes since previous estimates (2014-2016)
  - Improved Household amenities by 25-88%
  - Slight improvement in female literacy rates, child dependency ratio
  - 67% increase in direct exposure to conflict

- 2021 Index - vulnerable districts
  - **Highest %** of vulnerable residents
    - Chin (Falam, Matupi and Mindat),
    - Kayin (Hpapun),
    - Rakhine (Sittwe)
    - Shan (Loilen)
    - Sagaing (Hkamti)
  - **Highest number** of vulnerable residents
    - Yangon (North, South, East),
    - Bago
    - Ayeyarwady (Pathein)

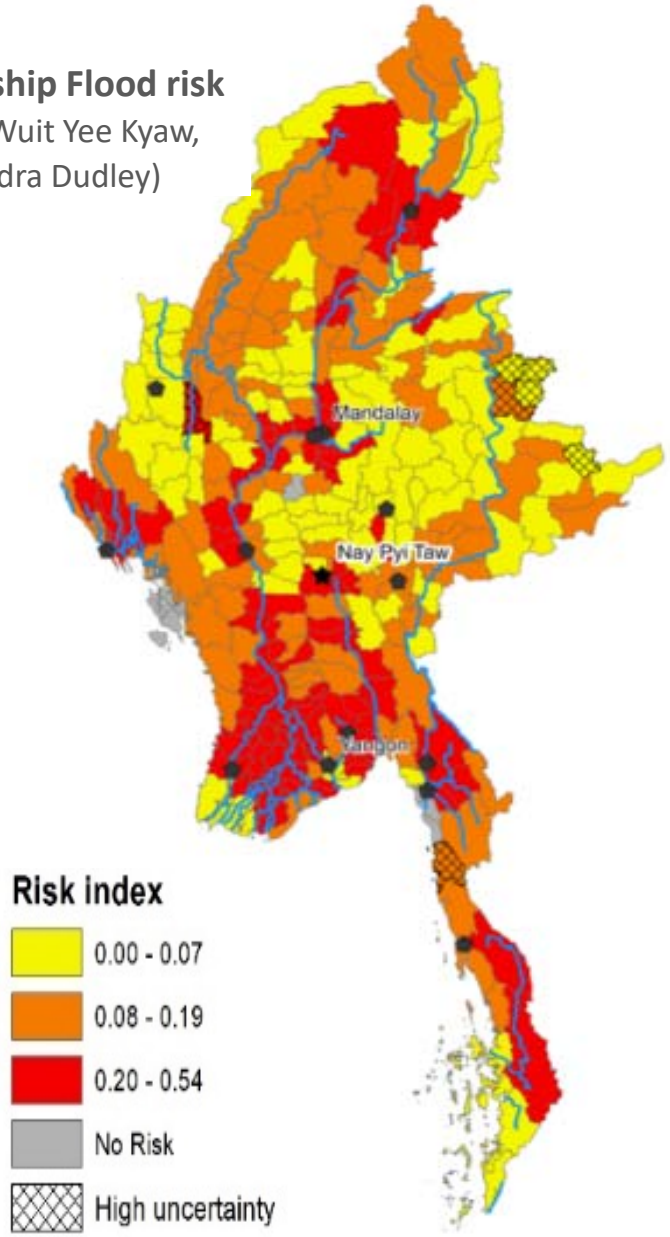


Flood and Vulnerability

- Myanmar's most frequent hazard – mainly riverine
  - 51% of recorded natural disasters affecting 100+ persons in 1970-2015
  - More frequent extreme flooding over last 10-15 years
  - Flood risk increasing due to climate change, environmental degradation (deforestation, farmland expansion)

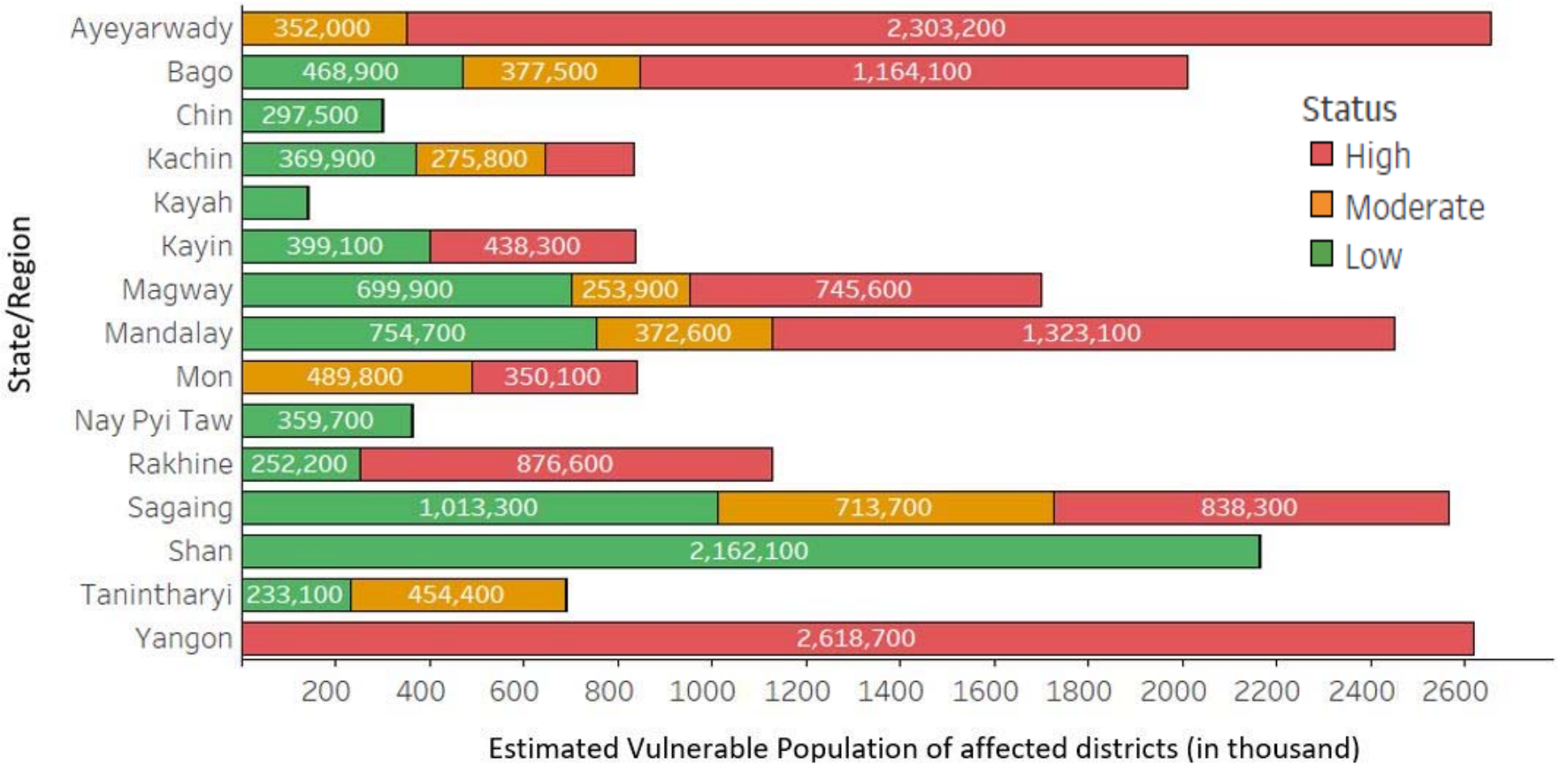
- Districts with the highest risk
  - Yangon, Ayeyarwady, Bago and Mandalay regions.
  - 28 million people at risk including 10.8 million vulnerable people (calculated at district level)

Township Flood risk
(Hnin Wuit Yee Kyaw, Alexandra Dudley)



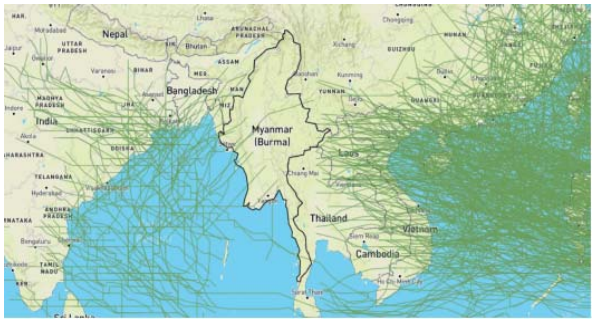
Flood and Vulnerability

28 million people including 10.8 million vulnerable people



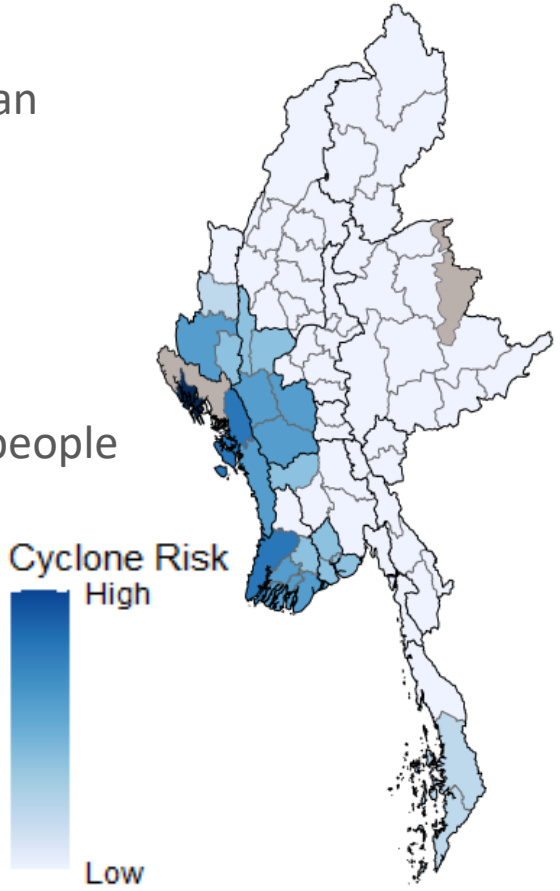
Cyclones and Storms, and Vulnerability

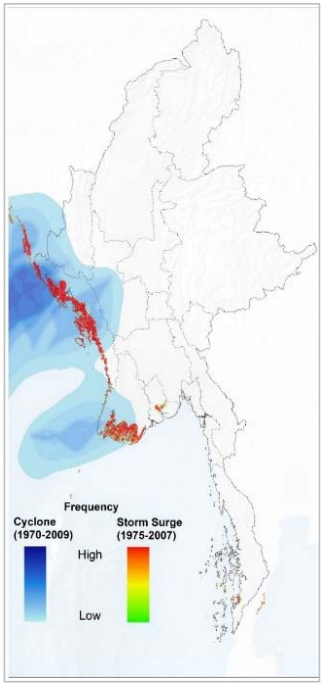
Cyclone tracks 1969-2009



- Less frequent than floods, but major damage, loss of life
  - 18% of disasters affecting 100+ people 1970-2015
  - Different areas at risk - wind/storm surge risk
  - Expected to become more intense with rising ocean temperatures
  - Vulnerability, mangroves affect resilience

- Districts with moderate to high risk of cyclones
  - 8.9 million people, including 4 million vulnerable people in Rakhine, Chin, Magway and Ayeyarwady
  - Residents of Rakhine State - higher likelihood of b affected.





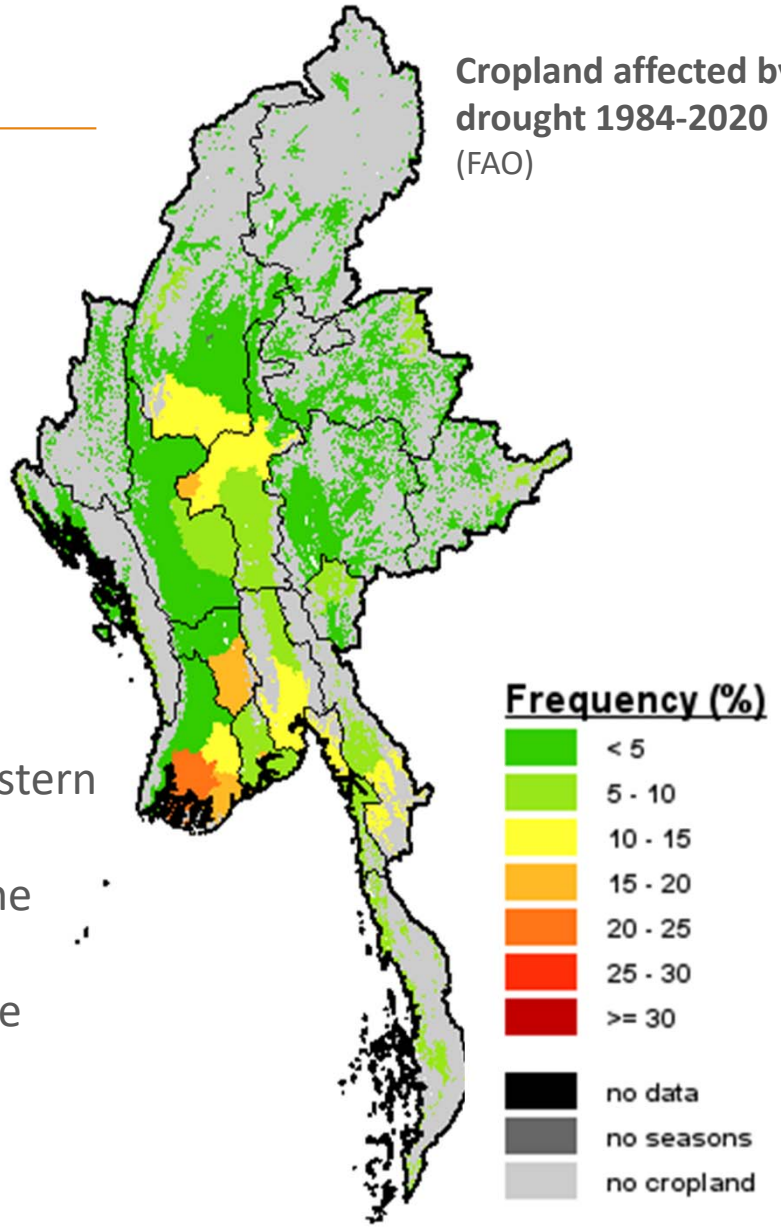
Drought and Vulnerability

❑ Longer duration than other hazards, different types

- Limited available info, complex to analyze
- Expect moderate droughts every 10-14 months; severe every 2-3 years
- Even when rainfall, water shortages in many S/R
- More likely with changing climate change, rainfall
- Forests and other natural ecosystems can reduce the probability of all varieties of drought.

❑ Districts at highest risk of exposure to drought

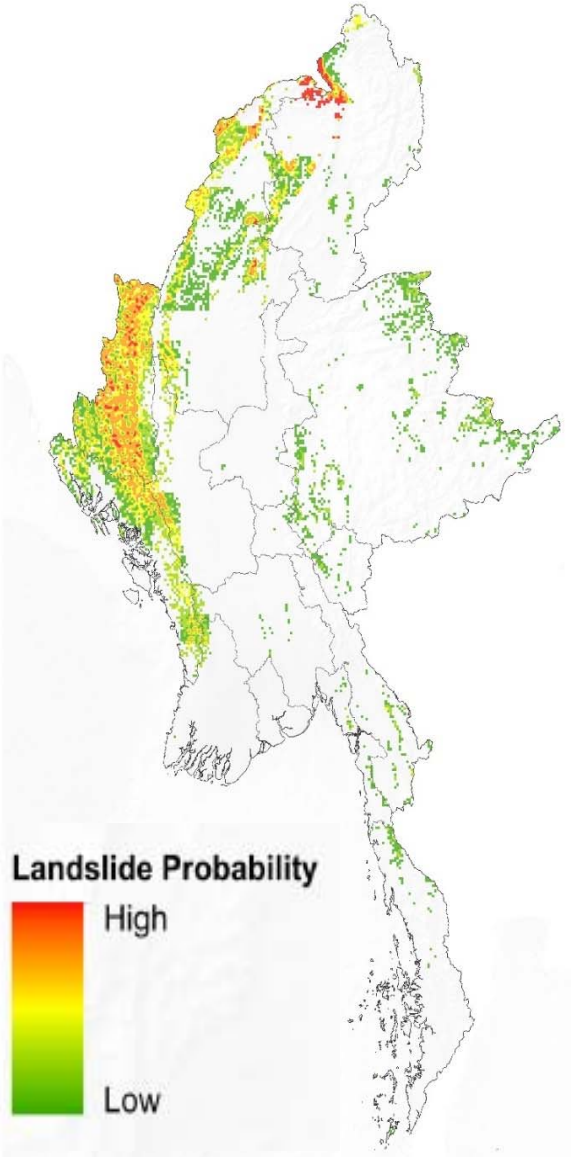
- Ayeyarwady Delta, Central Dry Zone, Northern and Eastern Hilly Regions (Kachin, Shan States)
- 11 million people including 4.5 million vulnerable in the Central Dry Zone alone
- Kayah, Shan - highest risk of negative impacts in severe droughts in 2015/16 and 2019/20



Cropland affected by drought 1984-2020
(FAO)

Landslide and Vulnerability

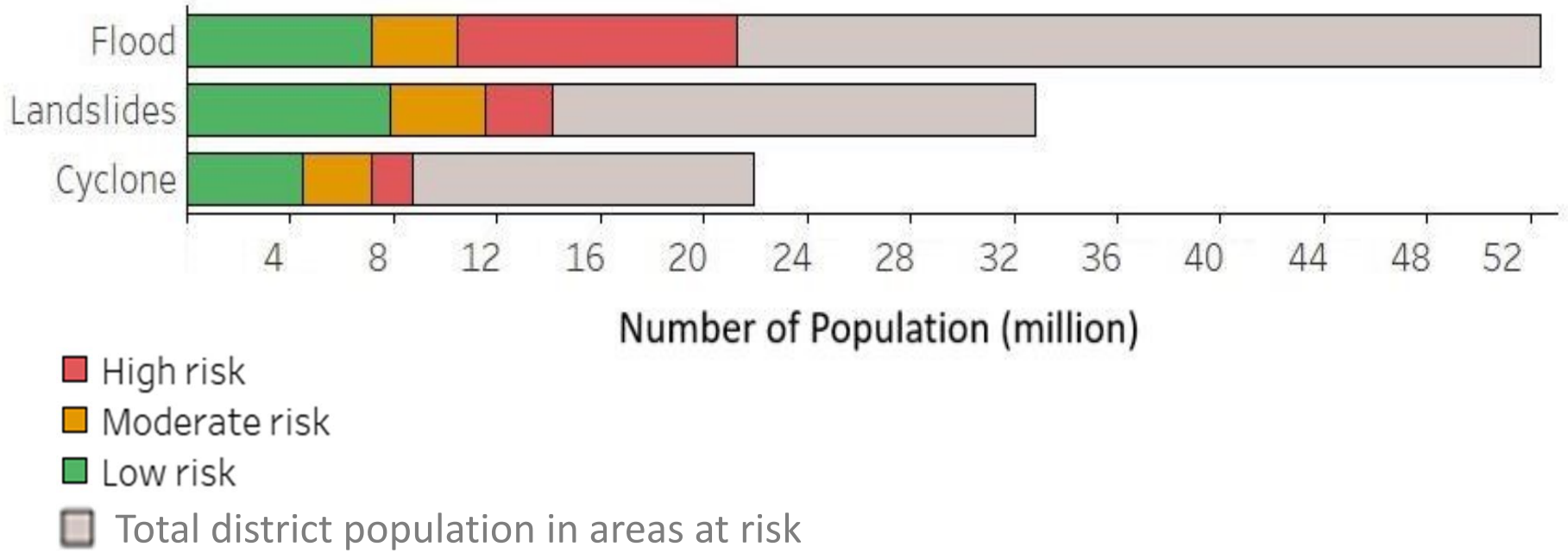
- 12% of recorded natural disasters affecting 100+ (1970 to 2015)
  - Loss of lives, impact on infrastructure, esp transport
- Affects mainly mountainous areas
  - Triggers – precipitation/flooding, deforestation, mining, ?dams, also earthquakes (not covered in this analysis)
- Districts at high risk of landslide exposure
  - Esp, Chin State (4 districts) and Sagaing (Hkamti, Mawlaik), every district of Rakhine State except Sittwe
  - 5 million people including 2.6 million vulnerable people



Global Data Risk Platform

Comparing Exposure and Vulnerability to common natural hazards

Estimated vulnerable population in districts by risk of natural hazard



Conclusion

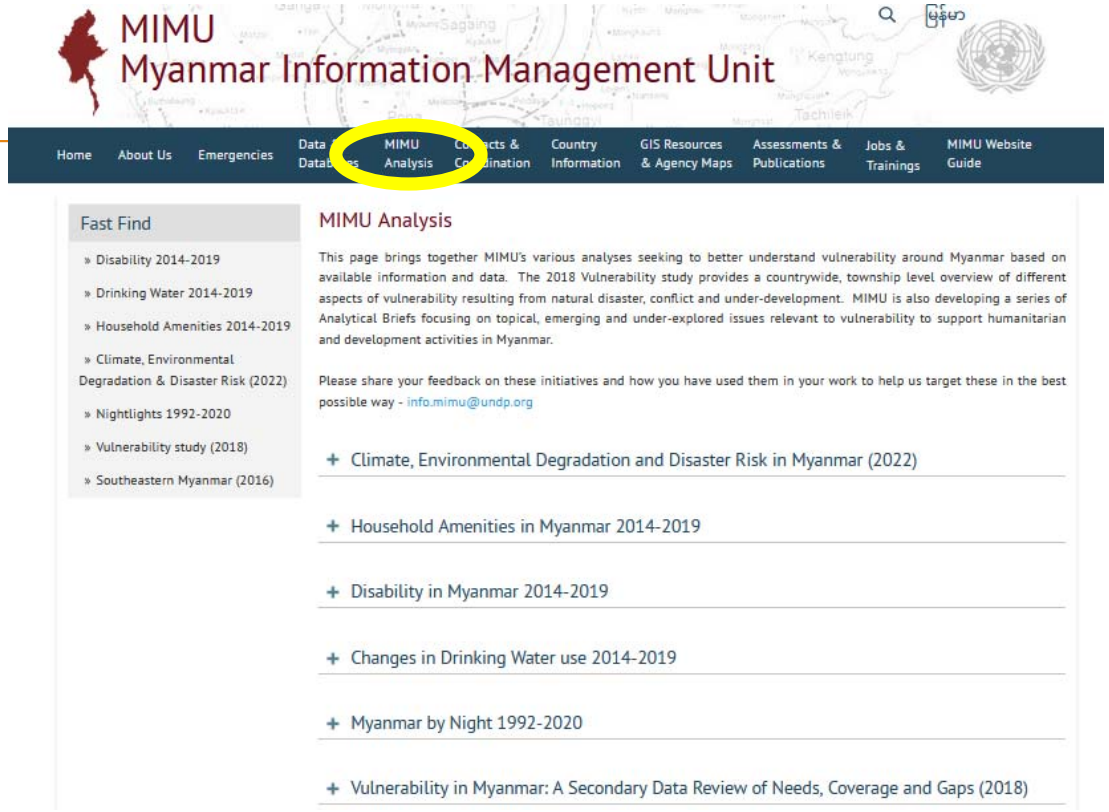
- Myanmar is one of the of the world's most affected countries in terms of natural disasters, and among the most vulnerable to new disasters in the years to come
  - Changing frequency and severity of natural hazards due to changing climate, environmental degradation are influencing the in Myanmar.
  - Losing protective natural ecosystems that help mitigate the effects of various hazards.
  - Extreme weather events are not disasters on their own – depends on vulnerability of the population.

- In planning for disaster response and reducing disaster risk
  - Consider current as well as projected disaster risks.
  - More research on effective approaches to reduce the effects of climate change and environmental degradation on disaster risk for communities.
  - Various vulnerability indexes - similar findings but would benefit from validation, fine-tuning.

Products of the Analysis

On the MIMU website

- Report – ENG, MMR
- Dataset
- Methodology



Contact – info.mimu@undp.org