















ASSESSING CLIMATE RISK IN MYANMAR

Summary for Policymakers and Planners

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March 2017

ACCOMPANYING TECHNICAL REPORT

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providing historical rainfall and temperature data from 19 stations

the Department of Meteorology and

The Summary for Policymakers is a synthesis of the 2017 technical report, Assessing Climate Risk in Myanmar: Technical Report. The technical report contains in-depth analyses and regional projections by season.

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CITATION

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Risk in Myanmar: Summary for

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Note: Like all future projections, climate projections have uncertainty embedded within them. Sources of uncertainty include data and modeling constraints, the random nature of some parts of the climate system, and limited understanding of some physical processes. In this report, the levels of uncertainty are characterised using state-of-the-art climate models, multiple scenarios of future greenhouse gas concentrations, and recent peer-reviewed literature. The projections are not true probabilities, and scenario-planning methods should be used to manage the risks inherent in future climate.







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ABOUT THE INSTITUTIONS

Department of Meteorology and Hydrology

The Department of Meteorology and Hydrology (DMH) is under the control of the Ministry of Transport and Communications. DMH responsibilities include taking precautionary measures against and minimising the effects of natural disasters, by issuing meteorological information, warnings, news, alerts, and special outlooks. DMH supports public weather services, information, data, and weather forecasts, providing advice and observations to decision-makers, policy makers and different sectors.

Columbia University's Center for Climate Systems Research

The Center for Climate Systems Research (CCSR) is the home of a cooperative relationship between Columbia University and the NASA Goddard Institute for Space Studies (GISS) and a research centre of the Earth Institute at Columbia University. CCSR was established with the objective of providing enhanced understanding of Earth's climate and its impacts on key sectors and systems. CCSR plays a large role in the dissemination of climate change research and information to governments, local and international organisations, educational institutions, and stakeholders.

WWF

For more than 50 years, WWF has been protecting the future of nature. The world's leading conservation organization, WWF works in 100 countries and is supported by close to 5 million members globally. WWF's unique way of working combines global reach with a foundation in science, involves action at every level from local to global, and ensures the delivery of innovative solutions that meet the needs of both people and nature.

Myanmar Climate Change Alliance

The Myanmar Climate Change Alliance (MCCA) programme is an initiative of Myanmar's Ministry of Natural Resources and Environmental Conservation, implemented by the United Nations Human Settlements Programme (UN-Habitat) and the United Nations Environment Programme (UN-Environment) and funded by the European Union. It aims at mainstreaming climate change into Myanmar's development agenda by raising awareness of policy-makers and public opinion, formulating policies, strengthening coordination, building technical capacities and helping communities to adapt.

ADVANCE Partnership

ADVANCE is a partnership between WWF and the CCSR at the Earth Institute. Launched in 2015, ADVANCE facilitates adaptation by providing new ways of generating and integrating climate risk information into conservation and development planning, policies, and practice. ADVANCE envisions a future where the world is using co-generated climate risk information based on the best-available science to guide conservation, development, and disaster risk reduction to benefit human well-being and ecosystem health.

ACRONYMS AND ABBREVIATIONS

CCSR – Center for Climate Systems Research

CMIP5 – Coupled Model Intercomparison Project Phase 5

DMH – Department of Meteorology (Myanmar)

EM-DAT – Emergency Events Database

ENSO – El Niño-Southern Oscillation

GCM – General Circulation Model

IPCC – Intergovernmental Panel on Climate Change

MCCA – Myanmar Climate Change Alliance

MoNREC – Ministry of Natural Resources and Environmental Conservation (Myanmar)

NASA – National Aeronautics and Space Administration

NASA GISS – NASA Goddard Institute for Space Studies

NASA NEX-GDDP – NASA Earth Exchange Global Daily Downscaled Projections

NOAA –National Oceanic and Atmospheric Administration (United States)

RCP – Representative Concentration Pathway

UN-Environment – United Nations Environment Programme

UN-Habitat – United Nations Human Settlements Programme

 $\mathbf{VA}-\mathbf{Vulnerability}\ \mathbf{Assessment}$

WMO – World Meteorological Organization

WWF – World Wide Fund for Nature



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EXECUTIVE SUMMARY

This brief aims to help decision-makers across sectors in Myanmar incorporate climate change risks into planning and investment decisions by summarising key messages from a detailed technical analysis of climate change in Myanmar that is released alongside this report.

Specifically, this brief does the following:

- **Provides climate risk information,** including observed historical climate and future projections of temperature, rainfall, sea level rise and extreme weather events.
- Highlights how climate change will affect sectors such as biodiversity and ecosystem services, coastal zones, health, agriculture, infrastructure, water resources, and urban areas.
- Provides on-the-ground examples of how climate risk information is being used by the Myanmar Climate Change Alliance (MCCA) to support local planning in the Ayeyarwady Delta and the Central Dry Zone.
- Supports a flexible adaptation approach, providing a range of possible future climates in Myanmar, which helps address changes and impacts already underway and guides planning for changes that are likely to worsen in the future for Myanmar's people, ecosystems, and economy.

Based on analyses of 19 observed weather stations, the climate in Myanmar is already changing:

- Between 1981 and 2010, average temperatures increased by 0.25°C.
- The pace of warming has been faster inland than in coastal areas, and the rise in daily maximum temperatures has been greater than the daily average.
- Annual total rainfall increased slightly between 1981 and 2010, with a greater rate of increase in coastal areas than in inland ones.
- In coastal areas the increases occurred throughout the year, while in inland areas the increases occurred mainly during the monsoon season.
- Research suggests that the summer monsoon season has become shorter by approximately one week, on average (Lwin, 2002).

The country's climate is projected to shift dramatically in the coming decades:

- In every region in Myanmar, temperatures are expected to rise by the middle of the 21st century by 1.3°C-2.7°C. Warming varies by both season and region, with the cool (November–February) and hot (March–May) seasons projected to see the most warming.
- The eastern and northern hilly regions are projected to see the most dramatic warming among all regions of Myanmar, with hot season average temperatures rising by up to 3°C.
- During 1981–2010, Myanmar had about one day of extreme heat per month. In the future, projections show that Myanmar could experience anywhere from four to 17 days of extreme heat each month.
- Changes in rainfall patterns are projected to vary by region and season, with increases projected during the monsoon season, while both increases and decreases are possible the rest of the year.
- Sea level rise projections for the coastline range from 20 cm to 41 cm by mid-century. Although projected changes in cyclone severity and frequency are still uncertain, coastal flooding both during and independent of cyclones will worsen as sea levels rise.



Many interventions will be required to address the risks identified in this brief and associated longer technical report. In general, decision-makers and planners in Myanmar should do the following:

- Change practices in specific sectors, e.g. crop choices, planting patterns, and water-use efficiency for agriculture.
- Strengthen infrastructure, including the use of ecosystem-based adaptation approaches such as mangrove forests to help protect communities from frequent floods.
- Protect forests and other ecosystems that provide services that help build climate resilience for people, such as safeguarding clean drinking water and preventing erosion.
- Assess conservation strategies to support adaptation for ecosystems and biodiversity (e.g. wildlife corridors to upland or inland areas).
- Develop disaster preparedness and response strategies to cope with increasing heat stresses, changes in the hydrological cycle, and extreme events.

INTRODUCTION

Myanmar is one of the countries most affected by extreme weather events (Kreft *et al.*, 2016). Recent events such as Cyclone Nargis in 2008, the extreme heat waves of 2010, and flooding in 2015 have had disastrous impacts on Myanmar's people, environment, and economy. Climate change threatens to compound the frequency and intensity of these events.

It is essential to understand and quantify the changes in climate that are already taking place in Myanmar and those likely to occur over the coming century. This report describes the country's climate and recent climate trends, and outlines how climate conditions are projected to change by the

2020S

(defined as the time period from 2011–2040) 2050S (defined as the time period from 2041–2070)

Projections include changes in temperature, precipitation, and sea levels. The report analyses extreme events, reviews key climate processes such as the monsoon, applies climate risk information to selected sectors, and describes how local vulnerability assessments and adaptation planning activities are utilising climate risk information. The report should be seen as a contribution to the broader work on climate change and to official projections being carried out by DMH and the Regional Integrated Multi-Hazard Early Warning System (RIMES), which are due to be released in the near future.

Local and regional decision-makers need to be aware of the changes that will directly affect the areas they govern. By understanding these climate risks, they can take action now to prevent the worst impacts of climate change from happening in communities in Myanmar and around the globe.



ONE OF THE BEST WAYS TO BUILD CLIMATE RESILIENCE IS TO HARNESS THE POWER OF ECOSYSTEMS AND THE NUMEROUS BENEFITS THEY PROVIDE TO PEOPLE; FROM FORESTS, THAT HELP PROVIDE CLEAN DRINKING WATER AND REDUCE FLOODING DOWNSTREAM, TO COASTAL MANGROVES THAT PROVIDE CRITICAL DEFENCES AGAINST COASTAL EROSION AND INCREASINGLY INTENSE CYCLONES.

DIRECTOR GENERAL, DEPARTMENT OF METEOROLOGY AND HYDROLOGY

Temperature and precipitation projections were developed using the NASA Earth Exchange Global Daily Downscaled Projections (NEX-GDDP) dataset released in 2015 (NASA, 2015). The NEX-GDDP dataset includes downscaled projections (0.25 degrees, ~25 km resolution) from the 21 climate models and scenarios for which daily scenarios were produced and distributed under the **Coupled Model Intercomparison Project** Phase 5 (NASA, 2015, CMIP5, 2016). The CMIP5 GCM simulations were developed in support of the Fifth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) (IPCC, 2013). Sea level rise projections were developed using model outputs from the CMIP5 GCMs, along with other data sources and methods that account for land-based ice loss and changes in land water storage (Horton et al., 2015).

CHAPTER 1: HOW CAN CLIMATE RISK INFORMATION SUPPORT PLANNING IN DIFFERENT SECTORS?

URBAN AREAS

Climate projections can help decision-makers consider future risks resulting from climate change. Measures must be taken to build resilience to the potential impacts that these changes may pose to ecosystems, livelihoods, infrastructure, and economic growth. Planning for a range of possible futures can foster a flexible approach to adaptation that keeps options open. Climate impacts will often affect several sectors in different ways, while responses and adaptation measures taken in one sector may also have implications for other sectors.

1.1 BIODIVERSITY AND ECOSYSTEM SERVICES

IMPACTS

Climate change will impact ecosystems and species in multiple ways, including direct effects of changing temperatures and rainfall patterns, and indirect effects as people respond to climate change. As Myanmar continues to rapidly develop, ecosystems and biodiversity will be particularly vulnerable to human responses to climate change, with people potentially further degrading ecosystems or impacting biodiversity as they build resilience to climate change.

- Range-restricted species, slow-moving species, low-dispersal species, and species already facing high threats are likely to be the most vulnerable to climate change.
- All types of services provided by ecosystems for people will be affected by climate change, especially in conjunction with other direct human impacts such as deforestation and land degradation. For instance, diverse and healthy forests can reduce flooding from heavy rainfall and coastal storms.

WHAT NEEDS TO BE DONE?

- Reduce existing human impacts on ecosystems that provide important benefits to local populations, such as upstream forests that reduce flood risk or coastal mangroves that support fisheries.
- Plan for indirect effects of climate change on ecosystems and biodiversity, i.e. impacts from human responses to climate change, such as migration, expanding agricultural areas, land use change, or infrastructure development.
- Update existing protected area management plans and species action plans to account for the changes described in this report.
- Monitor species and ecosystem responses to changing temperatures and rainfall, along with on-going re-evaluation of the effectiveness of climate-adapted conservation measures.
- Compile and apply local knowledge about weather impacts on ecosystems and species in planning adaptation actions.

Source: Mandle et al., 2016.

IMPACTS

Myanmar's extensive coastline will experience

WHAT NEEDS TO BE DONE?

• Take into account projected changes in

预览已结束, 完整报告链接和二维码如下:

https://www.yunbaogao.cn/report/index/report?reportId=5_18336

1.3 HEALTH

IMPACTS

Changing rainfall patterns, warming temperatures, changes in extreme heat, and other extreme weather events pose major challenges to the health sector. Heat waves and increasing frequency of very hot days, coupled with high humidity, can cause severe health complications and are a significant cause of weather-related deaths. The elderly and young are most at risk, while outdoor workers can also be severely affected by heat. More intense rainfall may result in more severe and frequent flooding, which poses an immediate threat to safety and can cause disease outbreaks.

WHAT NEEDS TO BE DONE?

- Consider implications of large increases in extreme heat in public-sector plans.
- Develop interventions to prevent heat exposure (e.g. increasing cooling, ventilation, or insulation of buildings, and creating cooling stations) and other adaptation measures to combat heat-related deaths.
- Develop regional flood warning systems, evacuation plans, and potential solutions for water supply and sanitation challenges during extreme flooding, to avoid spreading waterborne disease.