



Ready for the Dry Years

Building resilience to drought in South-East Asia

*With a focus on Cambodia, Lao People's Democratic Republic,
Myanmar and Viet Nam*



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Forewords



South-East Asia has many dry years ahead. This should come as no surprise. Many parts of the region have regularly been stricken by droughts that have destroyed crops, heightened fire risks, and led to acute shortages of drinking water. The hardest hit are the poor, especially farming communities that rely on regular rainfall for their annual crops and who have few resources to fall back on during periods of rain shortfall. They are already likely to live on the degraded land that is most vulnerable to the effects of drought.

Ready for the Dry Years offers a clear analysis of this subject, assessing prospects for the decades ahead and highlighting the principal risks. This Report points out that the future could be even worse. With climate change, many more areas are likely to experience extreme conditions with severe consequences. Droughts not only exacerbate poverty, inequality, and food insecurity, they also heighten the risk of conflict. As droughts degrade the natural environment, people find themselves competing for increasingly scarce land and water resources.

Building resilience will be fundamental for the continued development of ASEAN countries. In this context, the Report identifies the priorities for increasing resilience to drought and helping communities adapt. Most of the responsibility rests with national governments, and ASEAN member States already have many institutions and programmes that focus on drought. But there is also an important opportunity to provide a regional response among neighbouring countries.

Ready for the Dry Years, proposes three priority areas of intervention for ESCAP and ASEAN. The first is to strengthen drought risk assessment and early warning services, for example, by sharing data from space-based technologies. The second is to foster risk financing instruments that can insure communities against slow-onset droughts. The third is to enhance people's capacities to adapt to drought, thereby reducing the potential for conflict.

ESCAP and ASEAN are two organisations in the region that are well placed to support regional action on drought. For ESCAP, the guiding principles are embodied in the United Nations 2030 Agenda for Sustainable Development. For ASEAN, they are embodied in the ASEAN Community Vision 2025. More recently, the two organisations have worked together to align these complementary visions and have developed a joint Framework for Action.

More dry years are inevitable, but more suffering is not. Timely interventions now can reduce the impacts of drought, protect the poorest communities, and foster more harmonious societies. I hope that this report will serve as a valuable source of information on this important subject and help stimulate necessary debate and action.

A handwritten signature in black ink, consisting of stylized, flowing letters.

Armida Salsiah Alisjahbana

Executive Secretary

Under-Secretary-General of the United Nations and Executive Secretary of ESCAP



Humanitarian challenges due to natural disaster in South-East Asia has changed significantly in recent decades. In addition to rapid-onset natural disasters (such as earthquakes, tsunamis, cyclones and typhoons), the region is also facing the impacts of climate change and environmental degradation, which are considered as slow-onset disasters but cause considerable damages and disruption to human life.

As reported in the ASEAN Statistical Yearbook 2018, approximately 34 per cent of the South-East Asian population work in the agricultural, fisheries, and forestry sectors. These sectors are the region's largest source of employment based by industry and are vulnerable to the effects of drought, a major impact of climate change. Drought could bring about severe economic losses for ASEAN Member States through crop damage or failure, as agriculture contributes up to 25.9 per cent of GDP share in the region. Drought also threatens food security and limits access to water for consumption and domestic use which affects people's livelihood. There are also potential social impacts of drought, including human health problems due to limited and poor water quality, public safety threat by increasing forest and range fires, and changes in lifestyle through urbanization. In this light, understanding and monitoring drought becomes important through investment into research and development.

Consequently, tackling the impact of drought in South-East Asia has become the priority that ASEAN in 2016 agreed to conduct a thorough study on the drought situation in the member states to come up with solutions and preventive measures. This commitment expressed the solidarity and commitment among ASEAN Member States to facilitate the collective solution and actions to overcome the drought situation.

Slow-onset disasters, such as droughts, tend to receive less attention from policymakers and the media compared to the rapid-onset ones. Therefore, knowledge of what to do and how to react in these situations is fundamental, especially for ASEAN people living in disaster-prone areas. There is a need to establish a robust developmental approach by analyzing how resources are distributed within states, and how governments should be allocating more finance and personnel to risk reduction and capacity building for droughts.

I am pleased that ASEAN and ESCAP have jointly worked together in sharing experiences of drought management through identifying challenges and opportunities, particularly in the low capacity and high risk countries of Cambodia, Lao People's Democratic Republic, Myanmar and Viet Nam. It is essential for ASEAN to continue to advance local, national and regional systems by adopting a whole-of-society approach in addressing the issues of drought. The findings of the study shall foster an integrated and collaborative drought management plan for the governments and also increase awareness of ASEAN peoples that the severity of droughts will increase in the future and will require more robust mitigation and adaptation plans.

The priority areas of intervention highlighted in this report will contribute to the development of policy responses to mitigate the impact of future drought and eventually will strengthen efforts on building the ASEAN Community that is resilient to drought. These priorities are in line with the ASEAN Vision on Disaster Management 2025, and ongoing efforts to promote complementarities between the ASEAN Vision 2025 and the United Nations 2030 Agenda for Sustainable Development.

Dato Lim Jock Hoi

Secretary-General

Association of Southeast Asian Nations (ASEAN)

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Contents

Forewords	3
Acknowledgments	5
Executive Summary	12
CHAPTER 1. Slow but devastating – droughts in South-East Asia	14
Three decades of droughts	16
Box 1-1 – Drought hotspot: Myanmar	18
Box 1-2 – Drought hotspot: Viet Nam	20
Crises caused by 2015/2016 El Niño	23
Box 1-3 – The El Niño signature	24
An extensive risk	25
Impact on poverty	26
Heightening inequality	28
Box 1-4 – The dissimilarity index	29
Links between drought and conflict	30
Correlations between conflict risk and drought	31
Forecast changes in drought intensity and geography	32
Scenario 1 – Less severe El Niño	33
Scenario 2 – More severe El Niño	34
Nexus between drought, poverty, inequality, hunger, land degradation and conflict	36
Facing up to a widespread threat	37
CHAPTER 2. Frameworks for resilience	38
Cambodia	40
Disaster management governance	41
Lao People's Democratic Republic	41
Disaster management governance	42
Myanmar	42
Disaster management governance	43

Viet Nam	44
Disaster management governance	45
ESCAP and ASEAN frameworks for building resilience to drought	46
Box 2-1 – ASEAN Declaration on Culture of Prevention for a Peaceful, Inclusive, Resilient, Healthy and Harmonious Society	47
CHAPTER 3. Priorities for action	50
1. Strengthen drought risk assessment and early warning services	53
2. Foster drought risk financing markets	54
3. Reduce conflict by enhancing the adaptive capacity to drought	55
Ready for the Dry Years	56
Box 3-1 – ASEAN Dynamic Risk Assessment Guidelines and Experiences	57
Box 3-2 – Parametric risk insurance for drought and related disasters	57
Appendix A	59
Association between drought index and GDP	59
References	62

List of Figures

Figure 1-1	Number of droughts and people affected by country, 1988-2017	17
Figure 1-2	Rainfall pattern of Mandalay in the dry zone of Myanmar, 1981-2016	18
Figure 1-3	Rainfall and normalized difference vegetation index, Mandalay region, 2015	19
Figure 1-4	Vegetation stress in Myanmar from 2013-2016 for the month of June	20
Figure 1-5	Rainfall pattern of Ninh Thuan Province of Viet Nam, 1981-2016	21
Figure 1-6	NDVI-Rainfall Scatterplot of Ninh Thuan province of Viet Nam for 2015	21
Figure 1-7	Monthly rainfall pattern of Ninh Thuan Province of Viet Nam from 2013-2016	22
Figure 1-8	Vegetation stress conditions of Ninh Thuan Province of Viet Nam from 2013-2016 during the month of June	22
Figure 1-9	El Niño-triggered drought in South-East Asia (2015-2017)	24
Figure 1-10	Spatial patterns of El Niño events, 1982, 1997 and 2015	25
Figure 1-11	ASEAN countries: Percentage of damage from extensive and intensive disasters, 2000-2013	26
Figure 1-12	Cambodia: poverty rates and the damage from extensive disasters	26
Figure 1-13	Vegetative stress in non- El Niño years, 2013 and 2018	27
Figure 1-14	Mechanism of transmission of drought impacts on inequality	28
Figure 1-15	Inequality of outcomes and opportunities, and their relation to drought vulnerability	29
Figure 1-16	Exposure to projected conflict and natural disasters	30
Figure 1-17	Regional snapshots of conflict incidents and historical drought events	31
Figure 1-18	Localized conflict incidents and land degradation in South-East Asia	32
Figure 1-19	The seven domains for local drought severity change analysis	33
Figure 1-20	Projected drought conditions – less extreme El Niño, near future	33
Figure 1-21	Projected drought conditions – less extreme El Niño, far future	34
Figure 1-22	Projected drought conditions – more extreme El Niño, near future	35
Figure 1-23	Projected drought conditions – more extreme El Niño, far future	35
Figure 1-24	Standard scenario of drought impacts	36
Figure 1-25	Cascading impacts of drought	37
Figure 3-1	Building resilience to drought for the Sustainable Development Goals	52
Figure 3-2	Climate adaptation and disaster risk reduction are entry points that help reduce conflicts	55
Figure 3-3	Complementarities between the ASEAN vision and the 2030 Agenda	56

List of Tables

Table 3-1	Implementation of recommendations	58
Table A-1	Basis statistics for predicted, predictor, and control variables used in the estimation (N=49)	59
Table A-2	Regression estimates of drought, GDP, inequality, and per capita health expenditure	60

Acronyms and abbreviations

AADMER	ASEAN Agreement on Disaster Management and Emergency Response
ADAGE	ASEAN Dynamic Risk Assessment Guidelines and Experiences
ADPC	Asian Disaster Preparedness Center
ADRFI	ASEAN Disaster Risk Financing and Insurance
AHA Centre	ASEAN Coordinating Centre for Humanitarian Assistance on disaster management
AMS	ASEAN Member States
ARTSA	ASEAN Research and Training Center for Space Technology and Applications
ASCC	ASEAN Socio-Cultural Community
ASCN	ASEAN Smart Cities Network
ASEAN	Association of Southeast Asian Nations
ASMC	ASEAN Specialised Meteorological Centre
CCAPARD	Climate Change Action Plan for Agriculture and Rural Development
CCPC	Climate Change Partnership Conference
CLMV	Cambodia, Lao People's Democratic Republic, Myanmar, and Vietnam
CRED	Centre for Research on the Epidemiology of Disasters
DMH	Department of Meteorology and Hydrology (Myanmar)
DRR	Disaster Risk Reduction
EM-DAT	Emergency Events Database
ESCAP	Economic and Social Commission for Asia and the Pacific
FAO	Food and Agriculture Organization of the United Nations
GDP	gross domestic product
GISTDA	Geo-Informatics and Space Technology Development Agency (Thailand)
INDCs	Intended Nationally Determined Contributions
INFORM	Index for Risk Management
JSPADM	ASEAN-United Nations Joint Strategic Plan of Action on Disaster Management
MAPDRR	Myanmar Action Plan on Disaster Risk Reduction
MDPA	Myanmar Disaster Preparedness Agency
MICS	Multiple Indicator Cluster Surveys
NAPA	National Adaptation Programmes of Action
NAPCC	National Adaptation Program on Climate Change (Vietnam)

NCCS	National Climate Change Strategy (Vietnam)
NCCSAP	National Climate Change Strategy and Action Plan (Myanmar)
NCDM	National Committee for Disaster Management (Cambodia)
NDMC	National Disaster Management Committee (Myanmar)
NDMO	National Disaster Management Office
NDVI	Normalized Difference Vegetation Index
NGO	non-governmental organization
NHMSs	National Hydrometeorological Services
PDSI	Palmer Drought Severity Index
RESAP	Regional Space Applications Programme for Sustainable Development (ESCAP)
RIMES	Regional Integrated Multi-Hazard Early Warning System for Africa and Asia
RVA	Risk and Vulnerability Assessment
SDGs	Sustainable Development Goals
TNA	Technology Needs Assessment
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNOSAT	United Nations Operational Satellite Applications Programme
WMO	World Meteorological Organization



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Executive Summary

South-East Asia is regularly hit by droughts. Though starting slowly, droughts can have devastating cumulative impacts – striking hardest at the poor and heightening inequality, as well as degrading land and increasing the prospects of violent conflict. There will be many more dry years ahead, and the area affected by drought is likely to shift and expand. Increasing resilience to drought will require much better forecasting, and more efficient forms of response, at both national and regional levels.

Over the past 30 years, droughts have affected over 66 million people in South-East Asia. The most severe events have been during the El Niño years. Most of the economic impact of drought – around four-fifths – is absorbed by agriculture. However, the impact extends beyond agriculture. Through both demand and production, agriculture is linked with industry and services.

Compared with earthquakes and cyclones, which are sudden ‘intensive’ risks, droughts are considered ‘extensive’ risks with slower-onset, repeated or persistent conditions of low or moderate intensity. They are often highly localized and operate over longer timescales – with large, cumulative impacts on widely dispersed populations. Due to their slow onset and persistence, however, droughts, are often under-reported and receive relatively little attention from policy-makers.

Droughts undermine all aspects of food security by reducing food supplies, and cutting the incomes of poor communities. Water and land scarcities, coupled with a succession of disasters, erode traditional coping mechanisms, particularly for the poorest people who live on the most degraded land. By decreasing the incomes of the most vulnerable populations, droughts can then heighten income inequality. Some people will try to escape through migration, often to urban coastal areas in search of new opportunities.

In addition, droughts can create fertile ground for conflict. Natural disasters, and particularly drought, can lead to environmental degradation, which can provoke conflict over access to resources and land. In previous years, more than 80 per cent of localized conflict incidents in the Asia-Pacific region, have occurred in areas that were, at some stage, affected by drought.

In the future, drought severity in South-East Asia is likely to see a geographical shift. Historically, droughts have been concentrated over the north and south of Viet Nam, the southern part of Sulawesi and Borneo, and the central part of Java, Sulawesi and Papua. In the near future, even with less severe El Niños, the drought area will have extended to Cambodia and the southern part of Thailand, with similar conditions in the southern part of Sumatera and Borneo. For more severe El Niño conditions, in both the near and far futures, the northern part of Viet Nam and Lao People’s Democratic Republic will face extreme drought.

Building drought resilience

Building resilience to drought will rely primarily on national action. But national efforts also need to be set within frameworks of regional cooperation. These include the ASEAN Declaration on Culture of Prevention, ASEAN Vision 2025 on Disaster Management, ASEAN-UN Joint Strategic Plan on Disaster Management, ASEAN Agreement on Disaster Management and Emergency Response and ASEAN Disaster Risk Financing and Insurance. Drought resilience is also an integral part of the Agenda for Sustainable Development. Activities to build resilience contribute to the achievement of several Sustainable Development Goals (SDGs).

Based on the findings of this study and the existing frameworks, the following interventions are proposed for implementation by ESCAP and ASEAN:

1. Strengthen drought risk assessment and early warning services

Each country should have drought monitoring and early warning services. These can alert key sectors such as agriculture and trigger early support, while also gearing up social protection to cushion the impact on low-income groups. Risks can also be reduced by more accurate weekly and monthly forecasts that will allow early response and mid-course corrections. Longer-range forecasting can be complemented with near-real-time, in-season monitoring that can offer additional warnings several days ahead. Such monitoring can be provided by scaling up ESCAP's Regional Drought Mechanism which provides drought-prone countries with tools, services, capacity building and information that can be used to build tailored drought-management programmes.

ESCAP could also enhance its collaboration with the ASEAN Research and Training Center for Space Technology and Applications under its long-standing Regional Space Applications Programme for Sustainable Development in Asia and the Pacific. Through this programme and with other partners, ESCAP is constantly working to build capabilities and services for countries that request support.

2. Foster drought risk financing markets

There are also significant opportunities for using risk financing tools to support rural resilience against droughts. But, this will require a paradigm shift from post-disaster financing to a model where the financing is planned in advance and can be executed quickly and efficiently in order to save lives and protect livelihoods.

The old model for social protection against slow-onset disasters is also evolving. Rather than relying on post-event needs assessments, the idea now is to register recipients in advance and instead of providing food aid, making cash transfers that channel funds efficiently to those most in need. A relatively new development is forecast-based financing. In this case, some funds are disbursed on the basis of a forecast, that is, prior to the occurrence of an emergency or crisis.

3. Reduce conflict by enhancing the adaptive capacity to drought

Conflict risks will increasingly arise in complex and drought-affected areas. It will be important therefore to prepare for evolving conflict scenarios to prevent and mitigate the long-term adverse impacts on community resilience and stability. Competing interests can be channelled into non-violent resolutions through better management of natural resources, combined with climate adaptation.

Ready for the dry years

ASEAN countries will need to be increasingly prepared for the dry years ahead, and be ready to take the necessary action. In particular, they should protect the region's poorest people, who are already likely to live on the degraded land that is most vulnerable to the effects of drought. ESCAP is prepared to work with all partners to develop a roadmap. This will help promote synergies and ensure a continued, strong momentum in collaborative efforts with ASEAN countries.

While the dry years are inevitable, their consequences are not. Many timely steps taken now can mitigate the impacts of drought, protect the poorest communities, and foster more peaceful societies.



CHAPTER 1.

**Slow but devastating –
droughts in South-East Asia**



South-East Asia has been affected by a series of droughts, often triggered by El Niño events. Though starting slowly, droughts can have devastating cumulative impacts – hitting hardest at the poor and heightening inequality, as well as degrading land and increasing the prospects of violent conflict. There are many more dry years ahead, and the area affected is likely to shift and expand, with more parts of the region exposed to extreme drought conditions.

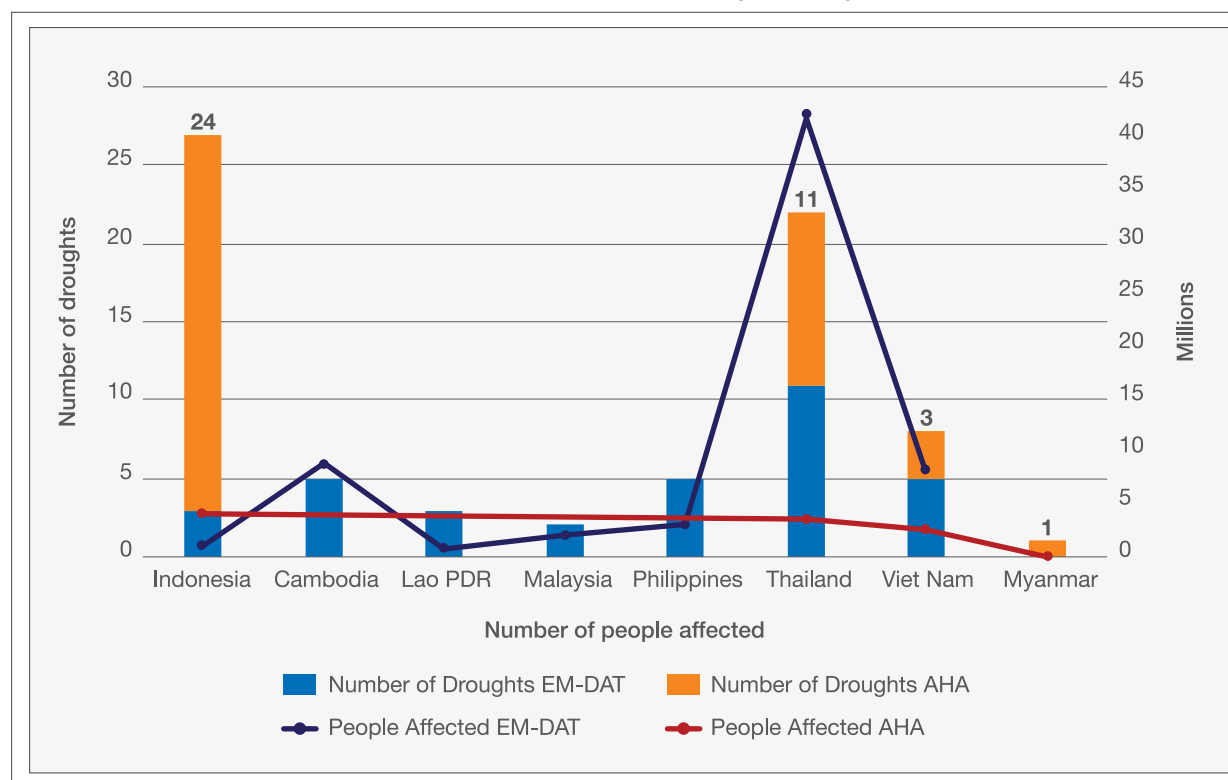
In South-East Asia, droughts have triggered major economic and social disruption, humanitarian disasters and food insecurity. Droughts are slow-onset events that, compared with the expected climate, result in prolonged, deficient precipitation. The scale of the impact depends on their extent, intensity and duration. The outcome also varies according to local conditions, land use patterns, and water usage.

Much will depend on a country's resilience to drought, which will be affected by its level of economic development and technological capacity as well as by socioeconomic factors, such as institutions and policies, social behaviour and culture.¹ ASEAN countries will therefore need to recognize and plan for future changes in weather patterns.

Three decades of droughts

Over the past 30 years, droughts have affected over 66 million people in South-East Asia. This is 17 per cent of the total number of people in the region that are affected by natural hazards – after storms (44 per cent) and floods (34 per cent).² However, this may be conservative since many drought events go unreported. As indicated in Figure 1-1, data from EM-DAT show that Thailand has been most affected by drought, followed by Cambodia, Philippines and Viet Nam. Monitoring reports from the AHA Centre show that during the third quarter of 2018 alone, more than 4.8 million people in the southern part of the ASEAN region were affected by drought.³

Figure 1-1 – Number of droughts and people affected by country, 1988-2017



Sources: EM-DAT: International Disaster Database - Universite catholique de Louvain (UCL) - CRED, D. Guha-Sapir-
www.emdat.be, Brussels, Belgium
AHA Centre Weekly Disaster Updates - <https://ahacentre.org/asean-weekly-disaster-update/>

Note: Data on Myanmar was not available from EM-DAT database. The stacked charts are not cumulative but show the number of incidents recorded by the AHA Centre vis-à-vis EM-DAT's. In the AHA dataset, several drought events are reported as separate incidents despite being only a few months apart and lying within the same location. In this figure, these have been treated as separate drought events and the 'number of people affected' have been added to calculate totals for each country. It is difficult to have precise data on drought frequency and impacts due to the absence of a standard definition and the difficulty of determining its onset and ending.

Droughts will have their greatest impacts on countries that depend heavily on agriculture. For ASEAN as a whole, agriculture generates around 11 per cent of value-added to GDP, and more than 25 per cent in countries such as Cambodia and Myanmar.⁴

The impact of drought is measured using regression analysis with data from the INFORM risk index, which takes into account the number of people affected, the frequency of drought, and the extent of exposed cropland. The analyses show that while drought by itself has no significant relationship on the GDP of the Asia-Pacific region as a whole, for ASEAN countries however, drought and GDP have a significant negative association where increase in the drought index has the potential to reduce the GDP of ASEAN countries. Thus, for the 10 ASEAN countries, a 1 per cent point increase in the drought index can lead to a 0.62 per cent point decrease in sub-regional GDP. Details of the analyses are available in Appendix A.

Most of the economic impact of drought, around four-fifths, is absorbed by agriculture. In Thailand, for example, agriculture accounts for 11 per cent of GDP. Following the 2015–2016 El Niño-induced drought, the total rice production fell to 27 million tonnes, the lowest since 2000–2001.⁵

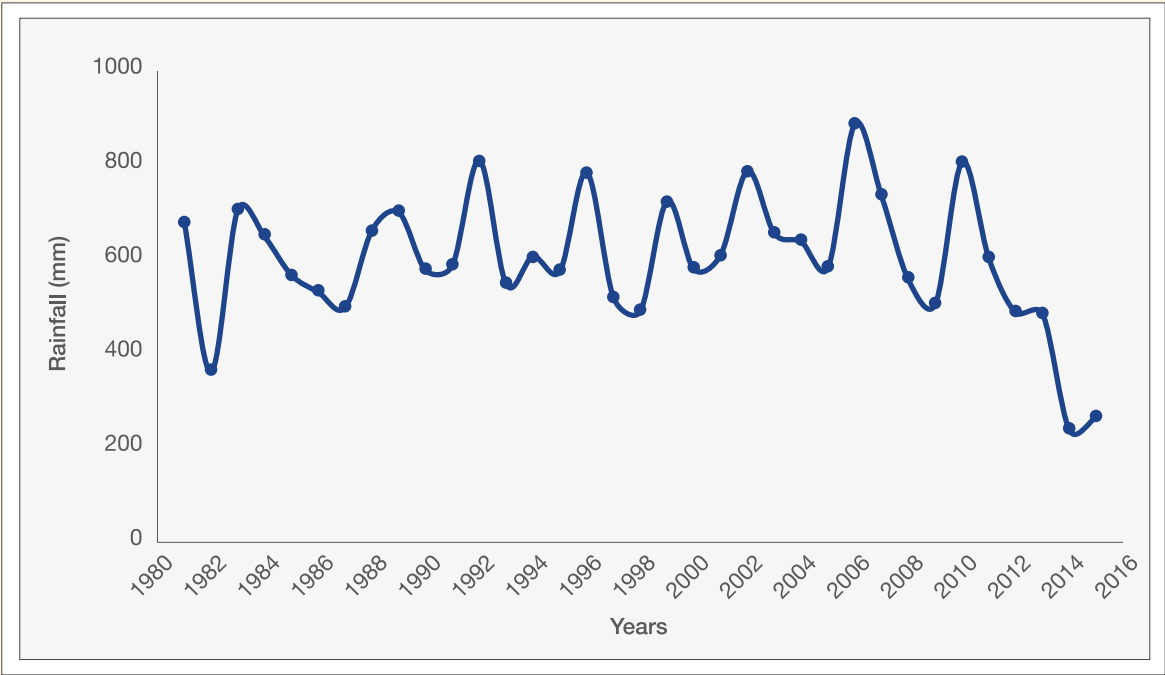
Droughts can be particularly damaging if people rely on agriculture for primary employment. In Viet Nam, for example, in 2016, drought in the Central Highland area caused a loss of 60 per cent of crop production for every farmer.⁶ While the impacts of drought on agriculture sector employment as a whole is yet to be quantified among ASEAN countries, agriculture employs 61 per cent of labor in Lao People's Democratic Republic, 41 per cent in Viet Nam, 31 per cent in Indonesia, 27 per cent in Cambodia, and 26 per cent in the Philippines.⁷

However, the impact of droughts extends beyond agriculture. Through both demand and production, agriculture is linked with industry and services.⁸ Reduced agricultural output therefore also slows overall economic growth, leading to a deterioration of a country's balance of payments and increased borrowing. This has been evident in many countries outside ASEAN. In India, for example, it has been estimated that a 1 per cent fall in agricultural output will decrease industrial output by 0.52 percentage points, and service sector output by 0.24 percentage points.^{9,10} Similarly, in Pakistan, where agriculture contributes about one quarter of GDP, floods in 2010 cut agricultural growth from 3.5 to 0.2 per cent, while GDP growth declined from 2.8 to 1.6 per cent. In the Marshall Islands, the 2015–2016 drought resulted in a 12 per cent drop in agricultural production, including subsistence and commercial sales, amounting to \$1.8 million. This also triggered decreases in output and higher production costs for other social and economic activities.

Box 1-1 – Drought hotspot: Myanmar

The dry zone in Myanmar has been under prolonged stress conditions for years. Government agencies, such as the Department of Meteorology and Hydrology and Ministry of Agriculture, monitor time-to-time conditions on the ground.¹¹ Satellite-derived data have shown that the Mandalay region in the dry zone experienced severe stress conditions during the El Niño period of 2014/2015 resulting in prolonged dry spells (Figure 1-2). 2014 and 2015 were the driest years on record.

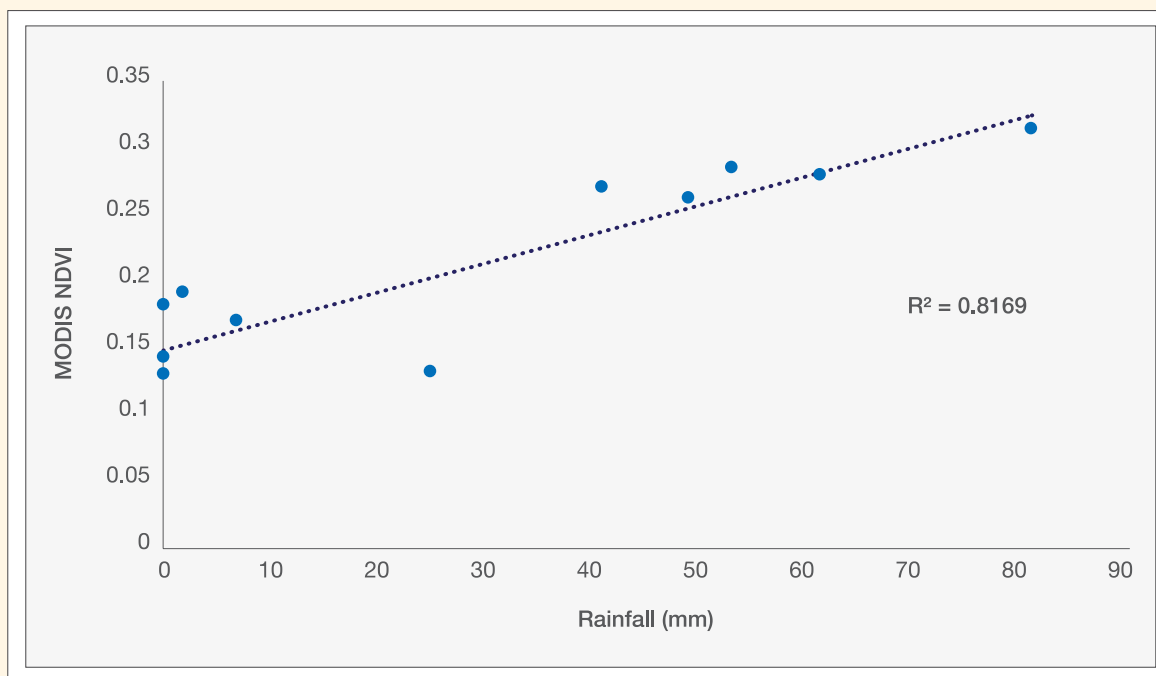
Figure 1-2 – Rainfall pattern of Mandalay in the dry zone of Myanmar, 1981-2016



Note: Figures 1-2 to 1-7 are all sourced from Dutta, 2018.

The dry spells reduced Myanmar's agricultural yield resulting in food insecurity during 2014 and 2015. Extremely high temperatures and water shortages led to lower yields compared with the previous years, and the effects continued even after the El Niño ended. The effect of rainfall on vegetation is measured from satellites using the normalized difference vegetation index (NDVI). This index quantifies vegetation by measuring the difference between near-infrared (which vegetation strongly reflects) and red light (which vegetation absorbs). Figure 1-3 uses satellite data to show the extent to which vegetative cover varies according to monthly rainfall.

Figure 1-3 — Rainfall and normalized difference vegetation index, Mandalay region, 2015

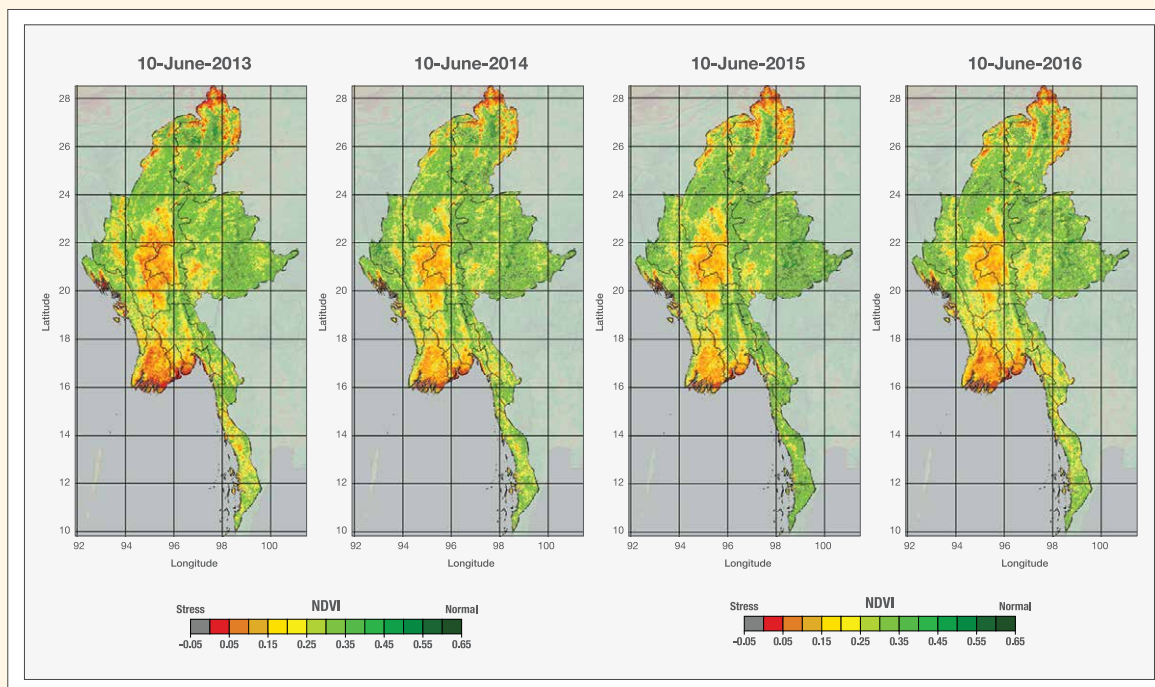


Note: MODIS refers to Moderate-Resolution Imaging Spectroradiometer satellite data. The Normalized Vegetation Index (NDVI) is a MODIS product which quantifies the health of crops. If crop is stressed by drought and/or lack of nutrients, NDVI shows lower values. The MODIS uses the NDVI profiles based on its time-series baseline data of stressed and unstressed years to assess drought situations. R^2 represents the linear relationship between NDVI and rainfall data from Climate Hazards Group InfraRed Precipitation with Station data (CHIRPS).

Figure 1-4 shows vegetative cover between 2013 and 2016. The red areas indicate vegetative stress.

Continued...

Figure 1-4 – Vegetation stress in Myanmar from 2013-2016 for the month of June



Data source: National Oceanic and Atmospheric Administration Advanced Very High Resolution Radiometer (NOAA AVHR). Available at: <https://noaasis.noaa.gov/NOAASIS/ml/avhrr.html>

Box 1-2 – Drought hotspot: Viet Nam

One of the provinces most affected in Viet Nam has been Ninh Thuan, which is one of the three provinces where a drought emergency was declared in June 2015.¹² The province suffered from an acute shortage of water and increased salinity intrusion and was placed under disaster level three. The situation was further exacerbated by lower-than-average rainfall and very high temperatures throughout 2015.¹³

Normal annual rainfall ranges between 1000 – 2500 mm. In 2015, however, it was only 876 mm (Figure 1-5). Figure 1-6 shows the influence of rainfall vegetation stress. Satellite data also indicates a consistent increase in stress conditions between 2013 and 2016 in the South and Central highlands of Viet Nam (Figure 1-7).

Continued...

Figure 1-5 — Rainfall pattern of Ninh Thuan Province of Viet Nam, 1981-2017

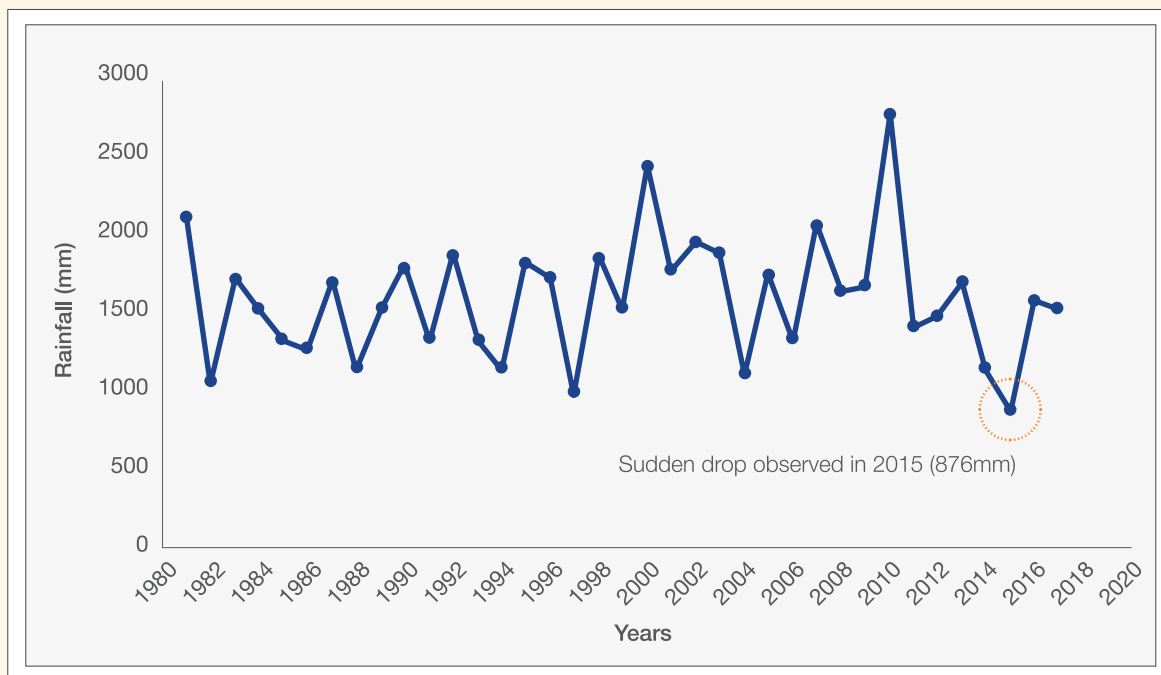
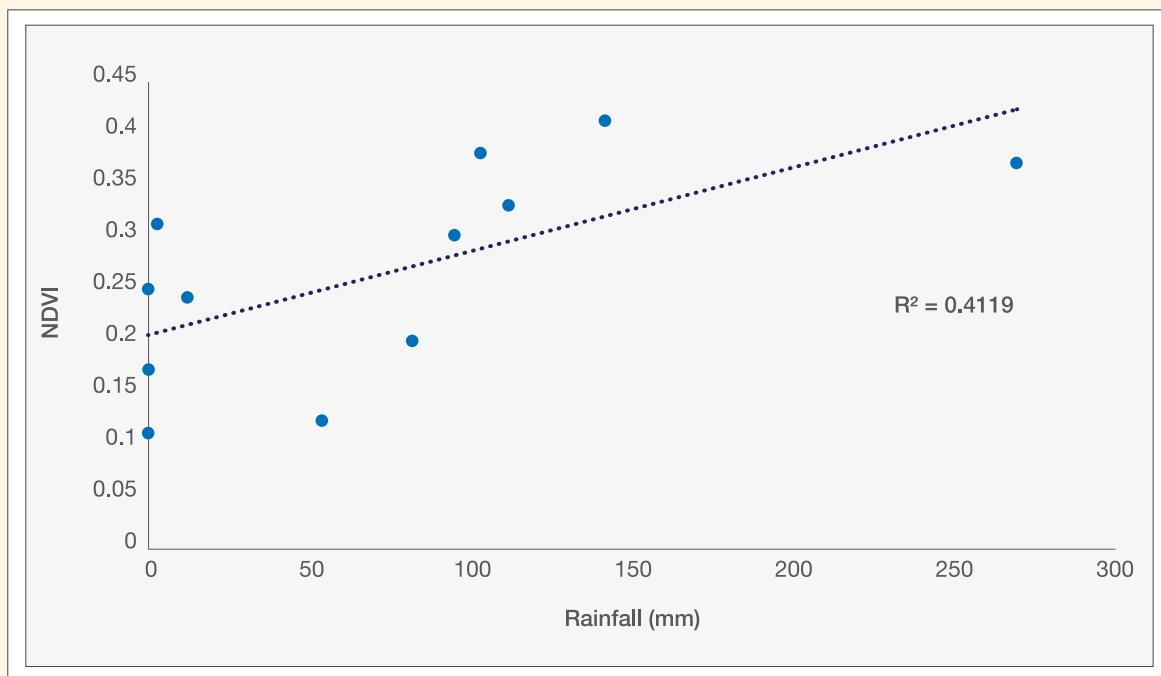


Figure 1-6 — Normalized Difference Vegetation Index (NDVI) and Rainfall Scatterplot of Ninh Thuan province of Viet Nam for 2015



Note: MODIS refers to Moderate-Resolution Imaging Spectroradiometer satellite data. The Normalized Vegetation Index (NDVI) is a MODIS product which quantifies the health of crops. If crop is stressed by drought and/or lack of nutrients, NDVI shows lower values. The MODIS uses the NDVI profiles based on its time-series baseline data of stressed and unstressed years to assess drought situations. R^2 represents the linear relation between NDVI and rainfall data from Climate Hazards Group InfraRed Precipitation with Station data (CHIRPS).

Continued...

Figure 1-7 – Monthly rainfall pattern of Ninh Thuan Province of Viet Nam from 2013-2016

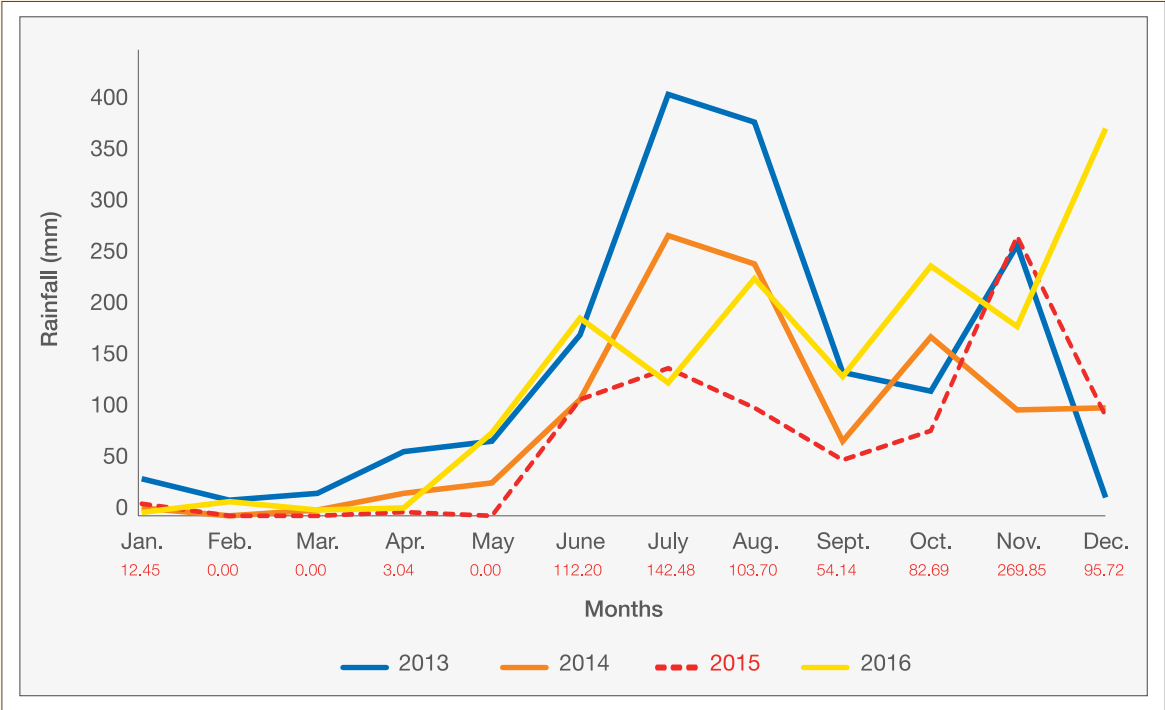
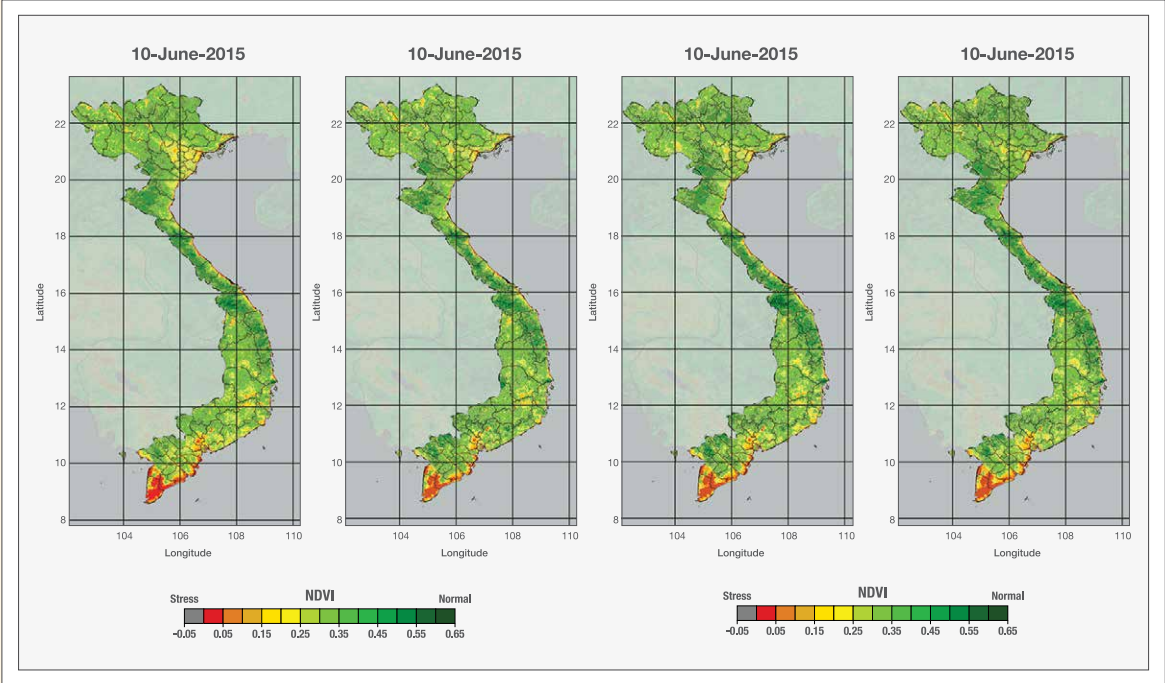


Figure 1.8 – Vegetation stress conditions of Ninh Thuan Province of Viet Nam from 2013-2016 during the month of June



Data source: National Oceanic and Atmospheric Administration Advanced Very High Resolution Radiometer (NOAA AVHRR). Available at: <https://noaasis.noaa.gov/NOAASIS/ml/avhrr.html>

Crises caused by 2015/2016 El Niño

Assessing the impact of droughts on vulnerable groups is complex because these events are typically not well documented. It is difficult to determine when a drought starts, and its effects are often not noticed until far too late into crop cycles or during harvest.¹⁴ Some impression of the scale of the damage can be gained, however, from the flash appeals that were made in response to the drought crises resulting from the El Niño of 2015/2016. These included:

Cambodia – An estimated 2.5 million people were affected by drought, water shortages, land degradation, loss of livestock and reduced agricultural productivity. In 2015, the drought affected almost 250,000 hectares of cropland, and destroyed over 40,000 hectares of rice.

Indonesia – A drought was reported in 16 of 34 provinces, while a total of 43 districts in eight provinces faced extreme drought. One of the worst-affected provinces was Nusa Tenggara Timur (NTT). Here the impacts of the drought were exacerbated by high levels of poverty and malnutrition. In NTT, besides the 500,000 people that needed immediate food assistance, an additional 700,000 were considered at risk of food insecurity.¹⁵ Additionally, three million Indonesians lived below the poverty line in severely drought-impacted districts, of whom 1.2 million relied on rainfall for food production. The late onset of rains and subsequent delays in planting had two critical cascading effects: the extension of the lean season, and the increased exposure of the second rice planting to the peak dry season which increased the probability of crop damage and failure.¹⁶ Between week 28 and 36 of 2018 alone, more than 4.8 million people were affected by drought.

Malaysia – The drought contributed to the destruction of several hundred hectares of crops as a result of fires in Sabah. It affected ten villages and caused both water pollution and water scarcity.¹⁷

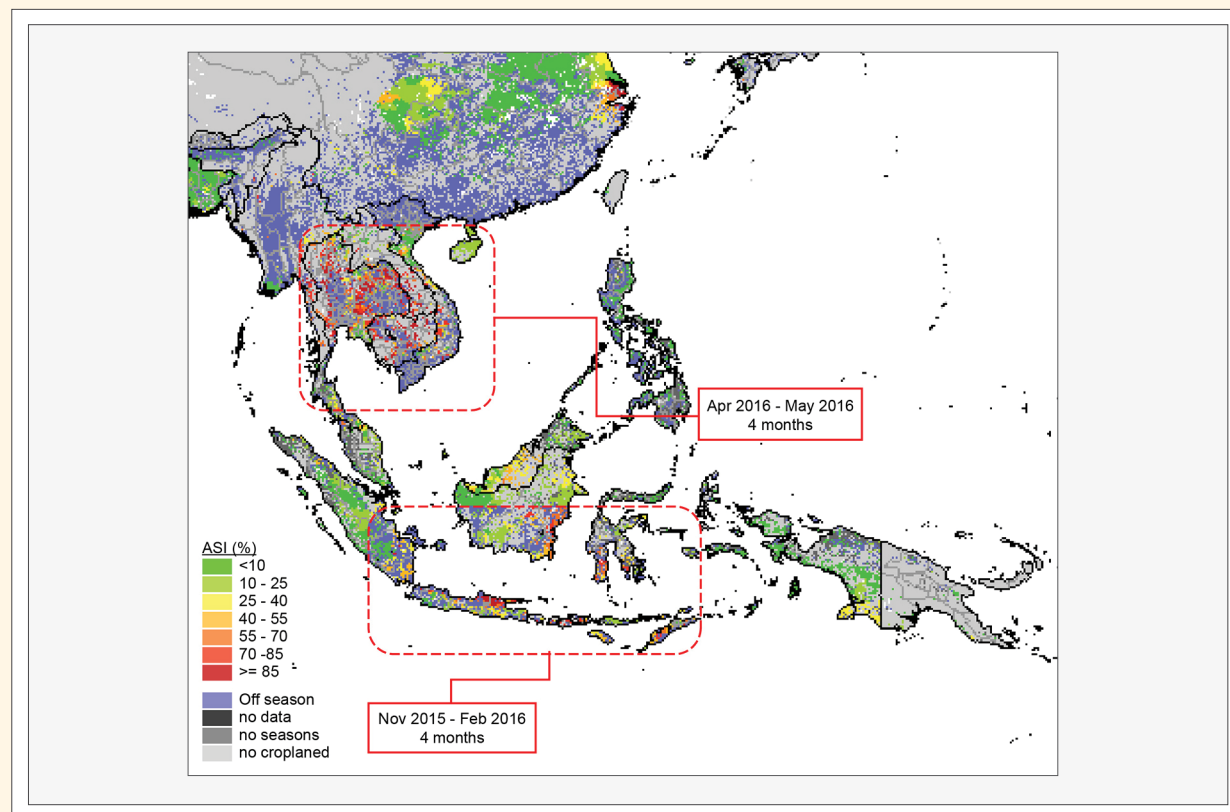
Myanmar – An estimated 300 villages suffered from water shortages,¹⁸ and the country experienced extreme temperatures, unusual rainfall patterns, dry soil, high risk of fires and acute water shortages.¹⁹

Philippines – In 2016, the province of Davao del Norte in Mindanao declared a state of calamity due to the El Niño-induced drought. An estimated 229,000 people were affected. Agricultural damage in the province was estimated at \$19.2 million. A total of 17 provinces across the Philippines were under a state of calamity.²⁰ For the first seven months of 2016, El Niño contributed to about \$258 million in crop losses, impacting the production of rice, vegetables and high-value crops and affecting around 285,000 farmers.²¹

Viet Nam – The El Niño resulted in the worst drought the country had seen in 90 years, affecting 52 out of 63 provinces. In addition, in some coastal areas saltwater intrusion extended up to 90 kilometres inland, leaving river water to be too salty for human or animal consumption, or to irrigate crops or continue fish-farming.²² During the peak of the drought (February/May 2016), an estimated 2 million people did not have access to water for consumption or domestic use, 1.1 million were food insecure and more than 2 million faced damaged or lost livelihoods. There was also a significant increase in the risks of water-related diseases and severe acute malnutrition. For 18 drought-affected provinces the total recovery needs from October 2016 to 2020, were costed at an equivalent to \$1.2 billion.²³

The effect of the drought, in South-East Asia, on vegetation and land surface temperature was also captured in satellite data. This is illustrated in Figure 1-9 which shows the impact from the onset of El Niño in 2015 until its neutral phase in early 2017. The impact is measured using the FAO's agriculture stress index.

Figure 1-9 — El Niño-triggered drought in South-East Asia (2015-2017)



Note: Agricultural Stress Index (ASI) is the percentage of crop land area affected by drought per Global Administrative Unit Layers 2 region.

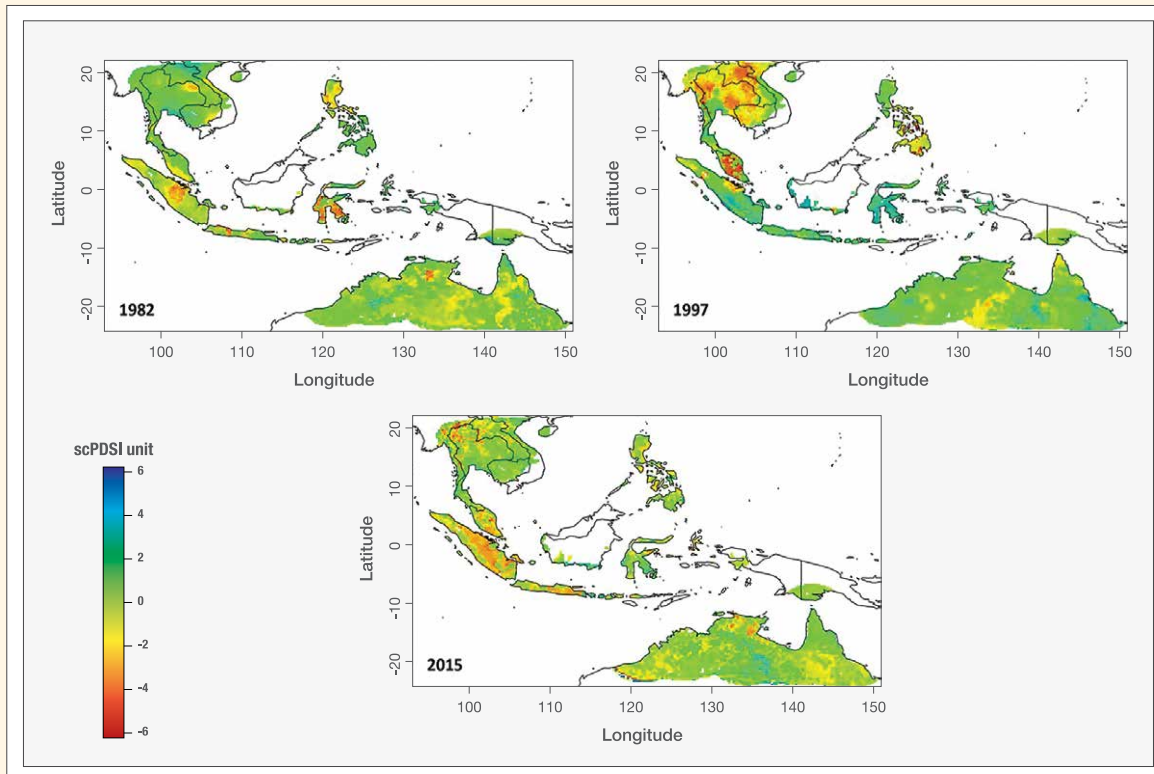
Box 1-3 – The El Niño signature

The strongest El Niño events on record were in 1982/83, 1997/98 and 2015/16. All three resulted in widespread drought in South-East Asia. But the spatial patterns of the three events differed. During the 1997 El Niño, drought was concentrated in the northern part of South-East Asia (Thailand, Cambodia, Lao People's Democratic Republic, Malaysia and the Philippines). In 1982 and 2015, on the other hand, the spatial pattern of droughts spread more towards Indonesia.

This is illustrated in Figure 1-10 below, which uses temperature data and the Palmer Drought Severity Index. The 2015 El Niño was weaker than those in 1982 and 1997, but it was one of the warmest, as shown by the temperature anomaly derived from the Climatic Research Unit (University of East Anglia) data with more than 40 per cent of the region experiencing warmer temperatures of more than 0.5°C than in an average year. The precipitation anomaly in September and November of 2015 was less than in 1997 but, was higher than in 1982, and was more severe and affected more areas.

Continued...

Figure 1-10 – Spatial patterns of El Niño events, 1982, 1997 and 2015



Source: Hariadi, July 2017.

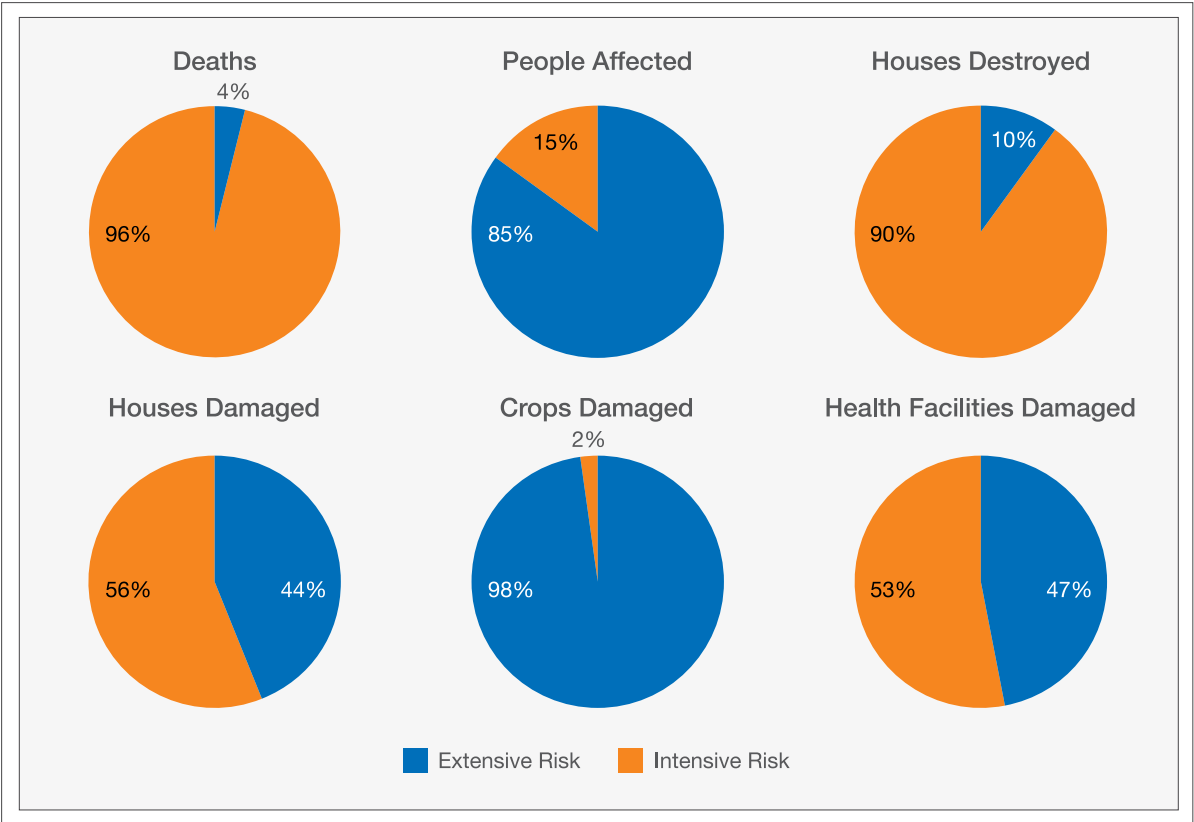
Note: The Self-calibrated Palmer Drought Severity Index (scPDSI) measures rainfall and temperature.

An extensive risk

Earthquakes and cyclones are ‘intensive’ risks which have sudden dramatic impacts. Droughts, on the other hand, are considered ‘extensive’ risks having a slower-onset and repeated or persistent conditions of low or moderate intensity. They are often highly localized and operate over longer timescales, with large, cumulative impacts on widely dispersed populations.²⁴

Extensive disasters are often not captured in disaster risk estimates or global risk modelling, but in fact, compared with intensive disasters, they affect a larger proportion of people and facilities.²⁵ Cumulative data from four countries in ASEAN show that while intensive disasters caused higher mortality rates and housing damage, extensive disasters made up a higher proportion of the damage in productive and social sectors (Figure 1-11).²⁶

Figure 1-11 – ASEAN countries: Percentage of damage from extensive and intensive disasters, 2000-2013

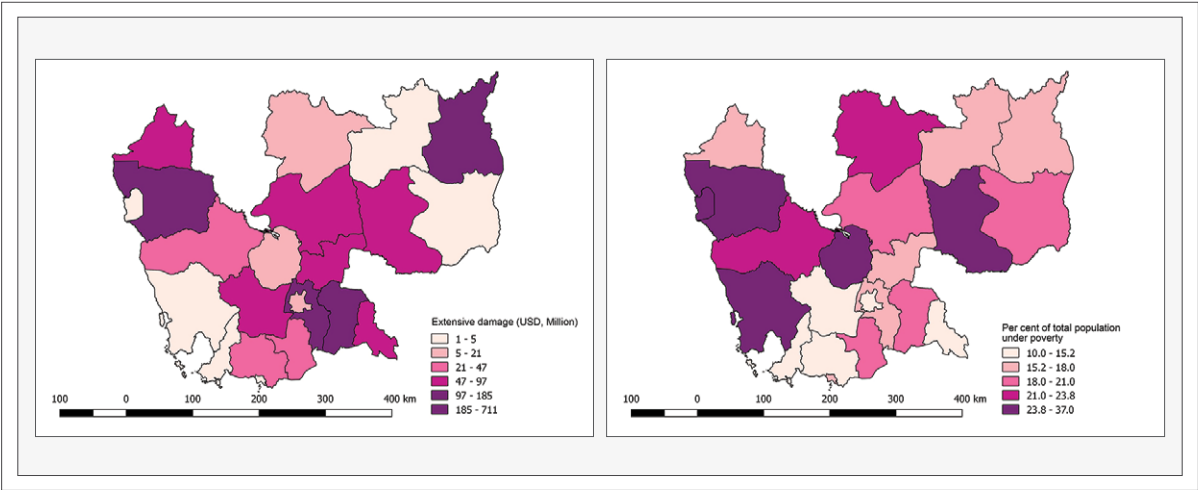


Note: Data are from Cambodia, Indonesia, Lao People’s Democratic Republic and Viet Nam.

Impact on poverty

Droughts can often hit hardest in the poorest parts of ASEAN countries. In Cambodia, for example, slow-onset extensive disasters also tend to take place in the poorest regions, notably in the provinces of Kratie, Battambang, Koh Kong, and Kampong Cham (Figure 1-12).²⁷ However, in Cambodia as elsewhere, data availability is sparse, with extremely poor household panel data as well as a lack of pre-disaster and post-disaster poverty data.

Figure 1-12 – Cambodia: poverty rates and the damage from extensive disasters



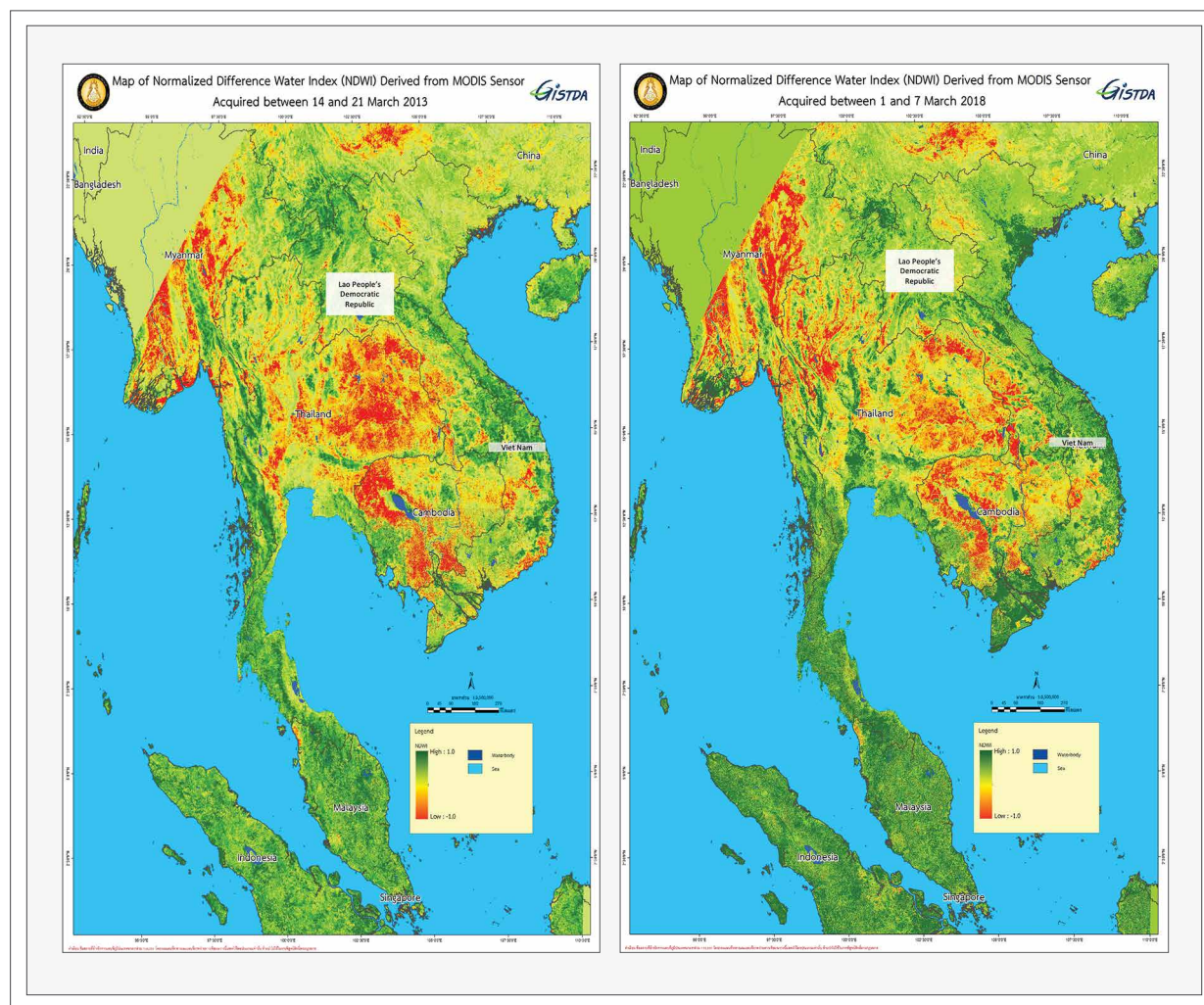
Data source: Desinventar

The impact of these disasters on livelihoods, especially of the poor, is still not well understood. But, it is clear that droughts undermine many aspects of food security, by reducing food supplies, and cutting the incomes of poor communities. Water and land scarcities, coupled with a succession of disasters, erode traditional coping mechanisms, particularly for the poorest people who live on the most degraded land.

Droughts can also have significant effects on health and well-being. Droughts have therefore been linked to malnutrition and stunting of children, as well as to lack of or unsafe drinking water, with longer-term impacts on health, hygiene and sanitation.²⁸ Due to their slow-onset and persistence, droughts, however, are often under-reported and receive little attention from policy-makers. Even if a drought is making poor households food-insecure, government support may not be forthcoming because the drought is not considered to be a 'major' disaster.

Apart from El Niño, droughts can result from other factors. Even in non-El Niño years many parts of the region suffered from severe water stress. This is illustrated by data from Thailand's Geo-Informatics and Space Technology Development Agency. Non-El Niño factors are beyond the scope of this study, but they could be explored as a follow-up.

Figure 1-13 – Vegetative stress in non- El Niño years, 2013 and 2018

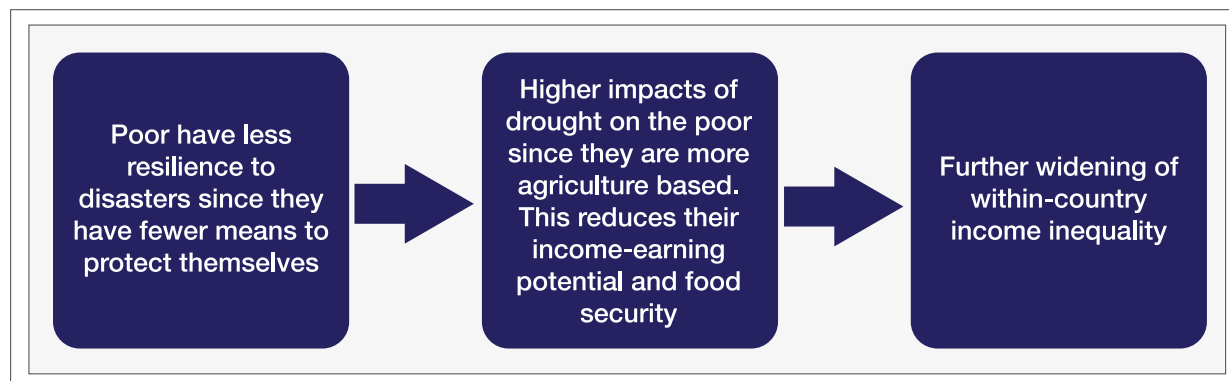


Source: Thailand Geo-Informatics and Space Technology Development Agency

Heightening inequality

By decreasing the incomes of vulnerable populations, droughts can then heighten income inequality. The potential pathway is illustrated in Figure 1-14.

Figure 1-14 – Mechanism of transmission of drought impacts on inequality

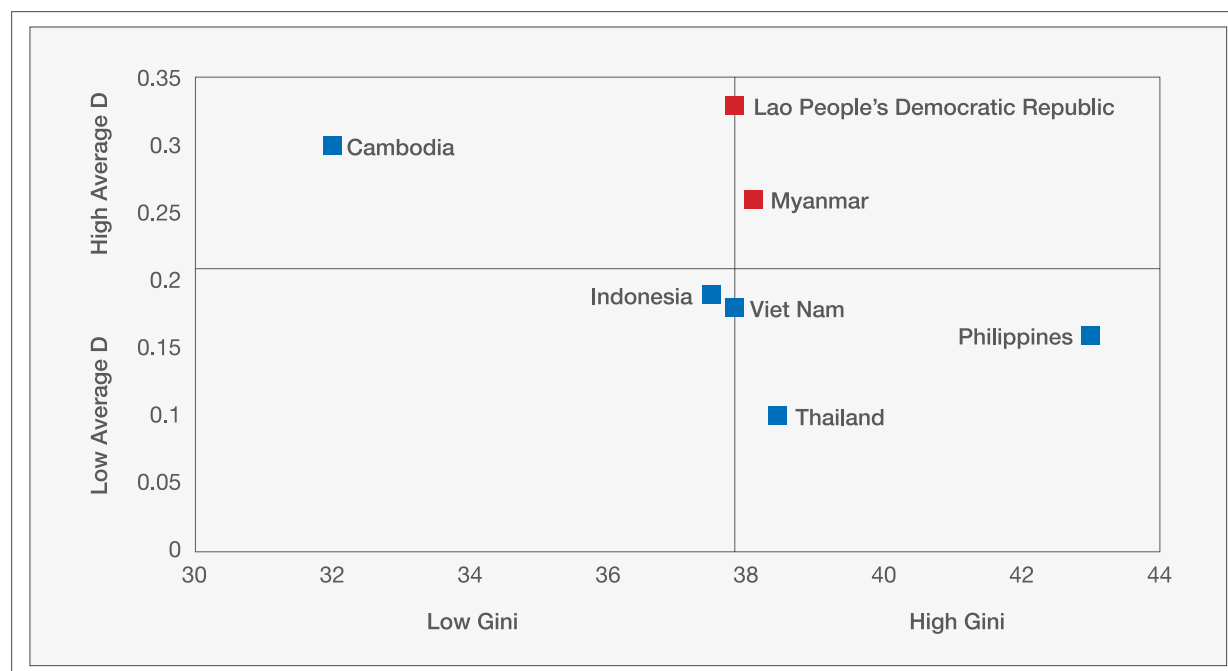


The resulting inequality of both outcomes and opportunities can be mapped using new datasets from ESCAP's recent theme study on inequality.²⁹ In this report, inequality of opportunity is measured using the D-index, which incorporates 14 individual or household-based indicators of opportunities critical for human wellbeing. Like the Gini coefficient, the D-index takes values from 0 to 1, where 0 indicates no inequality, and 1 indicates maximum inequality. Figure 1-15 plots countries in South-East Asia according to their Gini coefficients and D-indices. The colours of the dots correspond to drought vulnerability using the INFORM risk index.

All South-East Asian countries with a high disaster risk index have high income inequality (high Gini) or high inequality of opportunity (high D). Two countries in particular, Myanmar and the Lao People's Democratic Republic have both and are also highly vulnerable to drought.

Cambodia is the only ASEAN country with a low Gini and a high D value. It is one of the countries whose economy is transitioning from agriculture to manufacturing and services. Cambodia has higher inequality in access to opportunity but lower, albeit often increasing, income inequality.³⁰

Figure 1-15 – Inequality of outcomes and opportunities, and their relation to drought vulnerability



Source: ESCAP calculations using data from the latest Demographic and Health Survey and Multiple Indicator Cluster Surveys.

Note: The quadrants are split as per average Gini (36.96) and D-index values (0.19) for countries used in the analysis. Red dots and blue dots stand for drought risk index values from the 2018 INFORM Risk Index, with blue circles for low and medium risks (0-3.55) and red dots for high risk (3.60+) of drought.

Social impact data and analyses are generally sparse for drought. However, the analysis for this report did not find a significant association between drought and income inequality. Nor was there an association between drought and gender, using United Nations Development Programme's (UNDP) gender inequality index.

Nevertheless, drought can exacerbate social inequities. In ASEAN countries in particular, an increase in the drought index is significantly associated with a 0.34 per cent point decrease in per capita expenditure on healthcare. This could mean that people are coping with droughts by not seeking healthcare. They may also be eating less, withdrawing children from school, or selling livestock. These short-term coping strategies can be detrimental to their lives and livelihoods in the long-term. Details of the analyses are available in Appendix A.

Box 1-4 – The dissimilarity index

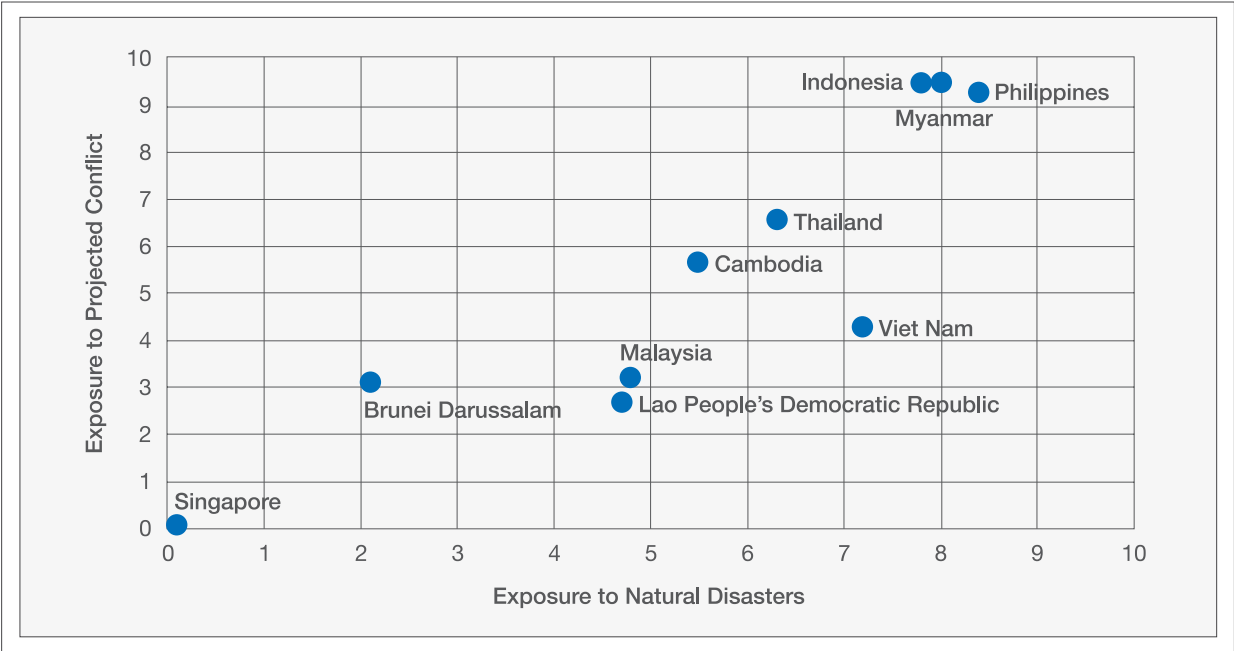
The dissimilarity index, or D-index was introduced in the 2017 ESCAP theme study *Inequality in Asia and the Pacific in the era of the 2030 Agenda for Sustainable Development*. This measure is similar to the Gini coefficient and can be used for measuring inequality for binary variables, for example, whether or not there is access to an opportunity such as education.

The D-index measures how all different population groups fare in terms of accessing this opportunity. For example, two countries with identical secondary education attainment rates may have very different D-indices if the distribution of attainment in one country excludes certain groups (such as rural women). The ideal level is a D-index of 0, whereby everyone has equal access to an opportunity.

Links between drought and conflict

Natural disasters, including drought, can create fertile ground for conflict. There is an evident correlation between the number of people affected by disasters each year and the number of conflict-related deaths.³¹ This can be assessed using data from the INFORM risk index. For conflict, INFORM uses two indicators: the current conflict intensity and the projected conflict risk.³² Exposure to natural disasters uses the full INFORM index.

Figure 1-16 – Exposure to projected conflict and natural disasters



Source: Based on the INFORM risk index, 2017 and showing index-scores for exposure to natural disasters and projected conflict on a scale of 1-10.

Note: Low values represent low exposure and the high values represent high exposure.

There is a very strong correlation (88 per cent) between projected conflict risk and natural disasters in the ASEAN region. The countries with the highest correlation – Indonesia, Philippines and Myanmar – are those that experience a variety of natural disasters and show particularly high exposure to earthquakes, floods, tsunamis and cyclones.³³ Natural disasters can aggravate existing conflict fault lines or exacerbate underlying conflict drivers and pressures, thereby creating cascading effects.³⁴ Conflicts are often clustered or concentrated in agricultural areas, or along river banks that run along border areas.

Natural disasters, and particularly drought, can lead to environmental degradation and resource scarcity, which have been shown to exacerbate poverty as well as contribute to conflict over access to resources and land. Environmental degradation can lead, for example, to 'simple-scarcity' conflicts due to declining levels of natural resources, or to 'group-identity' conflicts due to large population movements caused by environmental stress, or to 'deprivation' conflicts due to socio-economic deprivation from environmental scarcities.³⁵

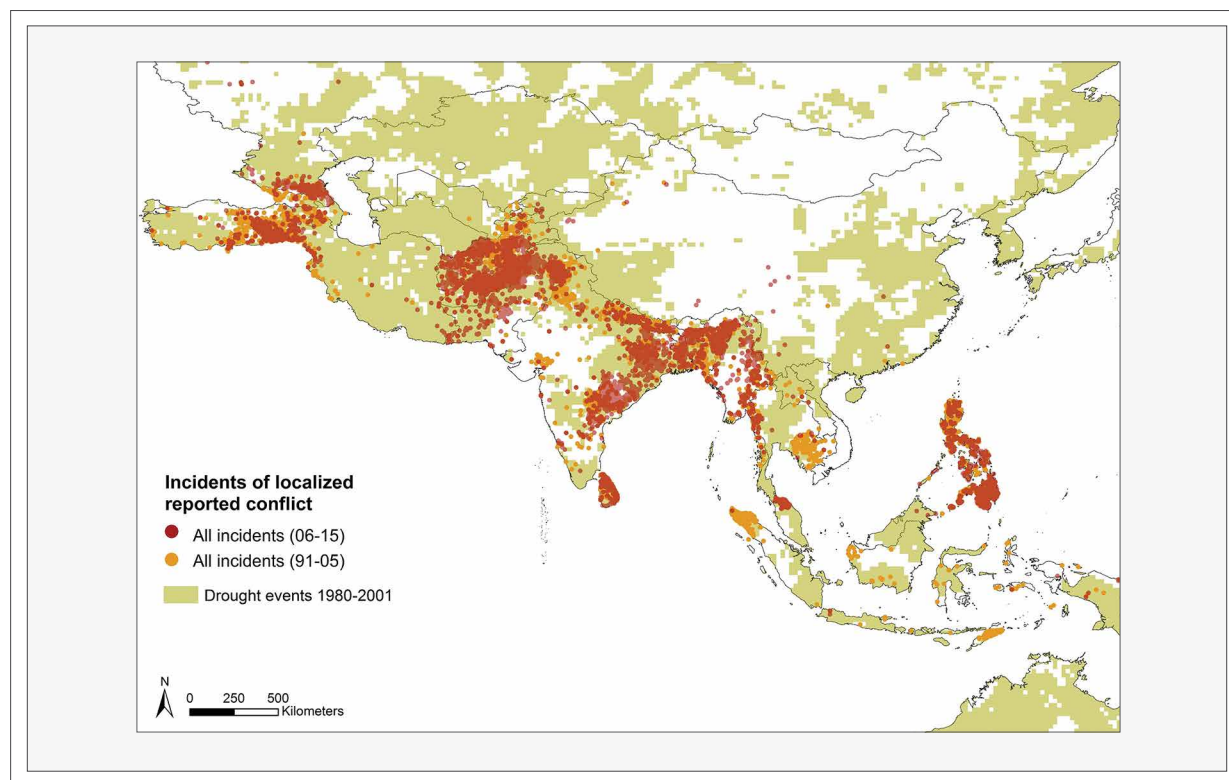
Droughts linked to environmental degradation have their most severe impacts in areas with high concentrations of vulnerable, poor or marginalized people. Some people will try to escape through migration, often to urban coastal areas in search of new opportunities. However, this also increases the risks as these areas too are vulnerable to natural disasters. The process can also work in the other direction; conflicts can weaken the resilience of communities and their capacity to cope with disasters such as droughts.

Correlations between conflict risk and drought

A study investigating subnational climate–conflict dynamics across Africa and Asia over the past 15 years concluded that while drought is not the sole factor instigating conflict, there is a “powerful reciprocal relationship between armed conflict and local drought, whereby each phenomenon makes a group more vulnerable to the other”.³⁶ The study found that drought had a stronger association with conflict in countries or regions with high agricultural dependency, as in South-East Asia. Severe drought may hamper local food security, worsen the humanitarian situation and can often instigate large-scale human migration and displacement.³⁷ In some countries the ‘harvest season’ can also be anecdotally associated with the ‘conflict season’.³⁸

As illustrated in Figure 1-17, more than 80 per cent of localized conflicts reported over the period 1980 to 2001, in the Asia-Pacific region, occurred in areas that were at some stage affected by drought. Drought can therefore be considered as an early indicator of future, potential disaster-induced conflict and human risk.³⁹ Mitigating the impact of drought is thus a key element in creating a culture of prevention in South-East Asia.

Figure 1-17 – Regional snapshots of conflict incidents and historical drought events

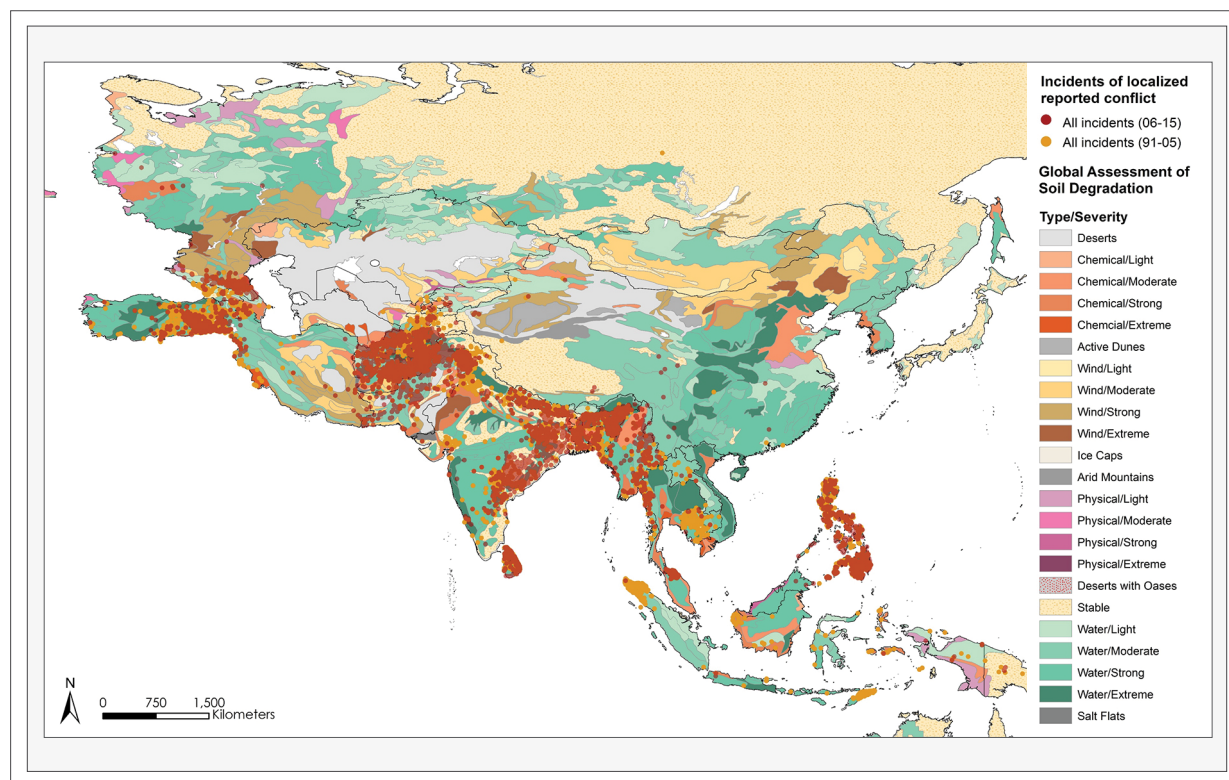


Source: ESCAP analysis based on UNEP/DEWA/GRID-Europe.

Conflict is often associated with land degradation, which refers to any decline of biodiversity and ecosystem functioning that reduces the provision of ecosystem services.⁴⁰ Land degradation can be caused by human activities as well as by natural processes and will be aggravated by drought and other impacts of climate change.

Data from the Global Assessment of Soil Degradation has shown that around 77 per cent of all reported incidents of localized conflict in the Asia-Pacific region occurred on land degraded by water erosion – light (17 per cent), moderate (29 per cent), strong (20 per cent) and extreme (11 per cent), (Figure 1-18). Further investigation is required to look into specific environmental degradation factors and their contributions to environmental conflict and natural resource scarcity.

Figure 1-18 – Localized conflict incidents and land degradation in South-East Asia



Source: ESCAP analysis based on FAO data.

ESCAP analysis suggests that conflict occurrence is cyclical, with variations that could be weekly or seasonal, and potentially linked to anthropogenic activities and emissions that are influencing weather cycles and climate patterns.⁴¹ In their fifth assessment report, the Intergovernmental Panel on Climate Change acknowledged, for the first time, the relationship between conflict and climate change, stating that “climate change can indirectly increase risks of violent conflict by amplifying drivers of these conflicts, such as poverty and economic shocks”.⁴²

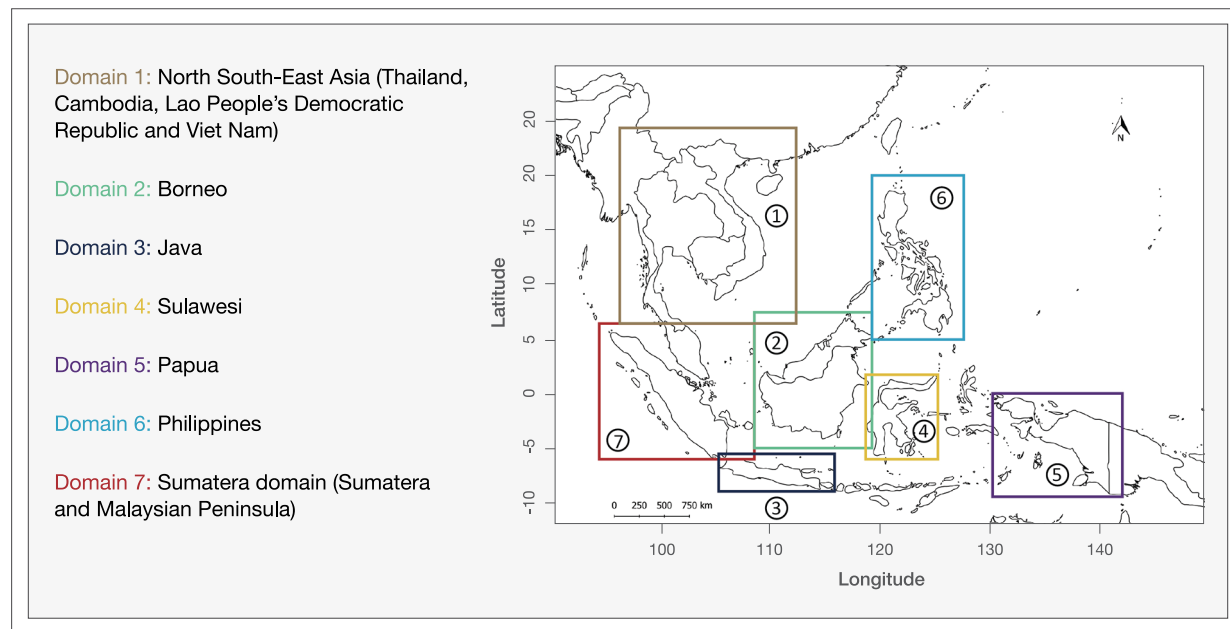
Forecast changes in drought intensity and geography

Drought severity in South-East Asia is likely to see geographical shifts. Climatological conditions for the near and far future scenarios suggest that drought conditions are more likely to become severe in the region. The variation in rainfall pattern (anomaly) and projected higher temperatures in the future are the likely cause of extreme dry conditions that have a high probability of leading to severe drought conditions.

A study entitled “Projected drought severity changes in Southeast Asia under medium and extreme climate change” published by the Royal Netherlands Meteorological Institute carried out an analysis for seven domains: Sumatera domain (Sumatera and Malaysia peninsula), Borneo, Java, Sulawesi, Papua, North and South-East Asia (Thailand, Cambodia, Lao People’s Democratic Republic and Viet Nam) and Philippines. The analysis covers three periods: the historical period (1971 to 2005), the near future (2021 to 2050), and the far future (2071 to 2100). Drought severity is measured using the Palmer Drought Severity Index (PDSI).

Much will depend on the severity of El Niño. This analysis offers two scenarios: the first is based on the less-severe 1982 El Niño and the second assumes more extreme conditions similar to the 1997 El Niño.⁴³

Figure 1-19 – The seven domains for local drought severity change analysis

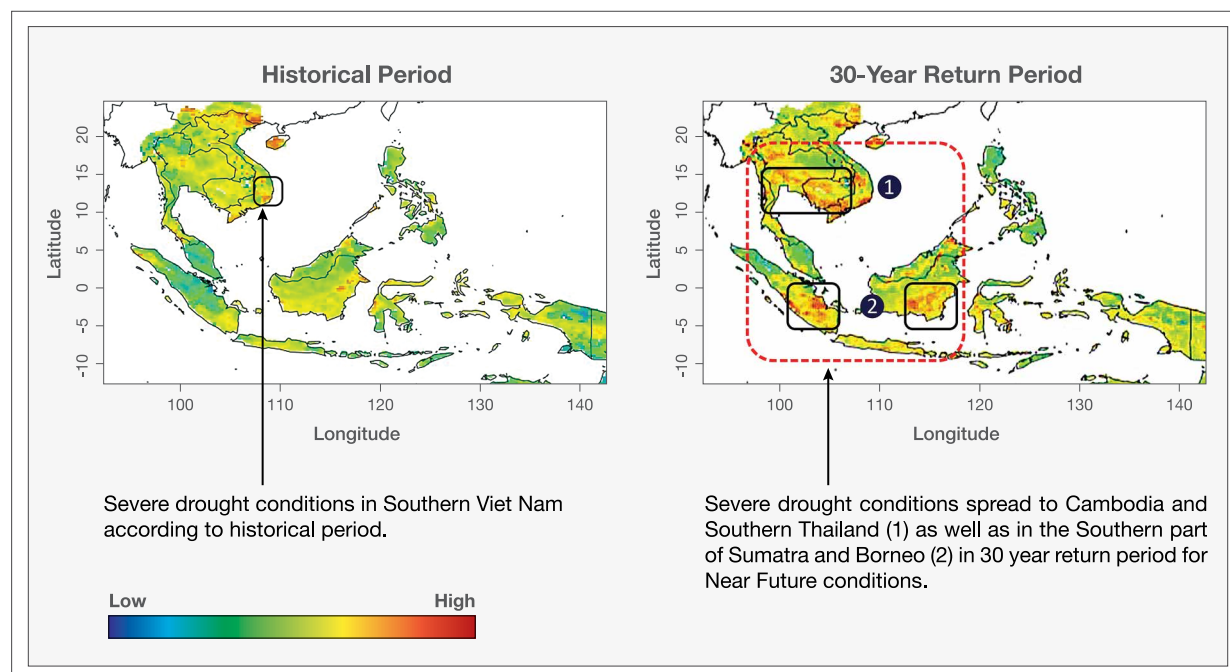


Note: Figures 1-19 to 1-23 are all adapted from Hariadi, 2017.

Scenario 1 – Less severe El Niño

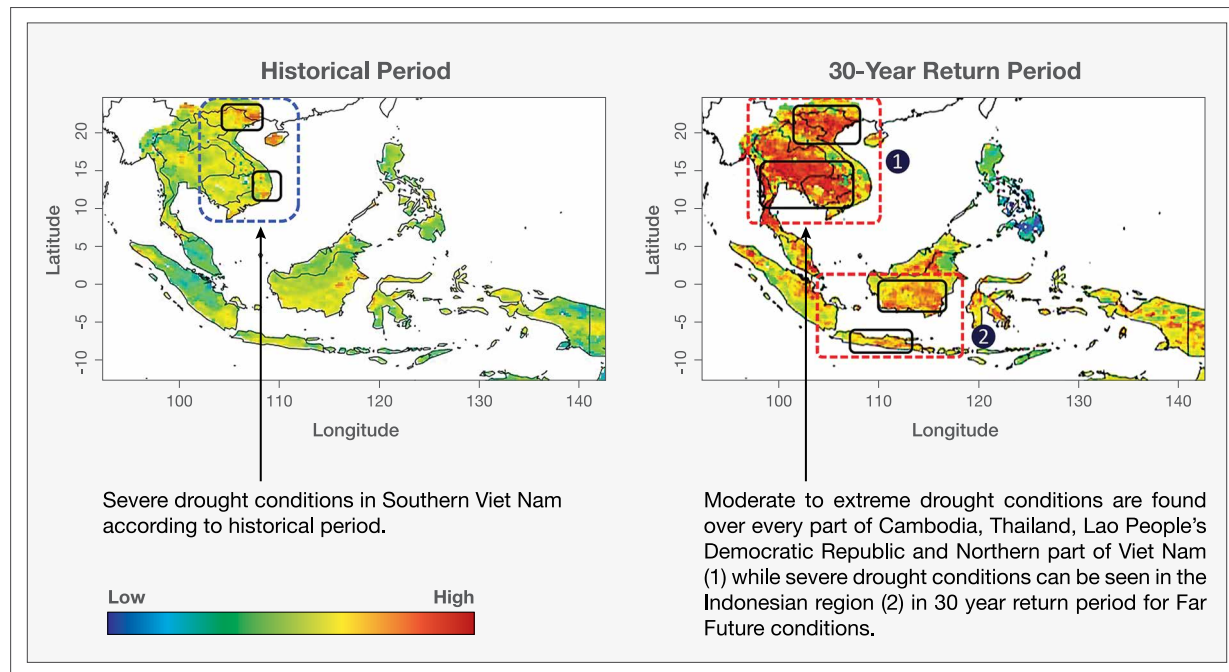
Historically, droughts have been concentrated over the north and south of Viet Nam, the southern part of Sulawesi and Borneo, and the central part of Java, Sulawesi and Papua. In the near future, this area is also likely to experience more severe conditions. In this scenario, the drought area in the southern part of Viet Nam will have extended to Cambodia and the southern part of Thailand, with similar conditions in the southern part of Sumatera and Borneo (Figure 1-20). In Java, the proportion of the island affected by drought will rise from 62 to 72 per cent.

Figure 1-20 – Projected drought conditions – less extreme El Niño, near future



In the far future, the conditions will be more severe. Almost every part of Thailand and Cambodia is likely to have moderate to extreme drought. The northern part of Viet Nam and some parts of Malaysia will have extreme drought conditions. For Indonesia, drought will be evident across the whole country, though in the Philippines the outcome will be more variable. In total, 96 per cent of the ASEAN region is likely to be affected by drought.

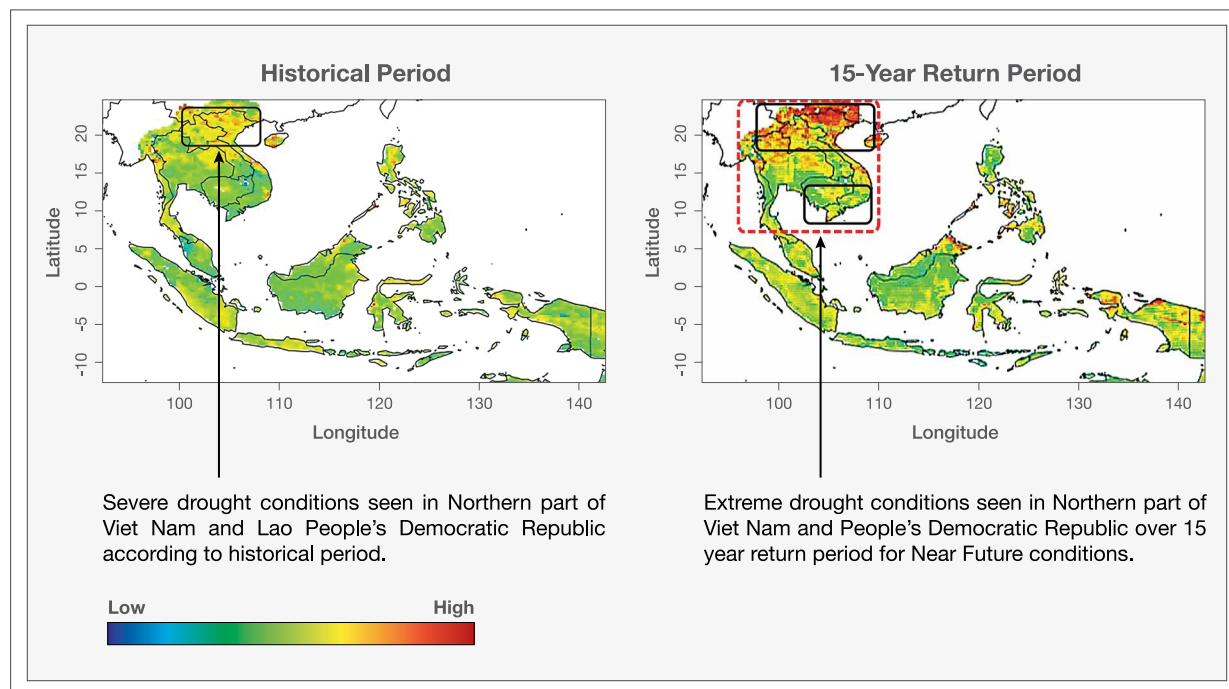
Figure 1-21 – Projected drought conditions – less extreme El Niño, far future



Scenario 2 – More severe El Niño

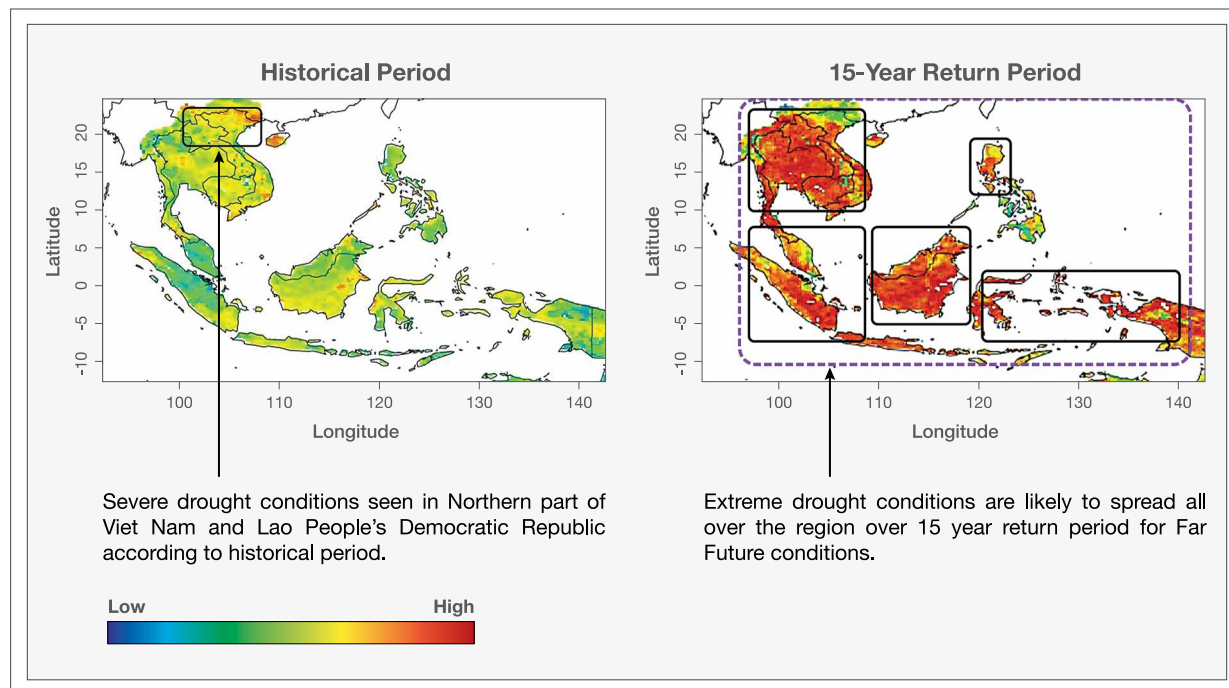
For more severe El Niño conditions, in both the near and far futures, the northern part of Viet Nam and Lao People's Democratic Republic will face extreme drought. In the near future, there will also be severe drought conditions in the eastern part of Sumatera, the northern part of Borneo and the southern part of Papua. Between the historical and near future periods the percentage of the area affected by drought will have increased from 40 to 63 per cent.

Figure 1-22 – Projected drought conditions – more extreme El Niño, near future



In the far future, severe drought is likely to affect Thailand, half of the south Sumatera and most areas of Borneo, Sulawesi and Papua. Furthermore, extreme drought conditions are likely to spread all over the region. Around 64 per cent of the area will be affected by extreme drought.

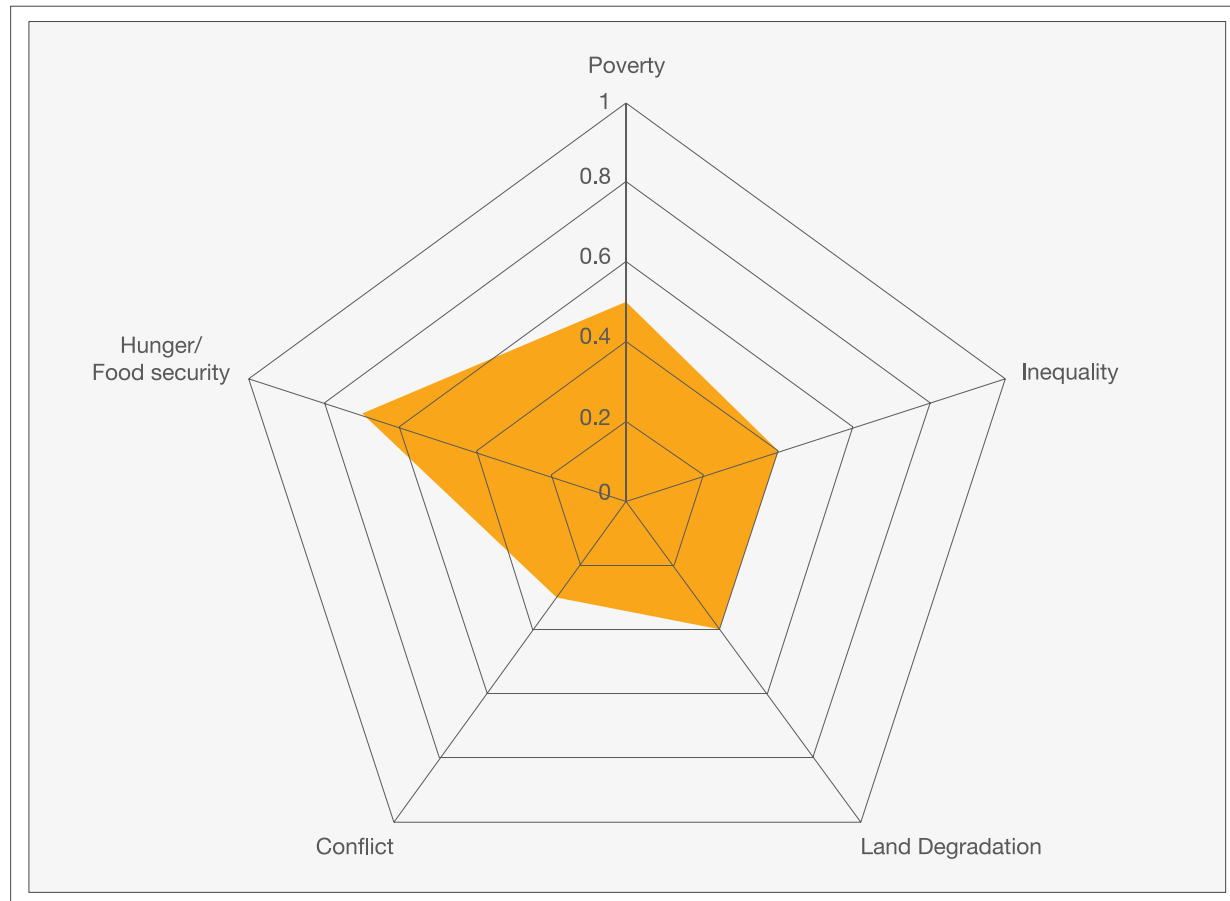
Figure 1-23 – Projected drought conditions – more extreme El Niño, far future



Nexus between drought, poverty, inequality, hunger, land degradation and conflict

Droughts are closely linked to, and interact with, poverty, inequality, food security and conflict. Droughts can lead to environmental degradation and food scarcity, which have been shown to exacerbate poverty as well as contribute to conflict over access to resources and land, and its unequal distribution. This is illustrated in a standard scenario in Figure 1-24, where each is given a notional weight assigned for illustrative purposes, assuming, for example, that the greatest impact of drought will be on hunger and food security. The five factors are:

Figure 1-24 – Standard scenario of drought impacts



Hunger/food security – Food security is severely undermined due to decreasing agriculture production and increasing water scarcity.

Poverty – Droughts reduce food supplies and cutting the incomes of poor communities. Water and land scarcity, coupled with a succession of disasters, erodes traditional coping mechanisms, particularly for the poorest people who live on the most degraded land.⁴⁴

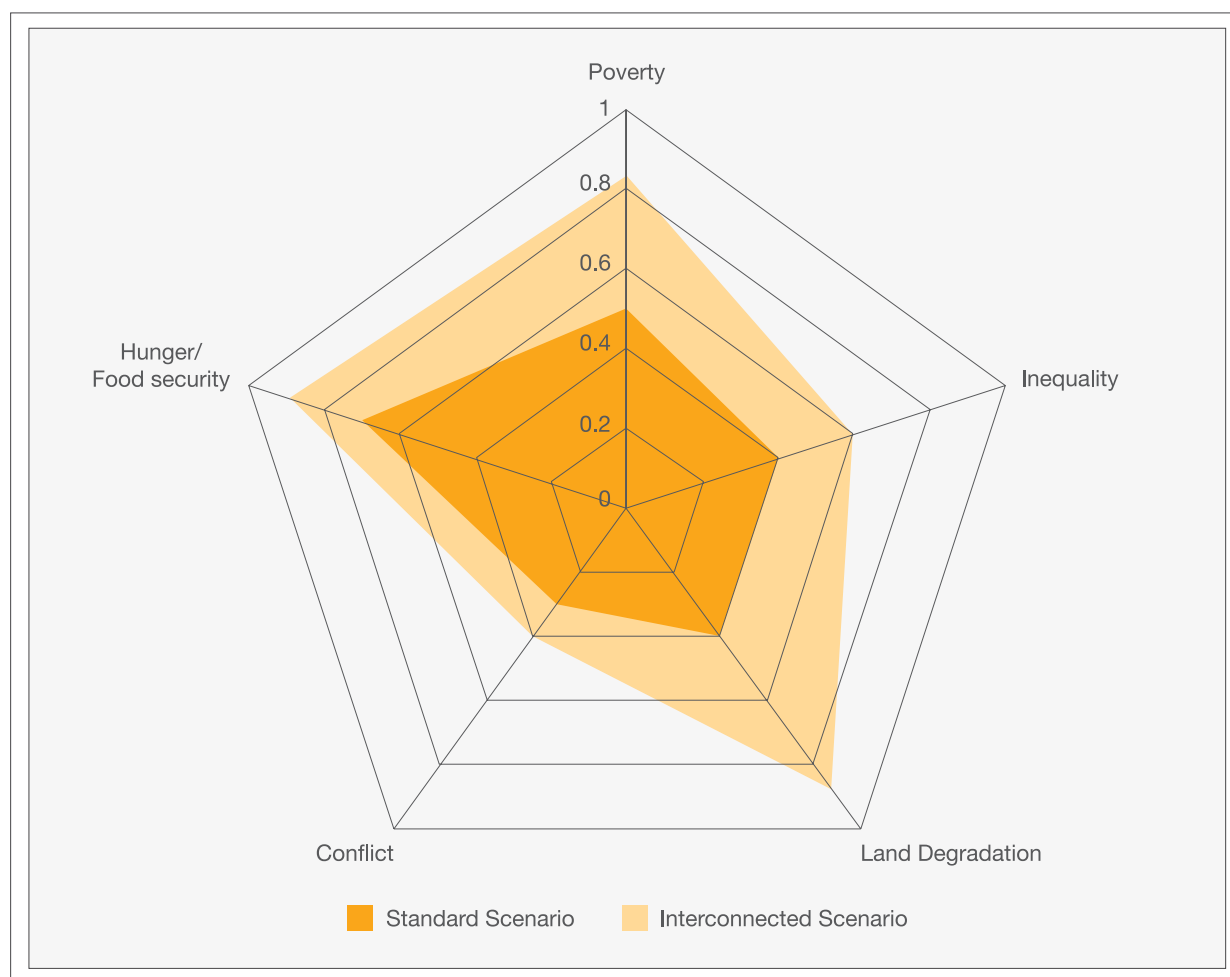
Inequality – Drought has a greater impact on the poor since their livelihoods are more agriculture-based. Income and wealth inequality then aggravate inequalities in access to health care, education, technology, and protection from natural disasters and environmental hazards.

Land degradation – Drought is one of the main drivers of land degradation, which is critical for the food-energy-water-environmental health nexus. This also results in migration pressures and conflicts over scarce natural resources.

Conflict – Drought that contributes to environmental degradation changes resource availability. Coupled with poverty, inequality, insecure land tenure and imbalances of power this heightens the risk of conflict.⁴⁵

Drought is a stressor for each of these five factors. Therefore, an increased stress will affect the other outcomes, increasing overall socio-economic vulnerability. This can also trigger changes in the other interconnected factors. Figure 1-25 illustrates the potential cascading impacts. In this hypothetical situation, the first consequence of drought is the degradation of agricultural land. Due to the timing and intensity of the drought, the crop largely fails, which damages the community's food security, causing hunger. Crop failure also increases poverty as farmers have no produce to sell, which triggers a negative multiplier effect, as people in other sectors also see their incomes fall. The wealthier members of the community have coping strategies and savings that serve to absorb the impact, but the poor have less to fall back on so incomes become more unequal. Rising poverty and inequality can then act as stressors to increase the likelihood of conflict and migration.

Figure 1-25 – Cascading impacts of drought



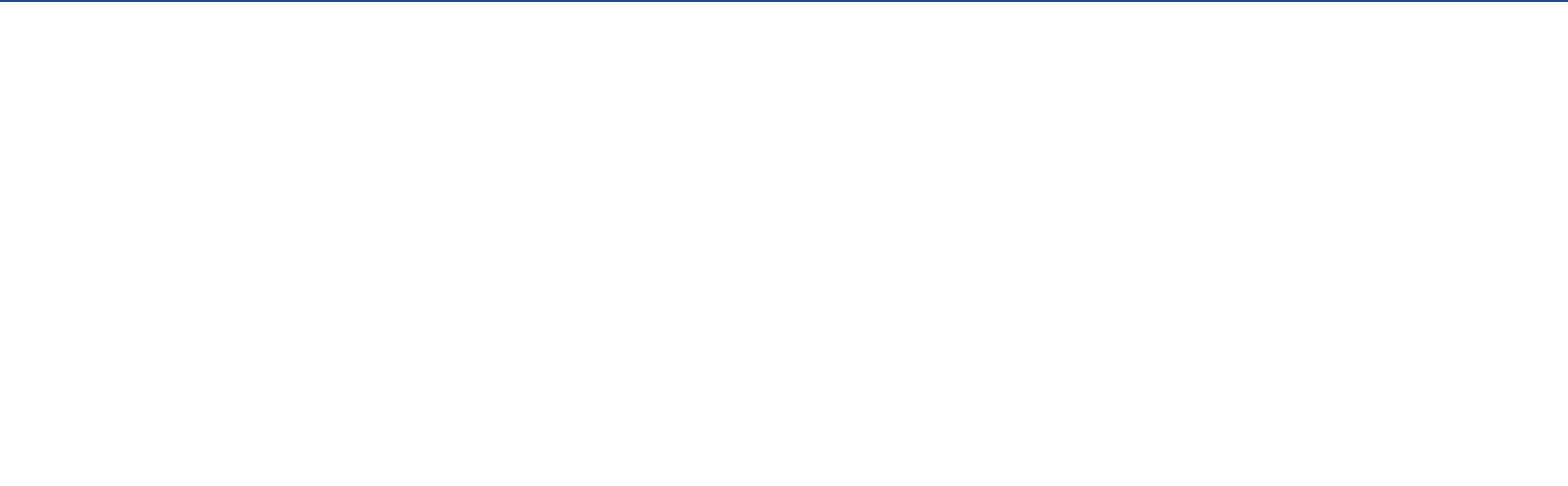
Facing up to a widespread threat

Droughts thus represent a widespread and increasing threat to ASEAN countries, and particularly to their poorest people. Many countries have strengthened their capacity to respond, but they need to do much more. The next chapter examines some of the measures taken by national Governments and shows how they can also take advantage of regional frameworks and institutions to cooperate, and share information and resources.



CHAPTER 2.

Frameworks for resilience



Building resilience to drought will rely primarily on national action. But national efforts should also be set within a framework of regional cooperation. This chapter reviews the actions taken by four ASEAN countries, and the regional mechanisms developed by ASEAN and ESCAP that feed into the Sustainable Development Goals.

Countries will be better able to manage disaster risk if they develop the necessary policy, legislative and institutional frameworks, track progress with measurable indicators, and achieve widespread consensus on disaster risk reduction. Such frameworks should include integrated disaster risk reduction mechanisms and national platforms for raising awareness which ensure cross-sectoral coordination and dialogue between national and local-level actors. Countries should also integrate disaster risk reduction into policies and development plans at all levels, while adopting or modifying legislation to support disaster risk management and allocating the necessary resources.

These frameworks are particularly important for drought. Compared with cyclones and floods, droughts might cause fewer casualties, but nevertheless affect many people and result in significant economic damage, particularly to agriculture. Moreover, it is easier to mitigate the impacts of drought, if there is early warning and if Governments have thoroughly integrated risk reduction into policies for agriculture, water management and social support.

The following sections review national efforts on disaster management and drought in four countries: Cambodia, Lao People's Democratic Republic, Myanmar and Viet Nam.⁴⁶

Cambodia

To identify areas vulnerable to drought, the Government of Cambodia aims to improve networks of meteorology and hydrology measurement, to provide timely information on weather impacts and potential hazards, including drought, thereby creating a suite of forecast services to address local needs. The Climate Change Strategic Plan for Water Resources and Meteorology does not identify the types of services needed, or the actors to manage drought, but emphasizes the need for partnerships to develop downscaled projections of future climate.⁴⁷

For addressing climate change, and adapting to more frequent and severe droughts, the Government aims to increase national capacity in biotechnology. The Agricultural Sector Development Plan 2014–2018 prioritizes the development of climate-resilient, high-quality varieties of the staple crop, rice, along with improving seeds for horticulture, second crops and agro-industrial crops, and improving livestock production systems.⁴⁸

Drought is also addressed through water resources management. The Climate Change Strategic Plan for Water Resources and Meteorology proposes a national groundwater database to assess resources for agricultural irrigation. Likewise, the strategy proposes rehabilitating small- and medium-scale irrigation systems to respond more efficiently during droughts.⁴⁹

Two projects relate directly to drought management. Strengthening Climate Information and Early Warning Systems to Support Climate-Resilient Development, in Cambodia, aims to build institutional capacity for monitoring weather and climate. Together with analysis, modelling and dissemination of information on climate trends and weather advisories, the project also works toward developing an early warning system. The second project is part of the Greater Mekong Subregion Flood and Drought Management and Mitigation. Within this, Building Disaster Resilient Communities II aims to enhance drought and flood management in Pursat Province thereby strengthening the capacities for flood and drought forecasting and warning, upgrading water management infrastructure, and building capacity for flood and drought management at the community level. The strategy is to increase leadership capacities and improve the coordination of national-level institutions for

integrating disaster risk reduction (DRR) and disaster management into their strategic plans. It also aims to help urban and rural sub-national institutions develop effective disaster risk reduction strategies, and increase resilience through community-based disaster risk reduction.

Disaster management governance

Prior to 2015, the disaster management system had very few financial resources. This restricted the action of the National Committee for Disaster Management (NCDM), whose budget had been derived from a Council of Ministers, rather than being defined and enforced by national law.⁵⁰

Another issue was the absence of a clear legal basis for participation in international and regional commitments and obligations, particularly the ASEAN institutions such as the Hyogo Framework of Action, and the Sendai Framework of Action for Disaster Risk Reduction, and coordination between international and regional partners for humanitarian assistance.

In 2015, the Government introduced a major change through the Law on Disaster Management. The law is relatively new, and implementation will depend on corresponding decrees and sub-decrees. However, a step forward is the legal status given to the NCDM. The law formalizes the financing of NCDM operations, which is now part of the budget plan of the Office for the Council of Ministers. The law lays out the Disaster Management Mechanism, represented by the NCDM, the NCDM Secretariat and the national sub-committees, though their membership, organizational structures and functions have yet to be defined by Royal Decree or Sub-decree.

The law also requires the nomination of focal points in all ministries. However, it does not re-establish the previous mechanism for inter-ministerial cooperation, that is, the Inter-Ministerial Disaster Management Group, or any sub-national entities whose organization and functions are covered by only one article of the law. A joint report by the International Federation of the Red Cross and UNDP recommended that such decrees define clearly the membership of the sub-national committees at province, district and commune levels, as well as village-level structures, budgets and resource allocation, responsibilities and accountability.⁵¹

In terms of international and regional commitments and obligations, the new law now provides a legal basis for the NCDM as the official coordinator of international assistance during major disasters. However, integrating the commitments of international and regional instruments into the disaster management system will require subsidiary legislation.⁵²

Lao People's Democratic Republic

Disaster management is under the responsibility of an inter-ministerial body, the National Disaster Management Committee (NDMC), and its secretariat, the National Disaster Management Office (NDMO).⁵³

The NDMC is the overall coordinator for disaster management policy, for mobilizing national and international aid in times of crisis, and for managing information and creating public awareness. It is responsible for disaster preparedness, response and rehabilitation, and coordinates the establishment of disaster management committees at provincial, district and village levels.

The NDMO is based at the Ministry of Labour and Social Welfare and is the focal point for all national and international disaster management networks. It collects and analyses disaster information, and coordinates joint assessments involving humanitarian institutions. It also coordinates the assistance provided by international organizations for preparedness, prevention, mitigation and recovery. In addition, it promotes and organizes disaster management training for government staff and communities.

At the sub-national level, provincial disaster management committees have been established with the participation of the directors of the provincial line departments, and are presided over by the vice-governors. Similarly, district disaster management committees are led by the district governor. Village disaster protection units are linked to local and district development committees.⁵⁴

National strategies do not specifically cover drought, but the need to prepare for and mitigate drought is addressed in the Government's priority to develop climate-resilient agriculture. National strategies also cover the identification of areas suitable for agricultural production as well as climate-hazard prone areas. They also address research on vulnerability and the impact of drought on agriculture.

In addition, there are strategies to avoid further soil degradation in drought- and flood-prone areas. The National Adaptation Programme of Action (NAPA) promotes the use of organic fertilizers, both to benefit agricultural production and to improve soil quality. NAPA and the National Strategy on Climate Change (NSCC) also prioritize conservation practices, such as crop rotation, to preserve soil structure and increase the supply of water during droughts. Furthermore, the use of short-cycle crops or varieties that allow farmers to better cope with insufficient rainfall. NAPA, NSCC, TNAs and INDCs promote crop varieties and animal species that are better adapted to stressful environmental conditions.

Disaster management governance

Although there is a basic legal and policy framework for disaster risk management, there is no fundamental law on disaster management. The decrees and regulations are basically concerned with the creation of a coordinating body.⁵⁵ The country therefore needs a national disaster management plan that details specific programmes, standard operating procedures and roles and responsibilities before, during and after disasters.⁵⁶

The relationships and coordination lines between the members of the NDMC are well-defined, but they need to be better disseminated among stakeholders, who are often unaware of or do not understand them. The NDMC meets only twice year, so is less able to make decisions, especially in times of crisis. Although the country is committed to disaster risk management, it needs to give stronger support to disaster management institutions and allocate the necessary resources.

The ten-member NDMO coordinates disaster management activities between the NDMC and humanitarian agencies but has limited human and financial resources. Since it is attached to the Ministry of Labour and Social Welfare it lacks the authority to plan, implement and monitor disaster management. It needs a better organizational structure, with clearly defined roles and functions.

The NDMO should also have stronger technical capacity and infrastructure on information management, for preparedness and contingency planning, and to support rapid analysis and response during times of crisis. To accomplish this task satisfactorily, the NDMO will need support to systematize information and build a permanent disaster information database. The NDMO also needs a training programme to improve the technical capacity of its staff for disaster risk analysis and vulnerability assessments by taking advantage of training available from regional and international organizations and donors.

Myanmar

Myanmar's National Climate Change Strategy and Action Plan 2016–2030 (NCCSAP) aims to integrate climate change into agriculture, fisheries and livestock planning, which involves drought-resilient agriculture. To increase the awareness of local government, civil society and community-based organizations, it promotes participatory adaptation planning. In addition, the strategy addresses drought management more specifically

through water management to protect the Dry Zone, retrofitting irrigation systems, and operating reservoirs efficiently through better dam instrumentation and hydro-meteorological monitoring and forecasting.

For agriculture, both the NCCSAP and NAPA promote the transfer of a wide range of climate- and drought-resilient, high-yield rice varieties for the Dry and Hilly Zones. To increase resilience of rural and subsistence farmers they also aim to diversify legume crops and high-income fruits. Furthermore, to reduce the vulnerability of local communities to drought, the NAPA promotes early warning systems and development of weather observation and monitoring capacity.

The United Nations Development Programme has two programmes that address drought. One is the Disaster Risk Reduction (DRR) project which aims to build disaster resilient communities through strengthening DRR institutions, systems, networks and mainstreaming DRR into development planning. This aims to enhance the country's disaster risk management institutions, systems and networks.⁵⁷ For risk management, the project should address the problem of water availability during dry spells in the Dry Zone by demonstrating to communities the benefits of sustainable agriculture and efficient water management practices. The second project is Addressing Climate Change Risk of Water and Food Security in the Dry Zone of Myanmar. This aims to make farmers less vulnerable to drought and rainfall variability and increase their capacity to respond to future impacts of climate change. The project has three components. The first addresses water supply by helping communities improve their capacities to capture and store water and implement conservation practices such as agro-forestry plots to protect soils against erosion and increase water retention. The second component considers drought-resilient farming, post-processing and storage methods, and diversified livestock production systems. The third component involves disseminating climate risk information.

Disaster management governance

In 2013, the DRR Working Group of Myanmar undertook a situational analysis of DRR. As yet non-exhaustive, this reviewed the capacities of the working group and gave recommendations for its strategic plan.⁵⁸ The analysis focused on preparedness, prevention and mitigation. It gave less attention to immediate preparedness and emergency response, since humanitarian work is addressed by the Inter-Agency Steering Committee.

The analysis highlighted three main needs. First, it stressed the importance of convergence between the policies on DRR/DM and the legal mechanism on climate change. Myanmar has produced its NAPA, but this work, as well as the preparation of related policies, is undertaken by a different ministry, and there is limited information exchange at the government or civil society level. Second, the DRR/DM policy framework needs to pay more attention to the rights and needs of vulnerable groups and their integration into the DM cycle. Third, it should also cover conflict. The Myanmar Action Plan on Disaster Risk Reduction (MAPDRR), the Standing Orders on Disasters and the DM Law only address natural disasters. However, some of the country's borders are afflicted by civil conflict that increases community vulnerability to natural disasters.

Disaster risk management in Myanmar relies on the Standing Order on Disaster Management of 2009 and the Natural Disaster Management Law and Rules of 2013 and 2015. These highlight the need for multi-hazard early warning systems based on risk, forecast and warning information.

In 2011, the Government of Myanmar constituted the Myanmar Disaster Preparedness Agency (MDPA). This is a 13-member governmental body that oversees disaster management and is supported by an Advisory Committee, providing technical support. There are 14 sub-committees that focus on specific themes related to several other ministries. Officials from the respective agencies are expected to develop activities related to disaster management at the regional and sub-regional, and the state and sub-state levels (district, township and village tract).

In 2009, the Myanmar Action Plan on Disaster Risk Reduction was prepared by a task force whose members comprised of representatives from 12 government ministries, the Myanmar Red Cross Society, the United Nations Development Programme, the United Nations Office for the Coordination of Humanitarian Affairs, ASEAN and the Asian Disaster Preparedness Center.⁵⁹ The plan covers institutional and policy arrangements, multi-hazard risk assessments (including mapping drought-prone areas) and early warning systems (including drought monitoring) from national to township levels, and integrating DRR into the development agenda (including a sub-component for the Dry Zone). The plan also addresses community-based preparedness and risk reduction, complemented with education, training and raising public awareness.⁶⁰

The plan aims to increase collaboration on drought monitoring between the Ministry of Agriculture and Irrigation, and the Department of Meteorology and Hydrology (DMH) in Mandalay. This task is led by the Forest Department, the DMH, the Irrigation Department, the Department of Agricultural Planning and the Dry Zone Greening Department. There are also components for the Dry Zone on integrating sectoral programmes for sustainable development and improving food security and livelihoods through a drought mitigation plan. These efforts are led by the Ministry of Environmental Conservation and Forestry and the Dry Zone Greening Department.⁶¹

The Disaster Risk Reduction Working Group integrates 49 agencies, including United Nations agencies, NGOs (international and local), the Red Cross and professional bodies, who share information on their work with a steering committee. The Relief and Resettlements Department acts as the honorary chair.⁶² This working group has noted that that work on preparedness, prevention and mitigation of natural disasters is separated from humanitarian work on emergency preparedness and response.

During normal periods, warning services are the responsibility of the DMH. For this purpose, it has established the National Multi-Hazard Early Warning Center which operates at national and local levels. The DMH disseminates information to mass media channels as well as to ministries and departments. During crisis, there is a National Disaster Management Committee composed of the Ministry of Home Affairs, the Ministry of Social Welfare, Relief and Resettlement, the Ministry of Foreign Affairs and the Ministry of Commerce. There are also sub-committees which cover such issues as: disseminating forecasts, offering emergency communications, making initial loss assessments and emergency assistance, confirming losses and damages, clearing roads and transportation, mitigating and establishing shelters, and providing health care and security.⁶³ At the township level, the General Administrations Office oversees information flows to villages.⁶⁴

Viet Nam

The Climate Change Action Plan for Agriculture and Rural Development (CCAPARD) maps drought-prone areas and the vulnerability of the affected populations. The plan also proposes that environmental impact assessments should be complemented with an econometric model to assess the impact of drought.

The Technical Assessments Needs for Adaptation support policies for fundamental, long-term research for developing drought-resistant crop species, and pilot programmes for testing research outcomes and strengthening the capacity of agronomy education institutions. CCAPARD also proposes a programme for experimental research. The National Adaptation Program for Climate Change (NAPCC) and the National Climate Change Strategy (NCCS) propose using biotechnology and modernizing agriculture with advanced production processes. The NAPCC proposes adjusting livestock patterns to adapt to climate change.

For better management of water resources, particularly during drought, the CCAPARD proposes monitoring the status of reservoirs and the impacts of drought, as well as measures for efficient water use. Both NAPCC and NCCS aim to improve the monitoring and forecasting capabilities of meteorological and hydrological

stations in order to ensure timely warnings of extreme events. CCAPARD and NAPCC also propose developing an agricultural insurance system to protect poor communities against the damage caused by droughts.

Two projects address drought in Viet Nam, particularly in the Central and South Central Regions. One is the Water Efficiency Improvement in Drought Affected Provinces project which aims to increase climate resilience and the productivity of irrigated agriculture in five drought-affected provinces in the Central Highlands and South Central Coastal Regions. The project will promote modernization of irrigation and management practices.

The second project is the El Niño Disaster Response Project. Since January 2016, more than two million people in 18 provinces in southern Viet Nam have been affected by drought and by salt water intrusion associated with the El Niño–Southern Oscillation.⁶⁵ These effects were aggravated by weak institutional arrangements and the lack of an integrated approach to disaster management. Financed by the Asia Pacific Disaster Response Fund, this project addresses the droughts induced by the El Niño–Southern Oscillation, focusing on infrastructure for water storage for human consumption, as well as on irrigation for crops so as to avoid food shortages.

There have also been efforts to improve social assistance for those affected by natural disasters. With funding from the World Bank, the Ministry of Labour, Invalids and Social Affairs has implemented the Viet Nam Social Assistance System Strengthening Project which has pilot projects in four affected provinces. It is also important to improve drought preparedness and the assessment of water resources. In view of the projected construction of a new reservoir in Ninh Thuan province, the Water Partnership Program will carry out a water system analysis across the whole of the Dinh river basin to assess surface and groundwater resources for current and future demand.⁶⁶

Disaster management governance

Over the last 10 years, Viet Nam has been building resilience to natural hazards and the impact of climate change. In 2007, the Government approved the National Strategy for Natural Disasters Prevention, Response, and Mitigation to 2020. This shifted the focus of disaster risk management from response to preparedness. More recently, the National Assembly passed the first law on Natural Disaster Prevention and Control (Law No.33/2013/QH13), which became effective on 1 May 2014. This takes an integrated approach to DRM under the direction of the newly designated Central Steering Committee for Natural Disaster Prevention and Control. Critical areas of reform include delineating institutional responsibility for key DRM functions, with the Ministry of Agriculture and Rural Development as a lead coordinating agency. Despite these efforts, weak institutional capacity for disaster preparedness and response at the provincial level limits the Government's capacity to manage disaster risks in a more systematic way.⁶⁷

Response to drought is also hampered by weak coordination across the water supply, energy and agriculture sectors, as well as by a fragmentation of disaster management and climate change adaptation policies. Management plans are not integrated in development planning activities at either national or local levels.⁶⁸

Viet Nam's Socio-Economic Development Plan for 2016–2020 proposed more effective sectoral plans to address natural disasters with universal responses.⁶⁹ Furthermore, in August 2017, the Government launched the General Department of Disaster Prevention and Control under the Ministry of Agriculture and Rural Development. This department is the standing body of the Central Steering Committee for Natural Disaster Prevention and Control and aims to strengthen capacity to reduce disaster risks and promote international cooperation with neighbouring countries.⁷⁰

Viet Nam has a well-established disaster risk management system. However, this is based largely on past experience with focus on previous storm and flood responses, and on rescue and relief operations.⁷¹ State and local agencies now need to address emerging risks.

Currently, no state institution performs vulnerability assessments, or determines the assets to be protected, or the potential damage. There is no specific regulation that establishes clear responsibilities in this regard. At the local level, such activities could be undertaken by People's Committees, but these often have limited technical capacity.⁷²

ESCAP and ASEAN frameworks for building resilience to drought

Drought knows no borders. National actions in ASEAN countries will therefore benefit from regional cooperation. For this purpose, there are a number of important frameworks and mechanisms offered by ASEAN and ESCAP which dovetail with global frameworks, namely the 2030 Agenda for Sustainable Development, Sendai Framework for Disaster Risk Reduction and the Paris Agreement.

ASEAN Vision 2025 on Disaster Management

The regional practices for addressing and managing drought risk and impacts have not yet evolved to the same level as those for frequent or high-impact disasters. Drought will therefore need to be an important component of ASEAN's disaster risk reduction and humanitarian landscape.

Resilience-building is at the core of the ASEAN Socio-Cultural Community. The ASEAN Community Vision 2025 aspires to achieve “a resilient community with enhanced capacity and capability to adapt and respond to social and economic vulnerabilities, disasters, climate change as well as emerging threats and challenges”, laying the groundwork for the ASEAN Vision 2025 on Disaster Management.⁷³ Outlining the strategic direction, the aim of the ASEAN Vision 2025 on Disaster Management is to ensure that the ASEAN Agreement on Disaster Management and Emergency Response (AADMER) is more people-oriented, financially sustainable, and networked. In the context of sustainable development, the objective of AADMER is to provide effective mechanisms to achieve substantial reduction of disaster losses in lives and in the social, economic and environmental assets of ASEAN member States. The vision recognizes that while ASEAN has progressed in terms of cooperation and collaboration, more needs to be done. For this purpose, ASEAN can adapt the implementation of AADMER to address current risks and future threats. This will ensure a comprehensive and robust disaster management and emergency response system along with mechanisms to mitigate and respond to drought.

ASEAN Declaration on Culture of Prevention for a Peaceful, Inclusive, Resilient, Healthy and Harmonious Society

The Declaration recognizes the importance of a culture of resilience and care for the environment. This is one of the thrusts of a culture of prevention, in conformity with the principles of the ASEAN Charter.

In many cases, the risk of disasters is compounded by conflict. Moreover, conflicts can undermine the capacity and commitment of States to prevent and respond to disasters and humanitarian crises. The Declaration acknowledges that deviant behaviour can occur when people are displaced from their homes as a result of human-induced, natural disasters, and environmental degradation. Drought, poverty and inequality are closely linked so addressing these issues can help avoid the socio-economic problems that cause violence.

The Declaration calls for “care for the environment,” to provide the much-needed push to shift from crisis management to prevention, through drought risk management. This will mean countering environmental degradation, restoring degraded ecosystems, and investing in irrigation infrastructure to better manage extended droughts.

Box 2-1 – ASEAN Declaration on Culture of Prevention for a Peaceful, Inclusive, Resilient, Healthy and Harmonious Society

In today's interconnected world, it is important to be aware that threats to peace and harmony are complex and compounded by socio-economic root causes. A challenge that ASEAN continues to face is the building of an inclusive society, in which all segments feel included and able to reap the benefits of development. Failure to do so can lead to the feeling of being marginalized and lacking a sense of belonging. Cognizant that new approaches are needed to handle these challenges, ASEAN Leaders have adopted the ASEAN Declaration on Culture of Prevention for a Peaceful, Inclusive, Resilient, Healthy and Harmonious Society at the thirty-first ASEAN Summit in Manila on 13 November 2017.

This Declaration is a testament to ASEAN's commitment to fostering an ASEAN Culture of Prevention. A culture that will further empower ASEAN to holistically tackle socio-economic challenges at their root causes. It aims to instil peace, intercultural understanding and social responsibility through developing effective preventive policies and initiatives. The Declaration calls for the promotion of six specific cultures which are: a culture of peace and intercultural understanding; a culture of respect for all; a culture of good governance at all levels; a culture of resilience and care for the environment; a culture of healthy lifestyle; and a culture supporting the values of moderation. The culture of resilience and care for the environment specifically aims to promote people's awareness and care for the environment, and to prepare people for emergencies as a means to prevent risks of natural, human-induced disasters and environmental degradation. Through various programmes and activities, ASEAN has and continues to engage people in the region in developing a prevention mindset.

ASEAN-United Nations Joint Strategic Plan of Action on Disaster Management 2016–2020

The ASEAN-United Nations Joint Strategic Plan of Action on Disaster Management 2016–2020 (JSPADM) outlines ASEAN's and the United Nations' intentions and commitments to continue to work together. The plan is guided by the strategies and priorities incorporated by ASEAN into the AADMER Work Programme 2016–2020, as well as other global priorities in humanitarian action.

The JSPADM allows ASEAN and the United Nations to enhance collaboration and strengthen coordination. This will enable them to address drought in all phases; from prevention, preparedness, and response to rehabilitation and reconstruction. This includes cooperation among ASEAN Member States and with relevant United Nations agencies to incorporate disaster risk reduction into national development and recovery policies, and formulate and implement risk reduction measures to ensure resilience for the Sustainable Development Goals.

ASEAN-United Nations work on disaster risk reduction supports the Member States' commitments for the achievement of the Sendai Framework for Action (2015–2030). This framework focuses on "preventing new and reducing existing disaster risk through the implementation of integrated and inclusive economic, structural, legal, social, health, cultural educational, environmental, technological, political and institutional measures that prevent and reduce hazard exposure and vulnerability to disasters, increase preparedness for response and recovery, and thus strengthen resilience."

Building resilience to drought can best be achieved by integrated technological, institutional and policy interventions. All eight priority programmes of JSPADM could be pursued through comprehensive action on drought. Priority Programme 1 (AWARE), for example, could be pursued through regular drought assessment. Priority Programme 4 (PROTECT), could include risk financing and social protection mechanisms. Priority Programme 5 (RESPOND as One), would be supported by improving response to drought disasters.

ASEAN Disaster Risk Financing and Insurance

Losses from drought represent a significant fiscal burden. The ASEAN Vision 2025 on Disaster Management also aims to improve financial management, highlighting the importance of disaster risk transfer, including the consideration of “insurance, reinsurance and capital markets through disaster insurance pooling mechanisms at the local, national and regional levels”.⁷⁴

Since 2011, ASEAN has been implementing a roadmap on Disaster Risk Financing and Insurance (DRFI). Phase 1 of the DRFI Roadmap and Programme had been completed, and Phase 2, which will focus on the considerations and pre-conditions for establishing a regional risk insurance pool in the region, has not yet begun. This is complemented by AADMER. Both highlight the importance of integrating disaster risk management in the economic development agenda. The impacts of drought can best be addressed by a combination of social protection schemes and disaster risk insurance (Box 3-2).

ESCAP Regional Road Map for Implementing the 2030 Agenda for Sustainable Development in Asia and the Pacific

The Road Map focuses on disaster risk reduction and resilience, climate change, and natural resource management. It will thus support initiatives for drought resilience. To boost the capacity of ASEAN member States to build resilience to drought, the Road Map identifies the following priority areas of regional cooperation:

- a. Promote effective regional and subregional efforts to strengthen disaster risk modelling, assessment, mapping, monitoring and multi-hazard early warning systems of common and transboundary disasters;
- b. Facilitate regional dialogue and cooperation in integrating disaster risk reduction into related development activities;
- c. Maximize the efficiency of existing regional cooperation mechanisms, including the World Meteorological Organization/ESCAP Panel on Tropical Cyclones and the Regional Cooperative Drought Mechanism for Drought Monitoring and Early Warning;
- d. Improve analysis to enhance regional knowledge on disaster risk and resilience, promote the wide dissemination of such knowledge, identify challenges and opportunities for data-sharing and provide the analytical basis for regional cooperation;
- e. Promote capacity-building regarding climate resilience, including climate-related disaster risk reduction, through policy dialogues and the sharing of experiences and information;
- f. Develop and implement holistic and participatory disaster risk management at all levels, in line with the Sendai Framework for Disaster Risk Reduction 2015-2030, the Asian Ministerial Conference on Disaster Risk Reduction in 2016 and the 2030 Agenda for Sustainable Development;
- g. Promote a “Build Back Better” approach in recovery, rehabilitation and reconstruction, as well as implementation of the health aspects of the Sendai Framework for Disaster Risk Reduction 2015-2030, including the Bangkok Principles, with a view to ensuring more systematic cooperation, coherence and integration between disaster and health risk management.

Complementarities Initiative (ASEAN Vision 2025 and the SDGs)

ASEAN also plays a proactive role in supporting and implementing the global agenda on DRR through promoting complementarities and investments in implementing ASEAN Vision 2025 and the SDGs related to disaster risk reduction. ASEAN has undertaken a series of activities to highlight complementarities between strategic measures of the ASCC Blueprint 2025 and SDGs, in terms of being “resilient” and “sustainable” and has conducted a mapping exercise of possible complementarities between the ASEAN Vision 2025 and the SDGs. ASEAN together with the United Nations has produced two publications on the Sustainable Development Goals in ASEAN, namely:

1. ‘Complementarities between the ASEAN Community Vision 2025 and the United Nations 2030 Agenda for Sustainable Development: A Framework for Action’ which identifies five focus areas and recommends seven “flagship initiatives” that would support countries in achieving the ASEAN Community Vision 2025 and the Sustainable Development Goals. The five areas identified include poverty eradication, infrastructure and connectivity, sustainable management of natural resources, sustainable consumption and production and resilience.
2. ‘Financing the Sustainable Development Goals (SDGs) in ASEAN: Strengthening Integrated National Financing Frameworks to Deliver the 2030 Agenda’ focuses on streamlining development financing and strengthening domestic resource mobilization in ten ASEAN countries in order to finance national development.

ASEAN Smart Cities Network

ASEAN is facing rapid urbanization with 90 million people expected to urbanize by 2030. This raises concerns regarding city congestion, water/air quality, poverty, rising inequalities, urban-rural divide, citizen security and safety. The ASEAN Smart Cities Network (ASCN) is envisioned as a collaborative platform where cities from the ten ASEAN Member States (AMS) work towards the common goal of smart and sustainable urban development. Its primary goal will be to improve the lives of ASEAN citizens, using technology as an enabler. By focusing on the people, it will adopt an inclusive approach to smart city development that is respectful of human rights and fundamental freedoms as inscribed in the ASEAN Charter. The networking of Smart Cities across ASEAN would also contribute to enhancing better mutual understanding across cultures. The fundamental aspects of the network include the development of action plans specific to member cities. These action plans consist of distinct projects and actions that member cities will set in motion from 2018 to 2025. Furthermore, an ASEAN Smart Cities Framework will be designed in collaboration with member cities. This framework will determine the bloc’s definition of a smart city, outline key propositions and identify the underpinning results. As part of the framework, member cities can each partner with one of ASEAN’s external partners to work on the development of smart cities.



CHAPTER 3.

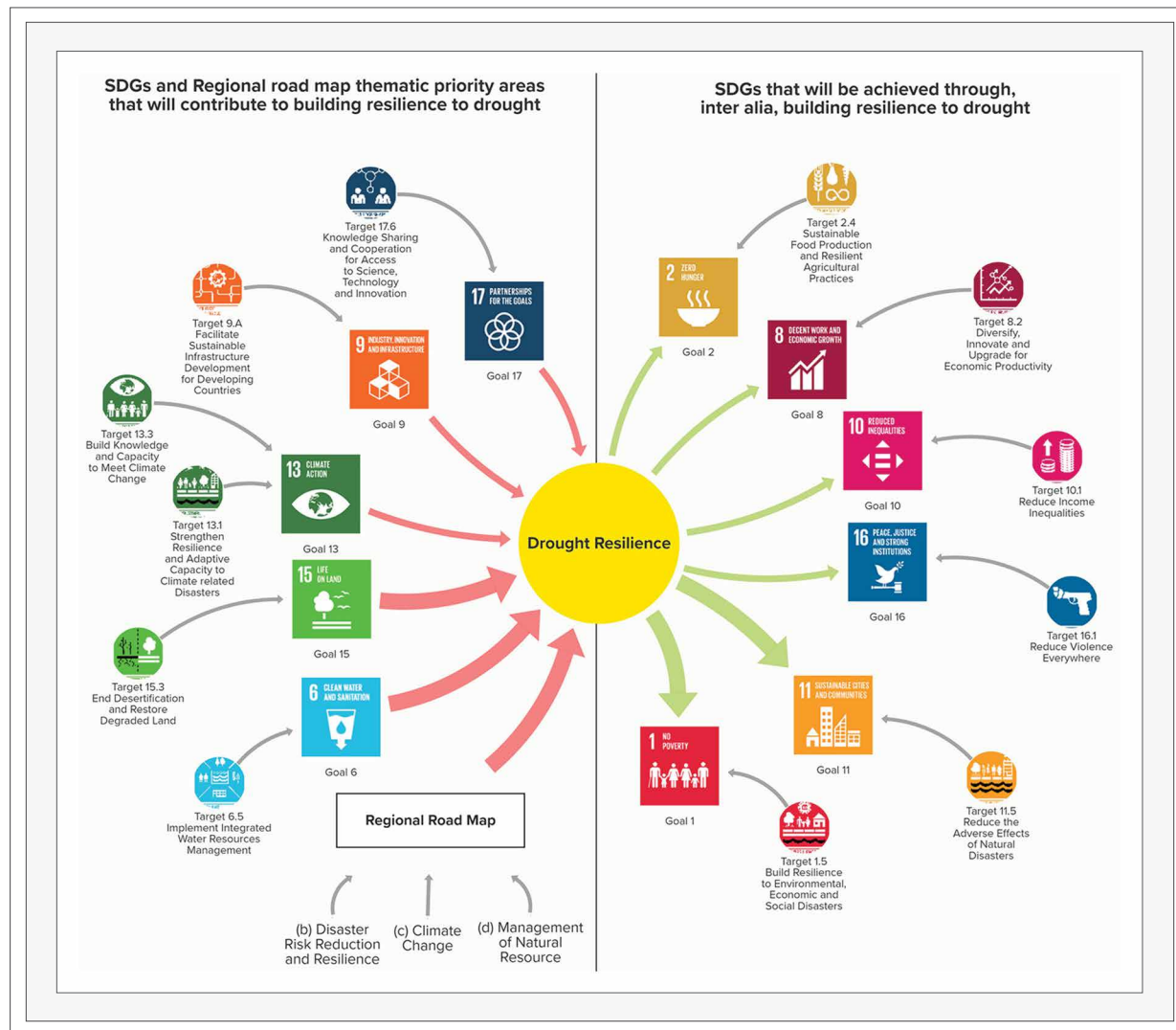
Priorities for action



ASEAN member States already have many institutions and programmes that address drought. But, in the future, the region is likely to face many more dry years that will put even greater stress on poor communities. Alleviating poverty and achieving the Sustainable Development Goals will therefore depend critically on building drought resilience into all relevant policies and programmes.

ASEAN Governments are increasingly recognizing the importance of combatting drought and have been building drought resilience into many of their policies and programmes. Drought resilience is also an integral part of the Agenda for Sustainable Development. Activities to build resilience contribute to the achievement of several SDGs. At the same time, resilience will also be achieved through several SDGs (Figure 3-1).

Figure 3-1 – Building resilience to drought for the Sustainable Development Goals



Government action will be more effective if it is based on best regional and global practices and if all member States have access to the latest information. To address poverty and reduce the impact of drought-triggered shocks on economies and households, ASEAN countries can also take advantage a number of regional goods.

Based on the findings of this study and the existing frameworks, the following interventions are proposed for implementation by ESCAP and ASEAN:

1. Strengthen drought risk assessment and early warning services

Each country should have drought monitoring and early warning services. These can alert key sectors, such as agriculture, and trigger early support, while also gearing up social protection to cushion the impact for low-income groups. Risks can also be reduced by more accurate weekly and monthly forecasts that will allow early response and mid-course corrections, as well as additional measures for drought mitigation. Longer-range forecasting can be complemented with near-real-time, in-season monitoring that can offer additional warnings several days ahead.

Many ASEAN countries were badly affected by the 1997/98 El Niño event. But they should be in a better position to address future events. Most countries have better infrastructure to produce seasonal forecasts. They also convene regular platforms via the Monsoon Forum through which they can engage with forecast users. Nevertheless, there is still more to do. In particular, countries need to move from generic forecasts to more customized drought forecasting and early warning services that could enable early action in priority sectors such as agriculture and water.

Drought forecasting and early warning services can be undertaken under the broader Global Framework for Climate Services. This is an initiative led by the United Nations through which members of the World Meteorological Organization (WMO), and inter- and non-governmental, regional, national and local stakeholders work in partnership to develop targeted climate services.

Other important regional institutions are the ASEAN Coordinating Centre for Humanitarian Assistance on Disaster Management (AHA Centre), ASEAN Specialised Meteorological Centre (ASMC), and the Regional Integrated Multi-Hazard Early Warning System for Africa and Asia (RIMES). These can provide regionally relevant datasets which can then be customized by national hydrometeorological services (NHMSs). ESCAP, the ASEAN secretariat and the WMO can help build the capacity of NHMSs to produce high-skill forecasts and early warning services for national and local decision makers. Efforts to increase the quality of forecasts should go hand-in-hand with efforts to increase the understanding of end-user requirements and fostering partnership between data providers and end-users. At the same time, it is also important to build national capacity, particularly national disaster management agencies, in order to understand, apply and react to forecast information. These efforts can be informed by the ASEAN Risk and Vulnerability Assessment (RVA) Guidelines which can be used to identify vulnerabilities and devise mitigation strategies. In addition, subsequent priority actions could also link with processes within ASEAN Climate Change Partnership Conference (CCPC).

Seasonal forecasts, conducted usually three to six months ahead, should be complemented by in-season drought monitoring. Such monitoring can be provided by scaling up ESCAP's Regional Drought Mechanism, which is a regional cooperation programme that utilizes partnerships under its long-standing Regional Space Applications Programme for Sustainable Development (RESAP) in Asia and the Pacific. Through this mechanism, countries experienced in using space applications can assist other, low-capacity, high-risk countries. RESAP uses various practical tools and components which are developed or supported by other government agencies and partners.

The Regional Drought Mechanism provides drought-prone countries with tools, services, capacity building and information that they can use to build tailored, drought-management programmes. These should include drought monitoring and early warning tools linked with seasonal and climate forecasts, and catchment water balance tools. Countries should then be able to build a cross-sectoral system that links policies and strategies with space, hydro-meteorological, census and ground-level data. The Break Detection in the Seasonal and Trend (BFAST) can complement the bottom-up drought monitoring done at the country level. This methodology uses satellite-sensed data which could be readily obtained from the ASEAN Research and Training Center for

Space Technology and Applications (ARTSA). AHA Centre's preliminary study on the application of BFAST demonstrates its potential to verify the available satellite data vis-à-vis drought reports available in the ASEAN Disaster Information Network.⁷⁵

Drought monitoring and early warning systems have been, or are being, tailored for national circumstances in Cambodia, Mongolia, Myanmar and Sri Lanka, with the support of the National Remote Sensing Centre of India, the Chinese Academy of Sciences, and the Geo-Informatics and Space Technology Development Agency of Thailand.

The Regional Drought Mechanism works through the Monsoon Forums organized by NHMSs, with technical support from RIMES, to integrate seasonal forecasts and planning with the monitoring systems in Myanmar, Cambodia, and Lao People's Democratic Republic, along with other Asia-Pacific countries. Capacity building on space applications and geographic information systems is provided by United Nations Operational Satellite Applications Programme (UNOSAT) and the national organizations, while capacity building for forecasting and meteorology is provided by RIMES.

ESCAP could enhance its partnership and collaboration with the ASEAN Research and Training Center for Space Technology and Applications. This is hosted by Thailand's Geo-Informatics and Space Technology Development Agency (GISTDA) at Sri Racha. The partnership engages in space and geo-informatics education and training, research applications and innovations in areas related to agriculture and disasters.

For longer-term planning and management, the Regional Drought Mechanism is developing a water accounting and balance system. Working with eWater Australia and the Australian Bureau of Meteorology, the initial pilot project is in Cambodia. With the support of Geoscience Australia, these tools are also being complemented by the DataCube tool, which enables more integrated management and interrogation of geospatial and other databases.

Through the RESAP network and other partners, ESCAP is constantly working to build Regional Drought Mechanism capabilities and services for countries that request support. Potential future partners include the International Centre for Tropical Agriculture, which will shortly begin a project on forecasts and local advisories for drought and disaster, and the FAO, which has tools on agriculture management and social protection.

2. Foster drought risk financing markets

Many risk financing tools are suitable for intensive disasters such as floods or earthquakes. But there are also significant opportunities for using such tools to support rural resilience against slow-onset droughts.

Risk financing is considered in global frameworks on climate risk management, for example, in the Paris Agreement and the Sendai Framework, throughout the SDGs, and through the G7 InsuResilience initiative. This has created an environment of mutual support and learning for a paradigm shift from post-disaster financing to a model where the financing is planned in advance, and can be executed quickly and efficiently, saving lives and protecting livelihoods.

The model for social protection is also evolving. Rather than relying on post-event needs assessments, the idea now is to register recipients in advance, and instead of providing food aid, to make transfers that channel cash efficiently to those most in need. Such programmes have been supported by risk-financing tools that marry global risk market capacity with developing country needs for budget stability. The African Risk Capacity, for example, has demonstrated that early warning combined with contingency planning and prior risk financing can reduce the overall impact of a drought by four to five times.⁷⁶

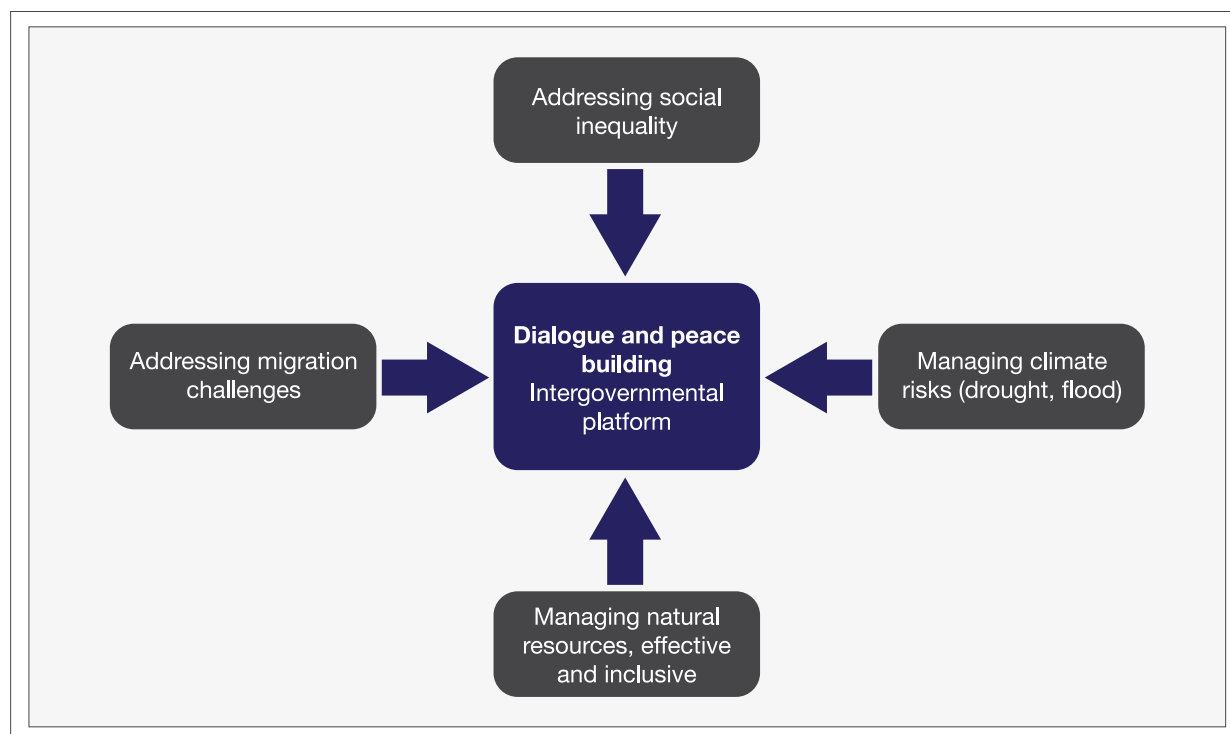
For rural households, one social protection mechanism has been agricultural insurance. But, this has proved expensive. Of the CLMV countries, Viet Nam has moved furthest towards the introduction of agricultural insurance, although with mixed success.^{77,78} There have also been initiatives to provide weather index insurance. However, when deployed alone and at the individual farmer level, weather index insurance has proven to be a disappointment. These insurance mechanisms are more effective when linked to other programmes within an integrated disaster risk framework. At the macro level, index insurance tools have had some success and the financing benefits are able to flow quickly and efficiently down to those in need.

A relatively new development is forecast-based financing. This is particularly relevant for slow-onset disasters like drought. In this case, on the basis of a drought forecast, some funds are disbursed prior to the event for preparedness and resilience-building activities, that is, before an emergency or a crisis occurs. For forecast-based financing, basis risk is even more difficult to establish than it is for conventional index insurance. But even limited pre-disaster emergency financing could lead to significant gains in resilience. Forecast-based financing is heavily dependent on remotely-sensed datasets and will benefit from the use of space-based data at the regional level. ESCAP could play a critical role in this respect, as demonstrated by the Regional Drought Mechanism.

3. Reduce conflict by enhancing the adaptive capacity to drought

In addition to more conventional peace-building approaches, further entry points for reducing conflict are offered by climate adaptation and disaster risk reduction strategies and measures. Where conflict is based on competition for scarce resources, competing interests can be channelled into non-violent resolutions through better management of natural resources, combined with climate adaptation.

Figure 3.2 – Climate adaptation and disaster risk reduction are entry points that help reduce conflicts



Conflict risks will increasingly arise in complex and drought-affected areas. It will be important therefore to prepare for evolving conflict scenarios so as to prevent and mitigate the long-term adverse impacts on community resilience and stability.

Ready for the Dry Years

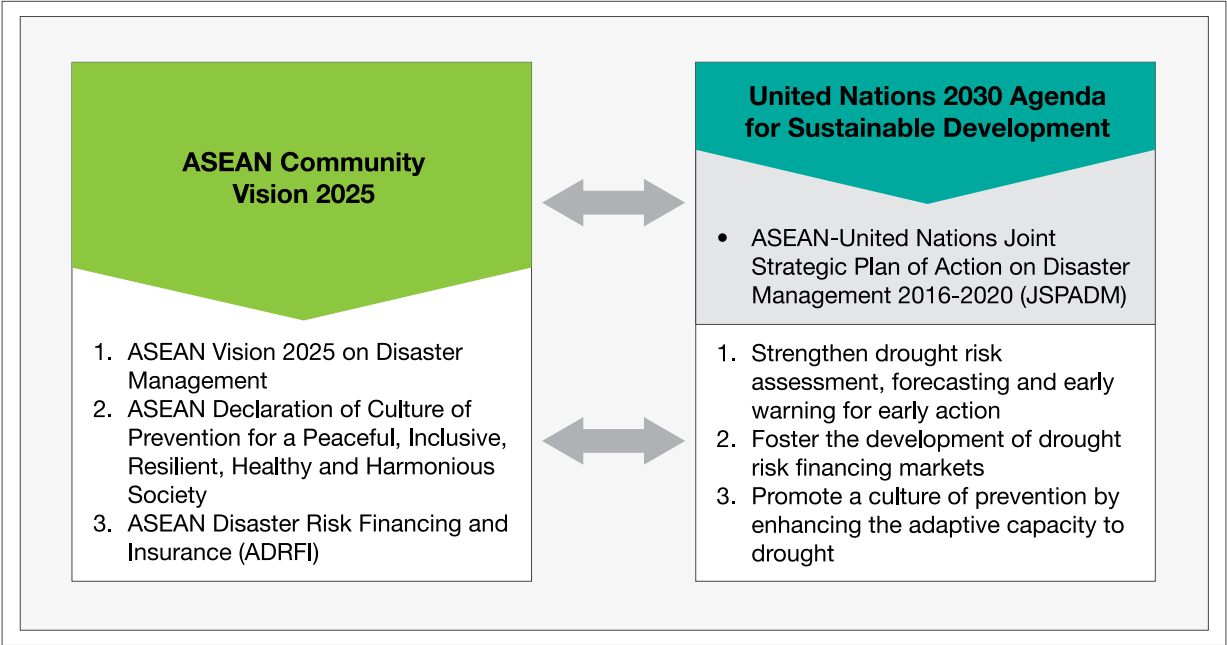
As this report has demonstrated, drought has had devastating impacts in South-East Asia, and there are likely to be many dry years ahead. ASEAN countries will need to be increasingly alert to the risks, and be ready to take the necessary action.

In particular, they will need to protect the region’s poorest people, who are already likely to live on the degraded land that is most vulnerable to the effects of drought. All the elements of drought planning should work together. And, as this report has shown, countries can also work individually and together to strengthen risk assessments and forecasting, develop risk financing markets, and enhance people’s adaptive capacity. The priority actions are listed in Table 3-1.

ESCAP is prepared to work with all partners to develop a two-year roadmap. This will help ensure a continued and strong momentum in our collaborative efforts, and promote synergies across priority areas. These efforts can be monitored under the ASEAN-United Nations collaboration, including the JSPADM. The proposed ASEAN Centre for Sustainable Development Studies and Dialogue provides technical advice for enhancing complementarities between the ASEAN Vision and the 2030 Agenda for Sustainable Development (Figure 3-3).

While the dry years are inevitable, their consequences are not. Many timely steps taken now can mitigate the impacts of drought, protect the poorest communities, and foster more peaceful societies.

Figure 3-3 – Complementarities between the ASEAN vision and the 2030 Agenda



Box 3-1 – ASEAN Dynamic Risk Assessment Guidelines and Experiences

Disaster risks, defined as a function of hazard, vulnerability and capacity, are dynamic in nature. Yet existing risk assessments predominantly incorporate only historical and static variables. Accounting for the dynamic variables in risk assessment processes (such as rainfall, water levels in rivers/reservoirs, tide levels, soil moisture) will help in better understanding the dynamic nature of disaster risks and will lead to more realistic forecasting of impacts.

Dynamic assessment is particularly important for drought risks whose impact partly depends on the interaction of the same hazard (for example, dry spells, droughts) occurring many times, over a period of time, at the same time, or in different magnitudes at the same place.

ASEAN Dynamic Risk Assessment Guidelines and Experiences (ADAGE) provides a framework for dynamic risk assessment, a selection of global databases that can be used as inputs to dynamic risk assessment, and examples of applications. It is intended to complement the application of the ASEAN Regional Risk and Vulnerability Guidelines with a sole focus on dynamic risk assessment. This is ESCAP's contribution to the implementation of Priority Programme 1 (Risk awareness and assessment of the ASEAN-United Nations Joint Strategic Plan of Action on Disaster Management) for which ESCAP is the lead United Nations agency.

Box 3-2 – Parametric risk insurance for drought and related disasters

Indonesia – The impacts and effects of adverse weather events, such as droughts, floods, and hurricanes, were felt during the most recent El Niño, when some of the worst-hit agribusinesses reported up to 30 per cent drops in projected yields. To mitigate future risks, the Government, in cooperation with reinsurance companies like PT Reasuransi MAIPARK, is using innovative parametric insurance products for agriculture damage, particularly related to drought and flood. The new insurance products intend to protect farmers, agribusinesses, and banks, and also attract further investment by reducing the risks associated with natural hazards and adverse weather events.⁷⁹

Philippines – In 2017, the Government of the Philippines launched a new catastrophe risk insurance programme to help the Philippines better respond to losses from climate and disaster risks. Insurance payouts are made when pre-defined parametric triggers are met. The programme provides the Philippine peso equivalent of \$206 million in coverage against losses from major typhoons and earthquakes to national government assets, and to 25 participating provinces against losses from major typhoons.⁸⁰

Table 3-1 – Implementation of recommendations

Steps	Policy Interventions	Nodal Institutions	Partnerships	Key Actions
Step 1	Strengthening drought risk assessment, impact-based forecasting, technology-supported monitoring and early warning	Geo-informatics and Space Technology Development Agency (GISTDA) & ASEAN Research and Training Center for Space Technology and Applications (ARTSA)	ESCAP, ASEAN, International Organizations, Regional Organizations (RIMES, ADPC), etc.	<p>GISTDA and ARTSA can work together with ESCAP, ASEAN, RIMES and ADPC towards fostering a mechanism that helps improve accessibility, availability and quality of data for drought risk assessment while also providing seasonal forecast and long-term scenarios for effective policy and strategic decisions for drought risk management.</p> <p>ARTSA can provide guidance to scientific and training programmes towards developing mechanisms to respond to new challenges such as current and future risks.</p> <p>It can further help ASEAN to build upon good practices towards addressing and managing drought risk and its impacts, so as to provide the much-needed push from crisis management to ex-ante drought risk management.</p> <p>ARTSA together with ESCAP can work with ASEAN to engage countries to actively contribute toward exchanging data, sharing best practices and mutually supporting each other, including facilitating the access and use of near-real time earth observation data to derive products for the timely monitoring of drought.</p> <p>ARTSA can take guidance from ASEAN Dynamic Risk Assessment Guidelines and Experiences (ADAGE) for dynamic risk assessment to complement the application of the ASEAN Regional Risk and Vulnerability Guidelines (2017). ESCAP is the lead United Nations agency to implement the Priority Programme 1 for Risk awareness and assessment of the ASEAN-United Nations Joint Strategic Plan of Action on Disaster Management.</p> <p>ARTSA, RIMES, ESCAP and ASEAN can further work together towards climate resilience and climate risk management by convening regular platforms, such as the Monsoon Forums, providing generic forecast to customized drought forecast and early warning services for agriculture and water sectors.</p>
Step 2	Fostering the development of drought risk financing markets	Geo-informatics and Space Technology Development Agency (GISTDA) & ASEAN Research and Training Center for Space Technology and Applications (ARTSA)	ESCAP, ASEAN, Insurance Agencies, Financial Institutions, International Organizations, etc.	<p>ARTSA can further support ESCAP and ASEAN towards developing parametric insurance products that would help farming communities towards adaptation to drought by protecting their investments against recurrent droughts.</p> <p>ARTSA through its research arm can support ASEAN towards a comprehensive risk management programme to address risk financing, through risk reduction, using improved resource management, risk transfer using insurance, and risk reserves using savings. This would result in the setting up of insurance of assets that would possibly provide the farming community with compensation for losses and prevent them from selling productive assets.</p> <p>ARTSA can also work towards developing risk financing tools to channel financing to those in need when drought occurs by linking to other programmes within a holistic disaster risk framework.</p>
Step 3	Promote a culture of prevention by enhancing the adaptive capacity to drought	ASEAN	ESCAP and other International Organizations	<p>ASEAN and ESCAP can work together towards fostering a culture of prevention by creating awareness towards building adaptive capacity to drought that would not only build resilience but would also promote the culture of prevention.</p> <p>Promote a culture of drought mitigation and preparedness.</p> <p>Support the use of knowledge, innovation and education to build a culture of safety and resilience at all levels.</p>

Appendix A

Association between drought index and GDP

The INFORM Risk Index data (found at <http://www.inform-index.org/>) was used for the main analysis. The data includes a drought index that aggregates three drought related variables: (1) agriculture drought probability (FAO); (2) people affected by drought, absolute and relative (EM-DAT, CRED) and (3) frequency of drought events (EM-DAT, CRED).

The regression main effects estimates included 49 countries in Asia and the Pacific. The interaction/mediating effect of drought on the socioeconomic variables (Drought*ASEAN) in ASEAN countries was determined for the 10 ASEAN countries as follows: Brunei Darussalam, Cambodia, Indonesia, Lao People's Democratic Republic, Malaysia, Myanmar, Philippines, Singapore, Thailand, and Viet Nam. The interaction effect was statistically significant for modelling the relationship between the drought index, GDP, and per capita health expenditure but not significant for inequality; signalling that among ASEAN countries, there is a differential impact from drought on some socioeconomic variables than among the rest of the countries in the Asia-Pacific region. In addition, it should be noted that while disasters have significant impacts, there are other variables for which data is not available which can be more significantly related to the dependent variables. The coefficients should also be interpreted with caution due to a relatively low sample size that may lead to more unstable estimates.

Table A-1 – Basis statistics for predicted, predictor, and control variables used in the estimation (N=49)

Variable	Mean	Range	Standard Deviation	Source
Drought Index (0-10)	3.02	0.0-5.60	1.68	Inform Index for Risk Management (2018)
Per capita health expenditure (Constant 2011 USD)	876.72	88.075-4357.26	1112.09	Inform Index for Risk Management (2018)
GDP (2010 USD Constant)	11087.4	926.77-50352.0	17093.1	ESCAP Statistical Database (Accessed, 16 April 2018)
Governance (0-10)	5.75	1.1-8.6	1.66	Inform Index for Risk Management (2018)
Land area (sq. km)	1059594.3	21.0-16376870.0	2840578.8	Inform Index for Risk Management (2018)
Total population	90235410.6	11097.0-1378664960.0	268991240.4	Inform Index for Risk Management (2018)

Table A-2 – Regression estimates of drought, GDP, inequality, and per capita health expenditure

	Standardized Beta	t-statistic	Significance	Model R-square
GDP				
Final Model			0.000	0.701
Constant	5616.72	9.379	0.000	
Drought index ASEAN (interaction)	-0.620**	-3.738	0.001	
Drought index Asia-Pacific region (main effect)	0.082	0.886	0.380	
ASEAN (main effect)	0.743	4.453	0.000	
Total population	-0.142	-1.612	0.114	
Land area (sq. km)	0.150	1.631	0.110	
Governance	-0.683**	-7.842	0.000	
Inequality				
Final Model			0.002	0.335
Constant	4.674	10.995	0.000	
Drought index ASEAN (interaction)	-0.076	-0.259	0.798	
Drought index Asia-Pacific region (main effect)	-0.173	-1.166	0.252	
ASEAN (main effect)	0.322	1.082	0.287	
Total population	0.035	0.243	0.809	
Land area (sq. km)	0.134	0.861	0.395	
GDP per capita	-0.713**	-4.610	0.000	
Per capita health expenditure				
Final Model			0.000	0.789
Constant	1150.705	4.052	0.000	
Drought index ASEAN (interaction)	-0.340**	-2.094	0.043	
Drought index Asia-Pacific region (main effect)	0.116	1.447	0.156	
ASEAN (main effect)	-0.541	-2.940	0.065	
Total population	0.126	1.637	0.109	
Land area (sq. km)	0.160	1.745	0.089	
GDP per capita	0.907**	9.532	0.000	

Note: ** $p < .05$

Endnotes

¹ Bekele Shiferaw and others (June 2014).

² While bearing in mind that disaster records are incomplete and that there is no standard definition of what constitutes a “drought” disaster.

³ AHA Centre (2018).

⁴ Ibid.

⁵ Wenant Kerdchuen (30 May 2016).

⁶ European Commission's Directorate-General for European Civil Protection and Humanitarian Aid Operations (30 August 2017).

⁷ ESCAP Statistical Database.

⁸ ESCAP (2017).

⁹ Ibid.

¹⁰ In the southernmost state of India, Tamil Nadu, it has been estimated that the 2012-2013 drought caused a 32 per cent drop in agricultural output which further cascaded to a 17 per cent fall in industrial output and an 8 per cent fall in the service sector. See ESCAP (2017).

¹¹ Rishiraj Dutta (2018).

¹² Viet Nam Academy of Water Resources.

¹³ FAO (2016).

¹⁴ South-East Asia: Drought – 2015-2017.

¹⁵ The Assessment Capacities Project (ACAPS) (15 March 2016).

¹⁶ Government of Indonesia and World Food Programme (28 January 2016).

¹⁷ European Commission's Directorate-General for European Civil Protection and Humanitarian Aid Operations (20 March 2016).

¹⁸ Government of Myanmar (14 March 2016).

¹⁹ United Nations, Office for the Coordination of Humanitarian Affairs (OCHA) (31 May 2016).

²⁰ United Nations, Office for the Coordination of Humanitarian Affairs (OCHA) (31 January 2017).

²¹ Ibid.

²² South-East Asia: Drought – 2015-2017.

²³ Viet Nam, United Nations Office for the Coordination of Humanitarian Affairs and United Nations Country Team in Viet Nam (21 October 2016).

²⁴ United Nations Office for Disaster Risk Reduction (UNISDR). “Terminology on Disaster Risk Reduction”.

²⁵ UNISDR (2009).

²⁶ The variables used to define the threshold between intensive and extensive disaster losses are mortality and housing destruction. Statistically, the threshold is fixed at: Mortality: less than 30 people killed (extensive); 30 or more killed (intensive). Or, housing destruction: less than 600 houses destroyed (extensive); 600 or more houses destroyed (intensive). This threshold has proved robust even as the universe of national disaster databases continues to grow (GAR 2015).

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²⁸ Ibid.

²⁹ ESCAP (2018b).

³⁰ Ibid.

³¹ ESCAP, “Natural disasters and conflict in Asia-Pacific: Issues of correlation and contiguity”.

³² Inform Index for Risk Management (2015).

³³ ESCAP (2017).

³⁴ ESCAP, “Natural disasters and conflict in Asia-Pacific: Issues of correlation and contiguity”.

³⁵ Thomas F. Homer-Dixon (1994).

³⁶ Nina von Uexkull and others (2016).

³⁷ Ibid.

³⁸ ESCAP (2018a).

³⁹ ESCAP, “Natural disasters and conflict in Asia-Pacific: Issues of correlation and contiguity”.

⁴⁰ United Nations Convention to Combat Desertification (UNCCD). (10 May 2013)

⁴¹ ESCAP, “Natural disasters and conflict in Asia-Pacific: Issues of correlation and contiguity”.

⁴² R. K. Pachauri and others (2014).

⁴³ The degree of severity corresponds to the return period (RP). The RP was considered for 30 years for El Niño 1997 and 15 years for El Niño 1982. The two periods were considered based on the highest percentage of moderate to extreme drought area in the historical period that was selected as a threshold condition. The 30-year RP was considered for El Niño 1997 with extreme conditions, while the 15-year return period was considered for El Niño 1982 representing the second highest extreme condition. These return periods will provide the recurrence interval of such conditions, that is, an estimate of the likelihood of the next drought event in a future scenario. It further highlights the evolving future risk in the area which would help decision makers to appropriately design their drought mitigation measures.

⁴⁴ UNISDR (2015).

⁴⁵ Thomas F. Homer-Dixon (1994).

⁴⁶ The source documents for this review include: national policies, strategies, adaptation programmes, action plans, nationally determined contributions for adaptation (NDCs), or intended nationally determined contributions (INDCs). They also include agricultural development plans, technical needs assessments in adaptation (TNAs) and sectoral strategies.

⁴⁷ Cambodia, Ministry of Water Resources and Meteorology (2012).

⁴⁸ Cambodia, Ministry of Agriculture, Forestry and Fisheries (2015).

⁴⁹ Cambodia, Ministry of Water Resources and Meteorology (2012).

⁵⁰ Salman Humayun and Mary Picard (2017).

⁵¹ Ibid.

⁵² Ibid.

⁵³ Lao People's Democratic Republic (1999). Decree on Establishment of National Disaster Management Committee.

⁵⁴ Ibid.

⁵⁵ Ibid.

⁵⁶ Ibid.

⁵⁷ Abhijit Bhattacharjee (2017).

⁵⁸ Myanmar DRR Working Group (June 2013).

⁵⁹ Myanmar, Ministry of Social Welfare, Relief and Resettlement (2016).

⁶⁰ Ibid.

⁶¹ Ibid.

⁶² Myanmar DRR Working Group (June 2013).

⁶³ Myanmar, Ministry of Social Welfare, Relief and Resettlement (2016).

⁶⁴ Ibid.

⁶⁵ World Bank and Global Facility for Disaster Reduction and Recovery (2017).

⁶⁶ World Bank and Global Facility for Disaster Reduction and Recovery (2017).

⁶⁷ World Bank (16 May 2017).

⁶⁸ World Bank and Global Facility for Disaster Reduction and Recovery (2017).

⁶⁹ Viet Nam, National Assembly of the Socialist Republic of Vietnam (2016).

⁷⁰ Viet Nam, Ministry of Natural Resources and Environment (20 March 2015).

⁷¹ FAO (2011).

⁷² FAO (2011).

⁷³ ASEAN Community Vision 2025, para 12.4.

⁷⁴ ASEAN Vision 2025 on Disaster Management.

⁷⁵ Sari, Pang, and Bisri (forthcoming 2019).

⁷⁶ African Risk Capacity (ARC).

⁷⁷ Ha Thi Thieu, Dao and Lai Van, Tai (2014).

⁷⁸ Viet Nam News (10 October 2015).

⁷⁹ Tina Taheri (27 April 2017).

⁸⁰ World Bank (15 August 2017).

References

African Risk Capacity (ARC). How the African Risk Capacity Works. (Accessed 14 April 2018). Available from: <http://www.africanriskcapacity.org/2016/10/29/how-arc-works/>.

ASEAN Community Vision 2025. Available from: <https://www.asean.org/wp-content/uploads/images/2015/November/aec-page/ASEAN-Community-Vision-2025.pdf>

ASEAN Coordinating Centre for Humanitarian Assistance on disaster management (AHA Centre) (2018). Weekly Disaster Update 3-9 Sept 2018. (Accessed October 2019). Available from: <https://ahacentre.org/weekly-disaster-update/weekly-disaster-update-3-9-sept-2018/>

ASEAN Vision 2025 on Disaster Management. Available from: https://www.asean.org/wp-content/uploads/2012/05/fa-220416_DM2025_email.pdf

Bhattacharjee, Abhijit (28 February 2018). Evaluation of Disaster Risk Reduction Project. Final Report. United Nations Development Programme, Myanmar. Available from: <https://erc.undp.org/evaluation/documents/download/10363>.

Cambodia, Ministry of Agriculture, Forestry and Fisheries (2015). Agricultural Sector Strategic Development Plan 2014-2018. Phnom Penh. Available from: <http://extwprlegs1.fao.org/docs/pdf/cam155661.pdf>

Cambodia, Ministry of Water Resources and Meteorology (2012). Climate Change Strategic Plan for Water Resources and Meteorology (2013-2017). Phnom Penh.

Dao, Ha Thi Thieu, and Tai, Lai Van (2014). Agricultural Insurance Market Development: The Role of Vietnam Government. International Journal of Economics, Commerce and Management, vol. II, No. 9. Available from: <http://ijecm.co.uk/wp-content/uploads/2014/09/2940.pdf>

Dutta, Rishiraj (January 2018). Drought Monitoring in the Dry Zone of Myanmar using MODIS Derived NDVI and Satellite Derived CHIRPS Precipitation Data. Sustainable Agriculture Research, vol. 7, No. 2. Thailand. Available from: <http://www.ccsenet.org/journal/index.php/sar/article/view/72870>.

EM-DAT: International Disaster Database. Available at: <https://www.emdat.be/>

European Commission's Directorate-General for European Civil Protection and Humanitarian Aid Operations (20 March 2016). Malaysia – Drought

(Media) (ECHO Daily Flash of 20 March 2016). (Accessed 2 May 2018). Available from: <https://reliefweb.int/report/malaysia/malaysia-drought-media-echo-daily-flash-20-march-2016>.

European Commission's Directorate-General for European Civil Protection and Humanitarian Aid Operations (30 August 2017). Vietnam: assisting drought-affected farmers in the Central Highlands. Available from: <https://reliefweb.int/report/viet-nam/vietnam-assisting-drought-affected-farmers-central-highlands>

Food and Agriculture Organization (FAO) (2016). "El Niño" event in Viet Nam: Agriculture, Food Security and Livelihood Needs Assessment in Response to Drought and Salt Water Intrusion. Ha Noi. Available from: <http://www.fao.org/3/a-i6020e.pdf>.

Food and Agriculture Organization (FAO) (2011). Strengthening Capacities to Enhance Coordinated and Integrated Disaster Risk Reduction Actions and Adaptation to Climate Change in Agriculture in the Northern Mountain Regions of Viet Nam: Institutional Needs Assessment for Risk Reduction and Climate Change Adaptation in the agriculture sector at provincial level for Lao Cai, Phu To and Yen Bai Provinces. Ha Noi.

Government of Indonesia and World Food Programme (28 January 2016). Indonesia Food Security Monitoring Bulletin Special Focus: The Impact of Drought related to El Niño, Volume 2, January 2016. Available from: <https://reliefweb.int/report/indonesia/indonesia-food-security-monitoring-bulletin-special-focus-impact-drought-related-0>

Government of Myanmar (14 March 2016). Over a quarter million Ayeerwaddy villagers could experience El Niño induced water shortages. Available from: <https://reliefweb.int/report/myanmar/over-quarter-million-ayearwaddy-villagers-could-experience-el-nino-induced-water>

Hariadi, Mugni Hadi (July 2017). Projected drought severity changes in Southeast Asia under medium and extreme climate change. Wageningen University and Research, and Royal Netherlands Meteorological Institute, Ministry of Infrastructure and the Environment, KNMI Scientific Report WR-2017-02. (M.Sc. thesis report). Available from: <http://bibliotheek.knmi.nl/knmipubWR/WR2017-02.pdf>.

Homer-Dixon, Thomas F. (Summer 1994). Environmental Scarcities and Violent Conflict: Evidence from Cases. *International Security*, vol. 19, No. 1, pp. 5-40.

Humayun, Salman and Picard, Mary (2017). Implementing the Law on Disaster Management in Cambodia: Developing Subsidiary Legislation. International Federation of Red Cross and Red Crescent Societies (IFRC) and United Nations Development Programme (UNDP). Available from: <http://www.ifrc.org/docs/IDRL/Cambodia%20DM%20Subsidiary%20Legislation%20Report%20LR.PDF>.

Inform Index for Risk Management (2015). INFORM Concept and methodology, (Version 2016). Available from: <http://www.inform-index.org/Portals/0/InfoRM/2016/INFORM%20Concept%20and%20Methodology%20Version%202016%20updated%20cover.pdf?ver=2015-11-26-123614-937>

Inform Index for Risk Management (2017). INFORM 2017: Results and data. (Accessed 15 April 2018). Available from: <http://www.inform-index.org/INFORM-2017-Results-and-data>.

Kerdchuen, Wenant (30 May 2016). Relief as rain falls, but drought's aftermath to linger. Bangkok Post. Thailand. Available from: <https://www.bangkokpost.com/news/general/994313/relief-as-rain-falls-but-droughts-aftermath-to-linger>

Lao People's Democratic Republic (1999). Decree on Establishment of National Disaster Management Committee. Available from: https://www.preventionweb.net/files/22033_15958ndmcpmdecree1.pdf

Myanmar DRR Working Group (June 2013). A Situational Analysis of Disaster Risk Reduction in Myanmar. Available from: https://www.preventionweb.net/files/workspace/37131_candidatepublicationasituationalana.pdf.

Myanmar, Ministry of Social Welfare, Relief and Resettlement (8 April 2016). Proceedings Lessons Learnt Workshop on Myanmar Action Plan on Disaster Risk Reduction (MAPDRR) Implementation. Nay Pyi Taw. Available from: http://themimu.info/sites/themimu.info/files/documents/Report_MAPDRR_Lesson_Learn_Workshop_Apr2016.pdf.

National Disaster Management Committee, Republic of the Union of Myanmar (October 2017). Myanmar Action Plan on Disaster Risk Reduction, 2017. Available from: http://www.mm.undp.org/content/myanmar/en/home/library/environment_energy/Myanmar_Action_Plan_DRR_2017.html

National Oceanic and Atmospheric Administration Advanced Very High-Resolution Radiometer (NOAA AVHRR). Available from: <https://noaasis.noaa.gov/NOAASIS/ml/avhrr.html>

Pachauri, R. K. and others (2014). Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. Intergovernmental Panel on Climate Change (IPCC). Geneva, Switzerland.

Sari, Pang, and Bisri (forthcoming 2019). BFAST (Break Detection in the Seasonal and Trend) for drought monitoring. ASEAN Risk Monitoring and Disaster Management Review (ARMOR). Jakarta: ASEAN Coordinating Centre for Humanitarian Assistance on disaster management (AHA Centre).

Shiferaw, Bekele and others (June 2014). Managing vulnerability to drought and enhancing livelihood resilience in sub-Saharan Africa: Technological, institutional and policy options. *Weather and Climate Extremes*, vol. 3, pp. 67-79.

South-East Asia: Drought – 2015-2017. Available from: <https://reliefweb.int/disaster/dr-2015-000180-vnn>

Taheri, Tina (27 April 2017). IFC Partners with PT Reasuransi MAIPARK to Insure Farmers Against Climate Risks. International Finance Corporation (IFC), World Bank Group. Available from: <https://ifcextapps.ifc.org/IFCExt/pressroom/IFCPressRoom.nsf/0/E5896666C23987DD8525810F002DB3B0> (accessed 4 May 2018).

The Assessment Capacities Project (ACAPS) (15 March 2016). Briefing Note: Indonesia Drought. Available from: <https://reliefweb.int/report/indonesia/acaps-briefing-note-indonesia-drought-15-march-2016>

United Nations Convention to Combat Desertification (UNCCD) with inputs from United Nations Department of Economic and Social Affairs and Sustainable Development Knowledge Platform (10 May 2013). TST Issues Brief: Desertification, Land Degradation and Drought. Available from: <https://sustainabledevelopment.un.org/content/documents/1803tstissuesdldd.pdf>.

United Nations, Economic and Social Commission for Asia and the Pacific (ESCAP) (2017). Leave No One Behind: Disaster Resilience for Sustainable Development. Asia-Pacific Disaster Report 2017. (United Nations publication, Sales No. E.17.II.F.16). Available from: http://www.unescap.org/sites/default/files/1_Disaster%20Report%202017%20Low%20res.pdf

--- (2018a). A Prevention Agenda for Resilience in Asia and the Pacific: Understanding Risk to Mitigate Conflict and Prevent Crises. Paper presented at the Regional Dialogue on Sustaining Peace, 18-19 January, Doha, Qatar.

--- (2018b). Inequality in Asia and the Pacific in the era of the 2030 Agenda for Sustainable Development. (United Nations publication, Sales No. E.18.II.F.13). Available from: <https://www.unescap.org/publications/inequalityasia-and-pacific-era-2030-agenda-sustainable-development>

--- Natural disasters and conflict in Asia-Pacific: Issues of co-relation and contiguity. (Unpublished manuscript).

--- Statistical Database. (Accessed 23 April 2018). Available from: <https://www.unescap.org/stat/data>.

United Nations Economic and Social Commission for Asia and the Pacific, based on urban data from UN-DESA, (2014). World Urbanization Prospects: The 2014 Revision, CD-ROM edition; multi-hazard risk index from UNEP/UNISDR (2013) and Global Risk Data Platform. (Accessed on 7 August 2017). Available from: <http://preview.grid.unep.ch/>

United Nations Framework Convention on Climate Change. Available from: <https://unfccc.int/>

United Nations World Food Programme, Center for Food Availability and Vulnerability Agency for Food Security, Remote Sensing Application Center Indonesia National Institute of Aeronautics and Space and, Food and Agriculture Organization of the United Nations (2016). Indonesia: Food Security Monitoring Bulletin, Special Focus: Impact of El Niño, vol. 2. Available from: http://documents.wfp.org/stellent/groups/public/documents/ena/wfp281158.pdf?_ga=2.15783285.295392897.1525331046-1942530761.1491222404

United Nations, Office for the Coordination of Humanitarian Affairs (OCHA) (31 May 2016). Myanmar: Natural disaster risks and past events (as of 31 May 2016). Available from: <https://reliefweb.int/map/myanmar/myanmar-natural-disaster-risks-and-past-events-31-may-2016>

--- (31 January 2017). Philippines: 2016 Highlights of Displacement and Effects Snapshot. Available from: <https://reliefweb.int/report/philippines/philippines-2016-highlights-displacement-and-effects-snapshot>

United Nations Office for Disaster Risk Reduction (UNISDR). Desinventar database. Sendai Framework for Disaster Risk Reduction. (Accessed 12 April 2018). Available from: <https://www.desinventar.net/DesInventar/results.jsp>

--- (2009). Global Assessment Report on Disaster Risk Reduction 2009. Available from: <https://www.preventionweb.net/english/hyogo/gar/report/index.php?id=9413&pid:38&pil:1>

--- (2013). Global Assessment Report on Disaster Risk Reduction 2013: From Shared Risk to Shared Value: The Business Case for Disaster Risk Reduction. Geneva.

--- (2015). Global Assessment Report on Disaster Risk Reduction 2015: Making Development Sustainable: The Future of Disaster Risk Management. Geneva.

--- Terminology on Disaster Risk Reduction. (Accessed 25 April 2018). Available from: <https://www.unisdr.org/we/inform/terminology#letter-e>.

United Nations, Office for the Coordination of Humanitarian Affairs (OCHA) (31 May 2016). Myanmar: Natural disaster risks and past events

(as of 31 May 2016). Available from: <https://reliefweb.int/map/myanmar/myanmar-natural-disaster-risks-and-past-events-31-may-2016>

--- (31 January 2017). Philippines: 2016 Highlights of Displacement and Effects Snapshot. Available from: <https://reliefweb.int/report/philippines/philippines-2016-highlights-displacement-and-effects-snapshot>

United Nations Framework Convention on Climate Change. Available from: <https://unfccc.int/>

United Nations World Food Programme, Center for Food Availability and Vulnerability Agency for Food Security, Remote Sensing Application Center Indonesia National Institute of Aeronautics and Space and, Food and Agriculture Organization of the United Nations (2016). Indonesia: Food Security Monitoring Bulletin, Special Focus: Impact of El Niño, vol. 2. Available from: http://documents.wfp.org/stellent/groups/public/documents/ena/wfp281158.pdf?_ga=2.15783285.295392897.1525331046-1942530761.1491222404

Viet Nam, Ministry of Natural Resources and Environment (20 March 2015). Steering Committee for Natural Disaster Prevention and Control established. Available from:

Viet Nam, National Assembly of the Socialist Republic of Vietnam (2016). Resolution on the Five-Year Socio-Economic Development Plan of 2016-2020. Ha Noi.

Viet Nam News (10 October 2015). Agriculture insurance vital to mitigate risks. Ha Noi. Available from: <http://vietnamnews.vn/society/276912/agriculture-insurance-vital-to-mitigate-risks.html#MxYU2fkZSOhAmP5K.97>.

Viet Nam, United Nations Office for the Coordination of Humanitarian Affairs and United Nations Country Team in Viet Nam (21 October 2016). Viet Nam: Emergency Response Plan 2016/17 - Update on Recovery (October 2016). Available from: http://www.un.org.vn/en/publications/doc_details/524-viet-nam-emergency-response-plan-201617-october-2016.html

von Uexkull, Nina and others (November 2016). Civil conflict sensitivity to growing-season drought. Proceedings of the National Academy of Sciences, vol. 113, No. 44, pp. 12391-12396.

World Bank and Global Facility for Disaster Reduction and Recovery (2017). Toward Integrated Disaster Risk Management in Vietnam: Recommendations Based on the Drought and Saltwater Intrusion Crisis and the Case for Investing in Longer-Term Resilience: Overview. Washington, DC. Available from: https://www.gfdrr.org/sites/default/files/publication/17027-Vietnam-Strategy-OVERVIEW-FINAL_EN_Web.pdf

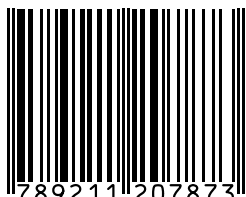
World Bank (15 August 2017). Philippines Launches Innovative Insurance Program to Boost Natural Disaster Risk Management. Washington D.C. Available from: <http://www.worldbank.org/en/news/press-release/2017/08/15/philippines-launches-innovative-insurance-program-to-boost-natural-disaster-risk-management>.

World Bank (16 May 2017). Vietnam - Emergency Natural Disaster Reconstruction Project. Vietnam. Available from: <http://projects.worldbank.org/P163146?lang=en>

World Vision (9 September 2002). Cambodia: 1 million at risk due to drought and floods. Available from: <https://reliefweb.int/report/cambodia/cambodia-1-million-risk-due-drought-and-floods>.

South-East Asia is regularly hit by droughts. Ready for the Dry Years offers a clear analysis of this subject, assessing prospects for the decades ahead and highlighting the principal risks. Though starting slowly, droughts can have devastating cumulative impacts – striking hardest at the poor and heightening inequality, as well as degrading land and increasing the prospects of conflict. The report shows that there will be many more dry years ahead, and the area affected by drought is likely to shift and expand.

This report identifies actions that ASEAN member States can individually and collectively undertake to mitigate the impacts of drought. Many timely steps taken now, to strengthen risk assessments and forecasting, develop risk financing markets, and enhance people's adaptive capacity, can contribute towards protecting the poorest communities and fostering more peaceful societies.



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