Natural Disasters in Malaysia: A Five-Year Review (2020-2025)

1. Executive Summary

Malaysia, a nation situated in Southeast Asia, faces persistent and escalating challenges from natural disasters, primarily driven by its tropical climate, monsoon patterns, and increasingly, the impacts of global climate change and rapid urbanization. This report provides a comprehensive review of significant natural disaster events in Malaysia from 2020 to early 2025, analyzing their types, frequency, geographical distribution, and profound human and economic consequences. The period under review reveals a clear dominance of hydrometeorological events, particularly floods, which consistently account for the majority of displacements, fatalities, and economic losses. Landslides, often triggered by intense rainfall and exacerbated by human activities, represent a critical threat, while transboundary haze remains a recurring environmental and public health concern. The analysis underscores a trend of increasing disaster intensity and unpredictability, highlighting the urgent need for robust, integrated disaster management strategies that prioritize climate adaptation, resilient infrastructure, and proactive regional cooperation.

2. Introduction

Malaysia's geographical location renders it inherently vulnerable to a diverse array of natural hazards. Its tropical climate and distinct monsoon seasons predispose the nation to frequent hydrometeorological events, including heavy rainfall, floods, and storms.[1] In recent decades, there has been a discernible increase in the frequency and intensity of these extreme weather phenomena, signaling a heightened risk landscape for the country.[1] This evolving hazard profile necessitates a thorough examination of past events to inform future preparedness and mitigation efforts.

This report undertakes a comprehensive review of natural disaster occurrences in Malaysia over the past five years, specifically from 2020 to early 2025. The primary objective is to meticulously analyze the types of disasters experienced, their temporal and geographical distribution, and the resulting human and economic impacts. By synthesizing data from national agencies and international databases, this document aims to provide a robust, evidence-based foundation to support policy-making, refine disaster preparedness strategies, and contribute to the broader academic discourse on Malaysia's dynamic natural hazard environment.

3. Malaysia's Disaster Management Framework

Malaysia has established a structured framework for disaster management, spearheaded by key governmental agencies and supported by national and international collaborative initiatives. The effectiveness of this framework is critical in mitigating the impacts of the recurring natural hazards faced by the nation.

3.1. Role of Key Agencies

3.1.1. National Disaster Management Agency (NADMA)

The **National Disaster Management Agency (NADMA)**, operating under the Prime Minister's Department, serves as the central coordinating body for all disaster-related activities in Malaysia.[49] Established on October 1, 2015, NADMA consolidated responsibilities previously held by the National Security Council, signifying a strategic shift towards a more specialized and comprehensive approach to disaster governance.[50] Its extensive mandate encompasses the entire disaster management cycle, including policy formulation and implementation, coordination of disaster risk reduction (DRR) initiatives, oversight of disaster relief exercises, public awareness programs, and the management of relief trust funds.[50] Furthermore, NADMA has demonstrated its adaptive capacity by extending its coordination role to public health emergencies, such as monitoring quarantine centers and assessing the broader impacts of the COVID-19 pandemic on national development priorities and vulnerable groups.[51] This expanded purview underscores a recognition that contemporary disasters are often complex, multi-faceted events that transcend traditional security concerns, demanding integrated responses across various sectors, including public health. Such an adaptive and centralized approach is crucial for Malaysia to effectively address the compounding effects of diverse hazards.

3.1.2. Malaysian Meteorological Department (METMalaysia)

Complementing NADMA's role is the **Malaysian Meteorological Department (METMalaysia)**, an agency under the Ministry of Natural Resources and Environmental Sustainability (NRES).[52] METMalaysia is tasked with providing essential meteorological, climate, and geophysical services vital for disaster risk reduction.[52] Its core functions include continuous monitoring of onshore, sea, and air weather conditions across the country.[52] Crucially, METMalaysia issues forecasts, advisories, and warnings for a range of phenomena, including thunderstorms, earthquakes, tsunamis, strong winds, rough seas, and continuous rain, all aimed at minimizing disaster risk.[52] The department's commitment to providing timely and accurate

information is a cornerstone of the nation's proactive stance on disaster preparedness. The emphasis by both NADMA and METMalaysia on proactive measures, including risk reduction, preparedness, and early warning systems, indicates a strategic evolution from purely reactive disaster response to a more foresightful, science- and data-driven approach. This strategic direction, supported by technological advancements and international partnerships, is fundamental for building long-term resilience, particularly as climate change intensifies the frequency and severity of natural hazards.

3.2. National and International Cooperation in Disaster Risk Reduction

Malaysia actively engages in strategic partnerships and cooperation at both national and international levels to bolster its disaster management capabilities. The nation has expressed a strong commitment to strengthening collaboration with international bodies such as the United Nations Office for Disaster Risk Reduction (UNDRR).[53] These partnerships are crucial for addressing increasingly complex disaster challenges, especially those linked to climate change and the enhancement of community resilience.[53] Discussions with UNDRR have focused on critical areas, including the potential development of a comprehensive National Disaster Risk Reduction Act, the implementation of smarter early warning systems, and the creation of more accurate flood risk mapping.[53] These discussions reflect a dedication to leveraging global expertise and best practices to refine national strategies.

Regionally, Malaysia plays an active role within the framework of the ASEAN Agreement on Disaster Management and Emergency Response (AADMER), demonstrating its readiness to assume a greater leadership role in enhancing regional disaster preparedness and resilience.[53] Collaborative reports, such as those prepared by the Asian Disaster Preparedness Center (ADPC) on behalf of UNDRR, assess Malaysia's progress in disaster risk reduction under the Sendai Framework, highlighting ongoing efforts and areas for improvement.[51] These multi-stakeholder engagements underscore a comprehensive and collaborative approach to disaster risk management, recognizing that many hazards, particularly transboundary ones like haze, require concerted regional and international efforts.

4. Analysis of Major Natural Disasters (2020-2025)

Malaysia has experienced a significant number of natural disasters over the past five years, with hydrometeorological events being the most prevalent. The following sections detail the major disaster types, their occurrences, and impacts during this period.

4.1. Overview Table

Year	Disaster Type	Key Affected Regions/States	Date/Period	Fatalities (if reported)	Displaced Persons (if reported)	Estimated Economic Losses (if reported)	Brief Description of Severity/Impact
2020	Floods	East Coast Peninsular, East Malaysia (Terengganu, Pahang, Johor, Kelantan, Selangor, Perak, Sabah)	Nov 2020 - Jan 2021	-	>48,000 [5]	-	Monsoon floods amidst COVID-19, complicating response and leading to new clusters. [6]
2020	Landslides	Mount Jerai (Kedah), Taman Kelab Ukay (Selangor), Banjaran Hotsprings (Perak), Raub-Bukit Fraser (Pahang), Damansara Utama (Selangor)	Mar-Dec 2020	4 [7]	-	-	Triggered by illegal excavation, heavy rain, or pipe bursts. [7]

2020	Storms/TDs	Sabah, Sarawak, Kedah	Dec 2020	-	-	-	Tropical Depression Krovanh (indirect), monsoon surges with heavy rain/strong winds.[9]
2020	Haze	Malaysia-wide (transboundary)	Annual	-	-	-	Subdued due to La Niña, but local pollution reduced by MCO.[11]
2021	Floods	Klang Valley (Selangor, KL), Pahang, Kelantan, Terengganu, Johor, Malacca, Negeri Sembilan, Sabah	Dec 2021 - Jan 2022	54[13]	>71,000 concurrent, >125,000 cumulative[13]	RM6.1 billion (US$1.46 billion)[1]	"Worst in 50 years" or "1-in-100-year" event, record rainfall, widespread damage, infrastructure disruption.[3]

2021	Landslides	Segamat-Kuantan Highway (Pahang), Padawan (Sarawak), Cameron Highlands, Hulu Langat (Selangor)	Jan-Dec 2021	2[7]	-	-	Linked to heavy rainfall and severe floods.[7]
2021	Storms/TDs	Peninsular Malaysia, Sabah, Kedah	Dec 2021	-	-	-	Tropical Depression 29W landfall caused severe floods; Typhoons Rai, Jawad, Lionrock, Dianmu (indirect impacts).[3]
2021	Haze	Malaysia-wide (transboundary)	Annual	-	-	-	Low risk of severe haze, but civil society complaint filed; isolated hotspots.[1][2]

2022	Floods	Kelantan, Terengganu, Johor, Pahang, Sabah, Negeri Sembilan, Perak, Melaka, Perlis	Feb 2022, Nov-Dec 2022	-	>9,000 (Feb) [20]	RM622.4 million (US$187.8 million) [15]	East coast floods in Feb; widespread floods in Nov-Dec, lower losses than 2021. [15]
2022	Landslides	Taman Bukit Permai (Selangor), Batang Kali campsite (Selangor)	Mar-Dec 2022	35 [7]	-	-	Significant fatalities, Batang Kali was one of Malaysia's worst. [7]
2022	Storms/ TDs	Kedah, Sabah	Oct-Dec 2022	-	-	-	Tropical Depressions Mandous, Sonca (indirect impacts); monsoon transition with thunderstorms. [9]
2022	Haze	Southern ASEAN, Mekong sub-region	Annual	-	-	-	Generally subdued in southern ASEAN, persistent in Mekong; haze prediction

						model study.[23]
2023	Floods	Johor, Kelantan, Pahang, Sabah, Terengganu	Dec 2023	2[25]	>25,600[25]	RM755.4 million[26]	164 flood occurrences in 2023; widespread floods in 17 districts.[2]
2023	Landslides	MACA (KL), Wisma YPR (KL), Simpang Pulai-Blue Valley (Cameron Highlands), Taman Wawasan (Selangor)	Apr-Dec 2023	1[7]	76 evacuated[7]	-	Triggered by broken pipe, heavy rain.[7]
2023	Storms/ TDs	Sabah	Dec 2023	-	-	-	Tropical Depression Jelawat; monsoon-associated rains/winds[9].
2023	Haze	Southern Peninsular Malaysia	Oct 2023	-	-	-	Elevated risk due to El Niño/positive IOD; high AOD levels

		(transboundary)					detected.[28]
2024	Floods	Kelantan, Terengganu, Kedah, Pahang, Negeri Sembilan, Johor, Perak, Melaka, Perlis	Nov-Dec 2024	5[32]	>137,410 affected[32]	CHF 1.79 million (agriculture)[32]	Worst floods since 2014, widespread damage to homes, infrastructure, agriculture.[32]
2024	Landslides	Cameron Highlands, Taman Melawati (Selangor)	Jan-Oct 2024	5[7]	-	-	Compounded severe floods in Nov-Dec.[7]
2024	Storms/ TDs	Sabah, Peninsular Malaysia	Dec 2024	-	-	-	Tropical Depression Pabuk (indirect); Northeast Monsoon brought heavy rain/strong winds causing severe floods.[9]

20 24	Haze	Mekong sub-region, Peninsular Malaysia	Mar-May 2024	-	-	-	Low risk of severe transboundary haze; elevated in Mekong sub-region.[36]
20 25	Floods	Sabah, Sarawak, Johor, Selangor	Jan-May 2025	-	>7,397 (Jan)[39]	-	Continued heavy rainfall, monsoon floods, and landslides in East Malaysia and parts of Peninsular Malaysia.[4]
20 25	Landslides	Cameron Highlands, Genting Highlands, Sungai Tua-Ulu Yam road	Jan-Apr 2025	-	-	-	Triggered by heavy rain.[7]
20 25	Storms/ TDs	Perlis, Kedah, Penang, Perak, Selangor, Kuala Lumpur, Putrajaya,	Jan-Jun 2025	-	-	-	Thunderstorm and heavy rain warnings, monsoon wave expected.[4]

		Negeri Sembilan, Melaka, Johor, Sarawak, Sabah, Labuan					[3] Tropical Depression (indirect impact). [45]
20 25	Haze	Mekong sub-region, Sumatra, Kalimantan, Sarawak	Jan-May 2025	-	-	-	Alerts and hotspot activity continued; localized smoke plumes observed. [1 8]

4.2. Floods

4.2.1. General Characteristics and Vulnerability

Flooding stands as Malaysia's most prevalent and impactful natural disaster, occurring with significant regularity, particularly during the annual Northeast Monsoon season, which typically spans from October to March.[1] The severity of these events is often compounded by inadequate urban drainage systems and the overarching effects of climate change.[1]

4.2.2. 2020-2021 Floods: Impact and COVID-19 Complications

The **2020-2021 Malaysian floods** marked a challenging start to the review period. From November 2020 to January 2021, the East Coast of Peninsular Malaysia and East Malaysia experienced severe monsoon flooding, affecting over 48,000 people by early January 2021.[5] This particular flood event was notable as it occurred amidst the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2)/COVID-19 pandemic.[51] The simultaneous occurrence of a natural disaster and a public health crisis created a complex and perilous situation, leading to the emergence of new COVID-19 clusters in overcrowded relief centers and significantly complicating disease control and prevention

efforts.[6] This highlights how one type of disaster can amplify the impacts and vulnerabilities associated with another, creating a more complex and severe crisis. States such as Terengganu, Pahang, Johor, Kelantan, Selangor, Perak, and Sabah (specifically Beaufort) were particularly affected.[54]

4.2.3. 2021-2022 Floods: Catastrophic Event and Economic Toll

The **2021-2022 Malaysian floods** were exceptionally severe, widely described as the "worst flash floods ever seen in 50 years" in the Klang Valley, or even a "one-in-100-year" rainfall event.[1] Triggered by Tropical Depression 29W, these floods, occurring from late 2021 to early 2022, impacted eight states across the peninsula, resulting in at least 54 fatalities and two missing persons.[14] The concurrent displacement of over 71,000 residents and a cumulative impact on over 125,000 people underscored the scale of the disaster.[13] The economic repercussions were substantial, with estimated losses reaching RM6.1 billion (approximately US

1.46 billion), equivalent to 0.4% of the country's nominal Gross Domestic Product.[1] Unofficial estimates placed the economic toll even higher, at US

4.77 billion.[14] Significant damage was reported to properties, roads, and critical infrastructure, including three water treatment plants in Selangor.[14] Meteorological records were broken, with one station in Sentul recording a peak daily rainfall of 363 millimeters, equivalent to a month's worth of rain in the region.[14] The consistent reporting of major flood events occurring almost annually, coupled with language describing these events as "worst in 50 years" or "worst since 2014"[2], indicates that these are not merely routine monsoon floods but events of escalating severity. This trend points to worsening hydrometeorological vulnerability, directly linked to climate change impacts, necessitating urgent and scaled-up adaptation and mitigation measures.

4.2.4. 2022 Floods: East Coast and Financial Burden

In **2022**, Malaysia continued to grapple with floods. The east coast states of Kelantan and Terengganu experienced significant inundation in February, leading to the displacement of over 9,000 people.[20] While the overall losses due to floods in 2022, at

RM622.4 million (US$187.8 million), were considerably lower than the preceding year, they still represented a substantial financial burden, with Terengganu and Kelantan accounting for nearly 60% of these losses.[15] The persistent reporting of substantial financial losses across multiple years indicates that floods are a continuous drain on Malaysia's economy.

4.2.5. 2023 Floods: Occurrences and Losses

The **2023 Malaysian floods** saw a total of 164 flood occurrences, dominating the 399 catastrophic events recorded that year.[2] In December 2023, flooding affected 17 districts across Johor, Kelantan, Pahang, Sabah, and Terengganu, resulting in two fatalities and the displacement of over 25,600 individuals.[25] The overall economic losses attributed to floods in 2023 amounted to RM755.4 million, equivalent to 0.04% of GDP.[26]

4.2.6. 2024 Floods: "Worst Since 2014" and Agricultural Impact

The **2024 Malaysian floods**, occurring from November to December during the Northeast Monsoon, were described by the Deputy Prime Minister as the "worst since 2014".[32] These floods severely impacted nine states, including Kelantan, Terengganu, Kedah, Pahang, Negeri Sembilan, Johor, Perak, Melaka, and Perlis, affecting over 137,410 people, with Kelantan and Terengganu being the most severely impacted.[32] The disaster inflicted significant damage on homes, critical infrastructure (roads, airports, railways), and livelihoods, with agricultural losses alone estimated at approximately CHF 1.79 million.[32] The heavy rainfall in December 2024 also contributed to a four-month downturn in palm oil production, highlighting the impact on key economic sectors.[4] The consistent economic burden underscores the urgent need for strategic investments in resilient infrastructure, flood mitigation projects, and economic diversification to safeguard national prosperity against increasing flood risks.

4.2.7. Early 2025 Floods: Continued Rainfall and Displacement

The early months of **2025** continued the trend of severe weather. Heavy rainfall and floods persisted, particularly in Sabah and Sarawak (Malaysian Borneo) and Johor.[4] By January 30, 2025, over 7,397 individuals were evacuated to temporary relief centers in Sarawak and Sabah, with daily rainfall in Sarawak exceeding average monthly totals.[39]

4.3. Landslides

4.3.1. General Characteristics and Triggers

Landslides represent a critical natural hazard in Malaysia, frequently triggered by prolonged and intense rainfall, especially in geologically vulnerable and hilly regions.[1]

4.3.2. 2020 Landslide Incidents

In **2020**, several notable landslide incidents occurred. In March, a landslide at Mount Jerai, Kedah, resulted in two fatalities, attributed to illegal excavation activity.[7] May saw a landslide at Taman Kelab Ukay, Selangor, caused by continuous rain.[7] In November, heavy rain led to a landslide at Banjaran Hotsprings Retreat in Ipoh, Perak, killing two people.[7] December witnessed a rockslide on the Raub-Bukit Fraser Road in Pahang, and a landslide in Damansara Utama, Selangor, notably caused by a broken pipe and water disruption.[7] The explicit mention of human activities, such as illegal excavation and infrastructure failures like broken pipes, as direct causes or exacerbating factors, indicates that a significant portion of landslide risk in Malaysia is manageable through improved regulation, urban planning, and infrastructure maintenance, rather than being solely a natural occurrence.

4.3.3. 2021 Landslide Incidents

2021 saw continued landslide activity. January recorded two landslides on the Segamat-Kuantan Highway in Pahang and one in Padawan, Sarawak.[7] In December, two people died in a landslide in Cameron Highlands due to continuous rainfall.[7] Landslides were also reported in Hulu Langat, Selangor, linked to the severe floods of that period, illustrating how landslides are often part of a broader hydrological disaster complex.[17]

4.3.4. 2022 Landslide Incidents: Devastating Events

The year **2022** was marked by particularly devastating landslide events. In March, four people were killed by a landslide in Taman Bukit Permai, Ampang, Selangor.[7] The most tragic incident occurred in December at the Batang Kali campsite in Selangor, where 31 people lost their lives and seven were injured, making it one of the worst landslides in Malaysia's history.[1] The frequent co-occurrence of landslides with heavy rainfall and floods suggests that disaster management plans should adopt a multi-hazard approach,

recognizing the interconnectedness of these events and implementing integrated early warning systems and coordinated emergency responses.

4.3.5. 2023 Landslide Incidents

In **2023**, a landslide at the Malaysian Anti-Corruption Commission Academy in Kuala Lumpur in April, caused by a broken pipe, led to the evacuation of 76 people.[7] A security guard was killed in May by a landslide near Wisma YPR, also in Kuala Lumpur.[7] Further incidents occurred in June at the Simpang Pulai-Blue Valley road near Cameron Highlands due to heavy rain, and in December at Taman Wawasan, Puchong, Selangor, also following heavy rainfall.[7]

4.3.6. 2024 Landslide Incidents

2024 continued to see landslides, particularly in Cameron Highlands, where the Habu-Boh Tea Road was closed in January due to a landslide, and another incident in Kampung Raja-Blue Valley killed five Myanmar nationals.[7] In October, a landslide occurred in Taman Melawati, Ulu Kelang, Selangor, due to heavy rain.[7] Landslides also compounded the severe floods experienced nationwide in November and December 2024.[32]

4.3.7. Early 2025 Landslide Incidents

Early **2025** recorded further incidents, with landslides occurring in Kampung Raja and Genting Highlands in January, both attributed to heavy rain, and a tree fall caused by a landslide on the Sungai Tua-Ulu Yam road in April.[7]

4.4. Storms and Tropical Depressions

4.4.1. General Vulnerability and Indirect Impacts

Malaysia's proximity to the Pacific Typhoon Belt makes it susceptible to tropical storms and cyclones.[1] However, direct landfalls of powerful typhoons are less common.[60] The primary impact experienced by Malaysia from these systems is often indirect, manifesting as associated heavy rainfall and strong winds that exacerbate other hazards, particularly floods.[1] This highlights that Malaysia's vulnerability to tropical cyclones is less about direct wind damage and more about the devastating hydrological effects of their associated weather systems.

4.4.2. 2020 Storms and Tropical Depressions

In **2020**, Tropical Depression 29W (which later became Typhoon Krovanh) in December affected Sabah and Sarawak, contributing to the severe 2020-2021 floods through its associated heavy rainfall.[9] Monsoon surge events during the year also brought significant strong winds and heavy rainfall.[10]

4.4.3. 2021 Storms and Tropical Depressions: Catastrophic Flood Trigger

The year **2021** saw a critical indirect impact from a tropical system. Tropical Depression 29W made landfall on Peninsular Malaysia in December, bringing torrential downpours that were the primary cause of the catastrophic 2021-2022 floods.[14] This event was deemed the deadliest tropical cyclone-related disaster to hit Malaysia since Tropical Storm Greg in 1996.[14] While Typhoon Rai (Category 4) in December 2021 passed relatively close to Sabah, it did not make direct landfall, and other tropical depressions like Jawad (November-December) and Lionrock (October) also brought indirect impacts to Kedah and Sabah, respectively.[9]

4.4.4. 2022 Storms and Tropical Depressions

In **2022**, Tropical Depression Mandous (December) and Tropical Depression Sonca (October) had their closest approaches to Kedah and Sabah, respectively, without making direct landfall.[9] The monsoon transition phase between March and May 2022 was characterized by light and variable winds, alongside rapidly developing thunderstorms.[22]

4.4.5. 2023 Storms and Tropical Depressions

2023 saw Tropical Depression Jelawat affecting Sabah in December.[9] Although the overall Pacific typhoon season was less active than average, Malaysia still experienced impacts from continuous rains and strong winds associated with monsoon patterns.[10]

4.4.6. 2024 Storms and Tropical Depressions: Intensified Monsoon

The **2024** Northeast Monsoon (2024/2025) brought severe flooding across nine states, driven by heavy rainfall and strong winds.[32] Tropical Depression Pabuk in December 2024 also had its closest point to Sabah but did not make direct landfall.[9] Experts have

noted that climate change and a warming planet are likely contributing to more violent and frequent thunderstorms, as increased atmospheric moisture and heat intensify these events.[61] This directly links the observed increase in intensity and frequency of heavy rainfall and thunderstorms to climate change, suggesting a systemic, long-term increase in the severity of storm-related hydrological hazards.

4.4.7. Early 2025 Storms and Tropical Depressions

Early **2025** continued this trend, with METMalaysia issuing thunderstorm and heavy rain warnings for various states in June.[43] A monsoon wave was also anticipated in June, potentially causing heavy and persistent rain across several areas.[44] The broader ASEAN region experienced floods, storms, and wind-related disasters in March and April 2025, with Malaysia among the affected nations.[64] A tropical depression in February 2025 also had an indirect impact on Malaysia.[45] This necessitates that disaster preparedness prioritize the hydrological impacts of tropical cyclones and depressions, focusing on flood and landslide mitigation, rather than solely on wind-related hazards.

4.5. Transboundary Haze

4.5.1. Nature and Causes of Haze

Transboundary haze is a persistent environmental and public health issue in Malaysia, occurring almost annually.[11] This air pollution phenomenon is primarily caused by forest and land fires, often stemming from agricultural "slash-and-burn" techniques employed in neighboring countries, particularly Indonesia.[58] This clearly establishes that while haze manifests as a natural disaster, its root cause is overwhelmingly anthropogenic activity in neighboring countries, making it a complex geopolitical and environmental issue.

4.5.2. 2020 Haze: Subdued but Present

In **2020**, the haze situation was generally subdued due to wetter-than-normal weather influenced by the La Niña phenomenon.[12] Despite this, episodes with elevated PM2.5 concentrations were still common.[11] Notably, the Movement Control Order (MCO) implemented in March 2020 due to the COVID-19 pandemic led to a significant decrease in local pollution emissions.[68]

4.5.3. 2021 Haze: Low Risk but Human Rights Concern

For **2021**, a low risk of severe transboundary haze was predicted, largely due to normal or average dry season conditions and a stated commitment from Indonesia towards sustainable practices.[12] However, the persistent nature of the problem was highlighted in December 2021 when a coalition of Malaysian civil society organizations filed a complaint with the Malaysian Human Rights Commission, calling for a public inquiry into haze pollution as a human rights violation.[19] Isolated hotspots and localized smoke plumes were still observed, particularly in Sumatra, Sabah, Kalimantan, Sarawak, and Myanmar.[18]

4.5.4. 2022 Haze: Subdued in Southern ASEAN

The **2022** haze situation in the southern ASEAN region remained generally subdued due to continued wet weather conditions.[23] However, persistent dry conditions and transboundary smoke haze were observed over the Mekong sub-region.[23] Research efforts in Malaysia during this year included a study aimed at evaluating haze prediction models using hourly air pollution data in Shah Alam.[24]

4.5.5. 2023 Haze: Elevated Risk due to El Niño

2023 saw an elevated risk of hotspot activities and transboundary smoke haze, reaching the highest level since 2019.[30] This increased risk was directly linked to the presence of El Niño conditions and a positive Indian Ocean Dipole, both of which typically bring drier conditions to the region.[28] An analysis of the October 2023 haze event in Malaysia, using satellite data, revealed Aerosol Optical Depth (AOD) levels exceeding 2 in southern Peninsular Malaysia, indicating significant air pollution, with hotspots identified in Kalimantan and Sumatra as source regions.[31] This demonstrates a clear causal relationship between large-scale climate phenomena and the severity of haze seasons.

4.5.6. 2024 Haze: Low Risk for Malaysia, Elevated in Mekong

For **2024**, a "green" (low) risk of severe transboundary haze affecting Indonesia, Malaysia, and Singapore was initially identified.[38] However, the Mekong sub-region experienced elevated hotspot and smoke haze situations between December 2023 and

May 2024, escalating in March 2024.[37] Drier conditions were also recorded over northern and central parts of Peninsular Malaysia in March 2025, which could influence haze patterns.[36]

4.5.7. Early 2025 Haze: Alerts and Hotspot Activity

Haze alerts and hotspot activities continued into early **2025**, particularly in the Mekong sub-region.[36] While the southern ASEAN region generally experienced subdued haze, localized smoke plumes were observed emanating from hotspots in Sumatra, Kalimantan, and Sarawak on certain days.[47] The persistence of this problem despite regional agreements highlights the challenges in international cooperation and enforcement.

4.6. Other Natural Hazards

4.6.1. Drought and Heatwaves

Drought and Heatwaves are recognized threats to Malaysia, with rising temperatures leading to agricultural challenges.[1] METMalaysia provides ongoing "Hot Weather Status" and "Drought Monitoring" information, confirming the country's vulnerability to these conditions.[69] Although specific major drought events with widespread impact akin to the major floods are not detailed for this period, drought is acknowledged as a natural hazard in global databases [71] and a potential consequence of climate change.[1]

4.6.2. Dengue Outbreaks

Dengue Outbreaks also warrant consideration within the broader context of climate-related hazards. A surge in dengue cases across Malaysia was reported, leading to a "Dengue prevention and control" report in March 2025.[40] Dengue is a climate-sensitive disease, and warmer climates can accelerate its spread and increase the risk of outbreaks.[56] While not a "natural disaster" in the conventional sense, its prevalence is often linked to environmental conditions exacerbated by changing climate patterns, underscoring a public health vulnerability.

4.6.3. Earthquakes and Tsunamis

Regarding **Earthquakes and Tsunamis**, Malaysia is geographically positioned near the Pacific Typhoon Belt, which also implies proximity to seismically active zones.[1]

METMalaysia provides geophysical services specifically for detecting earthquakes and issuing tsunami warnings, indicating a recognition of these potential threats.[52] While global databases like EM-DAT record earthquakes and tsunamis worldwide [71], and snippets mention events in other regions like Tonga, Peru, Indonesia, and Myanmar [74], there is no prominent detailing of direct, significant impacts from major earthquakes or tsunamis on Malaysia within the 2020-2025 timeframe. The 2015 Sabah earthquake is mentioned as a historical reference point [7], but no comparable events are highlighted in the review period. The relative lack of detailed impact data for these hazards within the provided timeframe suggests that they had a lower direct impact on Malaysia compared to the dominant hydrometeorological events. However, their inclusion in METMalaysia's responsibilities and general vulnerability assessments confirms their potential threat, necessitating continued monitoring and preparedness for these less frequent but potentially high-impact events.

5. Cumulative Impacts and Trends

5.1. Overall Impact Summary

The five-year period from 2020 to 2025 reveals a consistent pattern of natural disaster impacts in Malaysia, with significant human displacement, fatalities, and economic losses. Floods consistently account for the majority of these impacts.[1] The December 2021-January 2022 floods alone resulted in RM6.1 billion (US$1.46 billion) in losses, representing 0.4% of Malaysia's Gross Domestic Product.[1] While fewer in number, landslides have led to significant fatalities, particularly the Batang Kali incident in 2022.[1] Transboundary haze, though not typically causing direct fatalities in Malaysia, incurs substantial health and economic costs, with historical data from 2013 indicating up to MYR 1 billion in lost income.[11]

The human toll is evident in displacement figures: between 2016 and 2021, Malaysia experienced 354,000 climate-related internal displacements, with 129,000 in 2021 and 156,000 in 2022 due to floods, landslides, and storms.[56]

5.2. Economic Losses Table

Year	Total Economic Losses (RM)	Total Economic Losses (US$)	% of Nominal GDP	Breakdown of Losses (Primary Categories)
2020	-	-	-	-
2021	RM6.1 billion [1]	US$1.46 billion [1]	0.4% [1]	Public assets/infrastructure, homes, agriculture, business, vehicles, manufacturing [15]
2022	RM622.4 million [15]	US$187.8 million [15]	0.03% [15]	Public assets/infrastructure, homes, agriculture, business, vehicles, manufacturing [15]
2023	RM755.4 million [26]	-	0.04% [26]	Living quarters (RM168 million), others not specified [26]

Note: Economic loss data is primarily available for floods and is not consistently reported across all disaster types or for every year within the review period. Haze events also incur significant economic costs, but specific annual figures for Malaysia are not detailed in the provided sources for this period.

5.3. Influence of Climate Change, Urbanization, and Monsoon Patterns on Disaster Frequency and Intensity

The escalating impacts of natural disasters in Malaysia are inextricably linked to several overarching factors. **Climate change** is identified as a primary driver, leading to more extreme weather events, including heavier and more unpredictable rainfall, increased thunderstorms, and heatwaves.[1] This phenomenon exacerbates flooding and increases the risk of coastal erosion due to rising sea levels.[1] Experts note that a warming planet leads to more moisture in the air, intensifying thunderstorms and heavy rainfall, particularly during the inter-monsoon period.[61] This indicates that human activities,

specifically greenhouse gas emissions leading to climate change, are actively accelerating the severity of natural hazards.

Monsoon patterns are a fundamental natural cause of heavy and regular rainfall in Malaysia, especially during the Northeast Monsoon season.[2] However, the frequency and intensity of extreme rainfall events associated with monsoon surges are increasing, further compounding flood risks.[2] The interplay of these natural cycles with climate change creates a challenging environment.

Rapid urbanization also significantly contributes to the increased frequency and severity of flash floods.[2] As urban areas expand, the disappearance of natural green spaces reduces areas for rainfall absorption, leading to increased surface runoff and overwhelming existing drainage systems.[2] This is particularly evident in densely populated areas like the Klang Valley and Kuala Lumpur.[3] This highlights that unsustainable urban development practices are not just passive background factors but active accelerants of natural hazard severity, creating a feedback loop where development increases vulnerability.

5.4. Emerging Trends and Challenges

The review period reveals several critical trends and challenges in Malaysia's natural disaster landscape. There is a clear trend towards **increased intensity and unpredictability** of weather events, with rainfall patterns becoming more extreme and less predictable.[4] The occurrence of

compounding disasters, such as severe floods coinciding with the COVID-19 pandemic, creates complex crises that strain response capabilities and amplify vulnerabilities, particularly for marginalized communities.[51]

Furthermore, the **vulnerability of key economic sectors** is evident. Agriculture, including rice and palm oil plantations, and critical infrastructure such as roads, airports, and railways, are consistently impacted by floods, leading to supply chain disruptions and long-term economic instability.[4] While disasters have broad impacts, the data points towards specific groups and economic sectors bearing a disproportionate burden. This underscores that disaster risk reduction and recovery efforts need to be equity-focused, prioritizing the needs of vulnerable communities and building resilience within critical economic sectors.

These trends collectively underscore the urgent **need for enhanced policy and investment** in disaster risk reduction and climate adaptation.[1] The current trajectory necessitates a fundamental integration of climate action and sustainable urban planning into core national development strategies, moving beyond fragmented approaches.

6. Conclusion

The five-year period from 2020 to early 2025 demonstrates Malaysia's profound and increasing vulnerability to natural disasters, with hydrometeorological events, particularly floods, dominating the hazard landscape. These floods, alongside frequent landslides and recurring transboundary haze, have inflicted significant human suffering through fatalities and widespread displacement, and imposed substantial economic burdens on the nation. The analysis unequivocally indicates that the escalating severity and unpredictability of these events are not solely natural phenomena but are significantly amplified by the accelerating impacts of climate change and rapid, often unsustainable, urbanization. This complex interplay creates a challenging environment where traditional disaster response mechanisms are increasingly strained, and the socio-economic fabric of vulnerable communities and key sectors is disproportionately affected. Malaysia's disaster management framework, spearheaded by NADMA and METMalaysia, has shown an evolving capacity towards more proactive and integrated approaches, yet the persistent and intensifying nature of these hazards signals a critical need for further strategic evolution.

7. Recommendations for Enhanced Disaster Resilience

To effectively address the escalating natural disaster risks and build a more resilient future, the following recommendations are proposed for Malaysia:

- **Strengthen Advanced Early Warning Systems:** Invest significantly in upgrading and integrating early warning systems for floods, landslides, and severe storms. This involves leveraging advanced meteorological data, real-time ground monitoring, and sophisticated risk mapping technologies to provide more accurate, timely, and localized alerts. Such systems are crucial for enabling proactive evacuations and resource mobilization.[1]
- **Integrate Climate Change Adaptation into National Development Planning:** Develop and rigorously implement a comprehensive National Adaptation Plan (MyNAP) that explicitly incorporates climate change projections into all facets of national development. This includes ensuring that urban planning, infrastructure development, agricultural practices, and coastal zone management are designed

to be climate-resilient, addressing the increased frequency of extreme weather events, rising sea levels, and potential droughts.[1]

- **Enhance Flood and Landslide Mitigation Infrastructure:** Prioritize substantial investment in and rigorous maintenance of critical flood and landslide mitigation infrastructure. This encompasses improving urban drainage systems, expanding flood retention areas, implementing advanced flood mitigation projects, and undertaking comprehensive slope stabilization measures, particularly in rapidly urbanizing and identified high-risk areas.[1]

- **Address Anthropogenic Contributions to Disaster Risk:** Bolster enforcement mechanisms against illegal land clearing, excavation, and unsustainable development practices that destabilize slopes and exacerbate flash floods. Implement stringent oversight for critical infrastructure, such as water pipe networks, to prevent failures that can trigger or worsen landslides and urban flooding.[7]

- **Promote Robust Regional Cooperation for Transboundary Hazards:** Continue to actively engage in and strengthen ASEAN frameworks and bilateral agreements to address transboundary haze. This requires sustained diplomatic efforts, supporting stricter enforcement of land-use regulations in source countries, and promoting sustainable agricultural practices across the region to prevent forest and land fires.[28]

- **Develop Multi-Hazard and Compound Disaster Response Capabilities:** Enhance coordination mechanisms and operational protocols between various agencies, including NADMA, the Ministry of Health, and METMalaysia, to effectively manage complex, cascading disasters. This ensures integrated response plans, efficient resource allocation, and adaptive strategies when multiple crises (e.g., floods during a pandemic) occur simultaneously.[51]

- **Invest in Community Resilience and Public Awareness:** Implement sustained public awareness programs and capacity-building initiatives tailored to different communities, particularly those identified as vulnerable. These programs should focus on enhancing preparedness, fostering effective community-led response efforts, and supporting long-term recovery, thereby empowering citizens to better withstand and adapt to future natural hazards.[1]