infobrief

CIFOR-ICRAF infobriefs provide concise, accurate, peer-reviewed information on current topics in forestry, agroforestry and landscape research and development.

No. 419, February 2025

DOI: 10.17528/cifor-icraf/009359 | cifor-icraf.org

Revisiting the ASEAN response strategy to fire, smoke and haze

Swetha Peteru, Ahmad Dermawan, Sinta Haryati Silviana and Michael Allen Brady

Key messages

- Forest fires and transboundary haze in Southeast Asia cause significant environmental, economic, and health impacts, exacerbated by human activities like land conversion, agriculture, and climate change.
- Peatlands in the region are a particularly vulnerable ecosystem, and restoration efforts are critical to mitigating the impacts of forest fires and haze.
- ASEAN has implemented frameworks that form the basis for regional cooperation and action, including the ASEAN Agreement on Transboundary Haze Pollution (AATHP) and the ASEAN Peatland Management Strategy (APMS), focusing on fire prevention, peatland conservation, and sustainable land use.
- Weak law enforcement, insufficient investment, and sociocultural practices such as slash-and-burn farming pose challenges for progress.
- ASEAN aims to strengthen cooperation and implement updated strategies, such as APMS 2023–2030 and the ASEAN Haze-Free Roadmap, to achieve a haze-free region by 2030.

Introduction

Southeast Asia (SEA) is a region renowned for its abundant rainforests and thriving ecosystems but has a reoccurring environmental issue of wildfires and haze. These fires not only inflict devastation upon local ecosystems, but also have far-reaching ramifications, including acute air pollution and health hazards. Fires in SEA are often linked to human activities such as agriculture, land conversion and logging but are also part of the region's natural fire regime, which varies based on land characteristics (Gaveau et al. 2014; Hayasaka et al. 2014; Field et al. 2016). The repercussions of these fires, which are exacerbated by climate change, extend beyond environmental degradation as they also impact local economies and international relations.

Forests have supported economic development in the region, serving as a source of timber and non-timber forest products, such as fruits, rubber, rattan and bamboo. However, investments in the region for the expansion of agriculture and estate crops – such as rubber, oil palm and timber – through forest and land conversion, have made all the Association of Southeast Asian Nations (ASEAN) Member States (AMS) vulnerable to land and forest fires. The use of fire for land clearing; shifting cultivation; and a high rate of deforestation – as reflected by rapid land-use changes – make the region susceptible to fire.

This *Infobrief* focuses on the ASEAN response to fire and haze, examining the strategies, policies and initiatives implemented by the region to mitigate these environmental hazards. It provides a synthesis of current knowledge about land and forest fires as well as the causes and impacts of these events in Southeast Asia, building on and updating the Fire, Smoke and Haze: The ASEAN Response Strategy publication by the ASEAN Secretariat and Asian Development Bank (ASEAN & ADB 2001). Aiming to provide a comprehensive understanding of the regional and global actions (to date) taken to address this challenge, this article highlights both ongoing initiatives and areas for improvement in fire and haze management within the ASEAN region.

Forest fire history in the ASEAN region

The El Niño-Southern Oscillation (ENSO) is a recurrent climate pattern with fluctuating temperatures of the tropical Pacific Ocean, oscillating between unusually warm ocean temperatures (El Niño) and unusually cold ocean temperatures (La Niña). In SEA, El Niño results in a drier climate and conditions and has caused large-scale forest fires and haze. At least nine major fire events occurred from 1970 to 1998, mostly during the El Niño periods (Figure 1). However, recent data show that fires can occur in several AMS, making this issue a vital

Figure 1. A timeline of major fire events and affected countries from 1980 to 2023

Sources: asean.org; wri-indonesia.org; adb.org; and asmc.asean.org.

concern. In addition, some fires occurred outside of El Niño periods (see Box 1 for an example of fires in 2013). From 2004 to 2015, the six largest fire events collectively resulted in an estimated economic loss of approximately USD 93.9 billion (Kiely et al. 2021).

Drivers of fires

SEA is particularly susceptible to devastating fires driven by a complex interplay of factors, which can be categorized into direct causes and underlying drivers. Understanding both is essential for developing effective strategies to mitigate and prevent these events.

Direct causes

Direct causes of fires often involve immediate triggers, such as lightning strikes; human activities, including agriculture, land clearing and arson; as well as accidental ignitions, with some variation across the region. In southern ASEAN (Brunei, Indonesia, Malaysia

Box 1. Fires outside El Niño periods

In 2013 – which was not a year with low rainfall brought on by El Niño – fires in Indonesia and Malaysia produced more pollution than the previous 1997–98 record over Singapore. Fires emitted greenhouse gases (GHGs) that caused haze in several AMS (Gaveau et al. 2014; Musri et al. 2020). In Indonesia, fires in Sumatra – most of which were in Riau Province, despite a wetter-than-average preceding 12 months – emitted GHGs equivalent to 5%–10% of Indonesia's average annual emissions from 2000 to 2005, resulting in haze over Singapore and Malaysia. Singapore's 24-hour Pollutant Standards Index reached an all-time high of 246 (associated 24-hour PM10 concentration of 382 μg m^{-3}) on 22 June 2013 (Velasco and Rastan 2015). More than half of the total area burned in Riau (84,717 ha) was on land allocated to companies for plantation development (i.e., concessions), but 60% of the burned areas in concessions (50,248 ha) was also occupied by local residents or migrants (Gaveau et al. 2014b). In Malaysia, most of the fires were in Sarawak and largely in plantation areas, where open burning at night resulted in bush fires (The Star 2013).

Fire risks include illegal logging; land conversion for settlements, cultivation and large-scale plantations; and the development of plantation forests. In many places, fire remains a low-cost and effective tool to clear land for 'slash-and-burn' agriculture and to access swamps for local communities, smallholders and businesses.

and southern Thailand), significant land degradation and frequent fires have resulted from extensive drainage of peatlands for tree crops and palm oil production as well as timber extraction (Mishra et al. 2021). This is particularly evident in Indonesia and Malaysia, where the conversion of peatlands to plantations has created highly flammable landscapes (Gaveau et al. 2014a). In northern ASEAN (northern Thailand, Myanmar, Cambodia, Lao PDR and Vietnam), land clearing for the production of rice, sugarcane, and maize crops, along with the burning of associated agricultural residues, are the main causes of emissions and fires (Pongratz et al. 2009). The practice of slash-and-burn agriculture, though traditional, has intensified due to population pressures and economic incentives, increasing the risk of uncontrolled fires (Samek et al. 2004; Hamzah et al. 2019).

Underlying drivers

Underlying drivers of fire in the region are multifaceted and encompass broader socioeconomic and environmental factors that contribute to forests' vulnerability to fires. Biophysical characteristics – such as vegetation type, soil moisture levels and the presence of combustible materials – play a critical role in fire susceptibility (Field et al. 2009). Climate seasonality and its variations result in the availability of dry fuel, dry conditions due to low rainfall, or strong winds that can exacerbate and spread fires. The ENSO events, for instance, have been linked to severe droughts that heighten fire risks across the region (Field et al. 2016).

Climate change has exacerbated the frequency and severity of fires by altering weather patterns, leading to prolonged droughts and heatwaves that create conditions conducive to fire spread. The 2015 Southeast Asian haze crisis, driven by one of the strongest El Niño events on record, underscored the region's vulnerability to climate-driven fire outbreaks (Koplitz et al. 2016). Political, physiographic, sociocultural and institutional factors also contribute to potential fire dangers. Moreover, weak enforcement of land-use regulations, corruption and conflicting land-tenure systems often hinder effective fire management (Tacconi 2016). Sociocultural practices – such as traditional slash-and-burn agriculture – and the economic need for land clearing further exacerbate fire risks (Gellert 2015).

Immediate action is required to address the direct causes. Necessary measures include improving fire management practices, enhancing early warning systems and increasing public awareness about fire safety. However, addressing the underlying drivers necessitates a more comprehensive approach that includes policy reforms, sustainable land-use planning, and climate change mitigation efforts. By targeting both levels of causality, policymakers and stakeholders can work towards creating a more resilient and sustainable environment in Southeast Asia.

Impact of fires

Forest and land fires cause several dimensions of direct and indirect socioeconomic and environmental impacts – which may not always occur where the fires are burning – depending on the frequency and intensity of fires and other factors.

The economic impacts of fires are often substantial and far-reaching. For instance, the 1998 Indonesian forest fires resulted in estimated losses of USD 6 billion. Economic losses encompass not only the direct loss of goods and services but also the indirect consequences of forest degradation; increased susceptibility to pests and diseases; reduced raw material supplies; and the need for significant investments in forest rehabilitation. Furthermore, the economic losses include lower incomes for local communities; diminished opportunities for improvements in rural livelihoods; and health issues affecting the population, such as respiratory problems and other related illnesses.

The environmental impacts of fires can be seen in the degradation of forest quality; biodiversity loss; a decline in forest ecosystem health; the loss of wildlife habitats; and air pollution. Moreover, fires exacerbate climate change by increasing greenhouse gas emissions and reducing the capacity of forests to function as carbon sinks. Another significant example of impacts beyond the site of fires is transboundary haze pollution, which can manifest itself in numerous ways. Fires emit gas and particulate matter that impacts the composition and function of the global atmosphere. The distribution of haze and emissions depends on the wind and vertical mixing. See Box 2 for estimates and examples of impacts from recent fires.

These impacts, including transboundary haze, underscore the critical need for effective forest management strategies and sustainable practices to mitigate the devastating economic and environmental consequences of forest fires, both within national boundaries and at transboundary or regional levels.

ASEAN response to fires and haze

ASEAN has adopted several initiatives and strategies to address the air pollution and transboundary haze caused by fires. These initiatives can be categorized into three areas: (1) establishing a regulatory framework, (2) organizational development, and (3) coordinated actions. Figure 2 highlights some key developments in the ASEAN response to the fires and haze in the region.

Cooperation to overcome transboundary environmental problems at the regional level is essential for effective management. Recognizing this, at the 4th ASEAN Ministerial Meeting on the Environment in 1990, where transboundary haze pollution was first highlighted,

the Kuala Lumpur Accord on Environment and Development was adopted and the ministers agreed to initiate efforts on harmonization of transboundary pollution prevention and abatement practices. Further, the ASEAN Leaders at the 4th ASEAN Summit through the Singapore Declaration of 1992 charted the future of regional cooperation, not only stating that AMS need to actively protect the environment but also calling for AMS to enhance cooperation on transboundary pollution and forest fires (ASEAN 1992). This declaration works towards the coordination of environmental quality standards, aligning policy directions in overcoming transboundary ecological problems.

Development of regulatory framework

In 2002, many AMS signed the ASEAN Agreement on Transboundary Haze Pollution (AATHP), a landmark agreement aimed at preventing and monitoring transboundary haze pollution from land or forest fires through concerted national efforts and intensified regional and international cooperation. The AATHP was ratified by all AMS by 2014. In 2003, ASEAN environment ministers developed the ASEAN Peatland Management Initiative (APMI) in cooperation with various partners. Subsequently, AMS agreed to the ASEAN Peatland Management Strategy (APMS) 2006–2020, which was updated in 2013 to guide actions to sustainably manage peatlands and reduce fires as well as their associated haze in the region.

Box 2. Estimates of economic loss from major fire events in recent times

Forest fires have numerous negative consequences and are a source of international concern due to the large amount of greenhouse gas emissions they produce. Forest fires in peatlands have a significant impact on aerosol emissions, affecting human health, transportation, tourism and economic activities in Southeast Asia. Many costs are accounted for in fire losses, with haze from fires frequently causing the closure of airports, schools, offices and other sectors. Smog causes respiratory disease, as well as eye and throat infections, and degrades forest ecosystem services, such as biodiversity, siltation prevention, flood protection, soil regulation, and climate change adaptation and mitigation. A World Bank (2016) study estimated economic cost of the 2015 fires to Indonesia to be USD 16 billion, which exceeded both the value added from Indonesia's total 2014 palm oil production (USD 12 billion) and the estimated value added from its gross palm oil exports (USD 8 billion). The World Bank also estimated that economic losses from the 2019 fires could reach USD 5.2 billion. The six largest fire events from 2004 to 2015 caused economic losses totalling USD 93.9 billion, according to one estimate (Kiely et al. 2021).

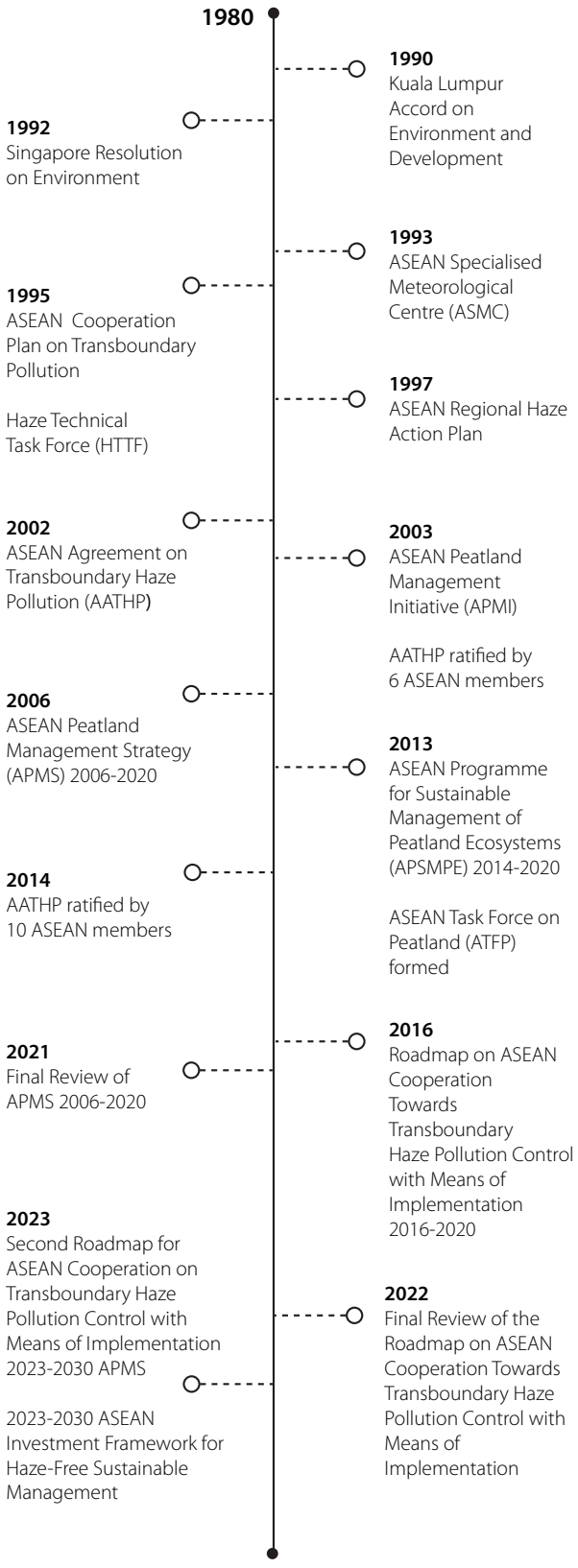

Figure 2. Key developments in the ASEAN response to fires, haze and peatland management

The APMS consists of 13 focal areas: 1) inventory and assessment; 2) research; 3) awareness and capacity building; 4) information sharing; 5) policies and legislation; 6) fire prevention, control and monitoring; 7) conservation of peatland biodiversity; 8) integrated management of peatlands; 9) promotion of best management practices of peatlands; 10) restoration and rehabilitation; 11) peatland and climate change; 12) regional cooperation; and 13) financing of the implementation of strategy.

To further operationalize the implementation of the AATHP, in 2016, AMS developed the Roadmap on ASEAN Cooperation Towards Transboundary Haze Pollution Control with Means of Implementation 2016-2020 (referred to as the ASEAN Haze-Free Roadmap). The roadmap sets out eight key strategic components that translate the AATHP principles into concrete and collective action: 1) implementation of AATHP; 2) sustainable management of peatlands for peatland fire prevention; 3) sustainable management of agricultural land and forest (non-peatland) to prevent large-scale land and forest fires; 4) strengthening policies, laws, regulations and their implementation; 5) enhancing cooperation, exchange of information and technology, and strengthening the capacity of institutions at all levels; 6) enhancing public awareness and cross-sectoral and stakeholder participation; 7) securing adequate resources from multiple stakeholders for preventing transboundary haze; and 8) reducing health and environmental risks, and protection of the global environment. ASEAN has been actively collaborating both regionally and internationally to improve the technical, legal and institutional capacities of its Member States to prevent and manage transboundary haze pollution.

In line with national and global climate-change agendas and national commitments, ASEAN reviewed and evaluated the achievements of the APMS and the ASEAN Haze-Free Roadmap towards the end of their timeframes. In 2019, AMS agreed to conduct a final review of the 2006–2020 APMS and developed a second APMS. The APMS review was conducted from 2020 to 2021 (ASEAN 2021) and aimed to provide a comprehensive evaluation of the APMS's implementation and achievements of targets at both the national and regional levels, and to produce data and insights to guide the development of the next strategy. The review evaluated the advancement of sustainable peatland management and the decrease in transboundary haze pollution associated with peatland management, finding that the APMS has been successful in encouraging the creation of National Action Plans on Peatlands (NAPPs) and related national implementation activities, particularly for AMS with significant peatland areas. The review also found that all 13 focal areas were progressing – with an average of seven AMS undertaking these activities – and that major progress was made in the focal areas of information sharing, awareness and capacity building, and regional cooperation. However, peatlands, climate change, and financing for the implementation of APMS are main areas that are lagging and require more attention (ASEAN 2021).

A similar process to the APMS review occurred with the ASEAN Haze-Free Roadmap 2016-2020. The review aimed to take stock of the achievements of the roadmap and maintain momentum for continued improvements to achieve the vision of a haze-free ASEAN (ASEAN 2022). Each of the eight strategies of the ASEAN Haze-Free Roadmap has detailed implementing actions, all of which were reviewed against selected relevant criteria. For example, a moderate score was given to the decrease in the number of hotspots and burned area under the strategy of sustainable management of peatlands. However, the review gave a low score to the area of peatland under a 'zero burning' regime (ASEAN 2022). Some strategies with moderate or high scores included the enhancement of cooperation and strengthening of laws and regulations. Additionally, the review found enhancing public awareness and cross-sectoral collaboration and securing associated resources are among the strategies that need to be significantly improved. The review provides a strong foundation for the development of the new roadmap.

Building on the reviews, both the APMS 2023–2030 and the second ASEAN Haze-Free Roadmap 2016-2020 were developed through a collaborative process with the AMS and in consultation with experts. Both documents were presented to and adopted by the 18th Meeting of the Conference of the Parties to AATHP (COP18) in August 2023. The APMS 2023–2030, which took effect in November 2023, builds on previous developments and has been updated with recent research and data, leading to the adjustment of focal areas and associated action areas. The Second ASEAN Haze-Free Roadmap 2023-2030 was launched in February 2024. It aims to address the challenges found in the previous phase, as identified in the final review, and to amplify the strength of the AMS in collaboration to achieve the vision of a transboundary haze-free ASEAN by 2030 (Sok and Peteru 2024).

Organizational development

ASEAN has also established organizations that support the various regulatory frameworks. In 1995, the ASEAN ministers formulated a cooperation plan with short- and long-term strategies to manage transboundary pollution. ASEAN actively collaborated to build the expertise and capacity of its Member States to address these issues and minimize their effects. In the same year, ASEAN Senior Officials on the Environment (ASOEN) established the Haze Technical Task Force (HTTF) and ASEAN Cooperation Plan on Transboundary Pollution. The HTTF was charged with producing a manual on implementing measures to mitigate and control haze-causing land and forest fires. The HTTF also formulated the Regional Haze Action Plan (RHAP) with three major component programmes:

prevention, mitigation and monitoring. This was endorsed by the ASEAN Ministerial Meeting on Haze (AMMH) in 1997, shifting the focus from discussing strategies to implementing actionable plans.

The ratification of AATHP provided the institutional foundation for the creation of the ASEAN Task Force on Peatlands (ATFP). Working on multiple initiatives, this task force provides training and capacity building for peatland policy and governance; peatland management; and peatland biodiversity assessment. In addition to overseeing the APMS's design and implementation, the ATFP's primary functions include monitoring peatland related programmes, facilitating cooperation with relevant partners and reporting on the APMS's implementation progress. Additionally, AMS have national efforts and follow-on actions, including the formulation and implementation of National Haze Action Plans (NHAPs) and NAPPs.

The ASEAN Specialised Meteorological Centre (ASMC), which was established in 1993, continues to monitor and assess land and forest fires as well as the occurrence of transboundary haze, while conducting seasonal and climate predictions based on the region's needs. The adoption and use of technology has evolved over the past three decades, especially for monitoring and responding to fires and haze. More advanced and satellite-based means are used by AMS in the region, enhancing environmental management and disaster response (see Box 3 and Table 1).

The AATHP also mandates the establishment of the ASEAN Coordinating Centre for Transboundary Haze Pollution Control (ACC THPC), a dedicated coordinating centre for facilitating regional cooperation and coordination among parties in managing the impact of land or forest fires and associated transboundary haze pollution. ACC THPC is structured with three key divisions to address haze pollution: monitoring and assessment, technical cooperation, and knowledge management. Its strategic implementation focuses on enhancing prevention, mitigation and monitoring mechanisms while developing robust early-warning systems that enable proactive intervention. During the 43rd ASEAN Summit in 2023, the ACC THPC – hosted by Indonesia – was launched and will serve as a focal point for coordinating responses to haze-related incidents and emergencies, streamlining communication and collaboration among AMS, and ensuring a more effective and efficient regional response. Lastly, it aims to support AMS to fulfil the commitment to the AATHP.

Stakeholder engagement is emphasised throughout the Second Haze-Free Roadmap 2023-2030 to improve effectiveness of fire prevention and suppreseion, strengthening sub-regional action and cross-sectoral and multi-level coordination.

Photo by Ricky Martin/CIFOR-ICRAF

Table 1. Evolution and use of technology and platforms for fire and haze monitoring in Southeast Asia

Year	Key milestone
1990–1997	Use of basic satellite imaging for fire detection, primarily relying on coarse resolution data from NASA's FIRMS.
1997	ASEAN launches the Regional Haze Action Plan (RHAP) to coordinate regional responses to haze episodes caused by land and forest fires. Singapore's Active Fire Monitoring: Daily fire monitoring initiated by CRISP at NUS using high-resolution SPOT images, complemented by MODIS hotspot data.
1997–1998	Satellite-based fire detection used for identifying hot spots and fires - NOAA Advanced Very-High-Resolution Radiometer (AVHRR) and a smoke-tracking Himawari.
1998	Enhancement of the ASEAN Specialized Meteorological Centre (ASMC) for better monitoring and early-warning systems.
1999	Indonesian Fire Danger Rating System (FDRS) was adapted from the Canadian Forest Service (CFS) model through collaboration between BPPT, BMG, and the Ministry of Forestry.
2000	ASMC begins operational activities focusing on weather forecasts and monitoring fire hotspots across Southeast Asia.
Early 2000s	Development of Malaysian FDRS based on the Canadian Forest Fire Weather Index System.
2003	ASMC initiates a regional FDRS to assess fire risks more effectively.
2004	Formalization of Indonesian FDRS: A comprehensive overview presented at the 22nd Tall Timbers Fire Ecology Conference detailing its design and operational framework.
2004	Formal Development of Malaysian FDRS: Malaysian Meteorological Service begins formalizing its FDRS for early warnings about potential fire hazards.
2005	Operational Implementation of Indonesian FDRS – the system begins to be utilized as an early-warning system for identifying fire-prone areas.
2005	Enhanced capabilities in haze monitoring and assessment by ASMC, providing real-time data to member countries.
2006	Synergistic use of satellites through the successful combination of MODIS hotspot data with high-resolution SPOT imagery for detailed fire mapping and analysis.
2006	Malaysian FDRS is integrated into a broader Southeast Asian framework for regional collaboration.
2010	Increased use of moderate-to-high-resolution satellites like VIIRS for finer details on fire activity and emissions (i.e., shift to higher spatial resolution).
2010	Improved Accuracy with VIIRS: Enhanced detection capabilities for smaller fires and accurate measurement of Fire Radiative Power (FRP).
2013	Improved satellite data-sharing agreements among ASEAN nations for better tracking of fire hotspots.
2015	Fire-Danger Rating System (FDRS) for Upper Southeast Asia officially operated by Thailand, adapting the system for regional fire environments using MODIS data.
2018	Introduction of specific systems in Indonesian FDRS through the development of SIPPEG monitoring platform and SIMATAG fire danger rating system for concession areas.
2021	Peat Fire Danger Rating System (PFDRS) in Indonesia focuses on developing a specialized system to enhance data accuracy on peatland conditions and fire risks.
2023	Refinement of regional FDRS by Malaysia by increasing weather stations and implementing new fire danger codes for northern ASEAN subregion
2024	Announcement by ASMC about changes to satellite tools, including the introduction of Geostationary Environment Monitoring Spectrometer (GEMS) for aerosol observations and burned area product development
Present Day (2020+)	Deployment of drones for rapid assessment, and machine learning tools (including AI) for real-time deforestation detection and haze disaster-response activities.

Sources: [1] ASEAN and ADB 2001; [2] https://iucn.org/sites/default/files/import/downloads/ff_framing_fires.pdf; [3] https://rfmrc-sea.org/current-fire-and-fire-weather-information/other-satellite-and-ground-monitoring-products/; [4] https://www.eria.org/ERIA-DP-2015-82.pdf; [5] https://asean.org/wp-content/uploads/2024/07/Adopted-Media-Release_25th-MSC-3-July-2024.pdf; [6] https://www.academia.edu/Documents/in/Forest_fires_and_haze_in_Indonesia; 7] https://asean.org/wp-content/uploads/2023/06/Adopted-Media-Release_24th-MSC-8-June-2023-Singapore-1.pdf; [8] https://www.met.gov.my/en/iklim/fdrs-asean/; [9] Tanpipat et al. 2023; [10] https://wildfire.forest.go.th/fdrs; [11] Groot et al. 2007; [12] https://asmc.asean.org/asmc-about/; [13] https://gambutkita.org/development-of-a-peat-fire-danger-rating-system-for-indonesia/

Box 3. Technology adoption and application

From 1990 to 2024, Southeast Asia witnessed significant progress in the application of technology for fire and haze monitoring. This evolution reflected a combination of established frameworks (i.e., RHAP, AATHP, ASEAN Haze-Free Roadmap, APMS), technological advancements, collaborative regional efforts, and ongoing challenges.

By the late 1990s, satellite technology – notably NOAA's AVHRR sensor – became instrumental in the real-time monitoring of land and forest fires. This capability allowed for precise detection of hotspots, which enhanced response efforts across affected regions, especially during the 1997–1998 fires. The integration of Geographic Information Systems (GIS) and monitoring platforms has further enabled AMS to share data in real time, improving coordination in monitoring and managing forest fires and haze. ASMC plays a critical role by providing analyses and satellite imagery for hotspot detection and continues to upgrade satellite systems while integrating real-time data analysis for enhanced capabilities.

As of 2023–2024, the use of remote sensing and geospatial data has become more refined, allowing for better prediction of fire risks and monitoring the progression of haze. Drones, machine learning and artificial intelligence are being used for real-time deforestation detection and haze disaster-response activities. However, continued investment in technology and regional cooperation is essential to further mitigate the impacts of fire-related haze pollution in the future.

Coordinated actions

In 2013, the APSMPE 2014–2020 was established to support collaboration among various stakeholders in the ASEAN region to achieve the goal of the APMS, which is to support and sustain local livelihoods, lower the risk of fire and related haze, support and sustain local livelihoods, and contribute to global environmental management by promoting the sustainable management of peatlands in the ASEAN region through enhanced cooperation and collective action.

At the country level, several AMS have made various efforts to coordinate actions to prevent and mitigate fires, with some positive results. This includes the development of NAPPs guided by the first and second APMS. Six AMS (Brunei Darussalam, Indonesia, Malaysia, the Philippines, Thailand and Vietnam) have already developed NAPPs, while others are in the process of developing these plans. Further, some countries have issued related regulations and created national initiatives. For example, in Indonesia, President Joko Widodo reaffirmed his dedication to environmental protection by establishing the Peatland Restoration Agency (*Badan Restorasi Gambut*, BRG) in 2016. The agency was mandated to restore 2.5 million ha of peatland. In 2020, the President extended the mandate of BRG to include restoration of mangroves and renamed the BRG to become the Peat and Mangrove Restoration Agency (BRGM). By the end of 2021, the agency had successfully restored over 300,000 ha of peatland (BRGM 2022). In Malaysia, the Ministry of Energy and Natural Resources is mandated to coordinate national action for peatlands and established the NAPP in 2011 with the goal of sustainably managing peatlands by enhancing knowledge, conserving resources, promoting integrated management, and ensuring effective multi-stakeholder cooperation to benefit present and future generations. Additionally, Malaysia set a target of rehabilitating 10,000 ha of peatland by 2024. Approximately 2,500 ha of peatland have been rehabilitated in Selangor (ASEAN 2021). Initiated by Thailand, the CLEAR Sky Strategy brings together Thailand, Laos and Myanmar to foster collaborative strategies for monitoring, information sharing, and implementing both immediate and long-term solutions to mitigate this environmental concern. This is in line with the target of reducing hotspots as indicated in the Chiang Rai 2017 Plan of Action, signed by the five countries of the Mekong River Basin.

The ASEAN Investment Framework for Haze-Free Sustainable Land Management, which aims to enhance multistakeholder partnerships and secure resources at local, national and regional levels, was also developed and endorsed by the COP18 AATHP in August 2023. Over the past three decades, many countries (bilaterally), donors and organizations have funded and supported work in ASEAN to mitigate fire and haze issues, given its international nature. This includes the Asian Development Bank (ADB), Australia's Department of Foreign Affairs and Trade (DFAT), Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH (GIZ), the German Federal Ministry for the Environment, Nature Conservation, Nuclear Safety and Consumer Protection (BMUV), the Global Environment Facility (GEF), the Global Green Growth Institute (GGGI), the European Union, the International Fund for Agricultural Development (IFAD), the International Union for Conservation of Nature (IUCN), Sustainable Rice Platform (SRP), the United Nations Development Programme (UNDP), the United Nations Environment Programme (UNEP), the U.S. Agency for International Development (USAID), and the World Wildlife Fund.

Haze from the forest fires blanket most parts of the landscape. The rainfall during the flight also contributed to the limited visibility.

Photo by Aulia Erlangga/CIFOR-ICRAF

Assessing the response

Beyond ASEAN's reviews and assessments of the first roadmap and the APMS, many researchers and academics have also examined ASEAN's response and progress on addressing fires and haze. The ASEAN response to transboundary haze pollution, primarily articulated through the broader AATHP, has faced challenges that undermine its effectiveness. Its implementation has been hampered by several weaknesses. A critical issue lies in the consensus-based approach of the ASEAN Way, which emphasizes non-interference and mutual respect among Member States (Varkkey 2012; Alvin 2022). This often results in delayed responses during crises, as immediate action requires unanimous agreement (Greenpeace Southeast Asia 2019). This approach has resulted in weak enforcement mechanisms, making it difficult to hold countries accountable for their contributions to haze pollution (Varkkey 2012; Alvin 2022).

The lack of binding enforcement mechanisms also exacerbates this issue; AMS are not held accountable for non-compliance, allowing harmful practices to persist without consequence (Irawan 2018; Yogaswara 2021). AATHP's provisions are often viewed as vague and lacking specificity (Sunchindah 2015), as the agreement does not establish clear penalties for violations, or a liability framework for affected countries. The absence of robust domestic legislation in many ASEAN countries complicates matters (Alvin 2022); while Singapore has enacted its own Transboundary Haze Pollution Act to criminalize contributing actions, other nations have not yet followed suit, leading to inconsistent enforcement across the region (Mai 2023; Sunchindah 2015) – most likely due to limited funding and incentives. Many governments also prioritize economic development over environmental protection, resulting in inadequate measures to address the root causes of haze pollution. Reliance on agricultural practices that contribute to forest fires reflects a broader trend where economic interests take precedence over sustainable land management practices (Sok and Peteru 2024).

Despite these challenges, some progress has been made through initiatives such as the establishment of monitoring systems and technical task forces aimed at enhancing regional cooperation, as outlined above. To achieve meaningful progress towards a haze-free region, ASEAN needs to pave the way forward based on evaluations of its strategies while strengthening its commitment to enforceable measures that prioritize environmental sustainability alongside economic development.

Moving forward

The recently adopted second APMS and Haze-Free Roadmap, along with the launched ACC THPC, will frame the actions and activities within ASEAN over the next few years to achieve a transboundary haze-free environment by 2030. The ACC THPC, as a specialized regional institution mandated to facilitate cooperative efforts, is strategically positioned to implement strategies aimed at achieving a haze-free ASEAN by 2030 by supporting the Second Haze-Free Roadmap. By leveraging collective expertise, technological innovations and institutional cooperation, the centre represents a critical mechanism for addressing the persistent environmental and health challenges posed by transboundary haze pollution in the ASEAN region.

These developments, supported by the existing regulatory and organizational framework, should have several impacts on the region's progress towards the 2030 goal:

- Improved information sharing. The increased emphasis on information sharing and monitoring is crucial for a timely response to haze events. Bolstered by previous and current institutions, the ACC THPC can facilitate real-time data exchange among AMS, leading to a greater likelihood of early detection and more effective management of fire hotspots and haze pollution.
- Research and data-driven policies. Emphasis on research and data analysis that contribute to evidence-based decision-making and data-driven policies can lead to more targeted and effective interventions that address the root causes of haze.
- Enhanced regional cooperation. The assessments and reviews have underscored the importance of regional cooperation in addressing transboundary haze pollution. AMS are now supported with updated strategies and a roadmap that stress cooperation and can frame how they work together to tackle this complex issue. The establishment of ACC THPC as a dedicated coordinating centre further strengthens the framework for cooperation.
- International and private-sector collaboration. ASEAN, through a functional and streamlined ACC THPC, can foster greater collaboration with international organizations, donor agencies, the private sector and neighbouring countries, potentially leading to increased support, resources and expertise for haze prevention and mitigation efforts.
- Public awareness and accountability. The emphasis on enhancing public awareness is vital for garnering public support and engagement in haze-prevention efforts. We need engagement at the international, regional and national levels, but also at the local community level.

Further, these developments show strengthened environmental governance around the issue of transboundary haze where the AATHP is being operationalized through regional strategies and national action plans. However, these strategies and actions need to be transformed into legislative and regulatory reforms as well as enforcement mechanisms to be effective. All the progress and developments need to have sustained commitments backed by political will, allocated resources and cross-sectoral collaboration at local, national and regional levels. Throughout implementation, it is vital to continue focusing on climate change, land-use practices and economic factors that influence the occurrence of haze.

About this brief

This Infobrief is part of the MAHFSA programme, a joint initiative between the ASEAN Secretariat and IFAD that supports efforts to reduce transboundary haze pollution and its impact in Southeast Asia (https:// hazeportal.asean.org/programmes/mahfsa/). MAHFSA is implemented collaboratively by the ASEAN Secretariat, the Global Environment Centre (GEC), and the Center for International Forestry Research (CIFOR). We would also like to thank the peer reviewers who provided helpful comments.

References

Alvin SD. 2022. Effectiveness of the ASEAN Agreement on Transboundary Haze Pollution. *Environmental Law Review* 24(4):305–313. https://doi.org/10.1177/14614529221126335

ASEAN (Association of Southeast Asian Nations) and ADB (Asian Development Bank). 2001. *Fire, smoke and hazard: The ASEAN response strategy*. Manila: ADB. ISBN No. 971-561-338-1

ASEAN (Association of Southeast Asian Nations). 1992. Singapore Declaration of 1992. Singapore, 28 January 1992. https://asean.org/singapore-declaration-of-1992-singapore-28-january-1992/

ASEAN (Association of Southeast Asian Nations). 2021. *Report of the final review of the ASEAN Peatland Management Strategy (APMS) 2006–2020*. Jakarta: ASEAN Secretariat.

ASEAN (Association of Southeast Asian Nations). 2022. *Executive summary of the final review of the roadmap on ASEAN cooperation towards transboundary haze pollution control with means of implementation*. Jakarta: ASEAN Secretariat.

BRGM (Badan Restorasi Gambut dan Mangrove). 2022. *Laporan kinerja 2021*. Jakarta: Badan Restorasi Gambut dan Mangrove.

Field RD, van der Werf GR, Shen SSP. 2009. Human amplification of drought-induced biomass burning in

Indonesia since 1960. *Nature Geoscience* 2(3):185–188. https://doi.org/10.1038/ngeo443

Field RD, van der Werf GR, Fanin T, Fetzer EJ, Fuller R, Jethva H, Levy R, Livesey N, Luo M, Torres O, et al. 2016. Indonesian fire activity and smoke pollution in 2015 show persistent nonlinear sensitivity to El Niño-induced drought. *Proceedings of the National Academy of Sciences* 113(33), 9204-9209. https://doi.org/10.1073/pnas.1524888113

Gaveau DLA, Sloan S, Molidena E, Yaen H, Sheil D, Abram NK, Ancrenaz M, Nasi R, Quinones M, Wielaard N, et al. 2014a. Four decades of forest persistence, clearance and logging on Borneo. *PLoS ONE* 9(7):e101654. https://doi.org/10.1371/journal.pone.0101654

Gaveau DL, Salim MA, Hergoualc'h K, Locatelli B, Sloan S, Wooster M, Marlier ME, Molidena E, Yaen H, DeFries R. 2014b. Major atmospheric emissions from peat fires in Southeast Asia during non-drought years: Evidence from the 2013 Sumatran fires. *Scientific Reports* 4:6112. https://doi.org/10.1038/srep06112

Gellert PK. 2015. "Palm Oil Expansion in Indonesia: Land Grabbing as Accumulation by Dispossession", *States and Citizens: Accommodation, Facilitation and Resistance to Globalization* (*Current Perspectives in Social Theory, Vol. 34*), Emerald Group Publishing Limited, Leeds, pp. 65-99. https://doi.org/10.1108/S0278-120420150000034004

Greenpeace Southeast Asia. 2019. ASEAN Haze 2019: The Battle of Liability. Greenpeace Southeast Asia. https://www.greenpeace.org/southeastasia/press/3221/asean-haze-2019-the-battle-of-liability/

Groot WJd, Field RD, Brady MA, Roswintiarti O, Mohamad M. 2006. Development of the Indonesian and Malaysian fire danger rating systems. *Mitigation and Adaptation Strategies for Global Change* 12:165–180. https://doi.org/10.1007/s11027-006-9043-8

Hamzah AS, Darmawan, Sumawinata B, Suwardi and Djajakirana G (2019) Spatial analysis of hotspot data for tracing the source of annual peat fires in South Sumatera, Indonesia. IOP Conference Series: Earth and Environmental Science 393:012068. https://doi.org/10.1088/1755-1315/393/1/012068

Hayasaka H, Noguchi I, Putra EI, Yulianti N, Vadrevu KP. 2014. Peat-fire-related air pollution in Central Kalimantan, Indonesia. *Environmental Pollution* 195:257–266. https://doi.org/10.1016/j.envpol.2014.06.031

Irawan, AP. 2018. The role of Indonesia in Association of Southeast Asian Nations (ASEAN) in dealing with haze and air pollution. Jakarta: BINUS University. https://ir.binus.ac.id/2018/11/19/the-role-of-indonesia-in-association-of-southeast-asian-nation-asean-in-dealing-with-haze-and-air-pollution/

Kiely L, Spracklen DV, Arnold SR, Papargyropoulou E, Conibear L, Wiedinmyer C, Knote C, Adrianto HA. 2021. Assessing costs of Indonesian fires and the benefits of restoring peatland. *Nature Communications* 12:7044. https://doi.org/10.1038/s41467-021-27353-x

Koplitz SN, Mickley LJ, Marlier ME, Buonocore JJ, Kim PS, Liu T, Sulprizio MP, DeFries RS, Jacob DJ, Schwartz J, et al. 2016. Public health impacts of the severe haze in Equatorial Asia in September–October 2015: Demonstration of a new framework for informing fire management strategies to reduce downwind smoke exposure. *Environmental Research Letters* 11(9):094023. https://doi.org/10.1088/1748-9326/11/9/094023

Mai L. 2023. Extinguishing a point of contention: Examining transboundary haze in Southeast Asia. Blog post published 17 November 2023. Washington DC: Center for Strategic and International Studies. https://www.csis.org/blogs/new-perspectives-asia/extinguishing-point-contention-examining-transboundary-haze-southeast

Mishra, SK, Page, SE, Cobb, AR, Lee, JS, Jovani–Sancho, AJ, Sjögersten, S, Jaya, A, Aswandi, & Wardle, DA. 2021. Degradation of Southeast Asian tropical peatlands and integrated strategies for their better management and restoration. *Journal of Applied Ecology*. 58(7): 1370-1387. https://doi.org/10.1111/1365-2664.13905

Musri I, Ainuddin AN, Hyrul MHI, Hazandy AH, Azani AM, Mitra U. 2020. Post forest fire management at tropical peat swamp forest: A review of Malaysian experience on rehabilitation and risk mitigation. *IOP Conference Series: Earth and Environmental Science* 504:012017. https://doi.org/10.1088/1755-1315/504/1/012017

Pongratz J, Reick CH, Raddatz T, Claussen M. 2009. Effects of anthropogenic land cover change on the carbon cycle of the last millennium. *Global Biogeochemical Cycles* 23(4). https://doi.org/10.1029/2009GB003488

Samek JH, Do XL, Silapathong C, Navanagruha C, Abdullah SMS, Gunawan I, Crisostomo B, Hilario F, Hien HM, Skole DL, et al. 2004. Land use and land cover change in Southeast Asia. *In* Gutman G, et al. eds. *Land change science: Observing, monitoring and understanding trajectories of change on the Earth's surface.* Dordrecht, The Netherlands: Springer. 277–291. https://doi.org/10.1007/978-1-4020-2562-4_7

Sok V and Peteru S. 2024. Stepping up for a haze-free Southeast Asia. *Forests News*. 22 April 2024. Bogor, Indonesia: CIFOR-ICRAF. https://forestsnews.cifor.org/87228/stepping-up-for-a-haze-free-southeast-asia

Sunchindah A. 2015. *Transboundary haze pollution problem in Southeast Asia: Reframing ASEAN's response*. ERIA Discussion Paper Series. https://www.eria.org/ERIA-DP-2015-82.pdf

Tacconi L. 2016. Preventing fires and haze in Southeast Asia. *Nature Climate Change* 6(7):640-643. https://doi.org/10.1038/nclimate3008

Tanpipat V, Manomaiphiboon K, Field RD, Groot WJd, Nhuchaiya P, Jaroonrattanapak N, Buaniam C, Yodcum J. 2023. An operational fire danger rating system for Thailand and Lower Mekong Region: Development, utilization, and experiences. *In* Vadrevu KP, Ohara T, Justice C. eds. *Vegetation Fires and Pollution in Asia*. Springer. 575–588. https://doi.org/10.1007/978-3-031-29916-2_34

The Star. 2013. Big plantations accused of being major cause of haze in Sarawak. Published 22 June 2013. https://archive.ph/20130628042627/http://thestar.com.my/news/story.asp?file=/2013/6/22/sarawak/13272781&sec=sarawak#selection-1083.0-1083.63

Varkkey HM. 2012. The ASEAN way and haze mitigation efforts. *Journal of International Studies* 8:77–97. https://e-journal.uum.edu.my/index.php/jis/article/view/7927

Velasco E and Rastan S. 2015. Air quality in Singapore during the 2013 smoke-haze episode over the Strait of Malacca: Lessons learned. *Sustainable Cities and Society* 17:122–131. https://doi.org/10.1016/j.scs.2015.04.006

World Bank. 2016. The Cost of Fire An Economic Analysis of Indonesia's 2015 Fire Crisis. Indonesia Sustainable Landscapes Knowledge Note: 1. Washington, D.C.: World Bank Group. https://hdl.handle.net/10986/23840

Yogaswara L. 2021. ASEAN Agreement on Transboundary Haze Pollution. Effective? *Jurnal Hubungan Internasional* 14(1):175–187. https://doi.org/10.20473/jhi.v14i1.19847

Global Environment Centre
IFAD Investing in rural people
ASSOCIATION OF SOUTHEAST ASIAN NATIONS

cifor-icraf.org
forestsnews.cifor.org

CIFOR-ICRAF
The Center for International Forestry Research and World Agroforestry (CIFOR-ICRAF) harnesses the power of trees, forests and agroforestry landscapes to address the most pressing global challenges of our time – biodiversity loss, climate change, food security, livelihoods and inequity. CIFOR and ICRAF are CGIAR Research Centers.

CGIAR