SINGAPORE INSTITUTE OF INTERNATIONAL AFFAIRS

HAZE OUTLOOK 2025

July 2025

Contents

About this Report

The Haze Outlook 2025 report provides a risk assessment of the probability of a transboundary haze incident affecting Indonesia, Malaysia, and Singapore for the year ahead. This is based on research conducted by the Singapore Institute of International Affairs (SIIA), a leading think tank in the region.

The Haze Outlook 2025 is the seventh edition of this assessment. It is directed by Simon Tay, Chairman, SIIA and Associate Professor, Faculty of Law National University of Singapore. The authors are Khor Yu-Leng and Aaron Choo, respectively Associate Director (Sustainability) and Senior Assistant Director (Special Projects and Sustainability), SIIA, with Abigael Eminza and Claudia Nyon, who are Research Associates at Segi Enam Advisors. All views expressed in the report are those of the authors, unless otherwise credited.

Our research includes quantitative information on weather factors, the impact of fires, and commodity prices. We also qualitatively consider government policies and private sector practices. These assessments are based on the SIIA's engagement with sustainability stakeholders in the region.

In particular, the authors would like to thank the following for their assistance and insights over the past year (in alphabetical order): Ambank Berhad, ASEAN Specialised Meteorological Centre (ASMC), Asia Pacific Resources International Limited (APRIL) Group, Bumitama Agri, Euro Asian Investment Holding, Glenauk Economics, Golden Agri-Resources (GAR), Indonesian Palm Oil Association (GAPKI), ISTA Mielke GmbH / Oil World, Landscape Indonesia, Musim Mas, PM Haze, Roundtable on Sustainable Palm Oil (RSPO), World Resources Institute (WRI) Indonesia. We are also grateful to government officials of the region who have engaged with the SIIA for our sustainability programme.

Established in 1962, the SIIA is a not-for-profit and independent think tank committed to fostering in-depth dialogues around politics, economic policy, and sustainability in ASEAN and the wider region. It is a founding member of the ASEAN-ISIS Network of think tanks for Track II engagement and convenes the ASEAN Think Tank Summit. In the field of sustainability and especially on the haze, the SIIA has been an early analyst and advocate. The SIIA championed the fight against the transboundary haze from 1997, when we co-organised Singapore's first haze dialogue chaired by Simon Tay. Following the severe transboundary haze in 2013, the SIIA established the Singapore Dialogue on Sustainable World Resources (SWR) in 2014 which has since become a leading platform for discussion in the region about key sustainability challenges including the haze.

1. Executive Summary

Risk of a Transboundary Haze Event in 2025:

Green: Low risk **Amber:** Medium risk **Red:** High risk

Amber

Our assessment is that there is an Amber or medium risk of a severe transboundary haze event affecting Indonesia, Malaysia, and Singapore for the rest of 2025, on a scale of green, amber, and red, where red is the highest risk. Agricultural prices are elevated and there has been some uptick in deforestation, increasing the risk of fires and haze. There was an escalation in hotspots and smoke haze in parts of Sumatra in mid-July, with transboundary haze observed to drift from central Sumatra into parts of Peninsular Malaysia, affecting air quality there.

There are also economic and policy shifts that may inadvertently trigger deforestation and higher haze risk, if fire is used to clear land. Increases in agricultural output are needed to meet rising demand for food security and energy. Care must be taken that this is done in a sustainable fashion and to avoid creating more fire-prone conditions. In the medium to long term, climate trends also suggest that another unusually dry season may occur around 2027-2030.

Our assessment is based on three areas: **weather**, **markets**, and **policies**, and is informed by our engagement with governments, businesses, think tanks, and NGOs.

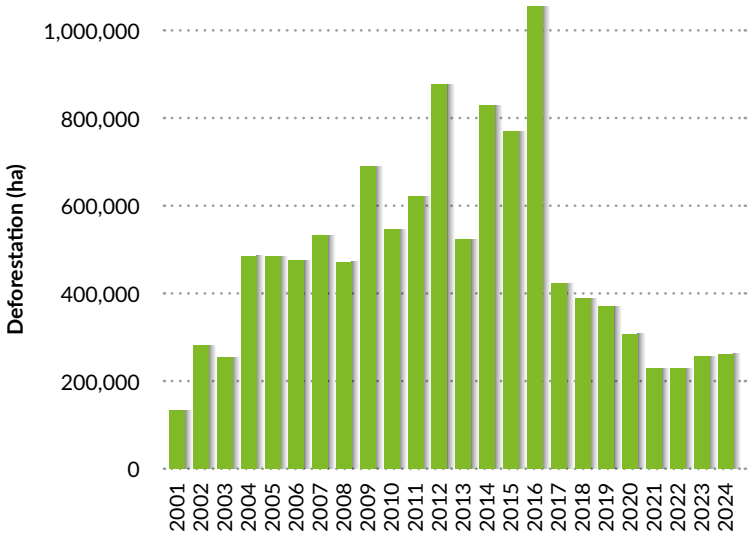
Weather: The haze results from fires in the region and drier weather has driven past episodes of haze. For the remaining months of 2025, meteorologists are expecting a milder and shorter dry season peaking in August. The risk from weather is relatively benign for now, though the fires in late July show that weather is changeable and some areas remain fire-prone. Looking ahead, some suggest that another extreme hot and dry period could occur around 2027-2030. The ASEAN region must remain prepared to face future extreme weather events and fire seasons amidst a warming global climate.

Markets: Fires that cause the haze are often linked to agricultural activity in the region and in commodity industries such as palm oil, pulp and paper, and others. Historically, spikes in agricultural commodity prices have been followed by increases in deforestation. Prices this year are elevated, and estimates show some uptick in deforestation in Indonesia from 2023 to 2024.

Policies: Government and private sector efforts are crucial to keeping fires and haze under control, and to ensure that forests and plantations are sustainably managed. Indonesia has made significant strides in sustainable forestry and emissions reduction under the Jokowi administration, including a 2021 commitment to make its forestry and land use (FOLU) sector a net carbon sink by 2030. Fire incidents in 2024 remained low. The current Prabowo administration has said it will continue forest management policies. However, Indonesia faces a triple challenge in meeting food security, energy, and export imperatives. The question of food versus fuel is rising in prominence, especially as Indonesia plans to increase its biodiesel mandate alongside introducing a new bioethanol mandate for gasoline. NGOs such as Mighty Earth and environmental media organisations like Mongabay have said that Indonesia's food and energy projects could result in more clearing of forests and peatlands. Care is needed to ensure that efforts to create new plantations are sustainable, and to increase the efficiency of existing plantations.

Figure 1: Declining deforestation in Indonesia

Deforestation in Indonesia, 2001-2004



Top Ten Provinces for Deforestation, 2024 (hectares)

2023	
West Kalimantan	35,162
Central Kalimantan	30,433
East Kalimantan	28,633
Central Sulawesi	16,679
South Kalimantan	16,067
North Kalimantan	14,316
Riau	13,268
South Papua	12,640
Central Papua	11,336
West Papua	10,990
27 other provinces	**67,858**

2024	
East Kalimantan	44,483
West Kalimantan	39,598
Central Kalimantan	33,389
Riau	20,812
South Sumatra	20,184
Jambi	14,839
Aceh	8,962
North Kalimantan	8,767
Bangka Belitung	7,956
North Sumatra	7,303
27 other provinces	**55,282**

Source: Chart and table from Simontini (2025), based on 2023 and 2024 estimates from Auriga Nusantara, and historical data from the University of Maryland and Ministry of Forestry, Indonesia

Deforestation and Demand

Estimates by think tank Auriga Nusantara (Figure 1) show an uptick in deforestation in Indonesia between 2023 and 2024. This includes an uptick in provinces in Sumatra near Singapore and Peninsular Malaysia, where fires have spiked in July 2025.

Despite some plantation expansion in recent years, analysts fear that supply is still lagging behind demand, pushing up the price of commodities. Palm oil produced in Indonesia and Malaysia is usually the world's cheapest vegetable oil, but it has traded at a higher price than soybean oil at key destinations for nine consecutive months. Latin America, a major producer of soybeans, is the current global frontier for agricultural expansion.

Economic and Policy Shifts

At the international level, commodity markets have so far stayed resilient despite imminent US tariffs. Another change which could affect markets is the EU Regulation on Deforestation-free products (EUDR), which will be implemented from 30 December 2025. Questions remain about its impact, and Indonesia has called for the EUDR to be further delayed to 2028.

At the national level, the Prabowo administration is exploring plantation development in Papua and transferring control of land across the country to a new state-owned enterprise called Agrinas, alongside promoting downstreaming of its industries. There is also an ongoing court case against three companies accused of circumventing palm oil export restrictions in 2022. In July 2025, Coordinating Minister for Political and Security Affairs Budi Gunawan asked Indonesian agencies to increase firefighting efforts as transboundary haze was affecting neighbouring countries. This signals that the government is placing businesses under scrutiny, and is taking haze as an important issue.

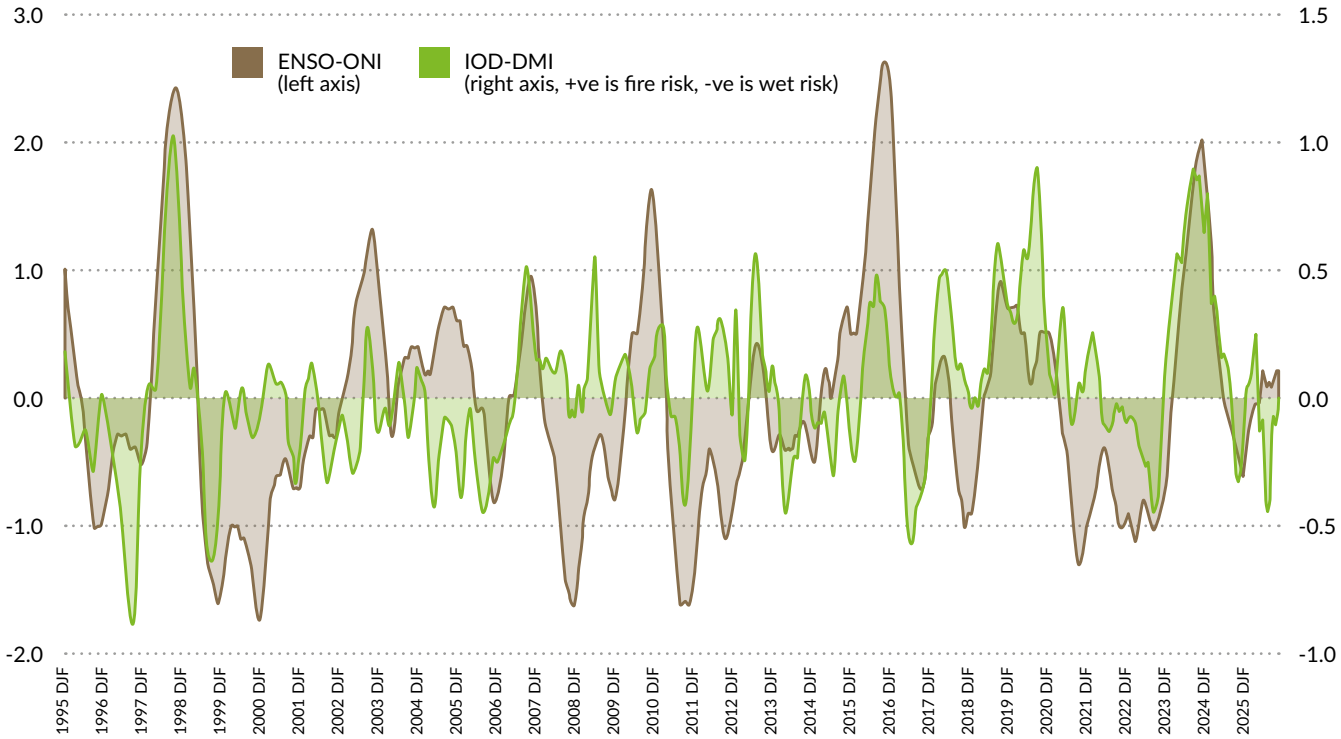
Our assessment is there is an Amber or medium risk of a severe transboundary haze event for the rest of 2025 – though even if this occurs, the haze should not be as prolonged as the incidents in 1997-1998 and 2015. As our Haze Outlook in 2024 was Green, this is a concerning shift. Good policies are needed to ensure that ASEAN is not at the mercy of the weather when it comes to preventing haze. Regional cooperation plays a significant role and must be enhanced through the ASEAN Meeting of the Technical Working Group (TWG) and Sub-Regional Ministerial Steering Committee on Transboundary Haze Pollution (MSC) and other mechanisms.

2. Issues to Watch in 2025

2.1. Weather: Milder and Shorter Dry Season in 2025

Figure 2: El Niño-Southern Oscillation (ENSO) and Indian Ocean Dipole (IOD)

ENSO - The Oceanic Niño Index (ONI; brown) and IOD - Dipole Mode Index (DMI; green) - positive and higher index points to dryer weather and larger negative index points to wetter weather. Australia BOM forecasts neutral ENSO and neutral-negative IOD for end 2025. Labelled intervals on x-axis are for Dec, Jan, Feb (DJF) at start of each year.



Source: Khor Reports - Segi Enam Advisors (2025), based on data from the US National Oceanic and Atmospheric Administration (NOAA) for 1995 to April 2025, Australia's Bureau of Meteorology (BOM) for May and June 2025 and forecasts compiled to Dec 2025.

The 2025 dry season has already seen a spike in fires in Sumatra, resulting in some transboundary haze affecting parts of peninsula Malaysia. However, the remainder of the dry season in 2025 is expected to be milder and shorter than most past dry seasons, peaking in August. For now, the weather is relatively benign, and fires can be kept under control unless the situation changes.

Past haze incidents have frequently coincided with intense drought periods, corresponding to the positive phase of the El Niño–Southern Oscillation (ENSO) and Indian Ocean Dipole (IOD) phenomena – most recently in 2023, 2019, and 2015 (see Figure 2). ENSO refers to variations in sea-surface temperatures, rainfall, surface air pressure, and atmospheric circulation across the equatorial Pacific Ocean, while IOD is a similar phenomenon for the Indian Ocean. For the ASEAN region, the positive phases of both phenomenon bring drier conditions, while the negative phases correspond to wetter conditions.

For 2025, ENSO-neutral conditions are expected for the remainder of 2025, through to early next year, while IOD is also expected to be neutral or negative. Southern ASEAN countries are still experiencing a dry season in the latter half of the year, but this is expected to be a relatively mild and shorter dry season.

- The US National Oceanic and Atmospheric Administration (NOAA) reports a transition from La Niña conditions to ENSO-neutral during February-April 2025, with conditions persisting in June-August. For November-January, chances are 48 per cent ENSO-neutral and 41 per cent La Niña (NCEP, 2025).
- The ASEAN Specialised Meteorological Centre (ASMC) notes that most models predict ENSO-neutral conditions from July-September 2025 (ASMC, 2025).
- Indonesia's Meteorological, Climatological, and Geophysical Agency (*Badan Meteorologi, Klimatologi, dan Geofisika* or BMKG) concurs with the ENSO-neutral prediction. BMKG also predicts that the country will have a shorter-than-normal dry season, beginning gradually in June 2025, reaching its peak between July and August, and concluding before the end of September (UMS, 2025).
- Australia's Bureau of Meteorology (BOM) forecasts that IOD will remain neutral until July, and may shift to negative after July (BOM, 2025).

Notwithstanding the conditions in 2025, it is possible that another severely hot and dry season could occur between 2027 to 2030. The interval between IOD events is unpredictable. El Niño events are also irregular, but in general a El Niño period occurs every three to five years. The last El Niño was in 2023-2024, meaning that another could take place towards the end of this decade. If the El Niño is strong, and if this coincides with a positive IOD, it would increase fire and haze risk for that year. Beyond 2025, the ASEAN region still needs to remain on guard against human-induced activities that result in fires during future dry seasons.

2.2. Markets: Short Term Resilience, Long Term Concerns

The Haze Outlook analyses market trends to determine if there are any factors increasing haze risk, comparing agricultural commodity futures to estimates of deforestation and plantation expansion. Historically, spikes in prices have been followed in subsequent years by rises in deforestation. Prices are currently elevated, and there has been a uptick in deforestation between 2023-2024, including in provinces in Sumatra, according to think tank estimates.

Despite this uptick, analysts are concerned that plantation expansion and agricultural commodities supply are still lagging behind demand. This could further drive up prices. Notably, palm oil, a major export of Indonesia and Malaysia, has typically been the lowest-cost vegetable oil in recent history. However, in an unprecedented development, palm oil has been trading at higher prices compared to competing vegetable oils such as soybean in some key destinations for nine consecutive months.

The global frontier for agricultural expansion is now Latin America, which is a major producer of soybeans and other agricultural products. Agricultural markets are connected and shifts in one market affect others elsewhere.

US Tariffs

The current high prices of palm oil and other agricultural exports from ASEAN are due to lagging supply versus rising global and regional demand, and are not directly related to the Trump administration's trade tariffs. Some ASEAN economies are more exposed to impacts from US tariffs, but US demand for Indonesian and Malaysian palm oil is seen as relatively inelastic. Even if US demand is affected, Indonesia and Malaysia have diversified export portfolios and can count on strong domestic demand for their own agricultural products to offset shifts in American demand. For the moment, US tariffs are therefore not having a strong effect on Indonesia and Malaysia's agricultural sectors, though this could change as the situation develops.

The US is a significant buyer of palm oil, but it is far from the largest. Indonesia is by far the world's leading exporter of palm oil, and its palm oil trade with the US accounts for 7 per cent of its total export volume. This makes it fourth-ranked as an export market for Indonesia, behind China, India, and Pakistan, around the same level as the EU.

EUDR

There are also questions surrounding agricultural commodities trade with the EU, as the European Union's Regulation on Deforestation-free products (EUDR) is now scheduled to take effect for large companies from 30 December 2025, following a one-year delay (see Annex 3). The EUDR covers seven commodity categories and aims to ensure that products traded and consumed in the EU are not linked to deforestation. There has been some controversy over the regulation, with critics contending that the due diligence and data requirements of the EUDR are too stringent, particularly for smallholder farmers.

Talks between the EU and its trading partners, including a trilateral Ad Hoc Joint Task Force (JTF) involving the European Commission, Indonesia, and Malaysia have made progress. The EU has streamlined the EUDR's reporting requirements, making compliance easier for businesses, but the matter of smallholder inclusion in supply chains has largely been left to the origin countries. Indonesia and Malaysia have created digital platforms to facilitate EUDR compliance, providing legality and traceability information. Smallholder farmers are included in these national systems. The platforms are intended to allow international buyers and trader-processors to file their EUDR due diligence submissions while still respecting Indonesian and Malaysian laws on data protection. However, it remains to be seen whether these systems will be fully embraced by buyers and EU officials, and consequently whether the EUDR will have lasting effects on trade flows. Indonesia has called for the EUDR's implementation to be further postponed to 2028 to allow all parties more time to prepare.

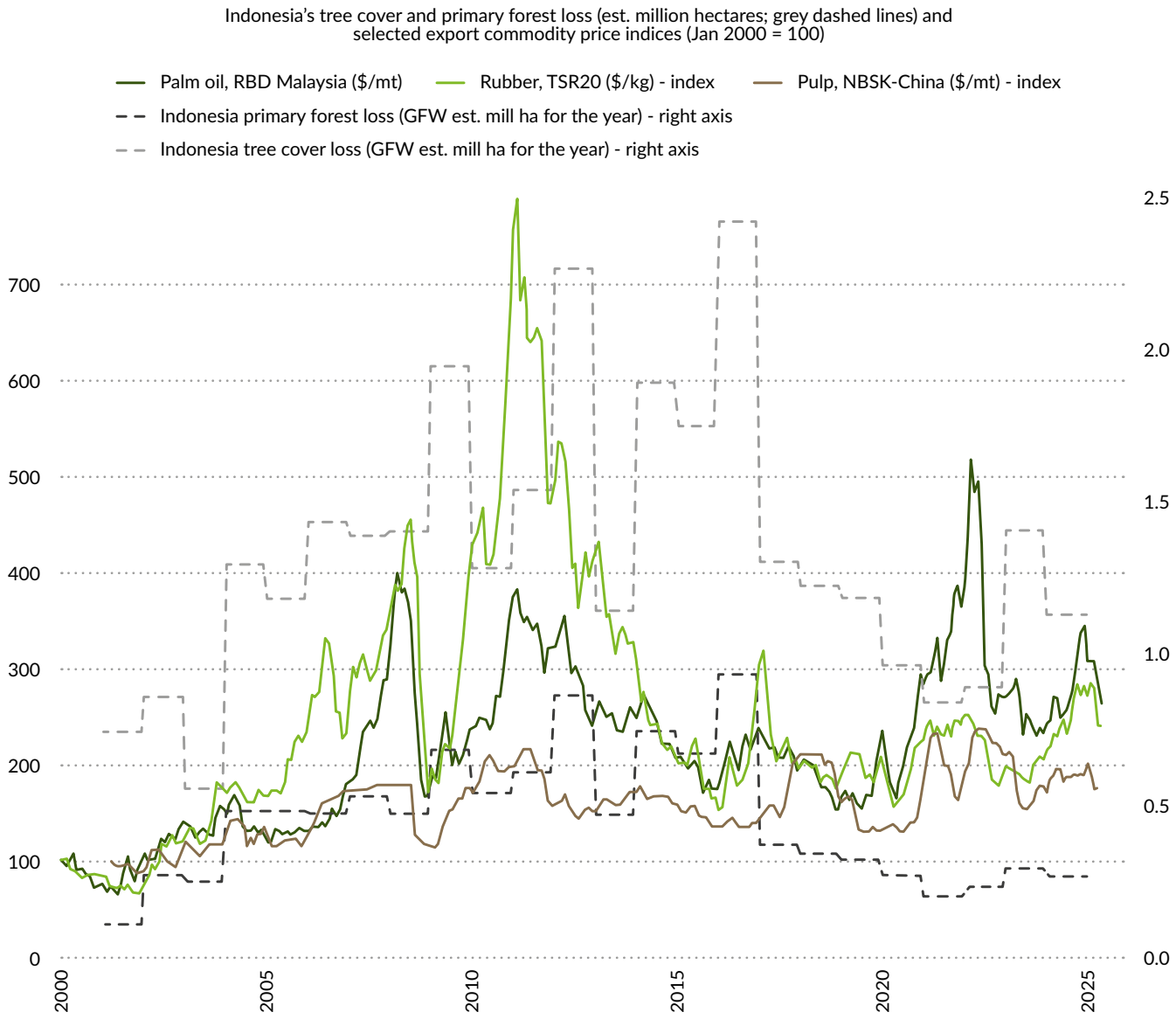
Commodity Price and Deforestation Trends

Prior to 2015, surges in agricultural commodity prices were typically followed by increases in tree cover loss and primary forest loss in Indonesia over subsequent years. Figure 3 shows total tree cover loss and primary forest loss in Indonesia represented by light and dark grey dashed lines, based on data from the World Resources Institute's (WRI) Global Forest Watch (GFW) platform. This data is compared, over time, to benchmark futures prices for selected key agricultural commodities in coloured lines.

The severe fires and haze in 2015 acted as a wake-up call for policymakers and businesses. Since 2015, some change in tree cover has occasionally followed price increases. But tree cover is a general term including plantations. Shifts in tree cover could reflect replanting or a change from one plantation type to another. From 2015 to 2019, the rate of primary forest loss, referring to natural ecosystems, trended downward or remained largely flat despite commodity price shifts. Policy moves such as Indonesia's permanent moratorium on new plantations on forest and peatland proved effective in reducing deforestation.

Commentators note that there has been a shift from illegal deforestation to legal clearing within government-approved concessions (Jong, 2025) in recent years. However, the situation since 2020 has been more complex than the 2015-2019 period. Think tank Auriga Nusantara (see Figure 1) estimates that there was an uptick in deforestation in Indonesia from 2023 to 2024, around 1.6 per cent.

Figure 3: Deforestation in Indonesia compared to commodity prices



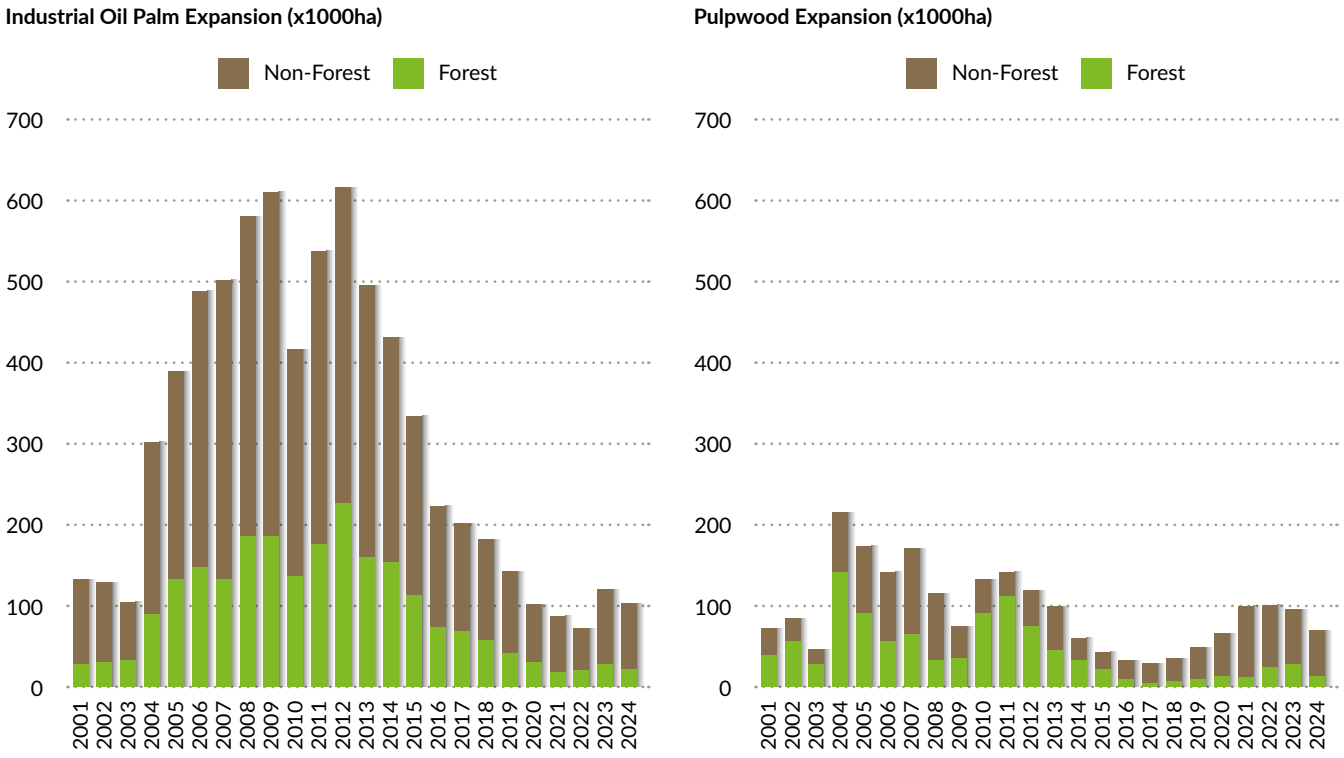
Note: Commodity futures price indices are relative to January 2000 as 100, deforestation rates in dashed lines are in millions of hectares

Source: Khor Reports – Segi Enam Advisors (2025), based on data from the World Bank for palm oil and rubber futures, FastMarkets for pulp, and Global Forest Watch for primary forest and tree cover loss estimates. Benchmark futures prices used are Refined, Bleached and Deodorised (RBD) palm oil traded on Bursa Malaysia (dark green line), Technically Specified Rubber (TSR, light green line), and Northern Bleached Softwood Kraft or NBSK in China (brown line).

Deforestation figures do not necessarily translate directly to the expansion of plantations. Figure 4 shows estimates on plantation expansion from consultancy The TreeMap (2025a, 2025b) which operates the *Nusantara Atlas* platform. In 2023, there was a spike in industrial oil palm plantation expansion in Indonesia, though this came down by 9 per cent in 2024 compared to the previous year. For 2024, oil palm plantations expanded by 117,139 hectares.

Pulpwood plantation expansion trended upwards from 2019 to 2022, though based on current estimates the expansion has declined year-on-year in both 2023 and 2024. Most of the pulpwood expansion seen in 2024 was on just two corporate concessions, rather than reflecting widespread activity by several companies.

Figure 4: Decrease in oil palm and pulpwood expansion in 2024



Note: Data does not include smallholder expansion

Source: Chart extracts from TheTreeMap (2024), based on data from Landsat and Sentinel-2 Time-series

Achieving Sustainable Growth

Some analysts such as Thomas Mielke, Editor and CEO of Oil World, note that while a decline in oil palm plantation expansion and related deforestation is positive from an environmental standpoint, the gap between supply growth versus increasing demand is concerning from an economic standpoint. Sustainable plantation development in non-forest areas is still needed, alongside a scaling up of efforts to replant aging areas with seeds that have been properly certified as good planting material. Efforts are also needed to address inefficient management in existing plantations, not just within the private sector but including government-linked businesses.

2.3. Policies: Progress and Future Challenges

Government and private sector efforts are crucial to keeping fires and haze under control, and in ensuring that forests and plantations are sustainably managed. The Haze Outlook explores government policies and private sector practices to understand the implications for haze risk.

Between 2014 and 2024, Indonesian President Joko Widodo, properly known as Jokowi, led his administration in making major progress in haze prevention and ecosystem restoration. These policies are continuing under current Indonesian President Prabowo Subianto, who remains closely allied with his predecessor. Mr Prabowo's Vice President, Gibran Rakabuming Raka, is Mr Jokowi's eldest son.

Indonesia agricultural industries face the challenge of needing to meet domestic food security and energy security needs, while also still generating revenue from exports. Policymakers and businesses will need to work together to balance these objectives without putting pressure on land use.

Progress under the Jokowi Administration

As the largest nation in ASEAN with vast forest and peat landscapes, and where haze is most acutely felt, Mr Jokowi and his government, notably the Ministry of Environment and Forestry, played a vital role in addressing the haze issue at the central government level.

One of the first major challenges Mr Jokowi faced in office was the 2015 transboundary haze crisis during his first year. This cemented haze as a key issue of his presidency and paved the way for several progressive initiatives targeting ecosystems and haze, such as the establishment of the Peatland Restoration Agency (BRG) in 2016, later renamed the Peatland and Mangrove Restoration Agency (BRGM). As of 2025, the agency reported that it had restored 1.6 million hectares of peatland and 84,396 hectares of mangroves.

Following the 2015 haze incident, the government said that companies involved in burning would have their permits revoked, and prosecutions of corporations liable for fires increased significantly. For example, the Supreme Court ordered PT Kallista Alam to pay US$26 million in fines and reparations, while PT Nasional Sago Prima was fined US$91.7 million. These high-profile rulings set a precedent for the high cost of non-compliance.

In November 2021, ahead of COP26 in Glasgow, Mr Jokowi signed a legally binding presidential regulation committing Indonesia to achieve a net carbon sink for the forestry and other land use (FOLU) sector by 2030. As FOLU accounts for nearly half of Indonesia's emissions, this move marked a major step toward meeting its Paris Agreement targets. If successful, it could deliver up to 60 per cent of the country's emissions reductions while directly addressing haze by curbing deforestation and peatland fires. In 2021, Mr Jokowi also issued a carbon pricing and trading regulation, including the prospect of carbon credit generation from ecosystem conservation and restoration projects.

There has been no severe transboundary haze affecting Indonesia, Malaysia, and Singapore since 2019, though less intense transboundary haze episodes have occurred in 2023 and more recently in July 2025.

The Prabowo Administration and Challenges Facing Indonesia

Mr Prabowo has signalled he will continue Mr Jokowi's forest management policies but has also set new priorities for his administration. Mr Prabowo is placing a strong emphasis on national self-sufficiency, alongside setting a target to achieve 8 per cent GDP growth by the end of his first term. Mr Prabowo's growth target is in line with long-term ambitions to make Indonesia a high-income economy by 2045.

At the same time, Indonesia faces several challenges. Even before the global economic uncertainty triggered by US trade tariffs, Indonesia's fiscal space was already constrained. The country's debt levels remain relatively high. Mr Prabowo's initiative to provide free meals to schoolchildren will create domestic consumption and growth but will also weigh on state spending.

The Prabowo administration has indicated that agricultural commodities production, and in particular palm oil, will remain a major part of Indonesia's economic strategy. Palm oil alone contributes 2.5 to 5 per cent of Indonesia's GDP and supports 16 million jobs. Indonesia's industries will have to meet both food security and energy needs, while continuing to generate export revenue. The new administration must ensure that the development of Indonesia's agricultural sector is conducted sustainably, in tandem with continued protection of the environment. There are several key initiatives that bear watching.

Danantara and Agrinas: The Prabowo administration has created Danantara, a second sovereign wealth fund. One of the new state companies linked to the fund is Agrinas, formed from the merger of three existing enterprises. The palm oil unit, Agrinas Palma Nusantara, is set to control up to one million hectares of area zoned for plantations. If fully realised, this could give Agrinas a 6 to 7 per cent market share of Indonesia's national palm oil output.

Downstreaming Industries: The Prabowo administration is prioritising downstreaming for the commodities sector, aiming to strengthen processing and refining within Indonesia — turning palm oil into oleo food products, oleochemicals, and vitamin precursors. The Ministry of Investment and Downstream Industry/Indonesian Investment Coordinating Board (BKPM) is focusing mainly on palm oil, though other crops like coconut are being explored.

Biofuel Mandates: Indonesia's efforts to encourage the use of biofuels began under the Jokowi administration. This push is intensifying under the Prabowo administration as part of the nation's broader downstreaming strategy. In early 2025, Indonesia increased its biodiesel blend from B35 to B40, referring to a 40 per cent vegetable oil content in diesel fuel. The increase is consuming an amount of palm oil comparable to Indonesia's annual exports to a market like the US and EU. The Prabowo administration hopes to achieve a B50 blend for biodiesel within Mr Prabowo's term. The Prabowo administration is also looking at a bioethanol blend for gasoline, starting with E5 as early as 2026, using feedstock from the country's sugar industry.

Development in Papua: Indonesian policymakers are hoping to create more food and energy estates in the province of Papua, one of the last remaining frontiers for development. However, land development costs in the province are high, and plans must ensure that community rights and sustainability standards are respected.

3. Qualitative Risk Assessment and Conclusion

There is a medium risk of a severe transboundary haze incident affecting Indonesia, Malaysia, and Singapore in 2025, rated as Amber on a scale of green, amber, and red. This assessment is based on three areas: weather, markets, and policies.

The dry season in the latter half of 2025 is expected to be around the long-term average for past seasons, or milder and shorter than usual. While there have already been spikes in fires in Sumatra and some transboundary haze has affected peninsula Malaysia, the weather situation is relatively benign. Fires can be kept under control unless the situation changes. Looking at markets, commodity prices are elevated and there has been an uptick in deforestation in Indonesia from 2023-2024, including in Sumatra, according to some estimates – which could correspond to increased fire risk. This underscores the need for good land and fire management policy for haze prevention.

There are several issues to watch that may impact haze risk in the longer term. El Niño climate events occur roughly every three to five years, and the last El Niño was in 2023-2024. The IOD is less predictable, but it is possible that a strong El Niño could occur again around 2027-2030, possibly coinciding with a positive IOD effect as well. If this happens, lower rainfall and higher temperatures would increase fire risk for the ASEAN region. As global warming intensifies, the frequency of extreme weather events may also rise.

Trade tensions persist, and it remains to be seen what effect US tariffs will have on global agricultural commodity markets and plantation industry activity in the coming months. The implications of current high palm oil prices also remain unclear. Global market shifts will affect Indonesia's plans to develop its agricultural sector and promote downstream industries.

Much will depend on Indonesia's governance of its plantation and commodities industry. A high-profile court case is currently ongoing at the Supreme Court level, involving representatives of three companies who are accused of circumventing Indonesian palm oil export restrictions in 2022. Businesses and investors are watching the situation closely.

The fact that agricultural commodity supply is falling behind the world's increasing demand will have ramifications for both national economies and the global economy. Arguably, the world still needs efforts to increase palm oil and other agricultural commodity output in ASEAN – ideally via sustainable expansion on non-forest areas, conversion of other croplands, yield increases, and replanting of aging areas.

While national level action is critical, regional cooperation continues to play a significant role and must be strengthened. ASEAN is taking steps to enhance multi-stakeholder partnerships to promote sustainable land management, such as through the ASEAN Meeting of the Technical Working Group (TWG) and Sub-Regional Ministerial Steering Committee on Transboundary Haze Pollution (MSC) meeting. At the 26th MSC meeting held on 10 July 2025 in Brunei, the meeting noted the progress made in implementing the Second Roadmap on ASEAN Cooperation towards Transboundary Haze Pollution Control with Means of Implementation (Haze-free Roadmap 2023-2030), which is essential in driving forward the shared vision of a Transboundary Haze-Free ASEAN by 2030. Efforts to establish the ASEAN Coordinating Centre for Transboundary Haze Pollution Control (ACC THPC) should be prioritised.

The SIIA aims to release a follow-up report that will analyse economic shifts and policy directions that may impact land management and haze prevention in the coming years.

Annexes

Annex 1: Literature Review

Building on our previous Haze Outlook reports, we reviewed 105 relevant recent studies related to the haze and peatland fires for 2024–2025. On the general topic of fire and land management in Indonesia, we identified 22 per cent on the social, political, and economic aspects of peatland fires, 17 per cent on technical land management matters, and 11 per cent on fire management. The remainder covered other issues such as health and climate effects.

Research on the socio-economic impacts of peatland fires and haze remains a major field for 2024–2025. Mendham et al. (2024) found that government programs in one village, Tumbang Nusa, in Central Kalimantan, had limited impact – only 17 per cent of demonstration plots, 16 per cent of capacity-building initiatives, and 11 per cent of livelihood programs remained active and adopted. Other significant studies about villages in peatland areas include Jalilov et al. (2024), Ekawati et al. (2024), and Puspitaloka et al. (2024).

Yunus et al. (2024) estimated the total economic value of peatlands in Indonesia's Riau province at USD 3,174 per household per year—about 1.3 times the annual household income. Ilham et al. (2024) conducted a value-chain analysis in Riau, identifying commodities that could be an alternative to oil palm cultivation: pineapple, areca nut, fish, and honey.

Studies on peatland management included research on rewetting and revegetation of peat areas (Elfis et al., 2024). Hooijer et al. (2024) reported positive effects on water levels and native tree species spontaneously growing on a site. In another study in Riau's Siak district, groundwater levels five meters away from canal blocks were significantly higher than in areas without them. Alhamd et al. (2024) and Wahyono et al. (2024). Widyastuti et al. (2025) found that repeatedly burned peatland had 10 per cent lower water-holding capacity than secondary forests.

We reviewed 11 papers on greenhouse gas (GHG) emissions from fires and land degradation. Hu et al. (2024) conducted controlled field research in Sumatran peatlands, showing that emission factors (amount of pollutants released per unit burned) varied significantly across fire stages and weather conditions, demonstrating the complexity of measuring emissions. Cahyaningtyas et al. (2024) found that post-fire carbon storage was influenced more by fire severity and recency than by fire frequency.

There were several impact studies on fine particulate matter, especially PM 2.5. (Grosvenor et al., 2024; Siregar et al., 2024; Madrigano et al., 2024, United States Environmental Protection Agency (EPA), 2025). Graham et al. (2024) found indoor air quality during the 2023 fire and haze season in Central Kalimantan to be as poor as outdoor air, estimating that fires resulted in 93–112 µg/m^3 PM2.5 concentrations, far exceeding WHO (15 µg/m^3) and Indonesian (65 µg/m^3) safe limits.

On forest management policy, Chervier et al. (2024) found that there were mixed effects of Indonesia's move to decentralise management to Forest Management Units (*Kesatuan Pengelolaan Hutan*, KPH) from 2001 to 2020 due to lack of resources in many areas. KPHs had a positive impact on fire-related forest loss, and the study found that earlier-established units also had better results. The authors note that KPHs have played a diminished role following newer programmes introduced by the Jokowi administration.

Key NGOs, campaigns, and media continue to scrutinise businesses for links to deforestation. Mighty Earth (2025) has reported on land clearing in Merauke, Papua, for rice cultivation. The Gecko Project (2024), in collaboration with Bloomberg News, has reported on businesses allegedly clearing forests in West Borneo. Jong (2025) in Mongabay reported on Auriga Nusantara's deforestation estimates. Bulolo (2024) in EcoBusiness has commented on the implications of the Prabowo administration's biofuel mandates.

Mongabay recently reported on a spate of controversies, notably a group of South Sumatran residents suing pulpwood companies for recurring haze pollution, citing violations of their right to a healthy environment (Jong, 2025). Other governance issues include indigenous concerns over government-backed projects in Merauke and other legal cases.

Annex 2: Case Study on Peatland and Mangrove Restoration

Although peatlands and mangroves occupy only 5.4 per cent of Southeast Asia's land area, restoring and protecting these carbon-dense ecosystems can contribute substantially to climate change mitigation, while maintaining valuable ecosystem services, livelihoods and biodiversity. This is according to a recent study in *Nature Communications* by Sasmito et al., 2025 titled 'Half of land use carbon emissions in Southeast Asia can be mitigated through peat swamp forest and mangrove conservation and restoration'.

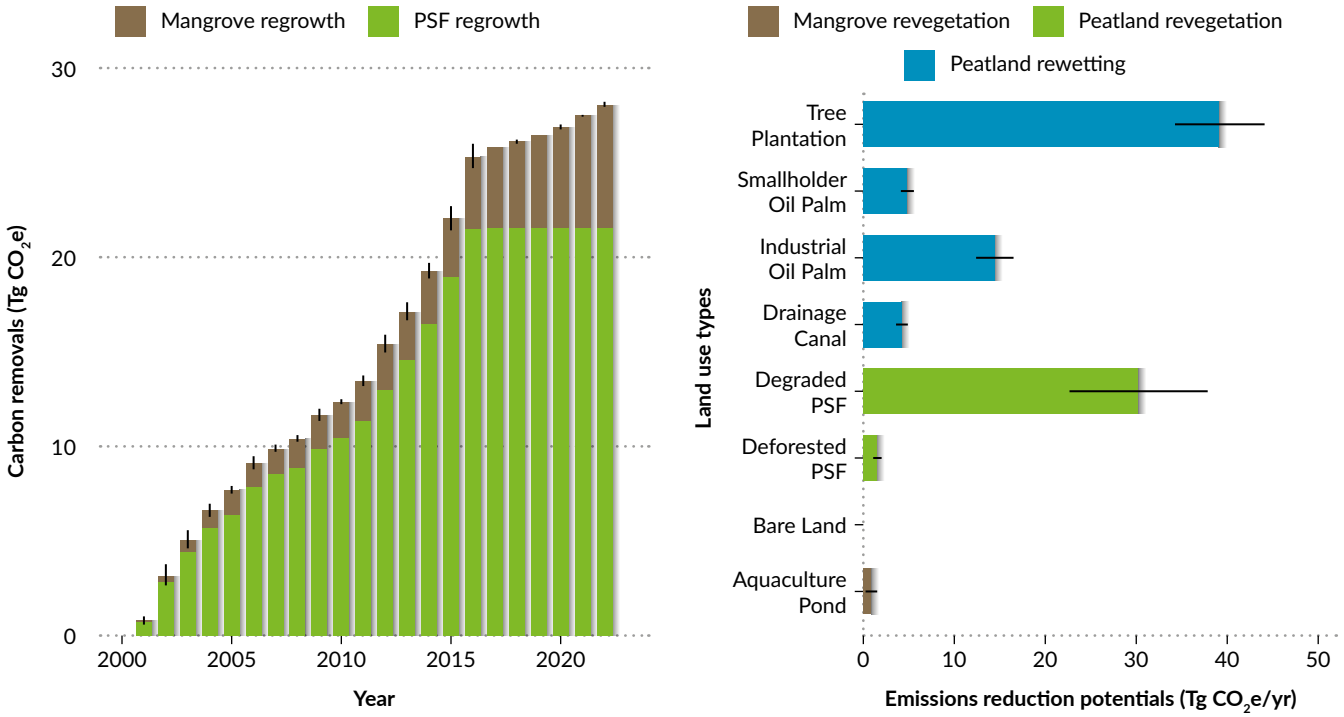
The authors of the study are international specialists from Australia, Indonesia, Singapore, the United Kingdom, and the United States. Notably, the authorship includes experts affiliated with Indonesian government bodies, namely the National Research and Innovation Agency (BRIN) and the Ministry of Forestry.

The study showed that peatland and mangrove restoration is especially important in Indonesia, which accounts for roughly 72 per cent of the region's annual emissions from tree cover loss, fires, and land-use change on peatlands and mangroves.

Indonesia has set a target of achieving a net carbon sink for its forestry and other land use (FOLU) sector by 2030. The study estimates that Indonesia has the potential to meet its FOLU emission reduction target of 500 Tg CO_2e without external support by conserving peatland and mangroves.

Carbon sequestration from peatland regrowth remained largely flat across all of the Southeast Asia region for the period 2017-2022, for unclear reasons, while mangrove regrowth continued to improve. Beyond 2022, it is expected that 66 per cent of the region's emissions reduction from ecosystem restoration will come from the rewetting of peatlands, with 33 per cent coming from revegetation of peat areas.

Figure A1: Carbon removal and emissions reduction potential from peat and mangrove regrowth



Source: Sasmito et al. (2025)

Annex 3: EUDR and Digital Traceability

The European Union's Regulation on Deforestation-free products (EUDR) was originally scheduled to take effect at the end of 2024. But its phasing-in period was delayed to give businesses and governments more time to comply. Currently, large and medium-sized companies have until 30 December 2025 to comply with the regulation, while micro and small enterprises have until 30 June 2026.

The EUDR covers seven product categories – palm oil, soy, wood, cocoa, coffee, cattle, and natural rubber. ASEAN economies are major exporters of most of these commodities, except for soy and cattle. Under the regulation, goods imported into the EU will need to prove they are not connected to any recent deforestation, defined as deforestation that occurred after 31 December 2020. Companies that fail to comply will be subject to checks and potentially fines or bans from the EU market.

The regulation aims to ensure that a set of products traded and consumed in the EU does not contribute to deforestation anywhere in the world. There has been some controversy over the EUDR, with critics both within and outside the EU contending that the due diligence and data requirements of the EUDR are too stringent, particularly for smallholder farmers. Critics say that small farmers who cannot meet the reporting requirements will effectively be barred from exporting to the EU, or being part of supply chains that go to the EU.

Talks between the EU and its trading partners on EUDR implementation have been underway since 2023, including a trilateral Ad Hoc Joint Task Force (JTF) involving the European Commission, Indonesia, and Malaysia. These have made progress.

The European Commission recently announced changes to simplify the administration of the EUDR, including softened requirements for due diligence reporting. The changes are intended to "reduce the administrative burden" of implementing the EUDR (European Commission, 2025).

The changes include:

- Large companies can reuse existing due diligence statements when goods previously on the EU market are reimported. This means that less information needs to be submitted in the IT system.
- Companies will be allowed to submit due diligence statements annually instead of for every shipment or batch placed on the EU market.
- Downstream companies have simplified obligations. A minimal legal obligation of collecting reference numbers of Due Diligence Statement (DDS) from their suppliers and using those references for their own DDS submissions now applies.

In principle, the changes will ease the administrative burden of EUDR compliance for large companies. The European Commission estimates the new measures will reduce administrative costs by 30 per cent.

However, the above changes do not address the issue of smallholder participation in export supply chains. This has essentially been left up to origin countries to organise. Countries like Indonesia and Malaysia have embarked on large-scale digitalisation efforts to provide traceability from farm to destination, including smallholder farmers.

These digital platforms are also intended to allow international buyers and trader-processors to file their EUDR due diligence submissions while still respecting Indonesian and Malaysian laws on data protection, letting companies go through the national dashboards. However, it remains to be seen whether the Indonesian and Malaysian systems will be embraced by buyers and EU officials. Ideally these platforms will be fully operational and deemed as completely meeting the EUDR's requirements.

References

- Alhamd, L., Sundari, S., Brearley, F. Q., & Rahajoe, J. S. (2024, August 26). Effects of fire on tree species composition and carbon stocks of a peat swamp forest in central Kalimantan, Indonesia. Taylor & Francis. https://www.tandfonline.com/doi/full/10.1080/13416979.2024.2389990

- ASMC. (2025, June 4). Regional Climate - Seasonal Outlook. https://asmc.asean.org/asmc-seasonal-outlook/

- Australian Bureau of Meteorology. (2025, June 12). Southern Hemisphere Monitoring Pacific, Indian and Southern Ocean regions. Australian Government Bureau of Meteorology. http://www.bom.gov.au/climate/enso/?ninoIndex=nino3.4&index=nino34&period=weekly

- BMKG. (n.d.). Prediksi Musim Kemarau Tahun 2025 di Indonesia - Prediksi Musim. https://www.bmkg.go.id/iklim/prediksi-musim/prediksi-musim-kemarau-tahun-2025-di-indonesia

- Bulolo, C. (2024, November 4). Will Indonesia's biodiesel push put its climate goals at risk? Eco-Business. https://www.eco-business.com/news/will-indonesias-biodiesel-push-put-its-climate-goals-at-risk/

- Cahyaningtyas, A. U., Setiawan, Y., Putra, E. I., & Tonoto, P. (2024). Effects of peatland fires on above-ground carbon stocks in Kepulauan Meranti Regency, Riau Province. Journal of Tropical Forest Management. https://journal.ipb.ac.id/index.php/jmht/article/view/50189

- Chervier, C., Atmadja, S. S., Nofyanza, S., Annisa, C. N., Nurfatriani, F., Kristiningrum, R., Sahide, M. A. K., Suhardiman, A., & Umar, S. (2024, October 16). Impact of Indonesia's forest management units on the reduction of forest loss and forest fires in Sulawesi. Science Direct. http://sciencedirect.com/science/article/abs/pii/S092180092400315X

- Climate Prediction Center / NCEP. (2025). Enso: Recent evolution, current status and predictions. https://www.cpc.ncep.noaa.gov/products/analysis_monitoring/lanina/enso_evolution-status-fcsts-web.pdf

- Climate.gov. (2016, January 18). El Niño and La Niña: Frequently asked questions. NOAA Climate.gov. https://www.climate.gov/news-features/understanding-climate/el-ni%C3%B1o-and-la-ni%C3%B1a-frequently-asked-questions

- Ekawati, S., Siburian, R., Yanarita, Surati, Nurlia, A., & Sundary, L. V. (2024). Peatland Forest Fire Mitigation Policies: Impact on Traditional Farmer's Food Security and Environmental Improvement. IOP Science. https://iopscience.iop.org/article/10.1088/1755-1315/1323/1/012014/meta

- Elfis, W, T. P., Chahyana, Permatasari, & Norlis. (2024). Towards paludicultural agroforestry: Land use practice based on Malay local wisdom to support peatland rehabilitation in Riau Province, Indonesia. Mires and Peat . http://mires-and-peat.net/pages/volumes/map31/map3108.php

- European Commission. (2025, April 15). Commission takes action to simplify the implementation of the EU deforestation regulation. European Commission - European Commission. https://ec.europa.eu/commission/presscorner/detail/en/ip_25_1063

- The Gecko Project. (2024). Insider testimony points to "sustainable" conglomerate as hidden hand behind destruction of Rainforest. https://thegeckoproject.org/articles/insider-testimony-points-to-sustainable-conglomerate-as-hidden-hand-behind-destruction-of-rainforest/

- Global Forest Watch. (2025). Brazil deforestation rates & statistics: GFW. Forest Monitoring, Land Use & Deforestation Trends. https://www.globalforestwatch.org/dashboards/country/BRA/?category=forest-change

- Goldman, E., Carter, S., & Sims, M. (2025, May 21). Fires drove record-breaking tropical forest loss in 2024. World Resources Institute Research. https://gfr.wri.org/latest-analysis-deforestation-trends?apcid=0065c4e47236be6ce5b05801

- Graham, A. M., Spracklen, D. V., McQuaid, J. B., Smith, T. E. L., Nurrahmawati, H., Ayona, D., Mulawarman, H., Adam, C., Papargyropoulou, E., Rigby, R., Padfield, R., & Choiruzzad, S. (2024, November 3). Updated smoke exposure estimate for Indonesian peatland fires using a network of low-cost PM2.5 sensors and a regional air quality model - graham - 2024 - geohealth - wiley online library. Advancing Earth and Space Sciences. https://agupubs.onlinelibrary.wiley.com/doi/full/10.1029/2024GH001125

- Grosvenor, M. J., Ardiyani, V., Wooster, M. J., Gillott, S., Green, D. C., Lestari, P., & Suri, W. (2024, November 2). Catastrophic impact of extreme 2019 Indonesian peatland fires on Urban Air Quality and health. Nature News. https://www.nature.com/articles/s43247-024-01813-w

- Hooijer, A., Vernimmen, R., Mulyadi, D., Triantomo, V., Hamdani, Lampela, M., Agusti, R., Page, S. E., Doloksaribu, J., Setiawan, I., Suratmanto, B., & Swarup, S. (2024, May 10). Benefits of tropical peatland rewetting for subsidence reduction and forest regrowth: Results from a large-scale restoration trial. Nature News. https://www.nature.com/articles/s41598-024-60462-3

- Hu, Y., Smith, T. E. L., Santoso, M. A., Amin, H. M. F., Christensen, E., Cui, W., Purnomo, D. M. J., Nugroho, Y. S., & Rein, G. (2024, October 22). Gambut field measurement of emissions from a tropical peatland fire experiment: From ignition to spread to suppression. CSIRO PUBLISHING. https://www.publish.csiro.au/wf/WF23079

- Ilham, Q. P., Purnomo, H., Rohadi, D., Puspitaloka, D., Herawati, T., Brady, M. A., Dermawan, A., & Okarda, B. (2024, March 1). Value chain analysis for community livelihoods in peatlands: A case study in Southern Riau. IOP Conference Series: Earth and Environmental Science. https://iopscience.iop.org/article/10.1088/1755-1315/1315/1/012009/meta

- ITC. (2019). Trade Statistics for International Business Development. Trade Map - Trade statistics for international business development. https://www.trademap.org/

- Jalilov, S.-M., Lestari, S., Winarno, B., Yuwati, T. W., Sakuntaladewi, N., & Mendham, D. S. (2024, January 1). Why is tropical peatland conservation so challenging? findings from a livelihood assessment in Sumatra, Indonesia: Published in Mires and Peat. Mires and Peat. https://mires-and-peat.scholasticahq.com/article/128758-why-is-tropical-peatland-conservation-so-challenging-findings-from-a-livelihood-assessment-in-sumatra-indonesia

- Jong, H. N. (2025, February 7). Surge in legal land clearing pushes up Indonesia deforestation rate in 2024. Mongabay . https://news.mongabay.com/2025/02/surge-in-legal-land-clearing-pushes-up-indonesia-deforestation-rate-in-2024/

- Madrigano, J., Yan, D., Liu, T., Bonilla, E., Yulianti, N., Mickley, L. J., & Marlier, M. E. (2024, July 2). Air Pollution and Blood Pressure: Evidence From Indonesia. Advancing Earth and Space Sciences. https://agupubs.onlinelibrary.wiley.com/doi/full/10.1029/2024GH001014#:~:text=In%20this%20study%20of%20over,lower%20exposure%20to%20air%20pollution

- Mendham, D. S., Sakuntaladewi, N., Ramawati, Yuwati, T. W., Budiningsih, K., Prasetyo, B. D., & Handoyo. (2024). Facilitating new livelihoods to promote peatland restoration in Indonesia - what are the challenges for ensuring sustainable and equitable livelihood transitions? https://www.researchgate.net/publication/377116827_Facilitating_new_livelihoods_to_promote_peatland_restoration_in_Indonesia_-what_are_the_challenges_for_ensuring_sustainable_and_equitable_livelihood_transitions

- Mighty Earth. (2025, February 7). Rapid Response: Palm Oil Report. https://mightyearth.org/wp-content/uploads/2025/02/RR47_v1_7Feb2025.pdf

- Milko, V. (2025, April 7). World's largest deforestation project fells forests for bioethanol fuel, sugar and Rice in Indonesia. AP News. https://apnews.com/article/bioethanol-deforestation-papua-indonesia-climate-fafbc84bba685d05acd75f78db68da63

- Puspitaloka, D., Purnomo, H., Juniyanti, L., Andrianto, A., Kusumadewi, S. D., Okarda, B., Zulkardi, & Dermawan, A. (2024). Adaptive business model development for community-based peatland restoration in Riau. IOP Science. https://iopscience.iop.org/article/10.1088/1755-1315/1315/1/012053/meta

- Safitri, R., Saharjo, B. H., & Basuki, I. (2024). The Impact of canal blocking to reduce fire risks and carbon emissions on tropical peatland, Siak District, Riau Province. IOP Science. https://iopscience.iop.org/article/10.1088/1755-1315/1315/1/012058/meta

- Sasmito, S. D., Taillardat, P., Adinugroho, W. C., Krisnawati, H., Novita, N., Fatoyinbo, L., Friess, D. A., Page, S. E., Lovelock, C. E., Murdiyarso, D., Taylor, D., & Lupascu, M. (2025, January 28). Half of land use carbon emissions in Southeast Asia can be mitigated through peat swamp forest and mangrove conservation and restoration. Nature News. https://www.nature.com/articles/s41467-025-55892-0

- Simontini. (2025, March 10). Indonesia Deforestation Status 2024. https://simontini.id/id/status-deforestasi-indonesia-2024

- Siregar, S., Idiawati, N., Berekute, A. K., Maulana, M., Pan, W.-C., & Yu, K.-P. (2024, November 6). Association between long-term PM2.5 exposure and mortality on Sumatra Island: Indonesian family life survey (IFLS) 2000–2014 - Environmental Monitoring and Assessment. SpringerLink. https://link.springer.com/article/10.1007/s10661-024-13323-5

- TheTreeMap. (2025a, February 16). Industrial palm oil deforestation in Indonesia slows slightly in 2024. Nusantara Atlas. https://nusantara-atlas.org/industrial-palm-oil-deforestation-in-indonesia-slows-slightly-in-2024/

- TheTreeMap. (2025b, April 11). Industrial Wood pulp deforestation in Indonesia slows in 2024. Nusantara Atlas. https://nusantara-atlas.org/industrial-wood-pulp-deforestation-in-indonesia-slows-in-2024/

- UMS. (2025, May 23). 2025 dry season predicted to be shorter, here's why. UMS RSS. https://www.ums.ac.id/en/news/global-pulse/2025-dry-season-predicted-to-be-shorter-here-s-why

- United States Environmental Protection Agency (EPA). (2025, March 27). Health and Environmental Effects of Particulate Matter (PM). https://www.epa.gov/pm-pollution/health-and-environmental-effects-particulate-matter-pm

- Wahyono, S. C., Kurnain, A., Nata, I. F., & Asyari, M. (2024, February 25). Investigation of Post-Fire Peatland Natural Recovery, South Kalimantan, Indonesia. Ecological Engineering & Environmental Technology. http://www.ecoeet.com/pdf-183577-105103?filename=Investigation+of.pdf

- Widyastuti, M. T., Haikal, M., Minasny, B., & Taufik, M. (2025, January 21). Frequent Fires Degrade the Hydrophysical Properties of Lowland Tropical Peatlands. SSRN. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=5104827

- Yunus, M., Pagdee, A., & Baral, H. (2024, June 16). Economics of Peatland Ecosystem Services: A study of use and non-use values and people interplays in Sumatra, Indonesia. MDPI. https://www.mdpi.com/2073-445X/13/6/866

About the Singapore Institute of International Affairs (SIIA)

Insights • Networks • Access

Established in 1962, the Singapore Institute of International Affairs (SIIA) is a not-for-profit, independent think-tank committed to policy-relevant research, analysis, and discussions on regional and international politics, economic policy, and sustainability. Our work serves as a bridge between policymakers, business leaders, and other stakeholders to nudge policy change through dialogue and collective action.

We provide insights and perspectives for businesses in navigating a complex world and help Singaporeans with sense-making and responding to issues they care about. We aim to contribute to a region that is inclusive, peaceful, and prosperous – An integrated, sustainable, and globally competitive ASEAN and a Singapore that is an open, dynamic hub and responsive node.

We have been consistently ranked as one of the leading think tanks in Southeast Asia and the Pacific, in the Global Go-To Think Tank Index by the University of Pennsylvania. Since 2017, the SIIA was ranked the No. 1 independent think tank in Asia. We were recognised as one of the top 50 think tanks globally, excluding the United States of America. In 2019, we were recognised as the No. 1 think tank in South Asia, Southeast Asia, and the Pacific (excluding India). In 2020, we were also recognised as one of the think tanks with the best policy and institutional response to the COVID-19 pandemic.

About the SIIA's Sustainability Programme

Our Sustainability Programme began in 1997 when we organized Singapore's first haze dialogue with the Singapore Environment Council on the critical haze problem. The programme has evolved to address a broader range of sustainability issues like agribusiness and forestry supply chains as well as the leveraging of green finance to advance ASEAN's climate action and carbon neutrality goals. Since 2014, the Singapore Dialogue on Sustainable World Resources (SWR), our annual flagship conference, provides a platform for discussion in the region about key sustainability challenges.

SINGAPORE INSTITUTE OF INTERNATIONAL AFFAIRS

For further information, contact the SIIA at:
60A Orchard Road, #04-03 Tower 1
The Atrium@Orchard, International Involvement Hub
Singapore 238890

t | +65 6734 9600
f | +65 6733 6217
e | membership@siiaonline.org
w | www.siiaonline.org

Singapore Institute of International Affairs
@think.siia
@siia_tweet
@siia_sg

Ranked No. 1 Independent Think Tank in Asia
ASEAN-ISIS Network of Think Tanks • Asia Society (USA) Strategic Partner • UN ECOSOC Consultative Status