Singapore Institute of International Affairs

SIIA HAZE OUTLOOK

FOR SOUTHERN ASEAN

PHASE ONE   **Special Report**   **June 2019**

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1 About This Report

The Southeast Asian haze shrouds much of Peninsular Malaysia, Singapore, and parts of Indonesia in hazardous air pollution during the mid-year dry season. The SIIA Haze Outlook is a risk-based assessment tool for understanding the probability of the incidence and severity of transboundary haze in the region. The SIIA Haze Outlook builds on work by the Singapore Institute of International Affairs (SIIA) to understand the haze and actively engage stakeholders from the public, private, and people sectors.

Launched at our 6th Singapore Dialogue on Sustainable World Resources (SDSWR) on 2 May 2019, Phase One of the SIIA Haze Outlook for Southern ASEAN presents an initial risk assessment framework based on meteorological data, and taking into account efforts by government, NGO, and private sector actors to mitigate the drivers of haze. Going forward, we hope to gather more input from stakeholders to present a more complete risk assessment.

HAZE OUTLOOK:
Risk of a Transboundary Haze Event in 2019
AMBER

The risk of a transboundary haze event is Amber for 2019 (on a scale of Green for a low risk of haze, Amber for a moderate risk of haze, and Red for a high risk of haze). The risk assessment is based on three clusters of risk factors, namely **Weather, Peat,** and **People.**

- **Weather:** The severity and extent of the fires and the resultant transboundary haze pollution that occurred in 1997 and 2015 were exacerbated by intense El Niño events that brought prolonged dry conditions. Based on the regional outlook from the ASEAN Specialised Meteorological Centre (ASMC) updated in May 2019, there are signs of El Niño conditions present. Model outlooks for the second half of 2019 show a wide spread of possibilities ranging from neutral conditions to moderate El Niño. Data suggests that the El Niño event, if it does develop, will not be as strong as in 1997 and 2015. Nonetheless, there is still a risk of dry conditions exacerbating fires.

- **Peat:** Degraded peatlands and logged-over peatland forest were primary locations of fires in 1997 and 2015. Since 2011, Indonesia has issued a moratorium on new permits for cultivation on peatland, and in 2016 established a national peatland restoration agency, Badan Restorasi Gambut (BRG). As of 2018, over 679,900 ha of peatlands have been restored, 60% of BRG's 1.1 million ha goal on public land, with another 1.4 million ha to be restored by companies within concessions. In the past three years, the number of hotspots within priority restoration areas compared to 2015 has fallen sharply. However, prolonged drought periods may still cause rewetted peatland to dry out and become vulnerable to fire.

- **People:** Since 2015, government agencies and agroforestry companies in Indonesia have intensified engagement with village communities and strengthened their fire prevention, detection, and suppression capabilities. For example, since 2016 BRG has engaged some 262 villages under its Peat Care Village Program (Desa Peduli Gambut), convincing communities of the importance of peat protection and restoration. The Fire Free Alliance (FFA) was formed in 2016 and now involves six major companies and three NGOs. From 2016 to 2017, FFA members increased the number of villages engaged by their fire-free programmes from 416 to 468. However, while these efforts do mitigate the risk of haze, there is still a danger of fires breaking out and spreading beyond control due to the geography of Sumatra and Kalimantan and the difficulty in reaching some areas.

🟢 GREEN: Low-Risk   🟠 AMBER: Moderate-Risk   🔴 RED: High-Risk

The SIIA Haze Outlook provides a risk assessment for the likelihood of transboundary haze affecting Southern ASEAN countries in the latter months of 2019. The Northern ASEAN countries such as Cambodia, Lao PDR, Myanmar, Thailand, and Vietnam experienced transboundary haze pollution earlier this year. However, the dry season over the Mekong sub-region typically occurs during the Northeast Monsoon season between December and April, under different circumstances.

To achieve its objectives, the SIIA Haze Outlook for Southern ASEAN draws on a synthesis of different sources, including a review of literature, a summary of haze-related policies, and an overview of interventions and initiatives to manage the haze. Key indicators for the risk of haze were identified, and a case study was also conducted, focusing on Riau. Phase One of the SIIA Haze Outlook for Southern ASEAN concludes with a discussion of the key findings, gaps, and next steps.

The SIIA has been working on the haze issue since the transboundary haze incident in 1997. The SIIA has helped efforts to proactively manage fires and haze by partnering with NGOs to support the construction of canal blocks in Indonesia, helping fund the distribution of N95 masks, and holding dialogues with key decision makers.

If you wish to share information and analysis for future editions of the SIIA Haze Outlook, please contact us.

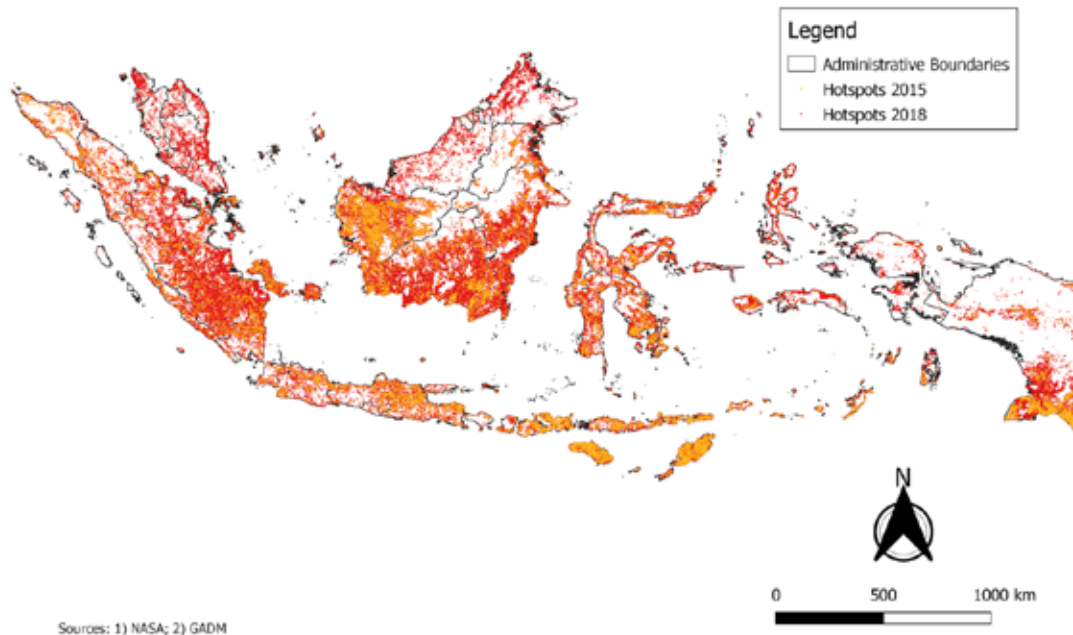SIIA Haze Outlook: Hotspots in Maritime Southeast Asia, 2015 and 2018

Legend
- Administrative Boundaries
- Hotspots 2015
- Hotspots 2018

Sources: 1) NASA; 2) GADM

Following the 2015 haze event, researchers have sought to understand the similarities and differences in the causes and drivers of the fires and haze in 2015, especially when compared to 1997, 1998, and other years. Since 2015, approximately 100 studies have been conducted to understand the sources, drivers, and impact of previous haze crises, as well as prevention mechanisms that can stop fires and haze from recurring. For Phase One of the SIIA Haze Outlook for Southern ASEAN, we reviewed 80 studies, and further identified some 30 studies as key sources.

Impact of the Haze

The Indonesian government estimates that 2.6 million hectares of land were affected by burning during the dry season in June to October 2015, and the World Bank estimates that the 2015 haze event cost Indonesia some USD 16 billion, larger than the USD 12 billion of value added from Indonesia's 2014 palm oil production (World Bank, 2016). During the 2015 haze event, PM10 particle count and carbon monoxide levels were over two times higher than normal, with the PM2.5 count also rising due to the accumulation of surface ash as peat fires progressed (Samsuddin et al., 2018, Roulston et al., 2018).

Fire-related carbon emissions and air pollution in 2015 reached the highest levels since the first major transboundary haze event in 1997. The 2015 fires were the largest and most severe since 1997. The September-October 2015 fires in Indonesia released large amounts of carbon into the atmosphere in the form of CO_2, CO and CH_4 at a mean emission rate of 11.3 Tg of CO_2 per day (Huijnen et al., 2016). This is corroborated by research using satellite data that estimates total emissions for 2015 to be 380 Tg carbon or 1.5 billion metric tons of CO_2 equivalent when with methane and nitrous oxide emissions (Field et al., 2016). Wooster et al. (2018) also looked at methane and particulate matter emissions.

The fires in 1997, 1998, and 2015 were predominantly on degraded peatland, and peat fires have been found to result in higher emissions of carbon monoxide, methane, and volatile organic compounds due to incomplete combustion of the carbon peat stock (Kusumaningtyas and Aldrian 2016, Lee et al., 2017, Turetsky et al., 2015). Significantly, several studies have drawn a causal link between the haze and health impacts among affected communities, such as a rise in respiratory illnesses, particularly from the lengthy haze crisis in 2015 (Koplitz et al., 2016, Mead et al., 2018, Sharma and Balasubramaniam 2017, Ming et al., 2018, Tan et al., 2019, Hassan et al., 2017).

The recurring transboundary haze therefore continues to raise questions about sustainability in Southeast Asia's plantation sector, particularly regarding the management of forests and peatland on a large scale in Indonesia.

Risk Factors: Weather, Peat, and People

It is important to note that not all instances of fire in Southeast Asia will result in transboundary haze. The occurrence of transboundary haze is dependent upon several factors. Physical variables include weather conditions (ENSO conditions, precipitation, winds, intensity of monsoons, etc.), biophysical conditions (carbon stock, availability of above ground woody biomass), and prior incidence of fire. Additionally, the condition of peatlands is crucial, given the current generally accepted understanding that previous forest and land fires occurred mostly on degraded peat rather than mineral soil. Finally, most researchers agree that many fires are man-made, although there are variations in human behaviour and the pattern of burning differs between geographical areas. Some fires may be naturally occurring rather than due to human involvement.

Weather

There is a clear link between the occurrence of land and forest fires (and the resultant transboundary haze pollution) and El Niño conditions. The severity of the fires and extent of transboundary haze pollution in 1997 and 2015 were exacerbated by strong El Niño events that brought prolonged dry conditions, especially in Borneo and Sumatra (Chen et al., 2016, Mead et al., 2018, Lee et al., 2017, Samsuddin et al., 2018, Miettinen et al., 2017, Wiggins et al., 2018, Taufik et al., 2017). The El Niño events in 1997 and 2015 were the most intense on record, based on sea surface temperature (SST) anomalies (Putra et al., 2018, Fanin and van der Warf 2016). According to Fanin and van der Warf (2016), the effect was more severe in 1997 than 2015.

The prevailing wind conditions also played a part in transboundary transport of smoke haze. Hotspots are generally concentrated in the fire-prone provinces of Jambi, Riau, South Sumatra, Central Kalimantan, and West Kalimantan. With the prevailing winds blowing from the southwest or southeast during the dry season, smoke haze from the hotspots was transported from these areas to neighbouring countries. In 2015, smoke haze from the hotspots in Sumatra and Kalimantan was observed to spread as far north as southern parts of Vietnam and the Philippines.
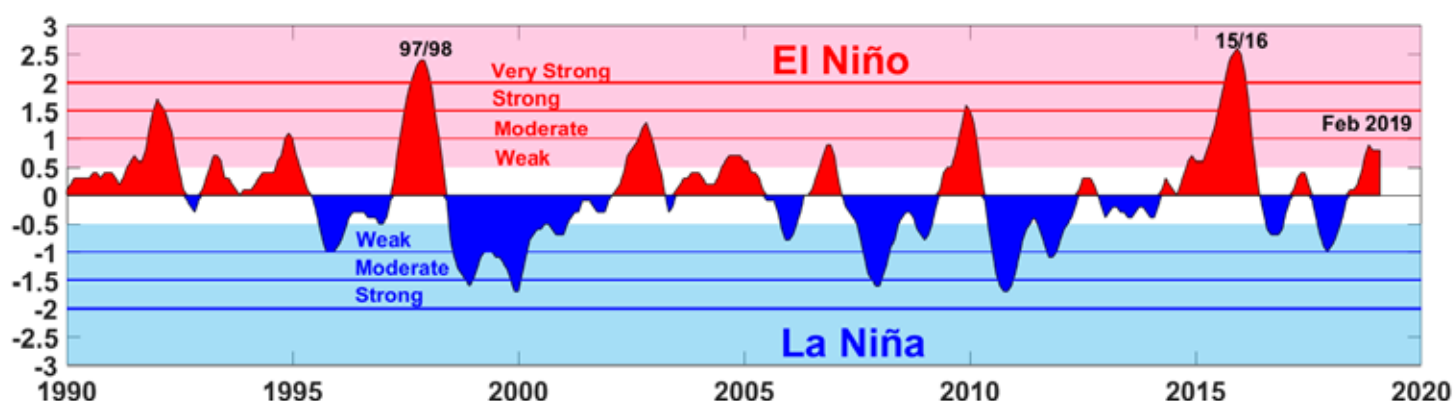
Source: US National Oceanic and Atmospheric Administration (NOAA), April 2019

Oceanic Niño Index (ONI) - Weak El Niño or Strong El Niño?

This graph shows Sea Surface Temperature (SST) anomalies in degrees Celsius (°C) in the east-central tropical Pacific, commonly used as an indicator of El Niño conditions. Current SST anomalies for 2019 are above average, but not as high as 1997-1998 and 2015-2016, the years with strong El Niño events.

Peat

Degraded peatlands are thought to have been the primary locations of fires in 1997 and 2015, and a chief source of the particulate matter that makes up the haze (Turetsky et al., 2015, Miettinen et al., 2017, Wiggins et al., 2018, Koplitz et al., 2016, Prayoto et al., 2017, Kettridge et al., 2015). Degraded peatlands pose significant fire risk due to the loss of the wet conditions that provide natural resistance to fire. Some researchers argue that logged-over peatland, where commercially valuable timber has been removed, is the most susceptible to fire.

Between 2000 and 2014, Sumatra and Kalimantan cumulatively lost some 2.6 million ha of disturbed and undisturbed natural peat forest (Miettinen et al., 2017, Wiggins et al., 2018, Koplitz et al., 2016, Prayoto et al., 2017). Peat forests are also at risk of repeated burn events as the standing and dead timber provides additional fuel, and the water table also recedes due to low precipitation and drainage (Page and Hooijer 2016, Putra et al., 2018). Therefore, studies agree that it is critical to manage peatlands appropriately in order to reduce future outbreaks of fires and haze.

In 2016, the Indonesian government established the Peatland Restoration Agency (BRG) to facilitate and coordinate the restoration of degraded peatlands between 2016 and 2020. According to one paper, which forecasted fires from Sumatra and Kalimantan from 2010-2030, protecting peatlands from fires could potentially reduce smoke concentrations in Singapore and Palembang by 70% and 40%, with an overall 60% reduction across Equatorial Asia (Marlier et al., 2015).

Experts argue that it is crucial for Indonesia to prevent future peatland clearance and drainage, maintain the required water table to reduce the risk of fires on peatland, and introduce rewetting or rehabilitation programmes for degraded or 'idle' peatland (Page and Hooijer, 2016, Miettinen et al., 2017, Astuti, 2017). According to Astuti (2017), peatlands face a higher risk of fire once the water table drops to 40 cm below the soil surface. Putra et al. (2018) recommends that the groundwater level for peatlands be kept at least 10 cm below the surface to guard against the outbreak of fire.

However, the Sarawak Tropical Peat Research Institute argues that sustainable agricultural development on peatland is indeed possible, with techniques such as mechanical compaction of peat serving to reduce susceptibility to fire (Melling and Tang, 2019). According to Melling and Tang (2019), it is not degraded peatland per-se that poses the greatest risk of fire, but unmanaged peatland. In this view, human intervention is able to offset any fire risk.

But there remains significant debate whether peat loss can be halted through methods such as peat compaction. Some scientists believe that a fully sustainable peatland agricultural production method does not currently exist, and agriculture on peatland may become increasingly untenable in the future (Hooijer et al., 2015, Sumarga, 2016, Wijedasa et al., 2017).

Currently, the three major approaches to peatland management can be summarised as follows (SIIA, 2017):

- "Full cultivation" aims to convert the maximum amount of peatland available to agricultural use, e.g. Sarawak, Malaysia
- "Full protection" aims to rehabilitate degraded peatland and prevent all drainage-based agriculture, e.g. Katingan Project, Central Kalimantan, Indonesia and Berbak, Green Prosperity Project, Jambi, Indonesia
- "The middle approach" sets aside some areas within a single peat system for protection and uses the remaining area for agriculture, e.g. Kampar Peninsula, Riau, Indonesia

Unfortunately, at present there is too much attention on the divide between cultivating and rehabilitating peatland. As a result, stakeholders who favour different approaches have overlooked opportunities to work together on areas of common interest, such as methods of engagement with local communities. Peatland management should be understood as merely the first step in a long-term transition to more sustainable land management practices (SIIA, 2017).

People

Despite the establishment of a zero-burning policy across Indonesia, it is believed that farmers and local communities living in peat landscapes continue to light fires for the purpose of preparing land for agriculture. The national, provincial, and regency-level authorities in Indonesia argue that stronger enforcement measures put in place since 2015 have led to companies being unwilling to burn, meaning that the current challenge is reaching out to smallholders and communities in remote areas. However, researchers still believe that large-scale industrial burning and the clearing of peatland is being carried out by some companies, at least as of 2015 (Marlier et al., 2015, Koplitz et al., 2016, Islam et al., 2016, Karthik et al., 2017). Continued scrutiny on the agroforestry sector is still required.

Fires in Jambi and South Sumatra appear to be linked closely to the dry season and the presence of El Niño conditions. However, fires in Riau and West Kalimantan occur all year round, though there is some intensification during the dry season, potentially due to clearing and planting cycles coinciding with the dry season. During the most recent dry season in 2018 hotspots were detected on peatlands and near concessions in Riau.

However, in 2018, hotspots were distributed across West Kalimantan, with many being far from plantation boundaries and not on peatland, possibly attributable to indigenous or small local communities practicing shifting cultivation. Human behaviour therefore varies between areas of Indonesia. While ASEAN's officials and experts continue to seek answers regarding the human drivers of the haze, human behaviour is complex, and there is no one-size-fits-all explanation that can be applied across all communities and areas.

Next Steps

Although much work has been done in recent years on the recurring transboundary haze, there are still information gaps and areas where there is a lack of consensus among experts. Further research is needed to understand the drivers of fires and haze in the region. The SIIA is continuing to track ongoing research in this area, and we welcome any information from academic institutes, NGOs, government agencies, private sector firms, and other stakeholders that can improve our understanding and contribute to future instalments of the SIIA Haze Outlook.

3 Managing the Haze: Timeline of Haze Policy (2015-2019)

Year	Events
2015	• Haze from fires in Sumatra and Kalimantan affects region • Indonesia extends moratorium on concessions on primary forest and peatland • APRIL Group launches Fire-Free Village Programme (FFVP) in Indonesia • Indonesian government threatens to revoke permits of companies involved in burning • Association of Banks in Singapore (ABS) releases guidelines on responsible financing • Major plantation companies in Indonesia expand firefighting efforts up to five kilometres beyond concession boundaries • Singapore's National Environment Agency (NEA) serves legal notices to companies under the Transboundary Haze Pollution Act (THPA) 2014
2016	• Indonesia establishes peatland restoration agency, Badan Restorasi Gambut (BRG) • APRIL Group, Asian Agri, IDH, Musim Mas, PM.Haze, Rumah Pohon, and Wilmar form Fire Free Alliance (FFA), with Carbon Conservation as secretariat • ASEAN adopts the Roadmap on ASEAN Cooperation towards Transboundary Haze Pollution Control with Means of Implementation (2016-2020), building on the ASEAN Agreement on Transboundary Haze Pollution (AATHP) • Singapore's NEA decides to take court action against an Indonesian company director in line with the THPA 2014 • Indonesia issues a blanket ban on cultivation on peatland
2017	• Indonesian President Joko Widodo begins leading the annual National Coordination Meeting on Forest and Land Fire Control in January, involving ministers and senior officials. • Indonesia further extends moratorium on concessions on primary forest and peatland • Indonesia's Ministry of Environment and Forestry establishes four regulations on the management of peatlands and industrial plantation forest • SIIA and the UN Environment Inquiry into the Design of a Sustainable Financial System launch the Collaborative Initiative for Green Finance in Singapore, supported by the Monetary Authority of Singapore (MAS) • The Singapore Environment Council introduces the enhanced Singapore Green Labelling Scheme (SGLS+) • Sime Darby and IOI Group join FFA
2018	• Indonesia issues three-year moratorium on new licenses for palm oil plantations and orders review of palm oil licensing • The European Parliament adopts a law to phase out palm oil from biofuels by 2030 • 2018 Asian Games held in Palembang and Jakarta; authorities in Sumatra pledge to keep fires and haze under control
2019	• The European Commission publishes delegated act, officially approving the measure to phase out palm oil from biofuels by 2030 • UN General Assembly declares the UN Decade on Ecosystem Restoration 2021-2030, specially highlighting the need to restore degraded peatlands • International Tropical Peatland Center (ITPC) established, based in Indonesia • Indonesia aims to conduct a review of nationwide peatland restoration efforts

Monitoring the Haze: The SIIA Haze Outlook Framework

Phase One of the SIIA Haze Outlook for Southern ASEAN integrates both quantitative and qualitative information into a risk assessment framework. In the process of creating the framework, we gathered data to provide the biophysical, socioeconomic, and meteorological context behind the region's transboundary haze, utilising published data sources. The framework also qualitatively examines ongoing efforts in peatland restoration and fire prevention, including interviews and correspondence with government agencies, companies, NGOs, and academics. The overall aim is to understand both the underlying risk factors behind the haze, but also what governments, companies, and other stakeholders are doing in response to the risk factors, and how effective their intervention efforts have proven to date.

Identifying Data Sources

The SIIA Haze Outlook for Southern ASEAN cites data from the ASEAN Specialised Meteorological Centre (ASMC), the Indonesian Meteorological, Climatological, and Geophysical Agency (BMKG), the Malaysian Meteorological Department (MetMalaysia), the United States National Oceanic and Atmospheric Administration (NOAA), and other sources. However, the primary source used in the SIIA Haze Outlook's analysis is the ASMC's assessments and forecasts.

We also examined a wide range of datasets, including Southeast Asian peatland data provided by the National University of Singapore's Center for Remote Imaging, Sensing and Processing (CRISP), tree plantation data from the World Resources Institute (WRI) and Transparent World, human settlement data from the European Commission's Joint Research Centre (JRC), and hotspot data from the United States National Aeronautics and Space Administration (NASA).

About the ASEAN Specialised Meteorological Centre (ASMC)

- Established in 1993 as a regional collaboration between the ASEAN Member States, and hosted in Singapore. ASMC works closely with ASEAN's national meteorological services and environment agencies.

- Since 1995, ASMC has been monitoring regional land and forest fires and transboundary smoke haze.

- ASMC publishes information on the latest weather and haze situation to aid ASEAN stakeholders in their fire prevention and suppression efforts.

- ASMC bases its assessment on various sources, including observations from ground stations, data from satellite remote sensing, and advanced numerical modelling tools.

- When there is an increase in the risk of transboundary haze, ASMC issues early warnings to the ASEAN Member States that may be affected, in order to help national authorities take timely mitigation measures on the ground.

Source: ASMC

Indonesia's One Map initiative illustrates the difficulties involved in gathering accurate data within a country the size of Indonesia, which spans over 17,000 islands. Indonesia has the seventh-largest combined land and sea area in the world. In 2011, Indonesia began work towards a single unified database, bringing together the disparate maps and datasets used by different Indonesian government agencies. In December 2018, Indonesian President Joko Widodo officially launched the One Map Policy Geoportal (KSP Geoportal), an online platform accessible by government agencies and the public.

While the One Map provides a useful tool to help authorities to better identify illegal plantations or areas with overlapping land claims, there are still gaps in the available data. For example, the One Map does not currently include maps of territory claimed by indigenous groups; the central government says these will only be included when all such maps are formally recognised by local governments. However, the One Map does incorporate maps of customary forests recognised by the Ministry of Environment and Forestry under the social forestry programme.

Tracking Intervention Efforts

For the SIIA Haze Outlook for Southern ASEAN, we sought input from government agency representatives located in Singapore and Indonesia. As Indonesia's government is at the forefront of tackling fires and haze across Indonesia's provinces in Sumatra and Kalimantan, we specifically engaged with BRG, the peatland restoration agency established by President Joko Widodo with a nation-wide mandate.

Recognising that companies in the agroforestry sector must be involved in addressing the causes of fire and ensuring sustainable practices, we reviewed private sector initiatives since 2015, with feedback from NGOs that monitor and work alongside companies, as well as a select number of firms.

Since the 2015 haze event, ASEAN governments, the private sector, NGOs, and local communities have intensified efforts to manage the risk factors behind the transboundary haze, with policies focusing on peatland management and governance of the agroforestry sector. Notably, the ASEAN Agreement on Transboundary Haze Pollution (AATHP) was ratified by Indonesia in 2014, meaning that all ASEAN countries have finally ratified the agreement. The grouping has developed a set of ASEAN Guidelines on Peatland Fire Management, and in 2016 the ten countries also agreed on a Roadmap on ASEAN Cooperation Towards Transboundary Haze Pollution Control with Means of Implementation, setting the target of achieving a Haze-Free ASEAN by 2020.

Despite this progress, challenges remain in addressing the problem of fires and haze, primarily due to Indonesia's geographical size, the complexity of federal-provincial-regency relations, and limited capacity of institutions. However, government, NGO, and corporate initiatives are attempting to address these issues.

Peatland Restoration and Landscape Management

In 2011, the Indonesian government introduced a moratorium on issuing new permits for cultivation on peatland, under Presidential Instruction Number 10 of 2011. Indonesia has also continued to extend the long-standing moratorium on the awarding of new concessions on primary forest and peatland, most recently in 2015 and 2017. In 2016, Indonesia issued Government Regulation Number 57 of 2016 to regulate peatland ecosystem protection and management. In 2018, Indonesia also issued a new three-year moratorium on new oil palm licenses, ordering a review of the licensing system.

In conjunction with the strengthening of policies, President Joko Widodo also established the national peatland restoration agency, Badan Restorasi Gambut (BRG), to facilitate and coordinate the restoration of around 2 million hectares of degraded peatland across Indonesia, within a work period of five years (2016 to 2020). Interventions to restore priority peat landscapes, especially those affected by fires in 2015, have been initiated in Riau, Jambi, South Sumatra, Central Kalimantan, West Kalimantan, and South Kalimantan.

To fulfil its mandate, BRG uses three main approaches: rewetting, revegetation, and revitalising the livelihoods of communities. The human element is crucial, and BRG's approach underscores the interconnectedness of the contributing factors behind fires and haze, drawing a link between peatland and people. Under the Peat Villages Programme (Desa Peduli Gambut), BRG has been working with 262 villages, convincing communities of the importance of peat protection and restoration. As of 2018, BRG has also built a network of some 11,275 peat restoration "local champions", including primary school teachers, paralegals, community workers, religious leaders, field school trainers, and others.

Since 2018, provincial governments have also been involved in designing and executing peatland restoration actions, via an Assisted Task (Tugas Pembantuan) state financing mechanism. Beyond the rewetting of peatland, BRG is also engaging with financial institutions, businesses, and experts. BRG hopes to create good business models for community farmers, encourage impact investment from financiers, and develop mixed crops for cultivation that will not damage the environment.

BRG has additionally designed peatland restoration monitoring and information systems, including an online platform that tracks the status of Indonesia's peatland, as well as providing updates on the progress of restoration activities. The platform also sends alerts regarding the opening of intact peatlands, such as from land clearing or canal development.

In the three years since BRG's establishment, hotspots within BRG's peat restoration priority areas have decreased significantly in both concession and non-concession land, compared to the number of hotspots detected during the haze crisis in 2015.

	No. of Hotspots	Percentage of Hotspot Reduction within 2.5 million ha of Peat Restoration Priority Area (vs. 2015)		
	2015	2016	2017	2018
Concession	17,115	98.57%	99.32%	97.98%
Non-Concession	23,736	98.60%	99.37%	91.39%

Source: BRG Peat Restoration Map and Indonesian National Institute of Aeronautics and Space (LAPAN) Hotspot Data

As of 2018, BRG has restored some 679,000 hectares of peatland in Indonesia, or more than 60% of the 1.1 million hectares the agency is targeting in government and community-controlled land. However, the rest of the 1.4 million hectares of peatland that Indonesia has earmarked for restoration is within private sector concessions. Peat restoration within concession boundaries is being carried out by companies, in accordance with government regulations. The government of Indonesia has scheduled an evaluation of nation-wide peatland restoration efforts, but this review is only expected later in 2019.

It is important to note that there are limitations to peatland restoration efforts and challenges to implementation. According to BRG, peatland restoration is effective at reducing the risk of fire within a two-kilometre radius of rewetting works. But peatland restoration efforts often depend on cooperation from local communities to build and maintain rewetting infrastructure. This in turn means that areas closer to villages are more likely to be covered versus outlying areas. Additionally, even if peat is rewetted, it is possible for the land to dry out again and become vulnerable to combustion during a prolonged dry period, such as a drought lasting around four weeks.

Private sector firms have also strengthened commitments to forest conservation, restoration, and protection. For example, in 2014, APRIL Group introduced a Sustainable Forest Management Policy (SFMP), followed by SFMP 2.0 in 2015, with independent third-party auditing from KPMG and oversight from an advisory committee. As part of the SFMP, APRIL Group has launched a project to restore 150,000 hectares of ecologically important forest in Riau, including daily patrols to ensure no fire is used for land clearing, and working with communities in the area to promote no-burn agricultural methods. In Kalimantan, Golden Agri-Resources (GAR) has been involved in long-term rehabilitation of a peat conservation area around 2,600 hectares in West Kalimantan that was damaged by the 2015 fires. Measures include restoring peatland hydrology and water tables, replanting the area, and carrying out participatory mapping and planning with local communities.

Fire Prevention, Detection, and Suppression

The involvement of local communities is critical in addressing the recurring transboundary haze. APRIL Group officially launched its Fire-Free Village Program (FFVP) in July 2015, aiming to promote a fire free landscape through education, capability building and infrastructure awards. In March 2016, the Fire Free Alliance (FFA) was formed, bringing together APRIL Group, Asian Agri, Musim Mas, and Wilmar as plantation companies, and IDH, PM.Haze, and Rumah Pohon as supporting NGOs. Carbon Conservation serves as the secretariat for the FFA. Sime Darby and IOI Group joined the FFA in March 2017. As part of their commitment, the companies in the FFA have either implemented village partnerships comparable to APRIL's FFVP or are sharing best practices from existing engagement schemes. Other forestry and plantation companies have also launched similar programmes, such as the Integrated Forestry and Farming System (IFFS) initiative by Asia Pulp & Paper (APP), and the Cargill Fire Free Village Program by Cargill Tropical Palm.

The specific implementation of programmes varies between companies, but there are common attributes. Programmes are conducted in conjunction with Indonesia's Ministry of Forestry and Environment and typically include a workshops with a full spectrum of fire prevention, detection, and suppression training. Companies work with villages to develop fire risk maps for the area, as well as offering mechanical site preparation as an alternative to burning, or helping villages to develop income-generating activities that do not require burning, such as sustainable agriculture, non-timber forest products, crafts, fish farm, and waste management.

Earlier community engagement schemes paid local communities for assisting with fire suppression, but this practice led to allegations that some villagers started fires deliberately in order to earn money from putting them out. Current programmes instead award infrastructure funding to villages that remain completely fire-free for a year, while villages with some burnt areas may receive a reduced amount or no reward. Fire prevention programmes are typically implemented alongside existing smallholder engagement, and are also aimed at improving productivity, raising and diversifying incomes, and increasing living standards for local communities.

Fire-Free Village Programmes in Indonesia: Selected Forestry and Plantation Companies
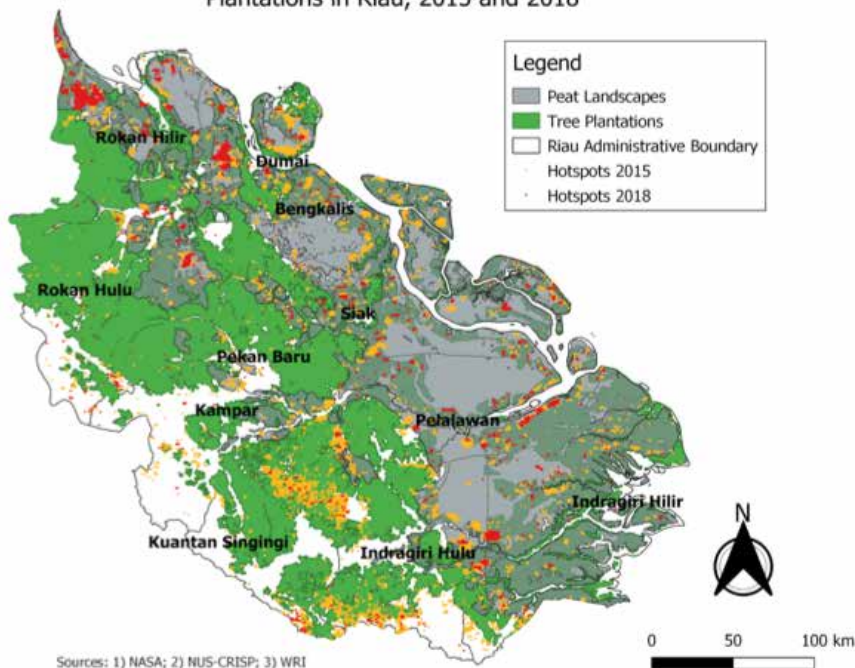
Company	Villages (2017)	Provinces
APRIL	77	Riau
APP	146	Riau, Jambi, South Sumatra, East Kalimantan
Asian Agri	16	Riau, Jambi
Cargill	16	South Sumatra, West Kalimantan
Musim Mas	71	Riau, West Kalimantan, Central Kalimantan
Sime Darby	160	Riau, South Sumatra, South Kalimantan
Wilmar	137	South Sumatra, Central Kalimantan

Source: Fire Free Alliance Members Review 2017 (2018), Asian Agri (2018), Asia Pulp & Paper (2019), Cargill (2016), Golden Agri-Resources (2017), Musim Mas (2017)

Although these initiatives are encouraging, partnerships between companies, government agencies, NGOs and communities are naturally contingent on villages being open to engagement. For example, there are "conflict villages", local communities that have territorial disputes with plantation companies over land tenure or legal boundaries. That said, fire prevention via community engagement is widely seen as a cost effective approach, and it is positive that efforts are underway to increase the uptake of fire-free programmes.

5 CASE STUDY: RIAU

SIIA Haze Outlook Case Study: Hotspots, Peat Landscapes, and Tree Plantations in Riau, 2015 and 2018

Legend
- Peat Landscapes
- Tree Plantations
- Riau Administrative Boundary
- Hotspots 2015
- Hotspots 2018
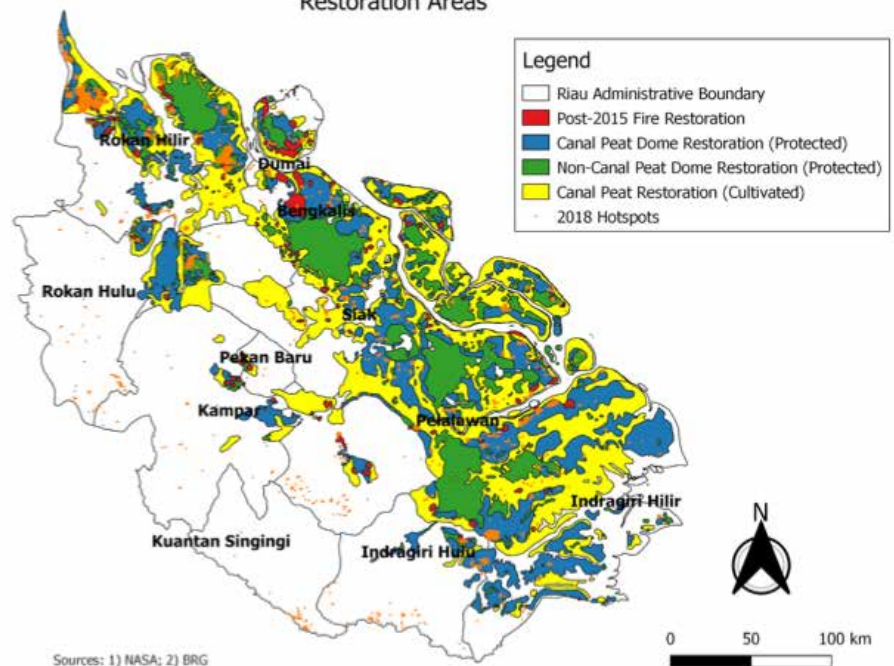
Sources: 1) NASA; 2) NUS-CRISP; 3) WRI

To illustrate the risk factors identified in Phase One of the SIIA Haze Outlook for Southern ASEAN, the following visualisations were created, focusing on the province of Riau in Sumatra.

Of the 5 million hectares of plantations (green) in Riau, there is considerable overlap with peat landscapes (grey). In 2015, the majority of hotspots (orange) occurred in or near plantations on peatland. Hotspots in 2018 (red) generally occurred in areas previously burnt in 2015, suggesting that burnt or degraded areas do remain vulnerable to fire.

Since 2016, Indonesia's national peatland restoration agency (BRG) has initiated interventions to restore priority peat landscapes, especially those affected by fires in 2015, including in areas across Riau, Jambi, South Sumatra, Central Kalimantan, West Kalimantan, and South Kalimantan.

However, in 2018, some hotspots were still detected in parts of Riau included under BRG's priority restoration areas, though with much lower intensity.

SIIA Haze Outlook Case Study: 2018 Hotspots and BRG Priority Restoration Areas

Legend
- Riau Administrative Boundary
- Post-2015 Fire Restoration
- Canal Peat Dome Restoration (Protected)
- Non-Canal Peat Dome Restoration (Protected)
- Canal Peat Restoration (Cultivated)
- 2018 Hotspots

Sources: 1) NASA; 2) BRG

6 SIIA Haze Outlook for 2019: Framework and Findings

☁ WEATHER

EL NIÑO (ENSO) Severe El Niño exacerbates dry season and increases risk of fires	• Based on ASMC's regional outlook, updated in May 2019, there are signs of El Niño or ENSO conditions. But there is some uncertainty as El Niño conditions may range between neutral and moderate in the second half of 2019. • Should El Niño conditions be present, the intensity is unlikely to be comparable to the strong El Niño events in 1997 and 2015.
PRECIPITATION Persistent low rainfall could result in fires	• ASMC forecasts drier than usual conditions over Peninsular Malaysia and neutral to drier conditions for Indonesia in the second half of 2019. • There is no universal agreement on what constitutes a dangerously low level of rainfall. Some experts have suggested a four-week period with <50 mm rainfall is concerning, while others have suggested a two-week drought would be enough to increase the risk of fires. There is therefore some danger in 2019.
WIND Winds determine direction and rate of haze dispersion	• Winds blowing from the south, southwest, or west may bring smoke from Sumatra to Singapore. For severe haze episodes, south-easterly or easterly winds can bring haze from Kalimantan. Wind direction for the second half of 2019 is uncertain but the outlook is expected to be clearer closer to the dry season.

🌲 PEAT

RECENT FIRE OCCURRENCE Prior fire occurrence areas have higher risk of fire season and increases risk of fires	• Riau and West Kalimantan appear to have some degree of hotspots all year round, meaning there is always some degree of fire risk, but fires in Jambi and South Sumatra appear linked closely to the severity of the dry season and El Niño conditions. • Prior fire occurrence may impact availability of fuel stock, though our comparison of hotspots in 2018 and 2015 indicates hotspots do recur on areas that have previously been burnt. These areas therefore have a higher risk of combustion during the dry season.
PEAT RESTORATION Degraded peatlands pose higher fire risk	• Degraded peatlands were primary fire locations in 1997 and 2015. Over 679,000 ha of peatlands have been restored in BRG's priority areas. Companies have launched forest conservation and peat restoration programmes under the direction of Indonesia's government. • BRG data for 2016, 2017 and 2018 shows peatland restoration is effective in countering the occurrence of fires, but it is still possible for rewetted areas to dry out if there is a prolonged period of low rainfall, which may occur in 2019.

👥 PEOPLE

POLICIES AND STRATEGIES Government and company policies are key to fighting fires and haze	• As of 2014, all parties have ratified the ASEAN Agreement on Transboundary Haze Pollution (AATHP). ASEAN has also adopted a Haze-free Roadmap (2016-2020), showing regional commitment to addressing the issue. • Indonesia issued a moratorium on granting new cultivation permits on peatland in 2011, and established BRG in 2016. • Singapore passed its Transboundary Haze Pollution Act (THPA) in 2014, and has served legal notices and pursued court action under the act in 2015 and 2016. Singapore also introduced the enhanced Singapore Green Labelling Scheme (SGLS+) in 2017. • Certification schemes are gaining traction in the agroforestry industry, such as the voluntary Roundtable on Sustainable Palm Oil (RSPO) Trademark, and national-level mandatory schemes such as the Malaysian Sustainable Palm Oil (MSPO) and Indonesian Sustainable Palm Oil (ISPO) standards.
FIRE PREVENTION Community engagement is necessary to reduce the risk of fires breaking out	• BRG's Peat Care Village Program has engaged 262 villages on the importance of peat protection and fire prevention, and aims to expand to 500 villages in BRG's priority restoration areas. • Companies and NGOs have formed a Fire Free Alliance (FFA), which now involves six major firms and 468 villages as of 2017. Other firms have implemented similar initiatives. Fire-free village schemes provide "no burn" rewards and assistance with sustainable agriculture. • However, there are "conflict villages" which are unwilling to cooperate with agroforestry companies, for instance due to disputes over land boundaries. • Fire regimes need to adapt to local circumstances. There are differences in the location of hotspots across Indonesia's provinces, suggesting that different factors are at work.
FIRE DETECTION Early warning systems are needed to detect fires	• Companies have invested in fire risk mapping and regular patrols, supplemented by satellite images, drones, and observation towers to detect and pinpoint fires as early as possible. Detection is key; the ability of firefighters to extinguish blazes is limited if they cannot reach the fires in time.
FIRE SUPPRESSION Rapid fire suppression is necessary when fires occur	• Companies have increased the capacity of fire suppression teams, e.g. investing in training, equipment, manpower, and creating rapid-response teams. One company reports training some 2,600 community firefighters from local villages since 2015, nearly equal to its own 2,700-strong full-time firefighting force.

HAZE OUTLOOK   AMBER

Risk of a transboundary haze event in 2019 is Amber (on a scale of Green, Amber, and Red). Even if El Niño conditions develop during the dry season, the effect is likely to be weak compared to the strong El Niño events in 1997 and 2015.

7   Moving Forward

Improving the SIIA Haze Outlook

In Phase One of the SIIA Haze Outlook for Southern ASEAN, we focused our efforts on creating an initial or prototype framework with input from a select number of experts and key stakeholders. While this Report offers a preliminary risk assessment for 2019, more work is necessary to improve the scope of the SIIA Haze Outlook in future years.

We have cited ENSO conditions as a major indicator for the risk of transboundary haze. However, there are other climatic conditions such as the Madden-Julian Oscillation (MJO) and Indian Ocean Dipole (IOD) that can significantly influence the weather over the Southern ASEAN region. Future instalments of the SIIA Haze Outlook may need to consider a wider range of meteorological indicators.

Due to time limitations, our private sector interviews were primarily with pulp and paper firms, with information on palm oil largely drawn from academic literature and publicly available sustainability reports.

Similarly, our analysis of forest management and haze policy also focused primarily on Indonesia, rather than other countries such as Malaysia.

Further consultation with a wider range of stakeholders from across the plantation sector is therefore necessary. In theory, ongoing mitigation and prevention efforts should gradually reduce the likelihood of a severe transboundary haze crisis, but further research is needed in order to evaluate the effectiveness of these interventions. The SIIA hopes that future instalments of the SIIA Haze Outlook for Southern ASEAN will include a greater degree of structured feedback from a wider range of experts and industry actors, allowing us to better assess the risk of haze in the months ahead.

From Amber to Green

Haze pollution from land and forest fires has troubled the region for decades, though new efforts have shown progress. Since the worst prolonged spell of health-hazard air in 2015, there have been almost three years of blue skies. Yet the problems are not solved, and there is no room for complacency.

Climate change can increase the intensity and frequency of extreme weather events, including prolonged drought that can lead to an increase in the risk of fire. In 2018, destructive fires swept California and, on the other side of the world, Australia. For the latter half of 2019, the outlook remains uncertain but there is a possibility of El Niño conditions coinciding with the dry season over the southern ASEAN region. This can bring warmer and drier weather over the southern ASEAN region. Our prognosis is therefore "Amber"; on a scale of Red-Amber-Green.

Predictions are always approximations. The main purpose of the Haze Outlook is not only to get the prediction right, but rather to draw the attention of the public, policy makers, and the private sector to this emerging situation so that timely and proactive actions can be taken.

The ten member states of ASEAN have set the ambitious target of a Haze-Free ASEAN by 2020. For ASEAN to achieve this goal, stronger interventions are needed to mitigate the risk of haze. Only then can we replace business-as-usual with a sustainable value chain, and go from Amber or moderate risk of haze, to Green.

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The SIIA is an independent think tank dedicated to the research, analysis, and discussion of regional and international issues. Founded in 1962 and registered as a membership-based society, the institute is Singapore's oldest think tank, and aims to help Singapore become a more cosmopolitan and global society through public education and outreach on international affairs. The SIIA is also a founding member of the ASEAN Institutes of Strategic and International Studies (ASEAN-ISIS), a regional alliance of think tanks, and plays a key role in Track II diplomacy, supplementing official dialogue between governments. Since 2013, the SIIA has consistently ranked highly as one of the top think tanks in Southeast Asia and the Pacific, in the Global Go-To Think Tank Index by the University of Pennsylvania.

About the SIIA Sustainability Programme

The SIIA's sustainability programme focuses on haze caused by fires in Indonesia and on the sustainability of the plantation sector, both key issues for Singapore. The SIIA also works on climate change issues facing ASEAN and Asia. The SIIA's sustainability work goes back to 1997, when it organised Singapore's first haze dialogue with the Singapore Environment Council. Over the years, the SIIA has increasingly broadened its sustainability work from haze to related issues, such as forest governance and sustainable livelihoods. In 2014, the SIIA launched the annual Singapore Dialogue on Sustainable World Resources, now in its 6th year, to highlight best practices within the plantation industry.

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