



HAZE

OUTLOOK 2021

June 2021

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About the Haze Outlook 2021

The Haze Outlook 2021 Report provides a risk assessment of the probability of a severe transboundary haze incident affecting Indonesia, Malaysia, and Singapore in 2021. The haze is a recurring air pollution problem in Southeast Asia caused by forest and land fires, posing serious health hazards and contributing significantly to climate change. The Report is produced by the Singapore Institute of International Affairs (SIIA) with information from several sources and through engagements with our many stakeholders. Our risk assessment is based on three factors: weather (projected rainfall and temperature), peat (land management policies), and people (human behaviour).

This is the third annual edition of the Haze Outlook. Our inaugural report was released at the 6th Singapore Dialogue on Sustainable World Resources, organised in May 2019 by the SIIA. The Haze Outlook 2021 Report comprises not only research and analysis but also builds on the SIIA's ongoing engagement with sustainability stakeholders in the region. A total of 25 stakeholders were interviewed and consulted for this report, representing a cross-section of government bodies, financial institutions, businesses, non-governmental organisations (NGOs), and academics.

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Foreword

The transboundary haze caused by forest and land fires has been a longstanding challenge for our region. It not only impacts Indonesia, which suffers the majority of fires, but also neighbouring countries affected by the pollution and the Association of Southeast Asian Nations (ASEAN) as a whole. The haze illustrates how environmental issues are not constrained by national borders. It is moreover an issue of global scale that has implications for climate change, with forest-related emissions a major component of Indonesia's overall carbon emissions.

The challenge is faced not only by governments and communities, but also a wide range of private sector actors. For while climate and weather can worsen conditions, the haze is driven mostly by human action. Irresponsible and exploitative behaviour can cause greater harm, whereas responsible business and sustainable practices can lessen fires and haze while providing livelihoods and profits for communities, growers and corporations.

The SIIA has studied and fostered dialogue and action on this topic for more than two decades. From 2019, we have consolidated our research and stakeholder engagement to produce an annual Haze Outlook, which provides a risk assessment of the likelihood of a severe transboundary haze incident to inform the public, private sector, and policymakers. This is the third edition of our Haze Outlook.

In this Haze Outlook 2021 Report, we note a number of factors where there have been positive developments. In particular, we recognise the many positive steps taken by the Indonesian government and the administration of President Joko Widodo. The Indonesian President has personally emphasised the issue as a legacy for the Indonesian people, and a raft of reforms and new policies have followed to push towards meeting the challenge of forest fires and haze. Institutional commitment by key entities including the Indonesian Ministry of Environment and Forestry and the relatively new Peat and Mangrove Restoration Agency, now in its second term, are also positive factors.

The Haze Outlook also recognises a number of concerns that have been raised. Despite national no-burning regulations, critics allege that some industrial-scale growers as well as smallholders may still be using fire to clear land and dispose of waste. In some areas, village communities are still allowed to use fire, such as in some parts of Kalimantan where the practice is deep-rooted. In addition to a risk assessment, our report also covers emerging issues surrounding sustainable land management.

The overall assessment of this Haze Outlook 2021 Report is that there is a low risk of a severe transboundary haze incident in 2021; on a scale of Green, Amber, and Red, the 2021 Haze Outlook is Green. This is the first time the risk rating has been Green, and it therefore bears some explanation.

This relatively positive risk outlook is based on three factors: weather (projected rainfall and temperature), peat (land management policies), and people (human behaviour). Projections say the 2021 dry season will see normal or average conditions, while Indonesian authorities have sent positive signals in recent months on their continued commitment to sustainability. Finally, while the price of agricultural commodities is rising, it is not yet clear that this will result in increased land clearing and burning. These result in a relatively low-risk year for the haze, but there are three important things to note about this assessment.

First, it should be emphasised that this rating is for the likelihood of a severe transboundary haze incident. Some degree of forest and land fires is to be expected – fires occur every year regardless of conditions. But based on the analysis of this year's Haze Outlook, a severe event – with denser smoke pollution spreading across borders, affecting Singapore and Malaysia for a prolonged period – is judged to be unlikely in the coming months.

Second, it is important to note that Indonesia is not the only country in the region that produces haze from agricultural burning. Transboundary haze has also been a problem for Thailand and the Mekong region. However, this report focuses on transboundary haze in the southern part of ASEAN, specifically Singapore, Malaysia, and Indonesia. For this reason, our analysis is focused on government policies and private sector practices in and concerning Indonesia, where fires and haze will affect our region the most due to proximity and prevailing wind directions.

Third, this assessment is limited to 2021. Present conditions are relatively positive but there are uncertainties ahead. A number of experts have voiced initial concerns about national-level policies in Indonesia that could potentially raise the haze risk in future years. This primarily relates to the Job Creation Act (or Omnibus Law) that was passed in October 2020 – a major piece of legislation intended to improve ease of doing business and unravel Indonesia’s complex bureaucracy. The promise is that the new Law and regulations will assist the country’s economic growth and recovery from the impacts of the pandemic. However, some have highlighted potential consequences for the environment. Our Report acknowledges these concerns for the future and notes that these issues bear watching. Yet for the year ahead, the authors conclude that these do not detract from the conclusion for a Green rating.

This is especially because the Indonesian government appears to be cognisant of the need to stay vigilant about fires and haze. In addition, Indonesia is recognising the value of keeping its natural ecosystems intact. At the 7th Singapore Dialogue on Sustainable World Resources in November 2020, Indonesia’s Coordinating Minister for Maritime Affairs and Investment Luhut Pandjaitan noted Indonesia’s potential to become a “carbon credit superpower” due to the carbon sequestration potential from its forest and mangrove resources. Indonesia is in the process of creating a national framework for carbon trading. In so doing, the Indonesian government not only recognises the risk of the haze and fires but is seeking to shift that risk into positive opportunities for conservation, carbon management, and investment.

Similarly, the Haze Outlook looks beyond seeing the haze as a risk to consider potential opportunities. Our report features a new section assessing the business opportunity related to the generation and sale of carbon credits from nature-based projects in Indonesia. With climate action emerging as a priority post-pandemic, Singapore is also aiming to become a carbon trading hub. A new global carbon exchange and marketplace, Climate Impact X (CIX), has been announced, and the Singapore government has convened a task force to closely consider the use of carbon credits in encouraging corporations to efficiently manage their transition to a carbon-constrained economy. A major part of this can potentially arise not only from technology but also what the United Nations Framework Convention on Climate Change refers to as nature-based solutions (NBS).

Nature-based solutions (which are also termed natural climate solutions) can be linked to haze prevention initiatives, and realise co-benefits such as increased conservation. As such, while NBS for carbon management can apply to many countries, the potential of nature-based projects in Indonesia is of special interest. At present, there are some pioneer projects like the Katingan Mentaya Project in Kalimantan, but our 2021 Haze Outlook reports that current efforts remain at a very early stage. It is also not yet clear how Indonesia will regulate and shape the development of this sector. The Indonesian government has been working on carbon market regulations, which has been delayed amidst the pandemic.

But should enabling conditions improve in the future, the resulting opportunity in nature-based solutions may induce more businesses to engage further with this space. This will help address fire and haze risk in the long run. Our Haze Outlook therefore foresees the need and potential for future growth for NBS in our region and for the carbon market more generally.

Our region is at a key juncture with respect to the transboundary haze, especially in relation to carbon and climate issues. Our Haze Outlook for 2021 is Green. But Indonesia and other ASEAN countries will inevitably be looking for ways to strengthen their economies in the wake of the pandemic. In the pursuit of growth and recovery, we must hope that governments and markets will not inadvertently allow unsustainable and pollutive patterns of production and business. Instead, the challenge and opportunity is to twin the recovery with newer and greener business practices, ones that can positively link efforts to conserve and restore existing natural ecosystems with climate action and investment.

In putting forward the Haze Outlook 2021 Report, we wish to acknowledge the contributions and inputs from many sustainability stakeholders, including Indonesian government agencies, agribusiness and forestry companies, NGOs, and academics. The conclusions of the report are our own, but this project would not be possible without their kind input and assistance, especially during the current COVID-19 circumstances.

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Haze Outlook

Risk of a Severe Transboundary Haze Event in 2021:

GREEN*



Weather: The previous transboundary haze incidents in 2015 and 2019 occurred during severe drought years. However, the weather was wetter than normal in 2020, with a delayed start to the dry season influenced by the La Niña effect. These wetter conditions have persisted into the early months of 2021. For the dry season in 2021 between June and September, meteorologists expect that conditions will be normal or average for our region, drier than 2020 but not unusually so, meaning there is no elevated risk of fires and haze from weather factors.



Peat: During the haze incident in 2019, nearly half of the hotspots detected in Indonesia by satellites were on peatland. This demonstrates that proper management of vulnerable landscapes is critical to fighting the haze. The pandemic has put pressure on government coffers in Indonesia, affecting the resources available for fire prevention. However, there are signals that Indonesia continues to take forest and land management seriously. In December 2020, the government renewed the operating mandate of the Peatland Restoration Agency (BRG) and expanded its responsibilities to include mangrove areas.

Some NGOs have cautioned that the passage of Indonesia's Omnibus Law in October 2020, intended to improve ease of doing business, may loosen environmental protections in the country. The Indonesian government is also creating food estates across the country, and questions have been raised about whether this food security push might lead to loss of forest and peatland areas. However, even NGOs and activists acknowledge that it is too early to tell what the impact of these initiatives may be. This is not a certain or definite problem, merely an issue to watch. We do not believe these policies increase the risk of haze in 2021, though developments should be monitored in the coming years.



People: Forest and land fires in Indonesia are largely caused by human action. The ongoing COVID-19 pandemic seems to have disrupted land clearing and planting activities, both by businesses and small farmers. There is some element of risk for 2021 as prices of agricultural commodities, including cash crops grown in Indonesia such as oil palm, are now on the rise. The global supply of commodities has decreased amidst the pandemic, while demand has remained stable, resulting in a price increase.

However, there are differing views on how this price increase will influence the behaviour of growers, and thus the risk of haze. Most companies we interviewed said plantations are a long-cycle business, and firms are unlikely to rush to plant more as an immediate reaction to market shifts. That said, one NGO told us that they are seeing smallholders and communities stepping up their planting to some degree. But the same NGO noted that even if farmers are planting more, they might not be opening up new land, but rather planting on existing areas. Currently we do not see this as posing a major haze risk in 2021, though the situation bears watching.

* GREEN: Low Risk AMBER: Moderate Risk RED: High Risk

Sustainable Business Opportunities Potential in Carbon Credits from Nature-Based Solutions in Indonesia

The smoke from forest and land fires represents a large amount of greenhouse gas emissions, and the destruction of ecosystems by fire is effectively a loss of carbon sequestration. Globally, countries and companies are now focusing on emissions reduction and committing to net zero targets. Hence, interest in the generation and sale of carbon credits for the voluntary offset market is growing. Singapore is aiming to become an international carbon trading and services hub, with an emphasis on trading carbon credits generated by nature-based solutions. Indonesia has been touted as a potential source for such credits, but what is the current state of play in Indonesia?

- **Early Stages:** Indonesia is already home to conservation and restoration projects that are generating and selling carbon credits to commercial buyers at scale, such as the Katingan Mentaya Project in Kalimantan. However, aside from these outliers, Indonesia is only at the early stages in the carbon credit business. From 2004 to 2016, there were only some 15 ecosystem restoration concession licences issued in Indonesia, which is the legal status required for a nature-based project to generate and sell carbon credits at scale. Additionally, the majority of these licence holders do not intend to enter the voluntary offset market - their focus is on other aims such as wildlife conservation and biodiversity. Even when licence holders are generating carbon credits from their projects, they may not plan to sell credits to buyers, as they are using the credits to offset their own business group's carbon footprint. Additionally, it is not clear to what degree Indonesian authorities will allow projects to sell carbon credits to global buyers, or to what extent credits will be reserved for the domestic offset market.
- **Future Prospects:** The Indonesian government is aiming to pilot a national carbon market, but there is no visibility on when the authorities may release regulations to this effect. A trial has been launched for carbon trading involving power plants. In theory, Indonesia's recently passed omnibus law will make it easier to get an ecosystem restoration licence or convert current plantation and logging concessions to restoration use. The law unifies Indonesia's separate land use licences into a single business licence, which will theoretically allow Indonesia's agribusinesses to explore carbon credit generation. However, it is not yet apparent how this will work in practice. Plantation sector companies are monitoring the situation, and most are at least considering the possibility of generating carbon credits from conservation areas within their land. But most companies are only at the exploratory stage. Companies have also questioned whether current carbon credit schemes are suitable for certifying credits generated by agribusinesses.

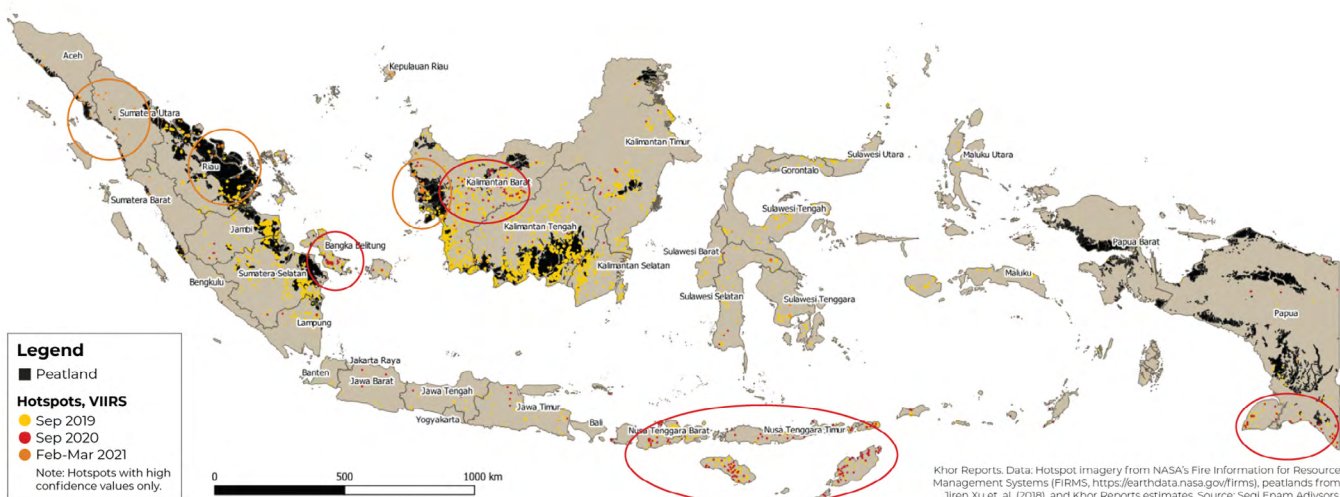
1. 2020 in Review: Analysis and Observations

There was no transboundary haze incident in 2020, despite early fears that the region might face two crises at once, with a haze incident occurring in the midst of the COVID-19 pandemic.

Fortunately, 2020 ended up being one of Indonesia's wettest years on record, in part due to the La Niña weather phenomenon in the last quarter of the year, which helped keep the fire situation under control. The Indian Ocean Dipole (IOD), the phenomenon that contributed to severe fires and haze in 2019, was also muted in 2020.¹

According to satellite data, Indonesia saw far fewer hotspots in 2020 compared to 2019. Some 1,032 fire alerts or high-confidence hotspots were detected between August and September 2020 at the peak of the dry season, compared to 10,513 alerts for the same period in 2019.² Satellite data does not precisely reflect actual fires on the ground, but official estimates of burnt area and deforestation show a similar decrease between 2020 and 2019.

Figure 1: High-confidence hotspots in Indonesia for selected months in 2019-2021



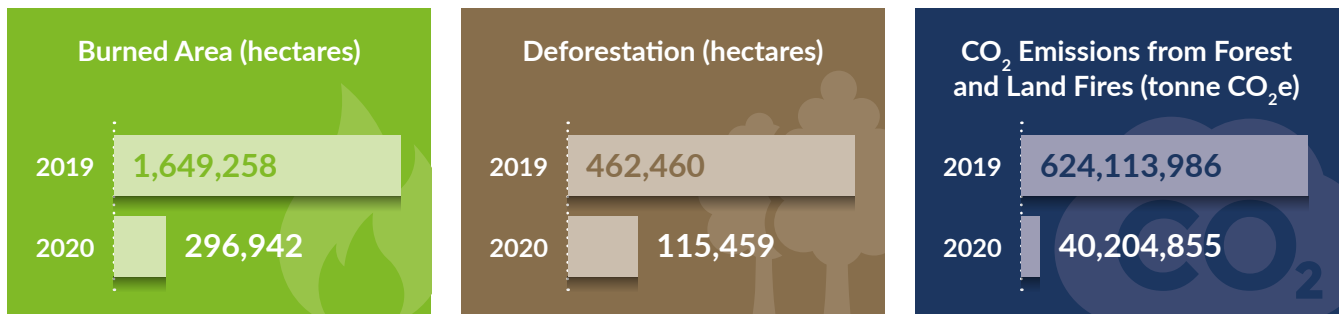
Note: This map depicts high-confidence hotspots in Indonesia recorded by NASA's Visible Infrared Imaging Radiometer Suite (VIIRS) during the peak of the dry season in 2019 and 2020, as well as in early 2021. Selected areas of interest are circled. Far fewer hotspots were detected in 2020 compared to 2019. Most 2020 hotspots were in areas previously burnt in 2019. While some hotspots were detected in North Sumatra, Riau, and East Kalimantan, the majority of hotspots in 2020 appear to have been in Bangka Belitung, West Kalimantan, West and East Nusa Tenggara, and South Papua, where haze from fires is unlikely to reach Singapore.

Source: Segi Enam Advisors

Indonesia's Ministry of Environment and Forestry (*Kementerian Lingkungan Hidup dan Kehutanan* or KLHK) reports that the country saw some 296,942 hectares of forests burned in 2020, an 82 per cent drop from the over 1.6 million hectares of burnt area in 2019.³ That said, not all the forest area affected by fire is necessarily lost. KLHK says there was only 115,459 hectares of deforestation in 2020.⁴

The World Resources Institute (WRI) has a larger estimate for the loss of primary forest in 2020, placing the figure around 270,000 hectares in terms of change in land cover. Experts we spoke to said the difference may be due to varying calculation methods or definitions of deforestation, and one expert added that KLHK does a significant amount of on the ground checking of burnt area, whereas WRI relies more on satellite data. However, even WRI's estimate represents an improvement over 2019 and this suggests that 2020 was one of Indonesia's best years in terms of avoiding deforestation.⁵

Figure 2: 2019 vs. 2020, selected official Indonesian figures



COVID-19 and the Haze

It is now widely accepted that peatland and forest fire incidents in Indonesia are largely caused by human action, a sentiment shared by Indonesian President Joko Widodo: “Ninety-nine percent of forest fires are perpetrated by humans, whether intentional or out of negligence”.⁶

To some extent, COVID-19 seems to have reduced burning in Indonesia, by directly impacting activity in the agricultural sector. A few businesses indicated that their replanting plans and other activities in Indonesia were hindered somewhat by COVID-19, and some suggested that smallholders and community farmers might also have felt some capital or work constraints during the pandemic. However, businesses and experts also noted that Indonesia’s plantation and forestry sector was not as heavily affected by COVID-19 compared to other sectors, as COVID-19 affected urban centres more than rural areas. Additionally, although Malaysia’s plantation sector saw widespread closures and stoppages due to their reliance on foreign labourers living in close quarters in dormitory conditions, this was not the case in Indonesia.

COVID-19’s Impact on Private Sector Fire Management and Monitoring

Private sector fire prevention and response efforts are critical in Indonesia, as vast areas of land are within concessions. All companies that we spoke to said they did not reduce resources dedicated to fire management amidst COVID-19, with a number of firms instead indicating that they had hired more fire management personnel over the course of 2020. However, companies observed that the need for split team arrangements, social distancing, and other COVID-19 measures did hinder their fire management efforts. For example, firefighters would have to quarantine themselves for several days if transferring between different areas. That said, one company representative noted that the wetter weather and reduced fire activity in 2020 meant that their firefighting teams were not unduly stressed despite these constraints.

Although firefighting personnel were able to carry out their duties during the pandemic, some businesses and NGOs told the SIIA that their community outreach activities suffered setbacks in 2020. Under normal circumstances, companies and NGOs engage with local communities on a regular basis to encourage fire prevention and share sustainable agricultural practices, often in cooperation with the Indonesian authorities. Face-to-face engagement is the norm for such programmes, but this proved problematic during COVID-19. In rural areas, it was often not possible to move such engagement online. One company we interviewed expressed concern that their community engagement programmes have been impacted and stated that rebuilding connections with villages will take some time in the wake of the pandemic. That said, another organisation claimed they were able to maintain the effectiveness of their community outreach by replacing large in-person meetings with more frequent smaller meetings.

Agribusiness firms likewise engage on a regular basis with plantation operators in their supply chain. Due to the pandemic, site visits and meetings with suppliers remain impossible in many areas, but the businesses we spoke to indicated that they were able to use technology to conduct remote assessments of their suppliers, such as using apps to view uploaded photos and documents.

COVID-19's Impact on Indonesian Government Policy

There were concerns in the early months of the pandemic that Indonesian authorities might scale back some of their forest protection efforts. KLHK's budget was reduced from IDR 9.32 trillion (SGD 869 million) to IDR 7.74 trillion (SGD 722 million) in April 2020.⁷ The budget cut was intended to free up resources needed to manage the pandemic but impacted efforts such as fire and forestry patrols. Even where resources remained available, travel restrictions during the pandemic had some impact on government initiatives. An Indonesian official based in Jakarta told us that their agency's ability to conduct fieldwork was limited, meaning that they had to rely on assistance from provincial and district governments to carry out their programmes.

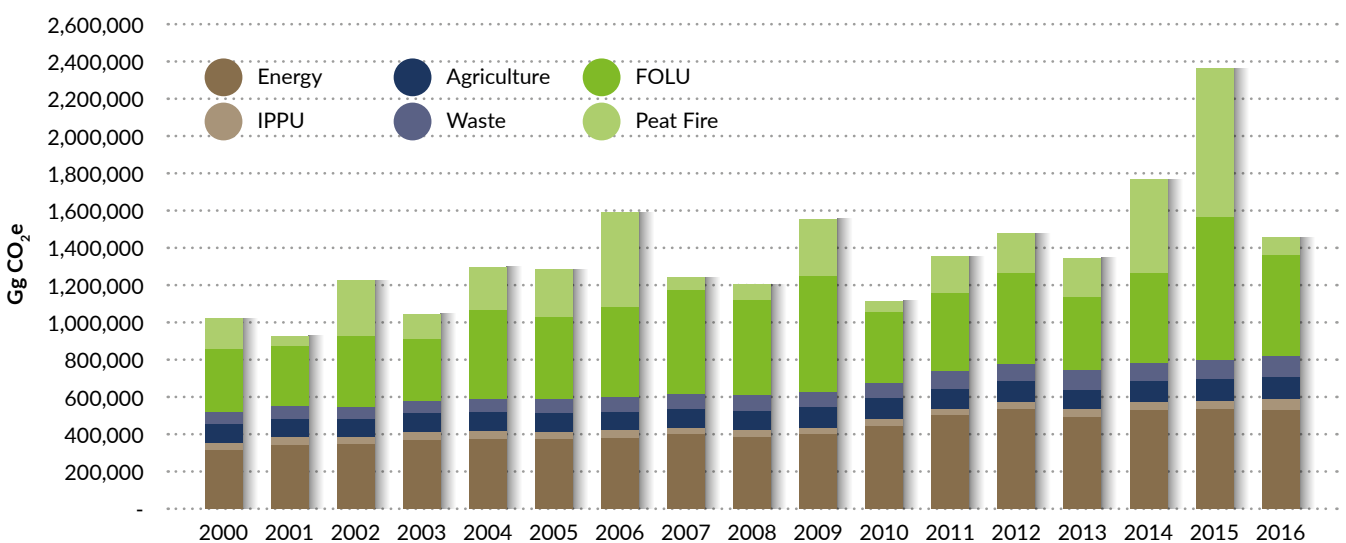
However, President Joko Widodo made it clear that Indonesia had to anticipate land and forest fires even amidst the pandemic, stressing the need to address both issues during a cabinet meeting in June. Despite resource constraints, Indonesian authorities continued to carry out weather modification efforts, such as cloud seeding and artificial rain. At the provincial level, six provinces, Riau, South Sumatra, Jambi, West Kalimantan, Central Kalimantan, and South Kalimantan declared states of emergency in 2020 to tackle fires, a precautionary measure to allow the use of emergency funds and give police and military regional commands more leeway to act.⁸

Indonesia's Efforts to Limit Deforestation

Indonesia's Nationally Determined Contributions (NDCs) under the Paris Agreement have promised to limit deforestation in the country to approximately 3.25 million hectares from 2020 to 2030, which effectively means that Indonesia has committed to keeping deforestation to around 325,000 hectares or less annually, averaged over the time period. This is almost 30 per cent less than the area deforested in 2019 according to official figures, but nearly three times the 2020 rate.

Agriculture together with Forestry, and Other Land Use (FOLU) accounts for 50 to 60 per cent of Indonesia's annual emissions in a normal year, and often a higher share during a severe haze year, making measures to keep deforestation in check a far more important emissions reduction strategy for Indonesia compared to most countries. Globally, agriculture and FOLU accounts for just under a quarter of man-made greenhouse gas emissions.⁹ In absolute terms, KLHK reports that the average emissions level from the country's forestry sector annually between 2000 and 2018 was about 440 million tonnes of carbon dioxide equivalent (CO₂e), or some 214 million tonnes of CO₂e if emissions from peat fires are excluded.¹⁰

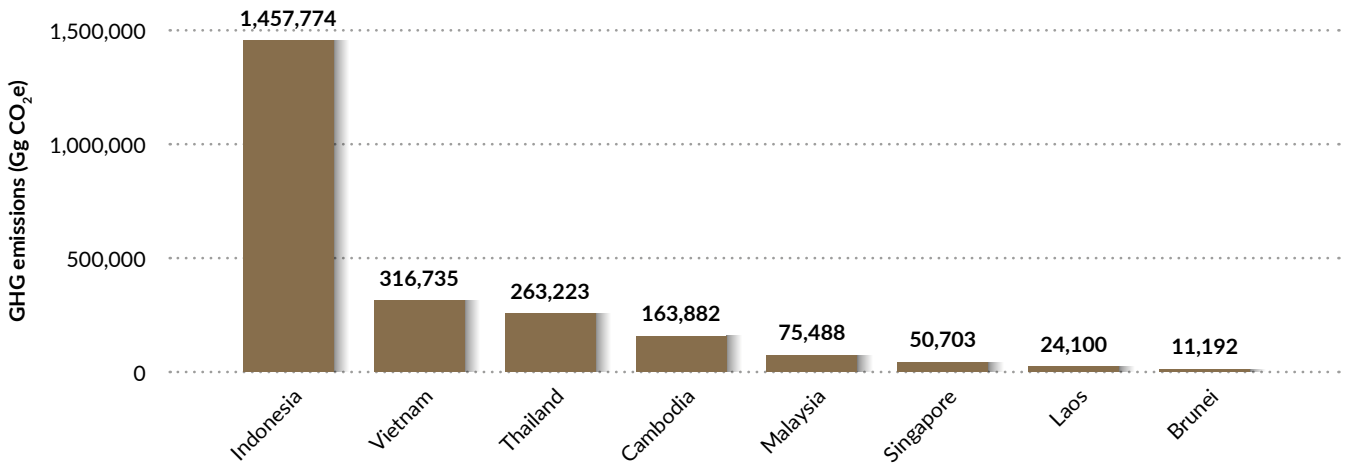
Figure 3: Indonesian national GHG emissions (including peat fires), 2000-2016



Note: Graph tracks Industrial Process and Product Use (IPPU), Forestry and Other Land Use (FOLU), and other sources of emissions.

Source: UNFCCC

Figure 4: GHG emissions for selected ASEAN countries, 2016

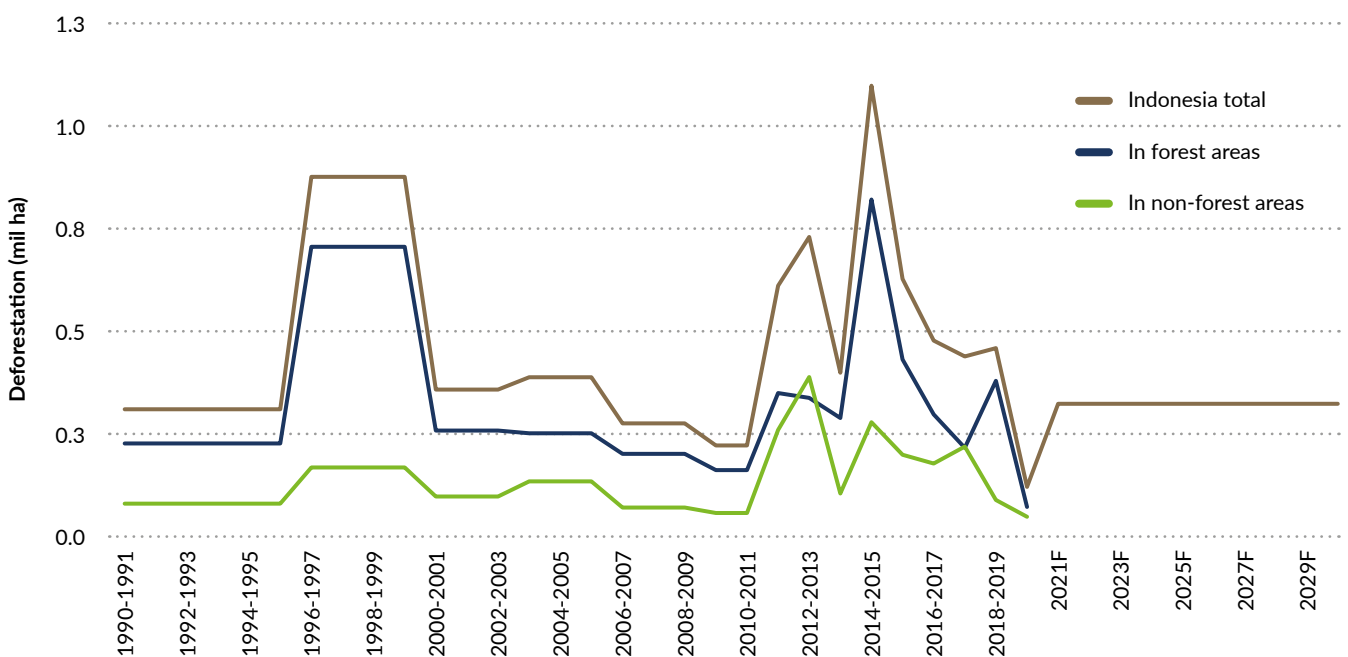


Note: Latest available data for Laos is from 2014

Source: UNFCCC

In this context, the record low deforestation seen in 2020 is a promising achievement for Indonesia. Some experts interviewed for this Report noted it is unclear how much of this reduction in deforestation rate is due to effective action by Indonesia's authorities, versus favourable weather and the unexpected disruption in economic activity caused by COVID-19. That said, other countries with vulnerable forest landscapes saw an increase in deforestation over the course of 2020 during the pandemic, so in comparison it seems Indonesia has done well. According to WRI, Indonesia in 2020 dropped out of the top three countries for primary forest loss to fourth place, for the first time since WRI's records began in 2000. For 2020, the top three countries for deforestation were Brazil, the Democratic Republic of the Congo, and Bolivia.¹¹

Figure 5: Official deforestation rate for Indonesia and forward targets, 1990-2030



Note: Forest areas refers to zones that should legally be maintained as forests, while non-forest areas are zones that lack such legal status (but may still have tree cover). The spikes in deforestation correspond to previous severe transboundary haze incidents, linked to weather conditions and economic factors such as the Asian Financial Crisis and growing demand for vegetable oils (including for biofuels).

Source: Official data and targets (annualised), KLHK

Beyond the favourable weather in 2020 and any economic impact from COVID-19, a range of policy measures are credited for Indonesia's success in bringing down deforestation since 2015, marred only by the transboundary haze that occurred in 2019. These include effective forest governance laws and a National Action Plan on Sustainable Palm Oil.¹²

President Joko Widodo and his government have also sent signals that they remain committed to ecosystem restoration and haze prevention going forward. Following speculation about its dissolution, the Peatland Restoration Agency (*Badan Restorasi Gambut* or BRG) was also granted an extension to its operating mandate to 2024 in December 2020. The agency's mandate would otherwise have expired at the end of 2020. Notably, the agency's mandate has also expanded to include the rehabilitation of 600,000 hectares of mangrove forests across nine provinces. Accordingly, the BRG is now known as the Peatland and Mangrove Restoration Agency (*Badan Restorasi Gambut dan Mangrove* or BRGM).

Originally set up in 2017, the BRG was tasked with rehabilitating some 2.6 million hectares of degraded peatland across Indonesia - wetlands that sequester a large amount of carbon, but correspondingly release a great deal of carbon if drained for agriculture and subsequently burnt. However, only some 900,000 hectares of that target are in public land where BRG could directly intervene in cooperation with local authorities. The remainder is within private sector concessions, where BRG could only play an advisory role, and the actual peat restoration must be carried out by the concession holders.

As of end-2020, BRG has managed to restore some 835,288 hectares of peatland outside of concessions. However, some NGOs and experts we interviewed for this Report questioned the BRG's effectiveness, citing the limits to the agency's authority and its inadequate resources. Some also observed that it is not entirely clear to what extent the area restored by BRG has truly been rehabilitated. That said, the BRG itself notes that ecosystem restoration should not be seen as a one-time affair. Follow-up is necessary to ensure that peat areas remain in good condition, including maintaining rewetting infrastructure such as canal blocks, and continuing engagement initiatives with local communities. It is therefore important that the BRG's mandate has been extended to ensure continuity in its programmes.

Going Forward

Although we do not believe there is a heightened risk of fires and haze in 2021, there remains some uncertainty arising from the COVID-19 situation, especially with other pandemic-related trends continuing to manifest such as disruptions to supply chains, and people returning to rural areas. Some analysts have suggested that the post-pandemic recovery period may in fact see a larger impact on human behaviour compared to the early days of the crisis, if people resort to slash-and-burn agricultural practices amidst financial woes.¹³ Such concerns may be heightened by the current surge in agricultural commodity prices, which we discuss in the following sections of this Report.

2. Issues to Watch in 2021

Weather: Meteorological Forecasts for 2021

Based purely on meteorological factors, there is a relatively low risk of fires and haze in the region for 2021, with no unusual drought conditions predicted.

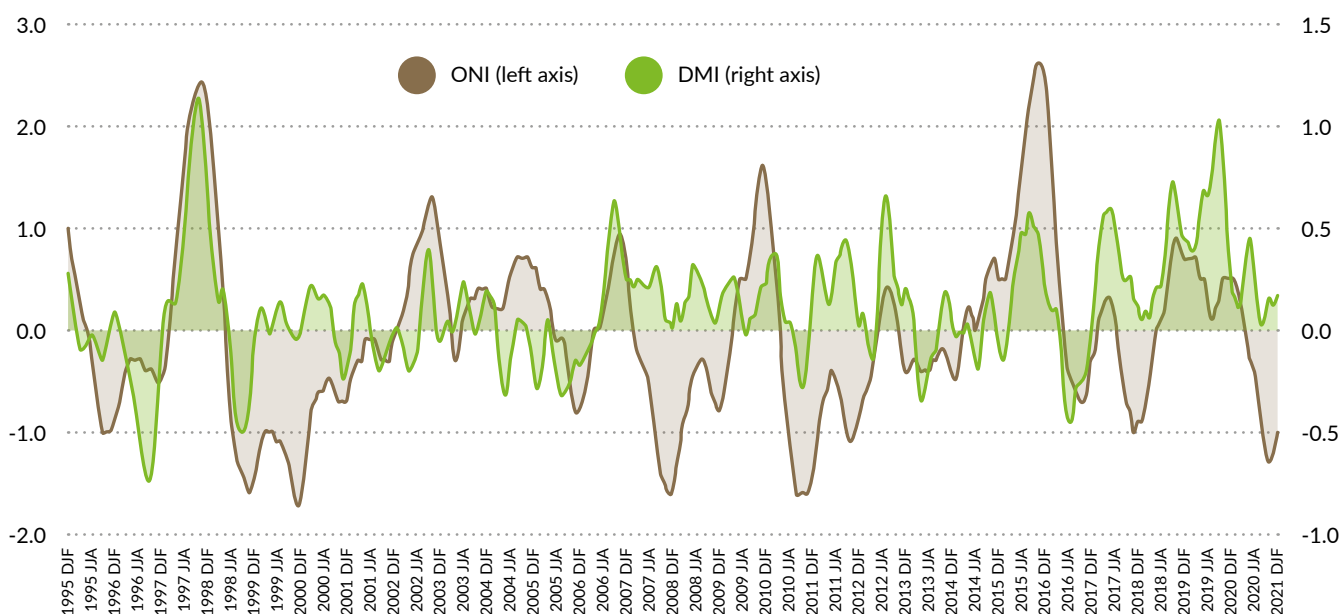
The weather is expected to be wetter than normal as we enter the typical June to September dry season. Indonesia's Meteorology, Climatology, and Geophysical Agency (BMKG) has predicted a slightly later start to the 2021 dry season for much of the region, including parts of Sumatra and Borneo, due to La Niña weather conditions persisting through May and resulting in wetter weather for the time being.¹⁴

The dry season itself is expected to be normal or typical, with BMKG and other meteorological organisations such as the ASEAN Specialised Meteorological Centre (ASMC) concurring that the weather will be drier than it was in 2020, but not as severe as the extreme drought conditions that contributed to the transboundary haze incidents in 2015 and 2019.¹⁵

The Indian Ocean Dipole (IOD), a climate phenomenon similar to El Niño that influenced the haze in 2019, is currently neutral and is expected to remain neutral through to October 2021.¹⁶ Similarly, the El Niño-Southern Oscillation (ENSO), a technical term for El Niño and La Niña as a whole, is also expected to be neutral through to the third quarter of 2021.

However, meteorologists that we spoke to for this Report did caution that it is difficult to accurately forecast conditions in our region during the transitional period between seasons in April to May, and there is therefore still some uncertainty as we enter the dry season. One expert also noted that some Indonesian provinces may see wetter or drier weather than the overall climate phenomena like IOD and ENSO would suggest. For example, despite the La Niña conditions from late 2020 to early 2021 that resulted in higher rainfall for most of our region, the Indonesian provinces of Riau, Bangka Belitung, and West Kalimantan actually saw lower-than-average rainfall during this period. As such, it is still important for Indonesian authorities and the private sector to be prepared and take appropriate measures to prevent and respond to fires during the dry season.

Figure 6: Climate phenomena impacting weather in Southeast Asia



Note: Graph tracks sea surface temperature anomalies in °C, i.e. how much the temperature varies from average. Two time periods are provided for each year, in climatological mean winter (DJF) and summer (JJA). Oceanic Niño Index (ONI, in brown) measures El Niño and La Niña, and Dipole Mode Index (DMI, in green) measures the Indian Ocean Dipole. Values below zero correspond to wetter weather for Southeast Asia in the dry season, while positive values indicate drier conditions.

Source: Segi Enam Advisors, based on data from NOAA

Peat and People: Policy and Human Factors in 2021 and Beyond

Given that climatic conditions are neutral, with no unusual drought conditions predicted for the 2021 June to September dry season, the actual risk of haze from fires in Indonesia will depend to a large extent on forest and peatland management policies in the country, as well as human behaviour.

Thankfully, policy signals are positive. In recent months, the Indonesian government has sent some policy signals demonstrating a continued commitment to sustainability, such as strong official messaging on the need

to protect mangrove areas in addition to peatlands, developing scenarios to achieve net zero emissions by 2070 at the latest, and making it clear that haze prevention must continue even amidst the pandemic. As such, we do not believe there is an elevated risk of fires and haze in 2021 arising from policy factors.

However, there are a number of developments in Indonesia which could affect haze risk beyond 2021. These are emerging trends or policy changes that might inadvertently have implications for the environment. It is too early to determine what the final effect of these shifts will be, as any impacts will only be apparent in the months or years ahead, but the following issues bear watching.

COVID-19's Impact

The COVID-19 pandemic is still ongoing. Officials, private sector companies, and NGOs that we spoke to for this report all mentioned that their fire prevention and community engagement efforts were affected in 2020, albeit to varying degrees. Presently, the COVID-19 situation has not resulted in severe transboundary haze in Southeast Asia. But it is not yet evident when the situation will be fully under control, and the pandemic could still increase the risk of fires and haze incidents in 2021 and beyond.

Rise in Commodity Prices and Effects on Human Behaviour

The pandemic has resulted in a surge in prices across agricultural commodity markets, including palm oil and other tropical commodities produced in Indonesia. These commodities are pushing multi-year highs, due to a number of supply and demand factors.

The pandemic has caused supply disruptions in the agricultural sector, such as business and plantation closures, labour shortages in some countries, and logistical problems in shipping goods between borders. Indonesia's agricultural producers have weathered the pandemic quite well, and have not been so affected by plantation closures and labour issues. Most Indonesian plantations have remained open, and they rely on a domestic workforce rather than foreign migrant workers. However, other countries in the region such as Malaysia have been affected by closures and labour shortages. The price of palm oil, a major product in the Southeast Asian region, has also been pushed upwards due to supply shortages for other vegetable oils produced elsewhere in the world.

While the supply of commodities has decreased, demand has remained relatively stable during the pandemic, and may have increased slightly for some commodities. As such, the world is seeing higher commodity prices. But will this price increase affect the behaviour of Indonesian growers, leading to more land clearing and agricultural activity, and thus increasing the risk of haze?

Private sector firms interviewed for this Report expressed doubt that the rise in commodity prices will influence the behaviour of both corporate and community growers in the near term. The firms noted that plantations are a long cycle business. For instance, it takes three to four years for a newly planted oil palm to produce fruit. The industry simply cannot respond quickly to price signals. Therefore, it is unlikely that any company will drastically change their planting or replanting plans in response to an unforeseen, and possibly temporary, shift in the market. Businesses also observed that due to tough scrutiny on the sector, new land is less easy to access these days, and it is also difficult to secure capital as banks are less supportive of expanding plantations.

The companies we spoke to believed that similar logic should apply to smallholder farmers and community growers as well. However, one NGO informed us that the rise in commodity prices certainly is visible to ordinary farmers, who can already expect a higher price for their products, and some farmers may be stepping up their planting of cash crops.

It is important to note that even if some smallholders and community farmers are stepping up planting due to rising commodity prices, they may not be clearing new land to do so. Farmers could be planting on land that was previously cleared but not utilised, or might convert land used for other crops to oil palm.

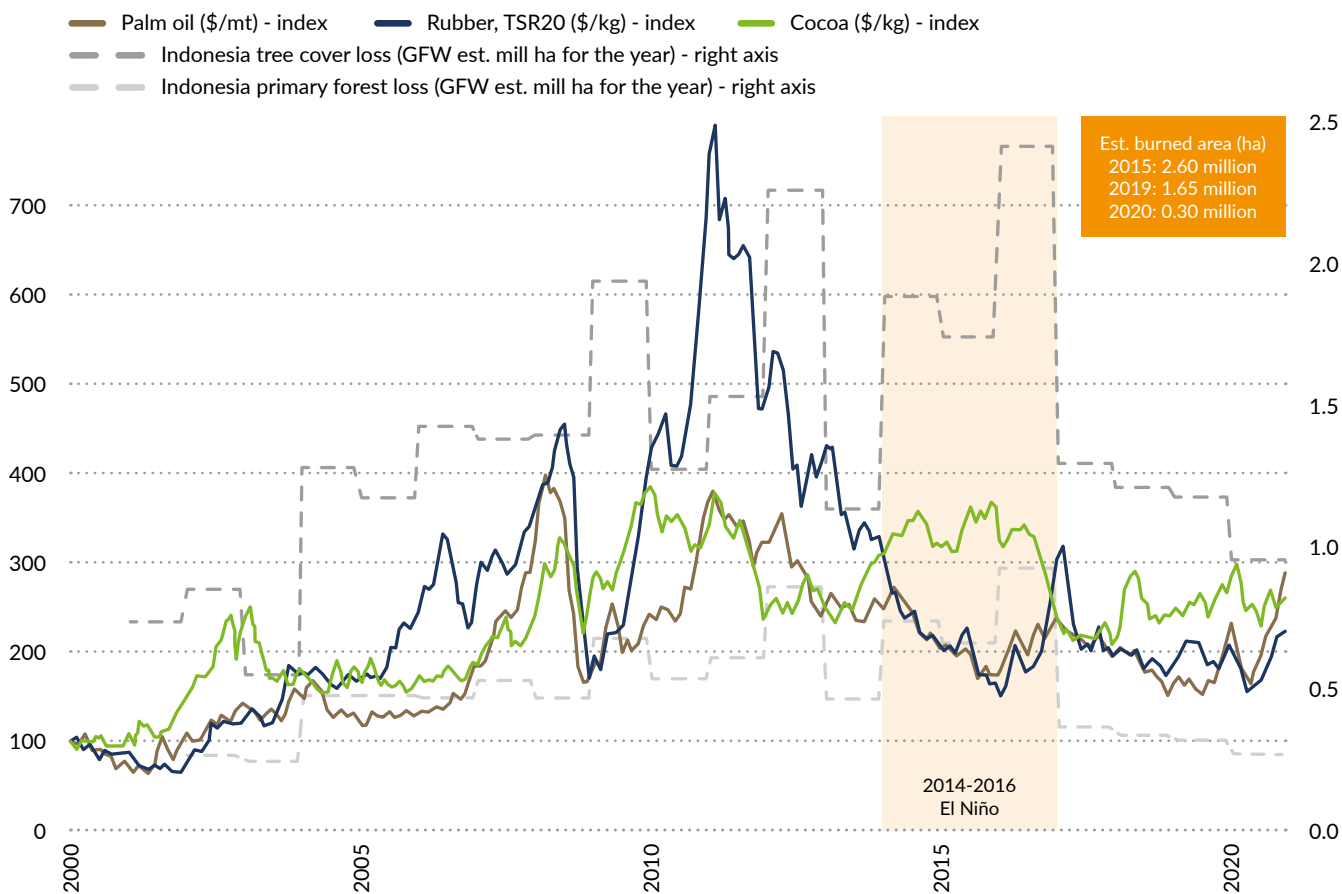
Additionally, even if plantation operators are currently clearing land, they might not make use of fire or other unsustainable practices. The economic downturn does create pressures to save money, but this does not mean that all growers will cut corners, even during the pandemic. One company we spoke to said that over the past year, they have been approached by growers that were previously removed from their supply chain for unsustainable practices. These growers now want a path to rehabilitation and access to better market opportunities, rather than being forced to stay in the uncertain leakage market.

There has been research linking price changes in the palm oil market to the rate of deforestation in Indonesia. But this is a complex issue, and some recent studies seem to suggest that any link is gradually diminishing, with price surges being followed by smaller amounts of tree cover loss over time.¹⁷

Likewise, there does appear to be some correlation between palm oil prices in Indonesia and sales of oil palm seeds, suggesting that growers indeed look to plant more in response to market signals, according to one consultant we spoke to. That said, the same consultant also noted that the rise in seed sales following a commodity price increase is no longer as significant as observed in the past.

If commodity price increases are no longer being followed by surges in agricultural activity and deforestation, it could mean that sustainability practices are gradually having a positive effect in Indonesia. However, there may be other factors at work, such as less land being available for expansion, fewer concession licences being granted, and corporate balance sheets being under strain. At the moment, it is difficult to draw firm conclusions about the effect of the current commodity price increase on the risk of fires and haze, especially as the present situation is unusual due to COVID-19. The price surge is a potential cause for concern, but not yet sufficient reason to sound an alarm.

Figure 7: Commodity prices and tree cover loss



Source: Segi Enam Advisors, based on data from The World Bank (2021) for palm oil and rubber prices, GFW (2021) for tree cover loss and primary forest loss, KLHK (n.d.) and KLHK (2017) for official estimated burned area in 2015, 2019, and 2020.

Beyond 2021: Indonesian Government Policies and the Environment

Following the record transboundary haze incident in 2015, the Indonesian government enacted several policies geared towards fire prevention and mitigation, which included the establishment of the BRG (now BRGM) and a moratorium on oil palm plantation licences. More recently, the government has implemented several policies that could have environmental consequences, including the Job Creation Act (or Omnibus Law) and food estate programme.



Omnibus Law: In October 2020, the Indonesian parliament passed a number of wide-ranging reforms with the intention to stimulate the country's economy and attract foreign investment. The Omnibus Law is intended to improve ease of doing business in Indonesia, by cutting through red tape and removing layers of bureaucracy. However, aspects of the law have proven controversial, particularly its labour reforms, sparking protest rallies with tens of thousands of people calling for the law to be retracted.

Some environmental NGOs and activists have argued that certain provisions in the law may also prove detrimental to environmental protection. For instance, the new law may have loosened the requirement that at least 30 per cent of a region's watershed or island area be maintained as forest. Businesses may also be subject to less stringent requirements for environmental impact assessments when securing licences, and it may be harder to hold companies liable for fires in their concession land.¹⁸

That said, it is important to note that while the Omnibus Law has been passed, the actual implementing regulations are still being rolled out by government bodies. Thus far, the regulations governing Indonesia's plantation sector have not changed. There has not been any relaxation in environmental rules to date. Both industry representatives and NGOs we interviewed for this Report agreed that it is too early to tell whether there will be any impact on environmental safeguards.



Food Estate Programme: The pandemic has highlighted Indonesia's food security vulnerabilities, giving a strong impetus for President Joko Widodo's administration to step up food security efforts. As part of its ambitious but controversial food estate project, the administration is putting considerable effort into establishing large-scale agricultural plantations in Kalimantan and Sumatra. The project, which intends to boost food security, involves converting forest area and peatland into paddy fields for rice production. Officially, the food estate programme will only convert land that is already degraded, and therefore need not be protected or conserved, but NGOs and academics are nonetheless concerned that the project may still contribute to some deforestation.

Experts have also criticised the initiative, comparing it to previous failures with the ill-fated Mega Rice Project (MRP) initiated in 1996, pointing out that the areas proposed for the food estate programme may have acidic soil unsuitable for rice crops, and that it may be impossible to ensure adequate irrigation. As an alternative to converting peatland areas into rice paddies, there has been increasing interest in recent years regarding paludiculture, or the growing of alternative crops on wet soils, including peatland, but this field is still in its early stages and it is premature to conclusively say that paludiculture could replace rice and other crops in Indonesia.

Both the Omnibus Law and the food estate programme could have an impact on the risk of fires and haze in Indonesia. However, it is not yet evident what impact these changes will have in practice, as the regulations to implement the Omnibus Law are still being rolled out, and the food estate programme is still in its early stages. These policy developments are unlikely to have any effect on the likelihood of fires and haze in 2021, but they are issues to watch in the years ahead.

Paludiculture: Crop Cultivation on Peatland

Paludiculture, the practice of crop cultivation on wet soils, including peatland, has been considered as a potential solution to balance the competing needs of economic growth, food security, and ecosystem protection. Theoretically, paludiculture would allow companies and communities to grow crops on peatland without needing to drain peat areas, thereby leaving them wet and less vulnerable to fire, a “win-win solution”.¹⁹ The BRGM has adopted paludiculture as part of its peatland restoration efforts, a direction encouraged by the Food and Agriculture Organization (FAO).²⁰

In the context of Indonesia’s food estate programme as well as interest among plantation companies looking to diversify their crops, paludiculture is promising. But research about paludiculture has largely centered around European peatlands. There is still a lack of scientific understanding of how the concept might work in tropical areas.²¹ More research is needed to determine whether sustainable paludiculture is viable in Indonesia and Southeast Asia more generally. Crop suitability remains a major question. Identifying plants that are both suitable for paludiculture and commercially profitable appears to be quite a task in itself.²² One study has suggested candlenut and dragonfruit are currently the most profitable tropical paludiculture crops, but more data is required to reach firm conclusions.

3. Opportunities for Climate Action and Green Recovery: Nature-Based Solutions and Carbon Markets

The recurring transboundary haze threatens public health in the region, and past incidents have caused economic loss due to business closures and negative effects on tourism. But in addition to these impacts, haze is also a major driver of climate change. The smoke from forest and land fires represents a large amount of greenhouse gas emissions, and the destruction of ecosystems by fire is effectively a loss of carbon sequestration.

Globally, countries and companies are now focusing on emissions reduction and committing to net zero targets. Logically, this effort should involve protecting and restoring ecosystems in Southeast Asia, as well as the prevention of fires and haze. Additionally, global interest in the generation and sale of carbon credits for the voluntary offset market has been increasing during the COVID-19 pandemic. Carbon finance is now seen as an added incentive for businesses to invest in sustainability.

Along this growing interest, Singapore is aiming to become a carbon trading and services hub, with an emphasis on trading carbon credits generated by nature-based solutions (NBS), also referred to as natural climate solutions (NCS), such as ecosystem restoration projects in the region. Similarly, Indonesia aims to pilot a national carbon market. In theory, there is synergy between Singapore’s aims, Indonesia’s own objectives to promote carbon trading, and the opportunity provided by peatland and other natural landscapes in the region.

Both Singapore and Indonesia want to create liquidity in the market, but how both countries can collaborate remains a subject of discussion.²³

In theory, nature-based projects help to reduce carbon emissions and provide carbon offsets, while also offering opportunities for investment. Based on the interviews conducted for this Report, there is a growing, yet watchful interest in the generation and sale of carbon credits from nature-based projects in Indonesia. Long-term prospects are promising, and the sector is likely to expand. However, currently the sector is in an early state, and there are only a handful of pioneers already generating and selling carbon credits from nature-based projects. In addition, it is not yet clear how the Indonesian government will regulate this space. Even if project developers are willing, it is not yet clear to what extent they will be able to sell credits on the international voluntary offset market, versus the domestic one.

Current Market Situation

In ASEAN, several commercial projects based on carbon sequestration and the generation of carbon credits from nature already exist. This includes Indonesia. The Katingan Mentaya Project in Central Kalimantan, managed by PT Rimba Makmur Utama, is the largest forest restoration and protection project of its kind in the world. The project generates an average of 7.5 million triple gold certified carbon credits annually, equivalent to taking 2,000,000 cars off the road each year. Major global multinational firms already purchase carbon credits from the project.

While the Katingan Mentaya Project demonstrates that carbon credit generation can work as a business model in Indonesia, between 2000 and 2016 there were only some 15 Ecosystem Restoration Concessions (ERC) licences issued in the country, which is the legal status required for a nature-based project to generate and sell carbon credits at scale.²⁴ These concessions cover some 573,455 hectares out of the 2.7 million hectares allocated by Indonesia for ERCs.²⁵ The majority of the current ERC licence holders do not intend to enter the voluntary offset market, as they are focused on other aims such as biodiversity and wildlife conservation.

Is it likely that more companies will enter the carbon market, and sell credits on the offset market from nature-based projects? There has been speculation that Indonesia's Omnibus Law might make it easier for new players to enter this space, because under the Omnibus Law, business licencing will be streamlined. Currently, there are three main types of land use licence for forest areas - logging, plantation, and ecosystem restoration concessions. It may be easier for new carbon credit businesses to secure an operating licence under this new regime. Potentially, the Omnibus Law might also allow plantation sector companies to more easily generate and sell carbon credits from forest conservation areas within their existing concessions.

Most Indonesian plantation sector companies that we spoke to for this Report said they are at least considering the possibility of generating carbon credits from their existing or future conservation efforts. Companies are of course unlikely to completely shift their business models from production to conservation and are in fact legally obliged to use their current concession land for plantation purposes. But some companies might be encouraged to engage more with nature-based solutions and the carbon market.

However, only one company we spoke to was already in the process of securing certification to generate carbon credits, and they stressed that the credits generated would only be used to offset emissions from their own business group. The firm has no intention to sell carbon credits on the open market. Another plantation company did signal that they were interested in selling carbon credits produced from one of their conservation projects. But the majority of businesses stated that they are still in a very early exploratory phase and have not made any firm commitments regarding carbon credits and the offset markets, calling such a decision "very far down the road".

Some agribusiness companies mentioned that they are focusing on other immediate priorities for the time being, such as reducing their Scope 1 and 2 emissions. While increased emphasis on carbon pricing, along with trade in carbon offsets, may be inevitable in the future, many felt that the carbon credit generation discussion was premature at this juncture.

Plantation sector company representatives we interviewed also expressed doubts about whether existing carbon credit certification standards would fit their businesses. They noted that these standards are generally designed for dedicated ecosystem projects and are not well-suited to the auditing of carbon credits generated from agribusiness-run conservation areas that exist alongside commercial plantations. NGOs and experts we spoke to also observed that most current platforms for the sale and purchase of voluntary offsets are geared towards large sellers and purchasers, with much less accommodation for small producers and buyers. Companies have also noted that Indonesia lacks domestic expertise in carbon credits, as few people in Indonesia are familiar with certification schemes and auditing processes.

Future Prospects

Climate Impact X (CIX), a Singapore-based global exchange and marketplace for high-quality carbon credits slated to launch later this year by DBS Bank, Singapore Exchange, Standard Chartered, and Temasek could address some of the gaps and issues identified above. CIX is intended to help facilitate price discovery, and one of CIX's platforms, the "Project Marketplace", seeks to connect corporate buyers with nature-based projects based on their specific needs.

Singapore's contribution to the global trade in carbon credits is promising, leveraging Singapore's strengths as a financial hub. However, efforts from Indonesia will also be critical. Currently, it is not clear what regulatory environment will exist in Indonesia to govern carbon credit generation and trading. A number of uncertainties need to be resolved, such as whether carbon credits purchased by corporate buyers can be claimed towards Paris Agreement emission reduction targets in their home countries, or whether these count towards Indonesia's national goals. Prior to the pandemic, Indonesia was working on a new government regulation, or a set of regulations, on carbon trading, part of the nation's goal to establish a domestic carbon market. This regulation was originally expected in 2020, but appears to have been delayed by the crisis, and there is currently no visibility on when it may be released.

Collaboration between national governments, including in ASEAN, is also needed to work towards alignment on carbon pricing and pave the way towards a liquid market for carbon credits. One possible area for international collaboration is in strengthening carbon certification schemes or creating new and better-recognised certification systems. In 2020, the Nature Conservancy, a major producer of carbon credits, was accused of selling "useless" offsets from forests in the United States of America. Carbon credits are generated from forest projects based on the idea that these forests would have been lost without active intervention, for instance due to logging or agriculture. But critics said the Nature Conservancy's forests were never in any danger. The controversy has cast a shadow over the voluntary offset sector. As global interest in carbon offsets grows, regulators will need to pay more attention to this space to ensure that carbon credit systems are trustworthy, ideally with input from the private sector and NGOs.

Another factor to watch is initiatives by major economies to prevent carbon leakage from trade. The EU is planning to implement a carbon border adjustment mechanism (CBAM), which will place charges on the imports of emissions-intensive goods into the EU. If this initiative goes ahead, and if other countries follow suit, there will be global pressure on economies to implement their own carbon pricing schemes, and there may be more demand for carbon offsets in affected sectors. In summary, the issues surrounding carbon pricing and carbon markets are complex, depending not only on national regulations but also a very fluid international context. The 26th UN Climate Change Conference of the Parties (COP26) is supposed to establish global guidelines for carbon markets under Article 6 of the Paris Agreement, though it remains to be seen whether consensus will finally be reached in Glasgow, or whether Article 6 will need to remain on the agenda for future summits.

Conclusion

For the Haze Outlook 2021 Report, we conclude that there is a low risk of a severe transboundary haze incident in 2021, rated **Green** on a scale of Green, Amber, and Red.

This Report aims to evaluate as accurately as possible the likelihood of severe transboundary haze, but it is not an iron-clad prediction. Indonesia sees some degree of forest and land fires every year, and it is possible that some amount of pollution may impact air quality in the region. The ongoing COVID-19 pandemic, with its associated impacts on the economy as well as haze prevention efforts, also introduces an element of uncertainty. That said, on balance, we see a low risk of a severe, prolonged, transboundary haze incident in the coming months.

It is important to note that this risk assessment is time-bound, and strictly for 2021. In this Report, we note a number of policy shifts in Indonesia and market factors that may increase the risk of fires and haze in future years. Continued action on haze prevention is needed, involving all levels of Indonesia's government from the central to district levels, companies both big and small, and input from NGOs and experts.

The fact that our region is expecting clear skies for the time being should not be a cause for complacency. Rather, we now have a chance to evaluate and strengthen sustainability commitments. There is now increasing awareness of the need to fight climate change. Properly managing Indonesia's forest and peatland ecosystems should be an essential element of climate action. In this context, we welcome moves by the Indonesian government to establish a carbon market. We also welcome moves by Singapore's financial sector, supported by government agencies, to establish a carbon market with an emphasis on carbon credits generated by nature-based solutions in the region. Moving forward, each of these efforts can potentially help increase the efficiency of effort and return on investment in limiting carbon emissions. They can also potentially have positive effects on limiting the danger of severe fires and haze in the future. We hope this Report's analysis of the state of play for nature-based projects in Indonesia is helpful to both businesses and investors interested in the voluntary offset market.

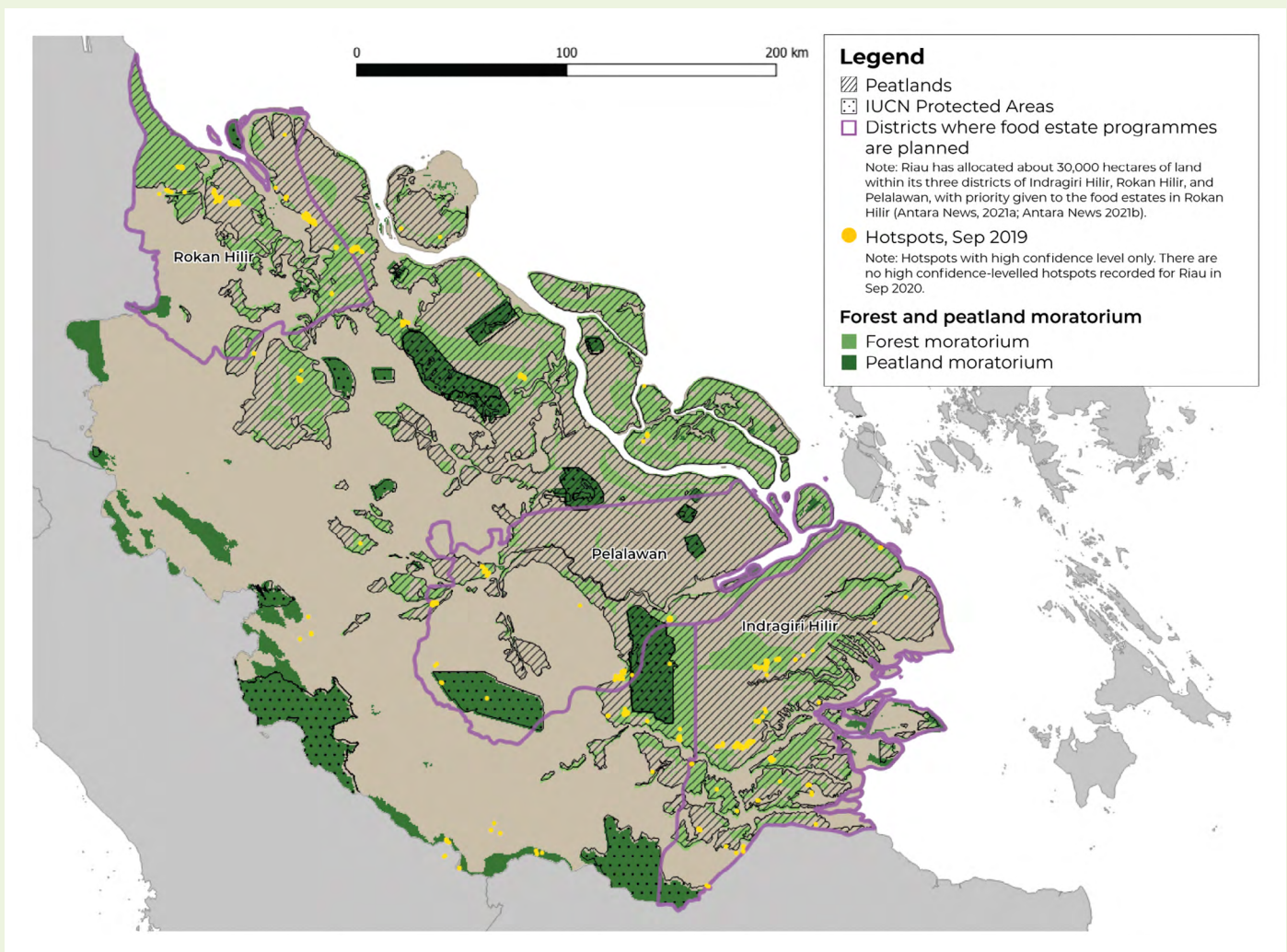
Regional cooperation on fighting the haze and climate change is also crucial. In August 2016, following the 2015 haze crisis, the Association of Southeast Asian Nations (ASEAN) set the goal of achieving a haze-free region by 2020. In a sense, this goal has been achieved, as there was no severe transboundary haze incident in 2020. But in order to ensure that the region remains haze-free beyond 2020, ASEAN must continue to keep sustainability on the regional agenda.

Much in the same way that ASEAN has established an economic community, a political-security community, and a social-cultural community, perhaps a future step for ASEAN would be to create a climate community, recognising the need to speak with a common voice and to increase cooperation on these issues of common concern. A forthcoming report from the SIIA will explore the prospects for bilateral and multilateral climate cooperation in ASEAN.

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Appendix - Case Studies

Figure 8: Riau province



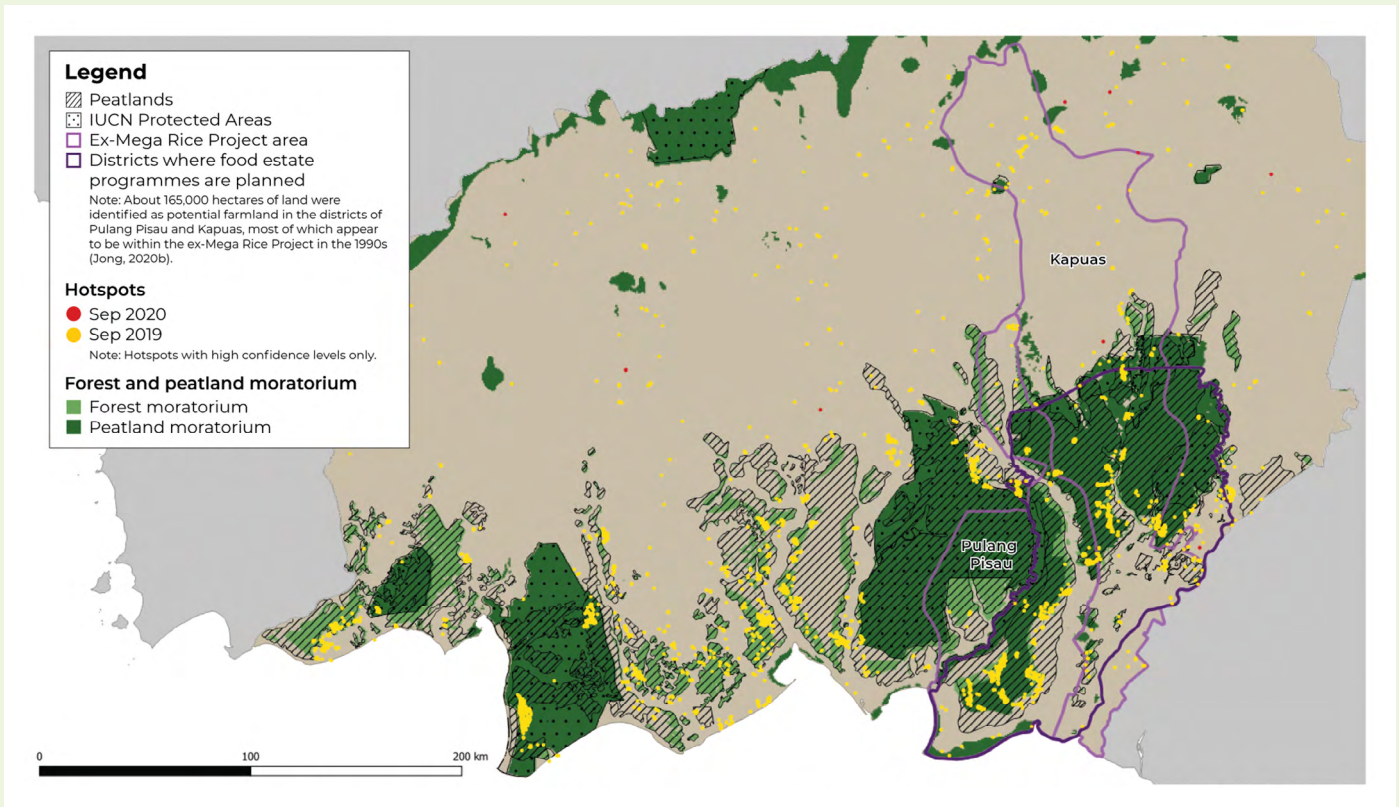
Source: Segi Enam Advisors, based on hotspot data from NASA, peatland locations from Xu et al. (2018), International Union for Conservation of Nature (IUCN) protected area locations from World Database of Protected Areas (2021), moratorium locations from KLHK (2020)

Case Study: Riau

Riau province, along with Jambi and South Sumatra, is thought to have been a major source of haze that affected Singapore and Malaysia in past severe transboundary haze incidents. During the peak of the dry season in September 2019, satellites did detect major groupings of high confidence hotspots in Riau. However, no high confidence hotspots were detected in September 2020. The provincial government of Riau has notably been proactive in launching its own subnational sustainability initiatives, under the umbrella of the “Green Riau” strategy, and these efforts may be bearing fruit.

However, several districts in Riau have been earmarked for the central government’s food estate programme, namely Rokan Hilir, Pelalawan and Indragiri Hilir, indicated in purple on the map. The precise locations of these future food estates are not known, but much of the land within the three districts is currently peatland, protected area, or covered by moratoriums intended to prevent the conversion of forest and peatland into commercial plantations. In Rokan Hilir and Pelalawan, there may still be room for food estates to be established without infringing on these areas, but Indragiri Hilir is mostly peatland.

Figure 9: Central Kalimantan province



Source: Segi Enam Advisors, based on hotspot data from NASA, peatland locations from Xu et al. (2018), International Union for Conservation of Nature (IUCN) protected area locations from World Database of Protected Areas (2021), moratorium locations and Mega Rice Project area from KLHK (2020)

Case Study: Central Kalimantan

Central Kalimantan, West Kalimantan, and East Kalimantan are thought to have been sources of haze in previous severe transboundary haze incidents, with smoke from these provinces more likely affecting Malaysia rather than Singapore due to wind and geographical proximity. Satellites detected major groupings of high confidence hotspots in Central Kalimantan in September 2019 (yellow dots), with sizeable clusters on or around peatland areas. However, relatively few hotspots were detected in September 2020 (red dots).

Central Kalimantan is of particular interest for environmental researchers and conservationists because it is home to the former Mega Rice Project (light purple outline), a government scheme initiated in 1996 that aimed to turn peatland into rice paddies. The project was largely unsuccessful and eventually abandoned, but the process of draining peatland for agriculture left large areas dry and vulnerable to fire, exacerbating the haze problem. The new food estate programme has often been compared to the Mega Rice Project by critics. Two districts earmarked for food security projects under the programme are Pulang Pisau and Kapuas (dark purple outline), and there is some overlap between this area and the old Mega Rice Project zone. Much of the land area in these districts is also currently covered by the government's moratoriums on the conversion of forest and peatland area into commercial concessions.

Appendix - Literature Review: Trends in Research on Fires and Haze

We briefly reviewed recent literature associated with forest and peatland fires in Southeast Asia and found about 150 research papers and articles focused on Indonesia and Malaysia. Similarly to our review for the 2020 edition of this Report, nearly half of these papers are on peatland fires, including discussions on fire management and carbon emissions. Almost a third focused on best practices and management of peatlands; another third was about the social, political, and economic ramifications of peatland burning and the resulting haze. However, we found markedly fewer studies about mapping peatland and hotspot locations compared to our previous review. There were also more papers dedicated to niche topics, including a study on the actual conditions necessary to start a peat fire with a cigarette butt - a situation which has been claimed as a source of accidental fires in previous transboundary haze incidents ([Martin, Agusta, and Palamba, 2020](#)).

A small number of papers exploring the link between the COVID-19 pandemic and land management are beginning to emerge. [Gumilar et al. \(2021\)](#) found that while communication via digital means, e.g. online monitoring systems and social media, has helped significantly in managing forest fires within the Riau province throughout the pandemic, it remains an imperfect substitute to face-to-face communication due to issues including unstable internet connection, participants' shorter attention span during virtual meetings, and the underutilisation of popular social media platforms in Indonesia by official agencies. [Harrison et al. \(2020\)](#) speculated that continued unsustainable management of tropical peatlands could contribute to the emergence of more zoonotic infectious diseases, and also warned that haze pollution from peat fires could increase susceptibility to respiratory ailments in conjunction with COVID-19. In general, the link between zoonotic diseases and deforestation appears to be a trending, and rather controversial, topic among academics and NGOs. For instance, [Morand and Lajaunie \(2021\)](#) suggested a link between vector-borne and zoonotic diseases with forest cover changes and the expansion of oil palm cultivation.

In light of the renewal of the then-BRG's (and now BRGM's) mandate, several papers have discussed the agency's role in Indonesia's peatland restoration efforts and the challenges it regularly faces. [Sarah \(2021\)](#) identified three primary factors inhibiting the BRG from effectively restoring peatlands in industrial plantation forest areas (*hutan tanaman industri* or HTI): (1) conflicts arising from overlapping policies relating to restoration areas between key stakeholders, namely the BRG and KLHK; (2) lack of coordination between central and local governments, resulting in the BRG's activities receiving insufficient support from local governments; and (3) reluctance by local governments to disrupt operations within HTI areas due to economic reasons.

[Hapsari et al. \(2021\)](#) found that since the BRG's inception in 2016, annual hotspot numbers in districts the agency works in has fallen compared to the pre-2015 average, apart from the harsh dry season in 2019. However, the authors cautioned that more research is needed to directly attribute lower fire incidences to the BRG interventions. The same authors noted that while the BRG's programme to provide alternative livelihoods to villagers has been successful, there is a concern that villagers might fall back to unsustainable farming practices, including the use of fire, if support from the programme ends.

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