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**A POLITICAL ECONOMY ANALYSIS OF
THE SOUTHEAST ASIAN HAZE AND SOME SOLUTIONS**

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Abstract

This paper studies the political economy of the Southeast Asian haze and discusses the obstacles that, unless overcome, could prevent a permanent and effective solution to this transboundary pollution problem, which originates in Indonesia. Following a cost-benefit analysis of the problem, the paper takes note of the weaknesses in Indonesia's governance structure, which make it difficult to enforce national policies aimed at curbing the haze problem. It also puts forward a number of suggestions for strengthening the current policy regime for tackling the problem.

The author is a Fellow of the Econometric Society. His work has been published in *Econometrica*, *Review of Economic Studies*, *Journal of Economic Theory*, *Journal of Public Economics* and other leading economics journals as well as in the popular media, including *the Economic and Political Weekly*, *The Straits Times* and *The Hindu*. He is on the editorial board of several international journals. He has been a visiting professor at the California Institute of Technology, Johns Hopkins University, University of Pennsylvania, Vanderbilt University and many other institutions. He was formerly head of the Department of Economics, National University of Singapore, and of the Indian Statistical Institute, New Delhi. He is currently Professor and Executive Director of the Centre for Environmental Economics and Climate Change at the Jindal Global University.

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1. Introduction

The Southeast Asian haze is a major environmental problem facing not only Singapore but also the region and the world. The purpose of this paper is to study the political economy of this problem and take note of the obstacles that, unless overcome, may prevent a permanent and effective solution. The paper also puts forward a number of suggestions for strengthening the current policy regime for solving the problem.

The immediate causes of the Southeast Asian haze are clear and well known. Indisputably, the haze stems from the use of fire to burn agricultural residue and clear forest and peatland for both large plantations and small farmers, mainly on the Indonesian islands of Sumatra and Kalimantan and in some parts of Malaysia. Fires also sometimes occur as a result of vandalism and accidental ignitions in these parts. The winds transport the smoke from fires most frequently to Singapore and Malaysia and sometimes also to Brunei and Thailand.

It is widely believed that the El Niño weather phenomenon exacerbates the haze problem¹ either because of drier conditions allowing fires to escape and burn out of control or because farmers take advantage of the dry weather and clear more land than usual². Indeed, all major outbreaks of the Southeast Asian haze from 1960 to 2016 occurred in El Niño years;³ there is no evidence of haze occurrence before 1960. Although the region experienced episodes of haze as early as in 1972–1973 and 1982–1983, it was viewed as a serious pollution problem only in 1997–1998, when Singapore and Malaysia were affected by it for two months. The most recent episode of the Southeast Asian haze was in 2015–2016. The haze did not occur in 2016–2017 as that was not an El Niño year and peatland areas were neither dried out nor on fire. But it might occur again with full force in 2017–2018, with the dry season expected to make a return.⁴

As I will argue below, the Southeast Asian haze is mainly a problem for Indonesia that becomes worse and spills over to Singapore and Malaysia in El Niño years. Emphasising this fact in discussions and negotiations through the institutions and mechanisms of the Association of Southeast Asian Nations (ASEAN) can better convince Indonesia that the main beneficiaries of measures to prevent and control

¹ (a) Spessa, A. C. et al., "Indonesia at Risk from Huge Fires Because of El Niño," *The Conversation*, June 17, 2015.
(b) Marlier, M. E. et al., "Fire Emissions and Regional Air Quality Impacts from Fires in Oil Palm, Timber, and Logging Concessions in Indonesia," *Environmental Research Letters*, August 12, 2015.

(c) Yirka, B., "Largest Indonesian Fires Linked to El Niño Events," *Phys.Org*, August 2, 2016.

(d) World Bank, "Indonesia's Fire and Haze Crisis," November 25, 2015.

² (a) Field, R.D. et al. and S.S. P. Shen, "Predictability of Carbon Emissions from Biomass Burning in Indonesia from 1997 to 2006," *Journal of Geophysical Research: Biogeosciences* 113 (2008). Doi: 10.1029/2008JG000694.

(b) Van der Werf, G.R. et al., "Global fire emissions and the contribution of deforestation, savanna, forest, agricultural, and peat fires (1997–2009)," *Atmospheric Chemistry and Physics*, 10 (2010).

(c) Reid, J. S. et al. (2012), "Multi-Scale Meteorological Conceptual Analysis of Observed Active Fire Hotspot Activity and Smoke Optical Depth in the Maritime Continent," *Atmospheric Chemistry and Physics*, 12 (2012).

³ See for example Gaveau D. L. A. et al., "Major Atmospheric Emissions from Peat Fires in Southeast Asia during Non-Drought Years: Evidence from the 2013 Sumatran Fires", *Scientific Reports*, August 19, 2014. pp.1-7.

⁴ Jong, H.N., "Government Sets Ambitious Targets of Reducing Forest Fires by Half," *The Jakarta Post*, December 17, 2016.

fires will be its own people and economy, not the people and economies of its neighboring countries.⁵ Accordingly, this paper focuses mainly on what Indonesia could do to tackle the Southeast Asian haze. However, this does not mean that the Southeast Asian haze is not a major environmental problem for Singapore and the rest of the region or that Singapore has no role to play in tackling the problem. In fact, this paper also considers what Singapore could do, for its part.

1.1 The damage

The Asian Development Bank has estimated regional business losses from the 1997–1998 fires and resulting haze at over US\$9.0 billion. This is in addition to loss of biodiversity, reduced agriculture productivity, contribution to global warming and loss in reputation and goodwill. The damage suffered by Singapore has been estimated by Quah⁶ to be US\$163.5–286.2. For Malaysia, it was estimated to be about US\$800 million. Thus, about 90 per cent of the estimated US\$9.0 billion business losses were borne by Indonesia alone. The financial damage to the region's economy from the most recent episode of the Southeast Asian haze in 2015–2016 is still being counted. Although estimates vary, none of them is below US\$16 billion; the Indonesian government's own estimates suggest it could be as high as US\$47 billion,⁷ a huge loss for the Indonesian economy. The variance in estimates depends on coverage of losses and the methodology used. For example, while some estimates may ignore loss in welfare if schools had to be closed for a few days because of the heavy haze others may assign a monetary value to the loss and include it. The monetary value of losses from, say, the closing of schools for a few days can be quite subjective as there is no unique method for assigning a monetary value to non-financial losses. Thus, the estimates of the damage from the haze may vary both because of differences in coverage and lack of a universally-accepted methodology for assigning monetary value to non-financial losses.

1.2 The types of land cleared by the use of fire

Fire is used to clear land in preparation for agriculture or planting because it is the cheapest and fastest method to do so. There are broadly two types of land that are cleared in this way:

- (A) Land with leftover from logging or old crop.
- (B) Peatland.

As will be seen, the distinction between the two types of land is extremely important. It is worth noting in this regard that peatland is an area where organic material such as leaves and twigs had accumulated naturally under waterlogged conditions in the last 10,000 years. This layer of organic material, known as

⁵ Judging from his recent statements and policy pronouncements, President Joko Widodo ("Jokowi") already seems to be convinced of this fact, but the wider Indonesian political leadership may still need some convincing.

⁶ Quah, E., "Transboundary Pollution in Southeast Asia: The Indonesian Fires," *World Development*, vol. 30 (3), 2002. pp 429-441.

⁷ Balch, O., "Indonesia's Forest Fires: Everything You Need to Know," *The Guardian*, November 11, 2015. Retrieved from <https://www.theguardian.com/sustainable-business/2015/nov11/indonesia-forest-fires>

peat, can be up to 20 metres deep. Excessive drainage in peatland by constructing drainage canals can dry out its top layer, which, owing to its high carbon content, is highly susceptible to burning, especially during the dry season. Clearing peatland by non-fire methods and preparing it for agriculture or planting is obviously more difficult as well as more costly than clearing non-peatland.

2. A Cost-benefit Analysis of the Southeast Asian Haze

Using fire is not the only method by which land can be cleared. Type A land can be cleared also by machines and chemicals. This method of clearing Type A land can cost up to US\$200 per hectare⁸ while using fire costs US\$5 per hectare. In contrast, clearing peatland by methods other than using fire is a lot more costly. Specifically, the cost of clearing drained and logged peatland with chemicals such as limestone as well as fertilisers and pesticides is about US\$2000–3000 while clearing it by using fire may cost only US\$200 per hectare.⁹ Although there have been few studies that have estimated the cost of clearing the two types of land by alternative methods, it is evident from the two studies mentioned that the cost advantage of clearing peatland by using fire is far greater than that of clearing non-peatland by fire.

As with the estimates of the cost of clearing land by alternative methods, not much information is available regarding the amount of land actually cleared by fire for agriculture or planting in 1997–1998. However, an indirect estimate can be made for the most recent episode of haze in 2015–2016, since an estimate is available of how much land in total was on fire in 2015–2016, i.e. less than 2.6 million hectares.¹⁰ This figure includes land that had been cleared previously and was already under agriculture or plantation use but was on fire unintendedly. Nonetheless, we shall use this figure for a cost-benefit computation. Less than half of the 2.6 million hectares that was on fire was of Type B (i.e. peatland). Using the average of the cost estimate (i.e. US\$2500 per hectares) of clearing peatland without using fire, it follows that the use of fire to clear land in 2015–2016 could have saved the Indonesian farmers and plantations at most US\$3 billion in costs of clearing land. This is a miniscule amount compared to the damage incurred of US\$47 billion, by the Indonesian government's own estimates as noted above. Even after allowing for errors in the estimates of the cost for clearing land without use of fire, the damage to the Indonesian economy alone from the 2015–2016 haze is far greater than the benefits to Indonesian farmers and plantations.

Although the relationship between the level of haze (assuming that it can be measured) and the resulting damage incurred is not linear, basic economic principles and the above estimates imply that Indonesia as a whole will be better off if it reduces the haze at least to a level where the damage to the Indonesian economy will be no more than US\$3 billion, compared to the US\$47 billion in 2015–2016. In other words, even after allowing for a non-linear relationship between the level of haze and the damage incurred,

⁸ Varkkey, H., "Patronage Politics, Plantation Fires and Transboundary Haze," *Environmental Hazard* 12 (2012), pp 200-217.

⁹ Tempo.co, July 1, 2013.

¹⁰ World Bank, "The Cost of Fire: An Economic Analysis of Indonesia's 2015 Fire Crisis," February 1, 2016. Retrieved from <http://documents.worldbank.org/curated/en/776101467990969768/pdf/103668-BRI-Cost-of-Fires-Knowledge-Note-PUBLIC-ADD-NEW-SERIES-Indonesia-Sustainable-Landscapes-Knowledge-Note.pdf>

balancing the damage and benefits from the haze for Indonesia requires the country to scale down the haze drastically,¹¹ perhaps to the same level as in the 1960's.

The cost-benefit analysis above also shows that there is no conflict of interests between Indonesia, Singapore and Malaysia. All three have incentives to cooperate and help drastically reduce the Southeast Asian haze, as they will each be better off. Indonesia will be better off because the reduction in the haze will lessen the damage to its people and economy more than the forgone benefits to its farmers and plantations; Singapore and Malaysia will be better off because they will no longer suffer from the haze. This means that the ASEAN Agreement on Transboundary Haze or simply the "haze treaty" has the basic characteristics of a good treaty in the sense that its effective implementation will make all countries, including Indonesia, better off. This is true irrespective of whether or not Singapore and Malaysia make financial transfers to Indonesia. I had previously advocated financial transfers from Singapore and Malaysia to help Indonesia meet part of its cost of reducing the haze. But the cost-benefit analysis above shows that Indonesia would be better off even if it receives no transfers from Singapore and Malaysia. That said, financial and technology transfers from Singapore and Malaysia that are less than the damage they each would have been spared may provide stronger incentives to Indonesia to reduce the haze and still make all three countries better off. Yet, limited progress has been made in reducing the Southeast Asian haze.¹² What could be the reasons?¹³

3. Governance Structure and Implementing Policies

Ratification of the ASEAN haze treaty by Indonesia in 2014 had raised hopes for a solution to the Southeast Asian haze problem. But these hopes have been dashed. This is not because Indonesia does not intend to abide by the treaty, but because despite its best intentions and efforts it has not been able to successfully enforce land and forest policies designed to meet the terms of the treaty. In particular, Indonesia's Environment and Forestry Ministry does not have the power to enforce national laws regarding land and forest fires. It is dependent on provincial governors and local district-heads to monitor and ensure compliance with national laws and policies on the ground.

Most theorists and many policy experts take for granted the ability of a government to implement its policies and programs. But this is not always the case. A look at the governance structure in Indonesia can help us better appreciate this point. Table 1 below shows that Indonesia has a highly decentralised governance structure, with five different levels of government. This structure often leads to conflict and

¹¹ A diagrammatic exposition of this argument can be found in the Appendix.

¹² (a) World Bank, "The Cost of Fire: An Economic Analysis of Indonesia's 2015 Fire Crisis," op. cit.
(b) Purnomo, H. and B. Shantiko, "The Political Economy of Fire and Haze: Root Causes," *Discussion Forum: Long term Solutions to Fires in Indonesia: Multi-Stakeholder Efforts and the Role of Private Sector*, Global Landscape Forum, Paris, 2015.
(c) Tan, T.S., "The Indonesian Transboundary Haze Pollution," *Economics & Society*, Economic Society of Singapore, Vol. 1, (2016). pp 16-21.

¹³ For those familiar with environmental economics, it is worth noting that the situation described above does not fit the classic Coasian case of a polluter and a victim of pollution, since in this case the polluter is also a victim of his own pollution, but still pollutes more than the amount that is optimal for it. It is a case of not only market failure but also government failure.

passive opposition to the central government's policies and programmes. While the Environment and Forestry Ministry has powers to make national policies regarding land and forest use, the authority to enforce them lies with the *bupatis* (heads of regency) or *walikotas* (mayors). The latter are entrusted with the responsibility of generating income for local development and have little incentive to conserve forests and peatlands in accordance with national policies as they see land and forest resources as a major source of profits and local revenue.¹⁴ The financial and political benefits from allowing business to proceed as usual exceed those from following national policies decided by authorities thousands of miles away who have limited capacity to verify what is actually happening on the ground.¹⁵

Table 1: The current governance structure in Indonesia

Level	Head of administration	Number
Central [<i>Central</i>]	President [<i>Presiden</i>] (elected)	1
Province [<i>Provinsi</i>]	Governor [<i>Gubernur</i>] (elected)	34
Regency & City [<i>Kabupaten & Kota</i>]	Regent & Mayor [<i>Bupati & Walikota</i>] (elected)	416 & 98
District [<i>Kecamatan</i>]	Head of district [<i>Camat</i>] (appointed)	7,160
Village [<i>Desa & Kelurahan</i>]	Chief [<i>Kepala desa/kepala lurah</i>] (Kepala desa: elected; Kepala lurah: appointed)	83,184

Source: OECD Economic Surveys: Indonesia 2016 (OECD, 2016: p.60)

In addition, obtaining local authority by winning local elections is highly lucrative as it provides access to central government funds and power to hand out licences to businesses in the mining and agriculture sectors. Thus local authorities often buy votes for their re-election by giving land (or the right to use land) to local voters—often through the village heads, who then distribute the land among local residents.

¹⁴ Jotzo, F. A., "Decentralization and Avoiding Deforestation: The Case of Indonesia," in *Federal Reform Strategies*, eds. S. Howes and M.G. Rao, Oxford University Press, 2013. pp. 273-301.

¹⁵ Henda, B., "Despite Tough Talk, Indonesia's Government is Struggling to Stem Deforestation", *The Economist*, November 26, 2016. Also, for a detailed study of how the decentralised governance structure may impede implementation of Indonesia's national government policies for controlling haze, see Purnomo, H. and B. Shantiko, op. cit.

Confirming this practice, Purnomo¹⁶ notes that over the last decade forest fires tended to spike prior to and just after local elections. Weak enforcement of laws generally provides further support to this practice.

The following example from another developing country that also has a decentralised governance structure, leading to unresolved pollution problems may help us better appreciate the obstacles in policy implementation. This is not to justify the Indonesian government's failure to enforce policies, but to understand the causes of failure and suggest possible remedies.

3.1 The haze in India's Punjab province

Small farmers in the primarily agricultural province of Punjab every year clear and prepare land for the next crop by burning agricultural residue (stubble) from the preceding crop. There is just a small window of about one month between the two crop cycles, during which time the land has to be cleared and prepared for sowing. So, all farmers undertake the burning around the same time. The smoke generated from the burnings drifts downwind and causes a haze in densely populated cities in the national capital region. Although the practice has been banned, it continues unabated every year. Since most of the farmers are poor small-scale landowners who cannot afford to switch to more costly mechanical methods other than fire to clear land during a small window of time, the practice of using fire to clear land is not viewed with disapproval by the village communities in which they live. Government officials are afraid to enter the villages and impose fines. Also, they do not feel that it is morally correct to impose fines on poor, small-scale farmers who cannot afford to use more costly methods to clear land.

In fact, not imposing fines for violation of the ban on fires suits government officials as the elected local government does not want to appear to be on the wrong side of such farmers, given their large numbers as voters.¹⁷ This is all the more so because a large number of would-be voters stand to benefit from the practice,¹⁸ while the damage is suffered mostly by people far away who are not eligible to vote in the local elections. The people in the national capital suffer from the haze, but the central government, which is housed in the national capital, has little leverage over the provincial government—elected and empowered by the constitution to enforce national policies and laws on the ground—to stop the practice. In these circumstances the only policy that may work, if at all, is a subsidy for using mechanical methods that do not use fire to clear land and a fine for using fire. Given the divergence of incentives between the central and the provincial governments, the subsidy will have to be clearly financed by the central government.

¹⁶ Purnomo, H., "Forest Fires & Haze: Link between Indonesia's Local Elections and Fires," *Indonesia Investments*, November 12, 2015.

¹⁷ Last year the Punjab state government tried to clamp down on the practice. It slapped fines on farmers, leading to agitation in the province. The drive had to be slowed down, if not abandoned.

¹⁸ Most political parties believe they will be voted back to power if they can deliver benefits to the voters.

4. The Crux of the Problem

Fires on peatland (i.e. Type B land) burn much longer and produce more smoke than fires in non-peat areas. They have been estimated to be the source of 90 per cent of the Southeast Asian haze.¹⁹ They also release far greater amounts of greenhouse gases that are responsible for climate change. In fact, during the 2015–2016 episode of the Southeast Asia haze fires on peatlands in Indonesia released more greenhouse gases than released, for instance, by Germany in a year.

This raises the question: how much of the peatland in Indonesia has been already cleared and how much is left that potentially may be cleared and developed for agriculture or planting in future years? If there is not much left, then the Southeast haze may occur, at most a few more times, if at all. In that case, there is no need to spend energy and resources for solving a problem that is soon going to die out on its own. But, unfortunately, this is not the case. Currently, Indonesia has 16.9 million hectares of peatland, of which 2.4 million hectares have been already drained and, unless rewetted, may be cleared and developed for agriculture or planting in the years to come or may catch fire accidentally. To appreciate the implications of this fact from a policy point of view, Table 2 summarises the spatial distribution of the remaining peatland in Indonesia.

Table 2: Spatial distribution of remaining peatland in Indonesia

No	Region	Original size (ha)	Remaining (ha)	Protected (ha)
1	Sumatra	7,282,000	4,613,000	341,000
2	Kalimantan	4,413,000	3,531,000	257,000
3	Sulawesi	44,000	34,000	--
4	Maluku	48,000	42,000	1,000
5	Irian Jaya	8,910,000	8,753,000	1,882,000
Total		20,697,000	16,973,000	2,481,000

Sources: (i) Silvius, M.J. et al. *The Indonesian Wetland Inventory: A Preliminary Compilation of Existing Information on Wetlands of Indonesia, Vol. I and II*. Bogor, Indonesia: PHPA, AWB/Interwader & Edwin, 1986.

(ii) International Mire Conservation Group. Retrieved from http://www.imcg.net/media/download_gallery/gpd/asia/indonesia.pdf

The huge amounts of the remaining peatland in Sumatra and Kalimantan, as seen from Table 2, are of greater concern for Singapore, since Singapore is most affected by the haze generated by fires in these regions. Although Indonesia has now issued a blanket ban on clearing peatland by use of fire and is making efforts to conserve and protect these peatlands, their existence is a risk and a potential environmental threat for the region and the world. It remains to be seen whether the Indonesian government will be able to enforce the ban effectively and protect and conserve the peatlands permanently. There are many risks. For one, the political environment and leadership in Indonesia may

¹⁹ Global Environment Center, Technical Workshop on the Development of the ASEAN Peatland Fire Prediction and Warning System, Kuala Lumpur: ASEAN Peatlands, 2010.

change and there may no longer be the same enthusiasm to enforce the ban. Another risk is climate change that, despite best efforts, may lead to the drying out of peatland areas, making them more prone to fire.

In sum, keeping the Indonesian peatland areas free from fire and protecting and conserving them forever is the key to stopping the Southeast Asian haze. Fires in non-peat areas are much less damaging and more easily controlled. Also, clearing non-peat areas using excavators or machines and chemicals is far less costly. Thus, a ban on using fire in non-peat areas is less difficult to enforce. A policy of subsidies for compliance and fines for violation of the ban on fires in non-peat areas can prevent farmers and plantations from using fire to clear land in these areas.

5. A Review of the Current Policies

Delays in the rectification of the haze treaty and failure of Indonesia to effectively combat the Southeast Asian haze led Singapore to seek solutions of its own. In pursuit of these solutions, it has passed the Transboundary Haze Pollution Act, designed to punish Singapore-domiciled companies or companies listed on the Singapore Stock Exchange that are engaged in agriculture and palm oil-related production and either directly contribute to the Southeast Asian haze or condone similar activities by their associates in the supply chain.²⁰ The Act has had some impact. A number of companies facing prosecution under the Act have become cautious. But it is too early to say how much difference the Act will make in reducing the haze. Ambiguities in Indonesia's official land ownership or user rights records make it difficult to effectively apply the Act.²¹

As the Southeast Asian haze made a return in 2015–2016, even after Indonesia had ratified the haze treaty in 2014, there was much anger on the ground in Singapore, and consumers were urged to boycott products from companies that used fire to clear land for agriculture or planting. Although the financial impact of such boycotts on companies is not huge as Singapore's consumption of paper and palm oil constitutes a small proportion of global demand, the boycotts can nevertheless deter companies from contributing to the haze as they would not want to risk bad press and lose goodwill. Singapore also has a Green Labelling scheme that certifies eco-friendly products. However, this certification is only for products to be sold in Singapore.

Similarly, Indonesia has instituted mandatory certification schemes such as the Indonesian Sustainable Palm Oil initiative, the Roundtable on Sustainable Palm Oil, and the Indonesian Palm Oil Pledge. But these schemes face challenges owing to exemptions for smaller producers and ambiguities in official records of land ownership or user rights.

²⁰ Attorney-General's Chambers (Singapore), Transboundary Haze Pollution Act, 2014. Retrieved from <http://statutes.agc.gov.sg/aol/search/display/view.w3p?page=0;query=CompId:113ccc86-73fd-48c9-8570-650a8d1b7288;rec=0>.

²¹ Tan, T.S., "The Indonesian Transboundary Haze Pollution," *Economics & Society*, Economic Society of Singapore, Vol. 1, (2016). pp. 16-21.

Indonesia has a so-called “two hectares” policy that grants each head of family or a new migrant user rights over two hectares of land. Although the two hectares policy was initiated as part of a poverty alleviation programme, it has been misused as mid-level plantation companies could simply employ some of the locals to claim two hectares each and then combine these small patches together to form one large area for development and planting. It has been estimated that village heads and land claimants can extract benefits of up to US\$856 per hectare if they clear the land using fire²² and then surrender their ownership or user rights to plantation companies. Thus, despite a blanket ban on fires, the two hectares policy provides strong incentives to clear the two hectares by fire, in violation of the ban.

Indonesia has recently created a Peatland Restoration Agency (BRG), which is tasked with restoring up to 2.4 million hectares of damaged peatland as well as blocking drainage canals to prevent peatland from drying out. Re-wetting dried out peatland costs US\$1000 per hectare.²³

The Indonesian government has recently unveiled a new strategy that focuses on preventing fires from happening as the cost of preventing fires is one fifth of the cost of putting them out.

6. Policy Recommendations

The recommendations here are aimed at strengthening the current policy regime and making it more effective.

In the case of Singapore, the aforementioned consumer boycotts can be made more effective if the names of the companies boycotted are publicised not just in the domestic media but also in the international media. This is because preference for environment-friendly companies has increased among consumers globally. In fact, there is ample theoretical and empirical evidence that consumers are willing to pay more for authentic eco-labelled products because of a general concern for the environment globally.²⁴ Additionally, Singapore has a 20 per cent share of the global trade in agricultural commodities, and much of the region’s supply of palm oil, timber, and pulp and paper is traded through Singapore. Furthermore, Singapore institutions are reputed to be less corrupt and accountable. Thus, consumers across the world are more likely to consider agriproducts and intermediates eco-labelled by a Singapore agency—that could be set up for this purpose—to be authentically environment-friendly. The possibility of selling products at higher prices globally can provide strong incentives to large plantations and pulp and paper companies in Indonesia and the region to follow fire-free practices so that their products can earn eco-labels from the proposed Singapore agency. Building a reputation for authenticity could be a slow and consuming process, but it can bring long-term economic gains to Singapore besides helping to curb the Southeast Asian haze. An added advantage is that, unlike the Transboundary Haze Act, which requires Singapore authorities to prove violations in Singapore courts, the companies seeking eco-labels

²² Purnomo, H., op. cit.

²³ Jong, H.N., op. cit.

²⁴ See for example Chander, P. and S. Muthukrishnan, “Green Consumerism and Pollution Control,” *Journal of Economic Behavior and Organization*, vol. 114 (2015). pp 27-35.

for their products will themselves have to provide verifiable information regarding land ownership or user rights.

Indonesia has already imposed a blanket ban on the use of fire to clear land. This ban stems from its recognition that preventing fires in peatland areas is crucial for controlling the Southeast Asian haze. Thus, Indonesia ought to take all possible measures to prevent fires, especially on peatland and in areas near peatland. For this, the BRG may be given more powers and funds to enforce the ban. In particular, it may be given powers to prosecute and fine violators of national laws to preserve peatlands.

But despite preventive measures, fires may happen accidentally. Thus, there would still be a need to create infrastructure for timely identification and suppression of accidental fires on peatland and in nearby forest areas. It has been reported that small farmers and plantations can get around the blanket ban by deliberately setting the adjoining areas on fire and claiming them to be accidental. To discourage this practice, no agriculture or planting should be allowed on land that has been burnt accidentally or claimed to have been so. Such land could be taken over as government land and left fallow for trees and vegetation to grow on it naturally or used for other public purposes. Such a policy backed by an appropriate law will de-incentivise the practice of burning land and lead to fewer fires.

In pursuance of efforts to control the Southeast Asian haze, Indonesia has now stopped the practice of releasing new forest land to oil palm and timber plantation companies. But for a number of reasons it may be difficult to sustain this freeze for long. In particular, since Indonesia is a major producer of palm oil, timber, and pulp and paper and the international demand for these products is rising, their international prices may rise if Indonesia's production and supply remains stagnant for a long time. A rise in prices will give stronger economic incentives and lead to domestic political pressures on the Indonesian government to release more forest and peatland for oil palm plantations and timber and pulp and paper companies. This is highly likely because palm oil continues to be a strategic industry (worth an estimated US\$18 billion) for the promotion of Indonesia's export growth, and there is also a powerful lobby in Indonesia that favours the growth of the industry at any cost. In addition, poverty alleviation remains an important goal and programme of Indonesia. Thus, it may not be politically viable for all future Indonesian governments to resist releasing more land under the two hectares policy. How can these additional demands for land be met without compromising the blanket ban on fires?

Given the weaknesses in governance and law enforcement and the huge cost advantage of clearing land by the use of fire, the current policy of leaving decisions on the clearing of new land released to the discretion of the recipient plantations or small farmers in effect amounts to inviting and tempting them to clear the land by using fire. This needs to change. Thus, to meet the demand for additional land, an agency, similar to the BRG, could be created and given the responsibility of clearing earmarked forest and peatland for agriculture or planting by using chemicals and land-clearing machinery. Over time, the agency could build a land-bank by clearing earmarked forest and peatland areas without using fire. Only land from this land-bank could be released to plantation companies or small farmers. No land that has not

been cleared by this agency should be released to plantation companies or small farmers. The cost of clearing the land mechanically before it is released to plantation companies may be recovered from the recipient companies. The agency could also be mandated and financially supported to innovate and improve existing technologies for clearing land without using fire. To realise economies of scale in clearing land, the services of the agency, after it has built up sufficient capacity to clear land mechanically, could be made available to existing plantations on a cost-plus basis.

The BRG is currently preparing a detailed zonal mapping of fire-prone peatland areas in seven provinces of Indonesia that had been suffering from annual fires. In the same vein, it may be useful to also develop a forward-looking map that identifies peatland areas that are likely to become dry in future and would be difficult to keep wet as climate change becomes stronger and water levels drop significantly owing to deficient rains. Since these peatland areas will become prone to fire in the near future, they could be earmarked for clearing by the proposed agency and included in the proposed land-bank after clearing.

In addition to creating a land-bank, the need for additional land for the growth of the palm oil industry and agriproducts may be minimised by raising the productivity of existing plantations and agriculture farms. Easy availability of fertilisers and pesticides can help in this regard. Additionally, easy availability of fertilisers and pesticides may discourage the practice of “shifting agriculture” that is prevalent among Indonesian farmers.

Since, the Southeast Asian haze cannot be stopped without preventing fires in peatland areas, as noted above, and the current Indonesian political leadership and government seems to have not only realised this but is also determined to protect and conserve peatland areas, it might be an opportune time to propose an ASEAN treaty to conserve and protect peatlands in all ASEAN countries. Funds for implementing the treaty may be sought under the provisions of the Paris Agreement on Climate Change and/or the U.N. initiative on Reducing Emissions from Deforestation and Forest Degradation in Developing Countries (REDD+). For a start, Norway has already promised US\$1 billion to Indonesia as part of this U.N. initiative.²⁵

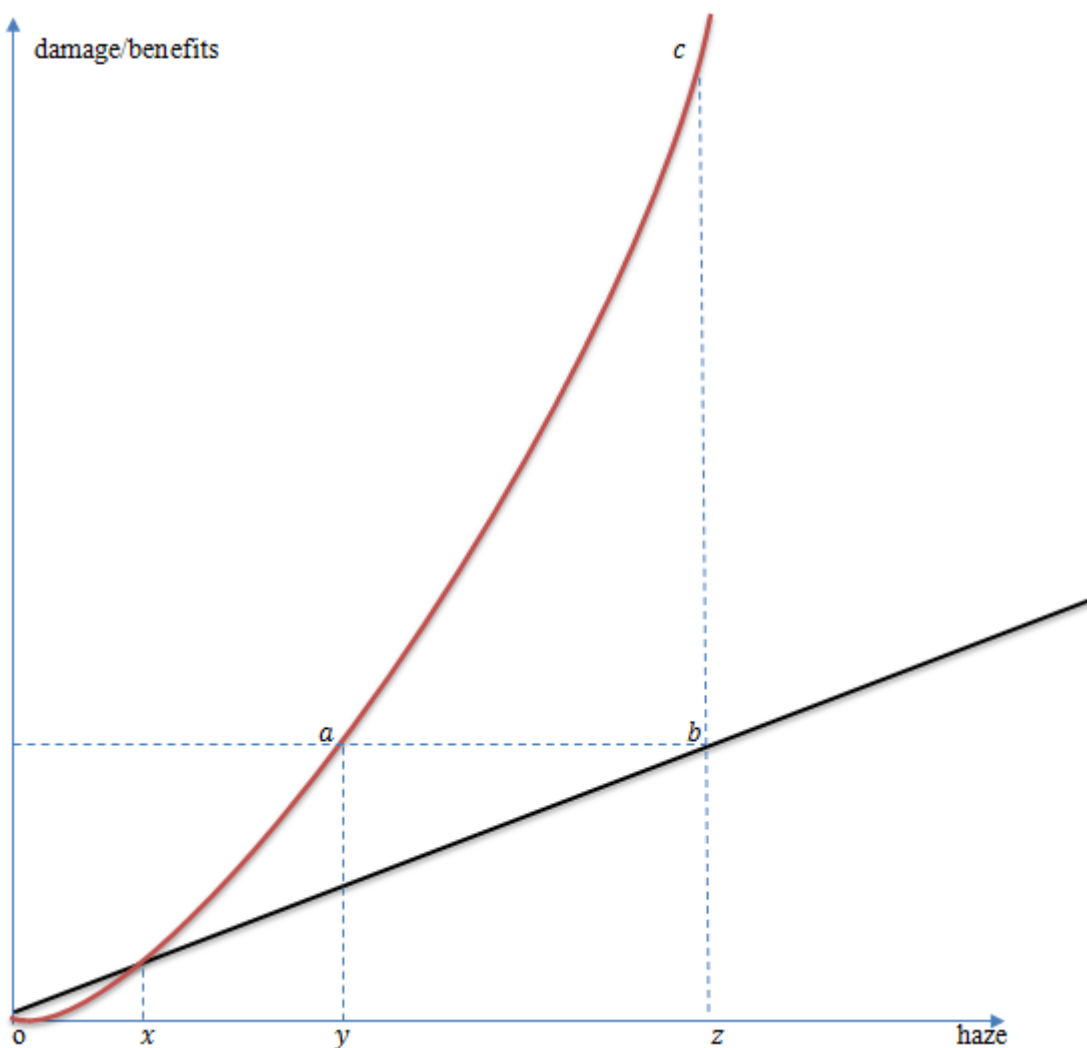
²⁵ A similar pledge to Brazil in 2008 accelerated a precipitous drop in the deforestation of the Amazon.

Appendix

The red curve in Figure 1 represents the damage wrought by the haze as a function of the level of haze caused by fires to clear land. As in reality, the damage is shown to rise more than proportionally with the level of haze. Similarly, the black line represents the benefits (i.e. the cost saved) from the haze. They are shown to rise linearly with the level of haze. But the same arguments can be shown to hold also if the benefits rise less than proportionally with the level of haze.

Since the optimal level of haze, by definition, is the level that maximises benefits minus damage, x is the optimal level. But since, as noted above, the damage from the current level of haze is higher than the benefits, the current level of haze, z , is shown to be higher than the optimal level, x . The area of triangle abc represents the amount of damage over and above the benefits if the current level of haze, z , is reduced to y such that damage is reduced and is equal to the benefits from the current level of haze, z

Figure 1: Gains for Indonesia from reducing the haze



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