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Plantation Land Management, Fires and Haze in Southeast Asia

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ABSTRACT

Forest fires and its resulting haze has been a recurring transboundary environmental problem in Southeast Asia. This research paper shows the strong correlation between the opening of plantation land in Indonesia and Malaysia and fires that cause haze. It argues that commercial plantations contribute significantly more to open burning fires than small-scale slash-and-burn farmers. It shows that economic motivation and governmental encouragement has motivated commercial plantations, especially for oil palm, to open land on fire-prone peatland and old cropland, producing smoke that often travels across borders. This has contributed to and exacerbated the transboundary haze problem in the region. This paper discusses two types of land use change often employed in Indonesia, and to a lesser extent Malaysia, for conversion into oil palm plantations, and how they are linked with increase in fires: conversions of pristine peatlands, and of degraded logged-over forests and old cropland.

Key words: peatland, plantations, oil palm, forest fires, open burning, land clearing

ABSTRAK

Pembakaran hutan dan jerebu merupakan isu pencemaran rentas sempadan yang berlarutan di Asia Tenggara. Artikel ini menunjukkan hubungkait yang jelas di antara pembukaan tanah di Indonesia dan Malaysia dengan asap pembakaran yang menghasilkan jerebu. Ia menyatakan bahawa ladang komersil melakukan lebih banyak pembakaran berbanding dengan pertanian pindah. Ia menjunjukkan bahawa dorongan ekonomi dan pihak kerajaan telah menggalakkan syarikat perladangan, khususnya kelapa sawit, untuk membuka tanah di kawasan yang senang terbakar seperti tanah gambut dan ladang terbiar. Pembakaran ini menghasilkan asap yang merentasi sempadan dan menyumbang kepada masalah pencemaran teruk di rantau ini. Artikel ini membincangkan dua jenis pembukaan tanah yang sering digunakan di Indonesia dan Malaysia untuk menanam kelapa sawit, dan bagaimana ianya berkait dengan pembakaran: penggunaan tanah gambut asli, dan hutan yang telah dibalak dan lading terbiar.

Kata kunci: tanah gambut, perladangan, kelapa sawit, kebakaran hutan, pembakaran terbuka, pembukaan tanah

INTRODUCTION

Forest fires in Southeast Asia have been extensively recorded since the 19th century (Eaton & Radojevic 2001: 2), particularly in Indonesia and to a lesser extent other heavily forested countries like Malaysia and Thailand. Indonesia experienced severe conflagrations, especially in the provinces of Kalimantan and Sumatra, since 1982, when 3.6 million hectares of tropical forests were destroyed. At the time, these fires were described at the worst fires the world had ever seen, and was dubbed the ‘Great Fire of Borneo’(Dennis 1999). Forest fires again razed Indonesia in 1987 (*Jakarta Post* 1987). However, the extent of the fires in 1997-1998 was the worst Indonesia had seen in 50 years (*Jakarta Post* 1998). These fires resulted in an estimated 10 million hectares burned around Indonesia (Applegate et al. 2002: 296-297; *Jakarta Post* 2009; Mayer 2006: 202-203; Othman 2003: 244-245), destroying forests and bushland, including conservation areas and national parks (Dauvergne 1998: 13-17). Forest fires have severe impact on the surrounding environment, affecting biodiversity, the natural hydrological cycle, the microclimate, and of course air quality due to smoke (Purbowaseso 2004: 40; Sudarmo 1985: 170). It was estimated that during the 1997-1998 fires, 2.5 million tonnes of carbon dioxide was pumped into the atmosphere as well (Koh 2008: 225).

FROM NATURAL TO MAN-MADE: PLANTATIONS AND FIRES

It is widely accepted that the 1997 haze around the Southeast Asian region, and the other haze events following that, was caused by smoke coming from large-scale burning for land clearance and conversion (Applegate et al. 2002: 292; Colfer 2002: 311; Othman 2003: 244-245; Tan et al. 2009: 422). Individuals interviewed for this research paper explained that while the cyclical *El Nino* phenomenon, which causes a prolonged drought across the country every three to seven years, creates conditions ripe for hot spots (Hilman [I7] & Interviewee I8 2010; *Jakarta Post* 1999; Suwarsono [I3] 2010)[1], "it cannot be denied that most of these fires are manmade" (Surya [I9] & Akbar [I10] 2010). Significantly, it was found that the percentage of forested area affected by fire was highest in areas that have been moderately or highly disturbed by human activity (Gellert 1998: 66).

Satellite images from the Centre for Remote Imaging, Sensing and Processing (CRISP) in Singapore in 2004 have provided strong evidence linking fires to oil palm companies (Casson 2002: 234-239; Colfer 2002: 310; Dauvergne 1998: 13-17; Geh [S25] 2010; Hooi & Kaur 2004; Lee [S20] 2010; Tan [S7] 2010). This coincided with Indonesia's targeted policy during that time of converting millions of hectares of forest into plantations (Francesch-Huidobro 2008: 251; Savage [S9] 2010). A comparison of fire hot spot maps from the period of 2001 to 2004 and the period of 2004 to 2008 published by Friends of the Earth (FOE) Malaysia show that more and larger fires have been progressively occurring on plantation land. Detail overlays of these maps over concession maps suggest that many plantation companies were systematically setting fire to both peatlands and other areas for land clearing (Chiew [M15] 2010; Ramakrishna [M20] 2010; Raman et al. 2008: 24). The biggest fires were found to be either directly or indirectly related to companies' land clearing activities (Colfer 2002: 316). Evidence of previous burning has also been found on plantation land through charcoal fragments (Fairhurst & McLaughlin 2009: 7-34). A representative from TH Plantations that was interviewed in fact admitted that "sometimes fires do happen on our peatland during the drought season" (Interviewee M28 2010).

Various figures exist for Indonesia, however almost all indicate a large amount of fires occurring within plantation land. Based on satellite data, it is estimated that 80% of the fires were set by plantation companies or their sub-contractors, while the remaining 20% were set by slash-and-burn farmers (Casson 2002: 234-239; Dauvergne 1998: 13-17; Tan [S7] 2010). Statistics from SKEPHI, (*Sekretariat Kerjasama Kelestarian Hutan* Indonesia or the Indonesian Secretariat for Forest Protection), an NGO, showed that 60% of the fires in 1994 were on plantation areas while 37% more were on transmigration and timber concession areas. Only 2% were in conserved forest areas, where nomadic tribes reside and conduct their small scale agriculture (*Jakarta Post* 1994). A WWF study showed that 65 to 80% of forested area burned in East Kalimantan was in forest concessions and estate crops (Saharjo 1999: 143).

[1] Some of my interviewees allowed me to use their real names for this research and some preferred to remain anonymous. Therefore, I have devised a system to indicate interview sources in this article. To indicate the country or institution where the interview was conducted the letters 'I' for Indonesia, 'M' for Malaysia, 'S' for Singapore and 'A' for ASEAN is used, along with a number to indicate the order of the interview. For example, an anonymous interviewee who was the fifth to be interviewed in Malaysia is referenced as 'Interview M5'. An interviewee who allowed himself to be named, who was the tenth to be interviewed in Singapore, would be, for instance, 'Ali [S10]'.

World Bank estimates of the 1997 fires placed plantation fires at a lower percentage (34%), but this still accounted for the highest single source of fires that year (see Figure 1) (Jones 2006: 434)

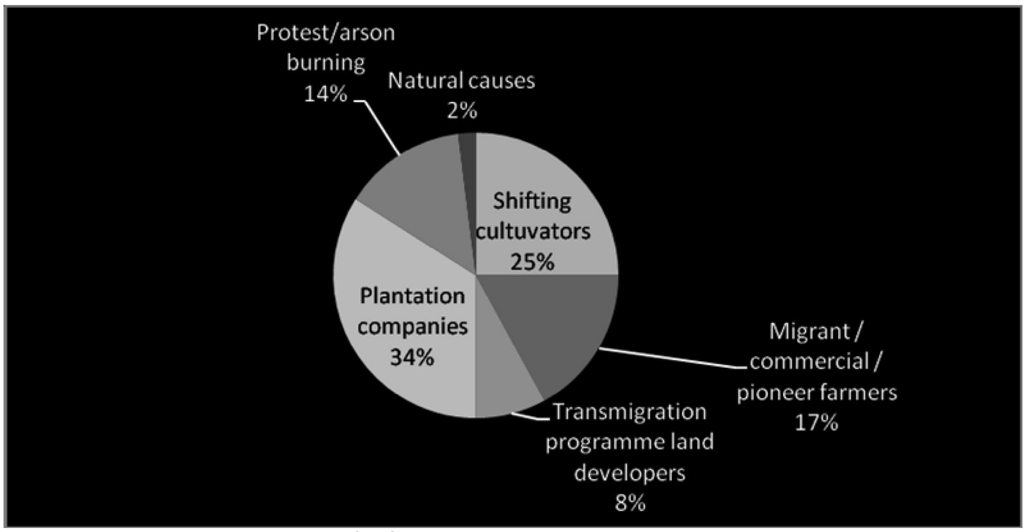

Figure 1. Parties responsible for fire in Indonesia, according to 1997 World Bank estimates
Source: Jones 2006: 434

The Indonesian, and to a lesser extent Malaysian governments' policy of land conversion into plantations during the 1990s (Francesch-Huidobro 2008: 251; Savage [S9] 2010) therefore can explain the added frequency of the haze. From the 1970s the haze made a minor appearance every five years or so, coinciding with the five-year schedule of forest burning by slash-and-burn farmers. However, the 1990s saw an almost annual and more intense occurrence of haze, coinciding with the schedule of annual open burning during the dry season to clear land on plantations (Gan 1972: 3). It has become apparent that forest fires are not merely the result of bad weather or poor methods of shifting cultivation, but the involvement of major business conglomerates engaged in pre-meditated burning with total disregard for the environment, simply for commercial gain (Parliament of Singapore 1998b). Consequently the incidence of forest fires and haze is closely associated with land use change, especially for oil palm development (McCarthy & Zen 2010: 155-156).

LAND USE CHANGE, FIRES AND HAZE

"The plantation mindset is that it is OK if we have haze for a week, because we are gaining so much"

(Syarif [I2] 2010)

Land use change in the Southeast Asian region often brings serious environmental and social implications such as the loss of biodiversity, loss of habitat for species like the orangutan, emission of greenhouse gases from carbon stock changes in biomass and soil, peatland forest fires and related respiratory diseases, illegal operations, and land tenure and human rights conflict (WALHI & Sawit Watch 2009: 1-5; Wicke et al. 2011: 193). Land use change for the establishment of oil palm plantations in particular, and to a lesser extent timber and pulp and paper plantations, have been identified in this region as a major cause of deforestation, forest fires, land and water pollution in the region (Sawit Watch 2007: 1). One explanation for the push for rapid expansion is that yield per hectare of oil palm is not increasing, and may in fact be declining, so that in order to make maximum profit, expanded hectarage is necessary (Cooke 2006: 9). The following sections discuss two types of land use change often employed in Indonesia (and to a lesser extent Malaysia) for conversion into oil palm plantations, and how they are linked with increase in fires: conversions of pristine peatlands, and of degraded logged-over forests and old cropland.

PEATSWAMPS: THE RAINFOREST TINDERBOX

Peatland, which make up a large part of burned land in the region, has an important role to play in the climate change equation. Peatland are good carbon sinks, thus when peat burns, carbon that was trapped in these sinks is released into the atmosphere, exacerbating global warming and climate change (Cotton 1999: 331-351). Although total emissions from individual ASEAN countries are still lower than most developed countries, emissions are increasing about six times faster than in developed countries (Glover & Onn 2008). An ADB-United Kingdom study also predicted that the Southeast Asian region will be the worst effected region in the world as a result of climate change (*Antara* 2009a), as the region possesses unique natural ecosystems and resources which feeds the world and sustains the global environment (*Antara* 2009b). Other than the release of carbon into the atmosphere that exacerbates climate change, the more visible effects of burning peatland, is the release of smoke, which, when in sufficient amounts to travel across boundaries, result in what is known as transboundary haze pollution.

Tropical lowland peat swamps are a major type of forestland commonly found in Southeast Asia. Peat generally occurs along coasts and in terrestrial conditions on low-lying, poorly drained sites, and are identifiable for their waterlogged, fluctuating water table conditions. Most peat swamp forests have a single species or very few species of tree dominating the plant community. Commonly dominating peatland forests are the Alan (*Shorea albida*), Ramin (*Gonystylus bancanus*) and Terentang (*Campnosperma spp*) trees which are all highly valuable commercial timber. The soil in peatswamps is acidic, low in inorganic ions and oxygen, high in carbon, and has high concentrations of humic acid that gives it a characteristic ‘blackwater’ appearance (Phillips 1998: 651-660).

Natural peatswamp forests are important water catchment and control systems. They function as aquifers by absorbing and storing water during wet periods and releasing this water slowly when rainfall is low. As a result, they help to reduce flood peaks and provide water in dry periods. Coastal peatswamps are also a buffer between marine and freshwater systems, preventing excessive saline intrusion into coastal lands and protecting off-shore fisheries from on-shore pollution. They also play an important role in the global carbon balance, as carbon is stored in the organic material forming the peat, creating carbon sinks (Phillips 1998: 654-660).

The Southeast Asian region is estimated to have 27 million hectares of peatland or 6% of total peatland in the world (Tan et al. 2009: 423). In Malaysia, peatswamp covers 2.7 million hectares of land, or roughly 8% of the nation’s total land area. Sarawak has the largest peatswamp area in the country, covering approximately 1.6 million hectares or 13% of the State (Phillips 1998: 654). Representatives from the Indonesian Ministry of Environment that were interviewed stated that Indonesia has about 70% of the Southeast Asian region’s peatlands (Hilman [I7] & Interviewee I8 2010), which is 22.5 million hectares or 12% of its total land area (Tan et al. 2009: 423). An interviewed Indonesian academic explained that Indonesia is 4^{th} in the world in terms of peatland area, with most of it in a “critical phase of degradation” (Satyawan [I20] 2010).

Traditionally, drained and reclaimed peatswamp land is desirable for development of highways, housing, and industrial use (Phillips 1998: 652-665). While agricultural development trends in the past had been to avoid peatswamps altogether (Phillips 1998: 665), the burgeoning need for land brought about by the oil palm boom in countries like Malaysia and Indonesia has encouraged the conversion of peatland to plantations (Colfer 2002: 314; Maitar [I12] 2010; Syaf [I27] 2010; Wicke et al. 2011: 201-203).

Deep peat and considered ‘problem soils’ because of a variety of constraints to agricultural development, including surface subsidence due to shrinkage, soil compaction, decomposition, leaching, and irreversible drying and loss of peat material during reclamation, which makes this soil extremely fire-prone (Raman et al. 2008: 21). To convert and prepare peatswamps for planting, the swamp has to be cleared from vegetation, drained, and dried so that the watertable drops. However, without adequate draining, plantation trees are unstable and readily subject to windthrow. However, if cleared and allowed to dry out, the peat shrinks, and becomes highly acidic with extremely low fertility (Maitar [I12] 2010; Phillips 1998: 664-665; Syaf [I27] 2010). Because of these constraints, and because of the functional importance of peatswamps, it has been asserted that undisturbed peatswamps, especially those more than two meters deep, may be more important to humans than if drained and developed for short-term profit production that results in irreversible damage to the peatswamp ecosystem (Phillips 1998: 654).

Hence, the infertile and wet soil is unsuitable for most crops, but when deeply drained, they are quite suitable for palm oil (Tan et al. 2009: 423). While these constraints make oil palm development on peat soil costly, higher oil palm prices have made it economically viable (Maitar [I12] 2010; Raman et al. 2008: 21; Syaf [I27] 2010). Coincidentally, oil palm grown on reclaimed peatsoil has high fruit production (Phillips 1998: 665). Opening up peatlands for plantations are also attractive to concessionaires because of the valuable timber growing in these areas. Plantations usually fuel further peatland expansion through sales of the timber growing in these areas which had to be felled prior to land clearing (Stone 2007: 1491). This was why the majority of companies that were set up in these peat regions were connected to established logging companies (Casson 2002: 221-242).

By the 1980s, with most inland forests cleared, plantations began building dykes to dry peatswamp to increase their acreage (Nowak 2008: 190; Phillips 1998: 665). In both countries, reclamation of peatland has increased drastically as most new plantation land (not previously used for other types of estate crops) has been opened up on reclaimed peatswamps (Wicke et al. 2011: 193-194). In Indonesia, nearly 25% of all oil palm plantations are on peatlands (Tan et al. 2009: 423; Wicke et al. 2011: 194-200). of the ‘existing and planned’ 10.3 million hectares of palm oil concessions in Indonesia, approximately 3 million hectares, or 27% is located on peatland (Wicke et al. 2011: 194-200). It is estimated that up to 100,000 hectares of peatland is converted to oil palm plantations every year (Forqan 2010).

In both Indonesia and Malaysia, problems arise during the draining and preparing operations (Basiron 2007: 289-295). Once the peatswamp watertable is dropped for draining, it dries very quickly, making it naturally fire-prone (Albar [I17] 2010; Applegate et al 2002: 302; Hilman [I7] & Interviewee I8 2010; Maitar [I12] 2010; Phillips 1998: 664-665; Resosudarmo [I26] 2010; Swajaya [I37] 2010; Syaf [I27] 2010). Interviewees explained that because of this, burning peatland is usually a fast way to clear unwanted biomass in preparation for planting (Interviewee I21 2010; Maitar [I12] 2010; Moore [I5] 2010; Surya [I9] & Akbar [I10] 2010). Once the valuable timber is removed to be sold, the peat is usually burned to remove any remaining vegetation (Stone 2007: 1491), either by the company directly or by using sub-contractors (Colfer 2002: 318).

Using machinery is expensive on the soft peatlands, and one way of keeping the costs down is to clear land using fire (Colfer 2002: 318; Interviewee I21 2010; *Jakarta Post* 1994; Maitar [I12] 2010; Moore [I5] 2010; Surya [I9] & Akbar [I10] 2010). Clearing land mechanically can cost up to USD 250 per hectare, whereas clearance by fire could cost a mere USD 5. Maintaining low production costs is a key to the continued profitability of oil palm producers, especially since draining peatland is already costly (McCarthy & Cramb 2009: 113; Tan [S7] 2010). Although not all companies burn to clear land, satellite imagery and field observations suggest that the larger plantation groups do practice open burning on peatland (Raman et al. 2008, pp. 3-5), as many interviewees attest (Interviewee I21 2010; Maitar [I12] 2010; Moore [I5] 2010; Surya [I9] & Akbar [I10] 2010). Even for the companies who do not deliberately use fire, disturbance to the naturally waterlogged condition in peatlands create extremely dry conditions and hotspots, which often spark unintentional fires (Jakarta Post 1994). An officer at the *Lembaga Penerbangan dan Antariksa Nasional* (LAPAN) or Indonesian National Institute of Aeronautics and Space explained that a 'hotspot' is an area where the temperature is high, and thus fire-prone[2] (Suwarsono [I3] 2010). Fires require (a) dry fuel, (b) oxygen, and (c) a spark (Colfer 2002, p. 310), and these elements are easily found on drained peatlands. Logged areas are much more susceptible to accidental fires since there is plenty of dead wood and they are generally drier than virgin areas (Hurst 1987: 173). For example, dry branches left behind during clearing sometimes rub against each other and provide the spark for a fire (*Jakarta Post* 1994).

Fires on peatland, especially deep peat, are extremely hard to put out. This is because the fires often extend underground are not visible to the naked eye. Therefore, conventional methods of fire fighting (Parliament of Singapore 1998a) and regular dousing is inadequate and often extensive flooding of vast areas of peat is needed. These underground fires cover large areas, and smoulder sometimes for weeks. The smoke that is released by these smouldering fires is usually thick and sooty, because of the organic material contained in the peat. This smoke is the main cause of the regional haze. It was claimed that more than 60,000 peatland fires occurred since 1997 causing the haze problem in the region (Tan et al. 2009: 423). The smoke is also high in carbon content, contributing to global warming. Conservative estimates suggest that 60% of particulates and carbon dioxide in smoke and haze arose from peat fires due to forest conversion burning, while others have estimated that about 80% of the haze problem is caused by burning on peat soils (Applegate et al. 2002: 294). Furthermore, drastic land conversion like this degrades and dries out the natural landscape in such a way that future hotspots and accidental fires are liable to occur again and are likely to be more severe (Colfer 2002: 309). Another way that concessionaires have been obtaining land for oil palm plantations is through the conversion of existing cropland or logged-over non-peat forest, which is discussed in the following section

TIMBER AND CROP CONVERSION

In Indonesia, most of the land conversion outside peatland occurs on logged-over land. Decades of reckless logging in Indonesia have left wide areas degraded and highly susceptible to fires (Dauvergne 1998: 13-17). Some land conversion also occurs on old croplands as well, where land for oil palm was obtained by converting other agricultural crops which have lower market values like cocoa, rubber, and coconut (Tan et al. 2009: 423; Wicke et al. 2011: 201-203).

Land degradation is described as 'a long term loss of ecosystem function and services, caused by disturbances from which the system cannot recover unaided' (Fairhurst & McLaughlin 2009: 7-34). This often means that logged areas are far more vulnerable to fires than old growth areas. They are drier, more open, and often contain a floor of kindling that provide the 'fuel' element for fires (Dauvergne 1998: 13-17). The Indonesian government has also encouraged companies to clear these otherwise 'idle' logged forests for plantations (Colfer 2002: 311; Dauvergne 1998: 13-17). It is expected that this conversion of logged-over tropical forests for palm oil production will likely continue over the next decade (Butler et al. 2009: 68).

Similarly with peat, fire is the cheapest and fastest method to clear logged forests and croplands. Fire is used to flatten the stumps left over from logging and old crops, as well as to clear smaller vegetation (Dauvergne 1998: 13-17). It is also useful in disposing of unwanted agricultural by-products that have no apparent use or value, such as straw and husks (Applegate

[2] There may also be 'false hot spots'; for instance at industrial areas, volcanoes and mines, which are not fire-prone. Fires resulting from hotspots are commonly known as 'forest fires', even though they may occur outside forest areas such as in large oil palm plantations and traditional farmlands (*Jakarta Post*, 2008). Most of Indonesia's hotspots were located in Sumatra and Kalimatan, and if left unabated, can result in the fires that produce smoke and haze.

et al. 2002: 294). The ash produced is also believed to give a shot of fertilizer to the soil. Clearing land with machines and chemicals can cost up to USD 200 per hectare (Dauvergne 1998: 13-17). Sometimes plantations companies also purposely light fires to reclassify forestland and NCR land as degraded land, so they can be legally converted into plantations (Casson 2002: 234-239; Colfer 2002: 318). Also, these deliberate fires can get out of control and spread to a wider area than intended, often spreading outside plantation areas and destroying pristine forests. On top of these deliberate fires, accidental fires also occur at these hotspots (*Jakarta Post* 1994). While the burning of these non-peat lands does not create the smouldering, persistent fires and thick, sooty smoke like those on peatland, the substantial scale of these fires do also contribute to the problem of haze in the region. Combined with the smoke produced from peatfires, the resulting haze becomes a serious concern.

CONCLUSION

This research paper has shown the strong correlation between the opening of plantation land in Indonesia and Malaysia and fires. It has argued that commercial plantations contribute significantly more to open burning than small-scale slash-and-burn farmers. It has shown that economic motivation and governmental support has encouraged commercial plantations, especially for oil palm, to open land on fire-prone peatland and old cropland, producing smoke that often travels across borders. This has contributed to and exacerbated the transboundary haze problem in the region.

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