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2015 Environ. Res. Lett. 10 091001

(http://iopscience.iop.org/1748-9326/10/9/091001)

Environmental Research Letters

PERSPECTIVE

Industrial concessions, fires and air pollution in Equatorial Asia

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Keywords: fire, deforestation, air quality, Indonesia, concessions

OPEN ACCESS

RECEIVED
22 July 2015

ACCEPTED FOR PUBLICATION
6 August 2015

PUBLISHED
1 September 2015

Abstract

Forest and peatland fires in Indonesia emit large quantities of smoke leading to poor air quality across Equatorial Asia. Marlier *et al* (2015 *Environ. Res. Lett.* **10** 085005) explore the contribution of fires occurring on oil palm, timber (wood pulp and paper) and natural forest logging concessions to smoke emissions and exposure of human populations to the resulting air pollution. They find that one third of the population exposure to smoke across Equatorial Asia is caused by fires in oil palm and timber concessions in Sumatra and Kalimantan. Logging concessions have substantially lower fire emissions, and contribute less to air quality degradation. This represents a compelling justification to prevent reclassification of logging concessions into oil palm or timber concessions after logging. This can be achieved by including logged forests in the Indonesian moratorium on new plantations in forested areas.

Natural fires are rare in tropical moist forest regions. In recent decades, fires have become increasingly common as they are used to clear vegetation and prepare land for agriculture. Fires emit a complex range of pollutants to the atmosphere including smoke particles, which cause a polluted haze that is particularly harmful to human health. The contribution of deforestation to climate change is well recognised; much less is known about how land-use change impacts air quality and public health [1].

Indonesia has experienced rapid forest loss over the last four decades. Indonesia lost 6 Mha of natural forests between 2000 and 2012 [2]. Kalimantan alone lost 31% (13 Mha) of natural forests since 1973 [3]. Smoke emissions from fires associated with these land-use changes result in transboundary air quality issues [4]. Fires in southern Sumatra and southern Kalimantan cause the greatest regional air quality degradation [5, 6], particularly during El-Niño-induced droughts [7]. However, an important question is the contribution of different land-use types, in particular concessions—areas of land allocated by the government to companies for extractive industries—to the occurrence of fire and resulting air quality issues.

Marlier *et al* [8] combined data on the location of industrial concessions with information on the location of fires to identify the contribution of concessions to air pollution in Equatorial Asia. They found that fires in concessions accounted for 31% of smoke emitted by all fires that occurred in Sumatra and Kalimantan during the El-Niño of 2006. Concession areas in Sumatra were particularly harmful, causing twice as much smoke emission per unit land area compared to areas outside concessions.

The impact of smoke on public health depends on the number of people exposed to the smoke emitted by fires. To quantify the exposure of populations to air pollution from fires, Marlier *et al* [8] combined their information on fire emissions across concessions with an atmospheric model to determine where prevailing wind patterns are transporting the smoke. They found that one third of the population exposure to smoke in Equatorial Asia is due to fires within concessions. The population of Singapore is even more heavily affected, with 37% of the smoke exposure in Singapore due to fires on concessions. This highlights the role played by concessions in regional air quality degradation, but also demonstrates that most of the air pollution is due to fires occurring outside concession boundaries.

Marlier *et al* [8] further explored fire occurrence across three different industrial concession types: oil palm concessions grow *Elaeis guineensis* to produce palm oil; timber concessions grow Acacia and Eucalyptus to produce pulp and paper; natural forest logging concessions are managed for selective logging of trees to produce round wood or plywood. Marlier *et al* [8] find that timber and oil palm concessions contribute more than ten times as much smoke emissions

and regional air quality degradation compared to logging concessions. This result demonstrates that logged forests do not contribute substantially to air quality degradation, consistent with the low rates of deforestation found within logging concessions [9, 10].

Primary forests may be irreplaceable for conserving tropical biodiversity [11, 12], but logged forests host an important fraction of the species found in intact primary forests [12–18] as well maintaining many ecosystem services [19]. The results of Marlier *et al* [8] highlight a largely unrecognised ecosystem service of logged forests—the provision of clean air across Equatorial Asia. This represents another compelling justification to step up the protection of logging concessions. The Indonesian moratorium on new plantations within primary forests [20], needs to be extended to cover logged forests (*Hutan Sekunder* in Indonesian), preventing reclassification of logging concessions to oil palm and timber plantations.

Another important finding from Marlier *et al* [8] is the large contribution of fires on both forested and non-forested peatlands to smoke emissions and air quality degradation. In Sumatra, fires on peatlands account for 62% of total Sumatran fire emissions. These findings underscore the need to focus fire prevention on peatlands. Prohibiting development of timber or oil palm concessions on forested peatlands would reduce future fire risk and associated air quality issues [21, 22] as well as preventing substantial emissions of carbon dioxide [23]. The Indonesian Moratorium includes peatlands and many major companies are beginning to take action, and some have committed to zero-deforestation. This is a step in the right direction, but needs monitoring to ensure compliance.

Marlier *et al* [8] demonstrate that oil palm and timber concessions, especially those on peatlands, contribute substantially to air quality degradation in Equatorial Asia. Attribution of fires to the activities of the concession holder is more difficult. Concessions are legally attributed to companies, but can include smallholders as well as local businesses competing over concession land because of numerous overlapping claims over land ownership. Analysis of fires within concessions in Sumatra during 2013 showed 60% of the area burned was occupied by communities [24]. In some cases granting concessions violates traditional community use and is controversial [25]. In other cases, local businesses take advantage of jurisdictional loopholes to violate the rights of concession holders. A more nuanced understanding of the underlying reasons for fire is needed, requiring on-the-ground surveys. Successful fire prevention likely requires resolution of land-tenure disputes between different land users.

Targeting future oil palm and timber expansion to un-forested land with mineral soils will limit air quality impacts as well as reducing negative impacts on biodiversity and carbon stocks [26].

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