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Expanding Oil Palm Cultivation in Indonesia: Changing Local Water Cycles Raises Risks of Droughts and Floods

Summary

During El Niño in 2015, devastating forest fires in Indonesia directed international attention towards land use changes and deforestation on the archipelago. At least partially a result of clearing land for plantation estates, those fires spurred debate about the sustainability of palm oil, which is the most traded vegetable oil. Recently, seven European governments signed the Amsterdam Declaration. Its signatories, including Germany, committed themselves to helping the private sector to achieve a fully sustainable palm oil supply chain by 2020.

Despite progress made in talks on sustainability, little is visible on the ground. To the contrary, as the Indonesian case shows, that palm oil expansions can cause soil and water resources to degrade. Especially weak law enforcement poses a major challenge to a sustainable production of oil palm. At the same time, the oil palm business has been expanding rapidly in Latin America and West Africa. For smallholders oil palm cultivation is an attractive land use option that requires little labour input and allows them to engage in off-farm income activities.

Current discussions about the ecological impacts of expanding palm oil production focus on how it destroys primary forest and peatlands, increases greenhouse gas (GHG) emissions and reduces biodiversity. Little attention has been paid to concerns that oil palm plantations severely impact local water resources and increase flood risks. This briefing paper makes use of a recent interdisciplinary publication (Merten et al., 2016) and extensive fieldwork to analyse the way expanding palm oil production impacts the hydrological cycle. It also discusses water management criteria in certification schemes and national regulations. Measurements of eco-hydrological processes and observations of Indonesian farmers indicate that large-scale oil palm monoculture has long-term negative consequences for smallholder farming systems and the water supplies of rural communities.

Our interdisciplinary study has revealed that: local populations report water shortages in dry seasons in the wake of new oil palm plantations; expanding oil palm plantations leads to more frequent floods; intensive monoculture plantation systems severely degrade the soil, impeding the recharge of groundwater reservoirs and increasing surface runoff; and oil palm cultivation impacts the local hydrological cycle more severely than other crops.

Based on these findings we recommend that:

1. The European Union (EU) should set mandatory sustainability standards for all palm oil products.
2. Water and soil management should have prominent roles in environmental impact assessments and sustainability standards.
3. Sustainability standards for agrofuels should be better monitored. If compliance cannot be guaranteed, the EU should consider a temporary ban on using palm oil for agrofuel production.

The controversial global palm oil economy

Palm oil is one of the most contested agricultural commodities. Civil society organisations and many scientists claim that large oil palm plantations have severe socio-ecological impacts. At the same time, companies and government officials from palm oil producing countries accuse Western NGOs and government institutions of campaigning against palm oil to protect their locally produced vegetable oils.

This heated debate is understandable in light of the fact that palm oil represents 40 per cent of the global trade in vegetable oils, with Indonesia and Malaysia accounting for 85 per cent of global palm oil production. Oil palm plantations cover approximately 11 million ha in Indonesia. This highly lucrative business has stimulated the expansion of oil palm plantations in Latin America and West Africa. Smallholders regard oil palms as attractive and profitable because they require relatively little labour input compared to other crops. The high demand for palm oil is mainly due to its low price and multipurpose usage – from cooking oil to cosmetics and pharmaceutics to agrodiesel. EU agrofuel policy has stimulated increased palm oil imports in recent years, with agrodiesel accounting for 45 per cent of EU palm oil consumption in 2014.

The rapid expansion of oil palm plantations in tropical countries has considerable socio-ecological costs: Industrial cultivation could lead to land tenure conflicts, poor working conditions on plantations and the violation of indigenous rights. The big forest fires in Indonesia in 2015 have drawn further attention towards the oil palm business. The establishment of large as well as small plantations often follows slash-and-burn land clearance. Many studies discuss the impacts of oil palm monocultures on biodiversity and GHG emissions but much less is known about how they impact local water cycles. This briefing paper investigates whether oil palm expansion degrades local water resources. First we show that private certification schemes and state regulations do not adequately address water issues and are insufficiently enforced. We then analyse how oil palm cultivation impacts water, and review mitigation measures.

Recent policy initiatives and certification schemes are insufficient

In reaction to reported negative socio-ecological consequences of oil palm monocultures, the Indonesian government, producers, consumer goods companies and civil society organisations, as well as some EU members have adopted policies to make the palm oil industry more sustainable. One of the most recent initiatives is the non-binding "Amsterdam Declaration in Support of a Fully Sustainable Palm Oil Supply Chain by 2020". Various schemes to certify sustainable palm oil already exist. However, all of them have been criticised for not being strict enough, providing only weak auditing and monitoring, thereby reinforcing power imbalances between actors and favouring business interests.

Established in 2004, the Roundtable on Sustainable Palm Oil (RSPO) is the most prominent certification scheme. Some RSPO criteria refer to water management, such as the protection of watercourses or the requirement for producers to develop a water management plan. The same applies for soil management, which is an integral part of water management. RSPO mandates plans and strategies for managing fragile soils, maintaining soil fertility and following good agricultural practices. Explicit measures and threshold values for achieving these goals are to be developed in national interpretation guidelines. However, the quality of these guidelines varies significantly. While in Malaysia plantation establishment on slopes over 25 degrees is not allowed, Indonesia allows planting on slopes up to 40 degrees under similar climatic and physiographic conditions. Using peatlands for oil palm cultivation is generally discouraged but not strictly forbidden although peatlands serve as important large fresh water reservoirs and carbon sinks. Many criteria for managing soil and water are unspecific.

In 2011, the Indonesian government created its own certification scheme – the Indonesian Sustainable Palm Oil System (ISPO). A major point of criticism about ISPO is that the system only certifies the compliance with existing Indonesian laws. In 2011, the Indonesian government signed the Forest Moratorium. It banned any further plantation establishment on primary natural forest areas and peatlands. Critics of both the ISPO and the Moratorium point out a much greater problem in Indonesia: the lack of law enforcement. National laws do protect water resources, for example, riparian buffer zones and upstream conservation forests must be maintained and water pollution controlled. Yet many riparian sites and forest areas are still being illegally converted to oil palm plantations.

To this day, too many loopholes remain in the monitoring and auditing of environmental laws and certification standards. Amnesty International recently accused Wilmar International Ltd., the largest producer of palm oil worldwide and a member of RSPO since 2005, of employing children on their oil palm plantations; the IOI Group, a major Malaysian palm oil company, was suspended from RSPO in April 2016. Although IOI was accused of major violations such as illegal plantation activities, encroaching on community land, felling protected forests and clearing forests with deep peat soils, its sustainability certification was restored after only four months, even though it is doubtful that such severe violations could be corrected in such a short time.

Current oil palm cultivation practices increase the risks of droughts and floods

Our study shows that current practices of oil palm cultivation increase drought and flood risks and seriously degrade local water resources – creating a major challenge for future rural water supplies. We conducted interdisciplinary research in an oil palm landscape in Jambi Province on the island of Sumatra (Merten et al., 2016). Sumatra accounts for 60 per cent of Indonesia's palm oil production.

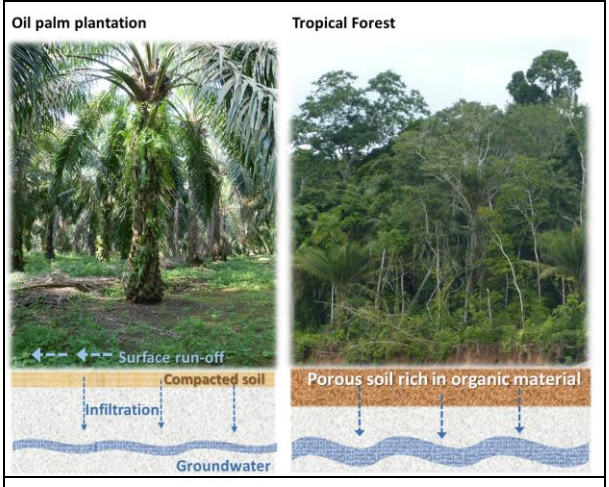
Our extensive fieldwork in different villages between 2012 and 2016 combined social and natural science methods to learn about the impacts of environmental change on local communities and farm systems. The field sites were part of the sampling framework of the Collaborative Research Centre 990 (Drescher et al., 2016).

The rural population of Jambi Province perceives the oil palm as a "water and nutrient greedy" crop. In qualitative interviews, rural households reported that since the land was converted to oil palm plantations, groundwater reservoirs and surface waters have been drying up more quickly (Figure 1). Despite the fact that oil palms are usually cultivated in tropical regions with only short dry seasons and at least 1500 mm annual rainfall, where irrigation is unnecessary, water shortages have become a problem. Water scarcity in such areas is a relatively recent phenomenon. Groundwater wells used for domestic water consumption are drying up and forcing villagers to collect water from distant rivers or to purchase bottled water. Since oil palm began to be cultivated extensively, small streams run dry more often in the dry season, jeopardising the irrigation of paddy rice, Indonesia's main staple crop.

Informants reported that floods are more frequent during the rainy season, and occur sooner after rainfall events than in the past, when forests and rubber plantations covered the area. Floods during the rainy season cause failures of crops that are not adapted to inundation. Oil palms can withstand short periods of flooding, but when fertilisation and harvesting activities are disrupted, productivity drops. This makes it difficult for smallholders in particular to use their land efficiently. However, larger companies can mitigate flood impacts with complex systems of dams, drainage channels and water pumps. However, such hydraulic interventions could cause flooding on adjacent plantations – an issue that has not yet received any scientific or political attention.

Our team used a variety of techniques to determine the underlying causes of increased water scarcity and floods.

Fig. 1: Compacted soils in oil palm plantations reduce groundwater recharge



Source: J. Merten

Box 1: Quotes from interviews conducted in Jambi in 2013

"Before, when people didn't open much of the forest, yet there was still water in the river and it still flowed after one month of drought. But since people opened the forest and plant oil palms, the water in the river gets less. It doesn't flow anymore." (Rubber farmer in Jambi)

"The negative thing about oil palm is that it is a plant that needs a lot of water. That's why, if we plant oil palm near swamp areas, after some time the swamp will run dry." (Oil-palm farmer in Jambi)

Source: Merten et al., 2016

We compared measurements of different eco-hydrological variables and parameters in smallholder oil palm plantations to forest ecosystems and rubber tree plantations. Transpiration rates, soil erosion, stream flow, interception loss, soil infiltration capacity and meteorological variables were assessed to cover a fairly broad spectrum of the potential causes of water scarcity in areas where oil palms predominate.

Our assessments underscore the villagers' observations. However, the biophysical processes partly differ from their assumed causes. Oil palm transpiration is high – higher than for crops like rubber – but the main differences and problems come from soil degradation. Forest conversion exposes bare soil to heavy tropical rainfall, which typically causes significant soil erosion. Frequent harvesting activities on oil palm plantations and the removal of ground vegetation leads to further soil compaction. Because rainfall cannot infiltrate compacted soil, it tends to run off the surface instead of recharging groundwater reservoirs (Figure 1). Furthermore, downstream erosion increases sediment loads in rivers, reducing water quality and making rivers shallower, thereby increasing flood risks (Dislich et al., 2016). Besides degrading soil, oil palms may stress local water cycles more than other local crops. While other cash crops such as rubber trees reduce water consumption during the dry season by partial leaf-shedding, oil palms consume more water at a relatively stable rate throughout the year. This is likely to exacerbate water shortages in oil palm areas during drier times of the year.

Mainstreaming water conservation in the oil palm sector

Many countries already require environmental impact assessments and have developed watershed management plans and regulations to protect water and soil resources. We argue that improved law enforcement is most important to ensure long-term sustainability effects on the ground.

If national regulations are inadequate, more specific steps to conserve soil and water resources could be incorporated into voluntary certification schemes. We recommend such measures as protecting slopes, preserving permanent vegetative cover, cutting back on agrochemicals, prohibiting highly toxic herbicides like Paraquat, stacking pruned oil palm fronds, never leaving land bare, carefully planning road networks and practising mixed cultivation. These are relatively simple measures to improve soil structure and

water infiltrability. Certification schemes like RSPO should incorporate them more consistently in their principles and criteria.

Private sustainability certification schemes cannot substitute for strong governmental regulation. Governance challenges such as land tenure conflicts, weak watershed management, corruption and insufficient law enforcement capacities cannot be resolved by private certification schemes. Severe violations of standard criteria and laws have occurred in RSPO certified plantations – indicating that the monitoring and auditing capacities of private actors are often not sufficient to safeguard sustainability.

European policy options

International cooperation should support palm oil producing countries' efforts to strengthen law enforcement, labour regulations, land tenure and sustainable agriculture – as well as water and forest policies. To reach their goal of "100 per cent sustainable palm oil by 2020" for the private sector, European governments should:

1. Create mandatory sustainability standards for all palm oil imported into the EU. Experience with FLEGT, the EU licensing system for timber that was recently launched in Indonesia, might help with the design of import standards. Similar regulation is essential to prevent palm oil production from being relocated to countries with lower environmental standards or the lack of certification for less visible products such as animal feed and pharmaceutical products.
2. Promote more credible and stringent standards by strengthening existing private certification schemes that include strong penalties for violations. Water and soil conservation measures should figure more prominently in standards, guidelines and environmental impact assessments of oil palm plantations.

Apart from safeguarding the sustainability of imported palm oil, the EU should also reconsider its agrofuel policies. The fact that zero deforestation and zero peatland conversion cannot be guaranteed when oil palm plantations are established calls into question existing GHG calculations related to oil palm cultivation. Moreover, the large-scale cultivation of energy crops creates additional risks for food security. If significant savings of C02 emissions cannot be ensured and the degradation of water resources avoided, the EU should consider temporarily banning the use of palm oil for agrofuel.

We are just learning about the hydrological impacts of large-scale oil palm cultivation, which needs additional scientific research. Smallholder land-use systems that cultivate a variety of crops could provide biodiversity benefits, maintain ecosystem services and ensure a more resilient income.

References

Merten, J., Röll, A., Guillaume, T., Meijide, A., Tarigan, S., Agusta, H., ...Hölscher, D. (2016). Water scarcity and oil palm expansion: social views and environmental processes. *Ecology and Society* 21(2), 5. Retrieved from: http://dx.doi.org/10.5751/ES-08214-210205

Dislich, C., Keyel, A.C., Salecker, J., Kisel, Y., Meyer, K.M., Auliya, M., ...Wiegand, K. (2016). A review of the ecosystem functions in oil palm plantations, using forests as a reference system. *Biological Reviews*. doi: 10.1111/brv.12295

Drescher, J., Rembold, K., Allen, K., Beckschäfer, P., Buchori, D., Clough, Y., ... Irawan, B. (2016). Ecological and socio-economic functions across tropical land use systems after rainforest conversion. *Phil. Trans. R. Soc. B*, 371(1694), 20150275.

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