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Landscapes of Globalisation in SE Asia

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Cover Page Footnote

Brian McAdoo is Professor of Environmental Science and Rector, Elm College, Yale-NUS. He completed an undergraduate degree in Geology from Duke University, a Post-Graduate Diploma in Science, Geology from the University of Otago (New Zealand) while studying on a Fulbright Scholarship, and a PhD in Earth Science from the University of California, Santa Cruz. His current research involves studying the intersection between nature and humans, hazards and risk in disaster areas, focusing on earthquakes, tsunami and tropical cyclones. His current work on how Chinese and Indian geopolitics are being played out in Nepal, as expanding trade routes and the increasing network of rural mountain roads are changing the physical landscape, putting thousands at risk of increased landslides.

Landscapes of Globalisation in SE Asia

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Abstract. As economies continue to expand in Southeast Asia, urban and rural landscapes are undergoing industrial-scale change at a staggering pace. A number of growing industries are responsible for these changes, from soil and biodiversity loss caused by palm-oil deforestation to rainforest flooded in the interest of “climate neutral” hydropower. To best understand the wide-reaching effects of these transformations, a radically interdisciplinary approach is needed to unravel the intersection between environmental degradation, economics and culture. Is the quest for biofuels and carbon-neutral energy to support burgeoning largely urban populations, sometimes in other nations, effectively shifting the environmental costs to rural communities? What are the trade-offs between economic development in rural communities vs. loss of habitat and traditions, as well as clean water and air? By exploring the complex intersections from a liberal arts and sciences perspective that attempts to view these challenges through interdisciplinary lenses, can we come to solutions to limit the damage before losses are irreversible? While the last may be an overly lofty goal, it is critical to have this approach as part of the conversation, as the siloed problem-solving methodology only gets us so far.

The recent emergence of Asian “tiger” economies has increased the stresses on a wide variety of environments. Extraction of resources in the hinterlands (hardwoods, pulp, paper, palm, rubber, mining, etc.), stupendously rapid urbanization, and overfishing in a degraded marine environment have each strained ecosystems to the point of not being able to deliver the services we have come to rely upon. On top of these environmental stresses, an increasingly erratic climate generates events of frequencies and magnitudes never before seen in a region replete with tectonic hazards that include the largest volcanic eruptions, earthquakes and tsunamis that humanity has ever witnessed. Populations in this region will continue to suffer losses (both economic and in terms of mortality) that will set nations back decades in terms of development.

To address these varied and complex challenges, we need a transdisciplinary² approach comprised of natural and social scientists, as well as humanists working together with affected populations. Transboundary issues, such as large-scale, environmentally driven migrations and the annual “haze” pollution that affects countries throughout SE Asia, are rarely, if ever, best understood from the perspective of a single lens. Inputs from researchers working on issues of globalisation,

¹ Brian McAdoo is Professor of Environmental Science and Rector, Elm College, Yale-NUS. He completed an undergraduate degree in Geology from Duke University, a Post-Graduate Diploma in Science, Geology from the University of Otago (New Zealand) while studying on a Fulbright Scholarship, and a PhD in Earth Science from the University of California, Santa Cruz. His current research involves studying the intersection between nature and humans, hazards and risk in disaster areas, focusing on earthquakes, tsunami and tropical cyclones. His current work on how Chinese and Indian geopolitics are being played out in Nepal, as expanding trade routes and the increasing network of rural mountain roads are changing the physical landscape, putting thousands at risk of increased landslides.

² The *transdisciplinary* approach involves research efforts conducted by investigators from different disciplines working jointly to create new conceptual, theoretical, methodological, and translational innovations that integrate and move beyond discipline-specific approaches to address a common problem (<https://www.hsph.harvard.edu/trec/about-us/definitions/>), while often enabling inputs across scientific and non-scientific stakeholder communities, facilitating a systemic way of addressing a challenge (<http://www.belmontforum.org/>).

neoliberalisation alongside regional economic cooperative agreements, natural resource extraction and conservation and radical changes in rural and urban landscapes and the environmental affects therein, community-level activism and indigenous rights movements and disasters impacting burgeoning, vulnerable populations that lack the resilience to return to a better functioning state. While this is indeed a broad net, the transdisciplinary approach is the best way to get to the bottom of increasingly complex and interconnected landscape.

Much of this complexity is encapsulated in the industrial-extractive landscapes around Miri, Sarawak State on Malaysian Borneo. Miri is an oil town, adjacent to the Sultanate of Brunei, where offshore oilfields have given it the second highest per-capita GDP (just behind Singapore) in SE Asia. Energy has been a major resources in Borneo since oil was discovered there by Royal Dutch Shell over 100 years ago. The oilfields around the city of Miri have brought both wealth and industrialisation to the region. On 19 December, 1941, only nine days after the Pearl Harbor attack, a ten-thousand-strong Japanese army occupied Sarawak following two days of fighting with a small garrison of Dutch troops (<http://www.geoexpro.com/articles/2010/02/miri-1910>), and the Miri oilfields supplied the Japanese with over three quarters of a million barrels of oil during WWII. Malaysia nationalised the Miri oilfields with the formation of Petronas in the early 1970s, wisely arranging joint ventures with the capital-rich Royal Dutch Shell (<https://en.wikipedia.org/wiki/Petronas>). By geopolitical fortune, most offshore oilfields lie in the territorial waters of the Sultanate of Brunei, yet many multinational oil service companies, including Halliburton and Baker and Hughes, have set up shop in Miri.

Inland from Miri, the forest concessions begin. Deforestation of Sarawak began in earnest in the 1970s. Since then, estimates of 30% of Borneo's forest, which has some of the highest biodiversity in the world (McKinnon K (1996) *The ecology of Kalimantan*: [Hong Kong]: Periplus Editions), has been removed (Gaveau DLA, Sloan S,



Credit: Tom Iain White, 2016

Molidena E, Yaen H, Sheil D, Abram NK, et al. (2014) Four Decades of Forest Persistence, Clearance and Logging on Borneo. *PLoS ONE* 9(7): e101654. doi:10.1371/journal.pone.0101654). This has had a tremendous impact on not only the species of the world's most biodiverse island, but also on the erosion of topsoil, which can be between 8-14 tonnes per hectare *in a mature palm plantation* during a given year (Mattsson, Cederberg, & Blix, 2000). The amount of erosion during the time of clearing to the plantation's maturation remains undocumented.

Sometimes this erosion is a steady trickle of sediment running from hillsides, but occasionally in the precipitous terrain, it comes in the form of deadly landslides (<http://www.theborneopost.com/2014/05/20/landslides-do-not-kill-unsafe-slopes-do/>). Preliminary assessments suggest that removal of vegetation and poor road construction are the primary drivers of landslides, and these are exacerbated by heavy monsoonal rains and possibly climate change (Walling & Webb, 1996). Further documentation of the occurrence of landslides in the Baram River area, along with assessing the triggers is critical to the sustainability of this vulnerable landscape.



Landslide in Betong, Sarawak. The landslide damaged the 22-door longhouse at Rumah Aji Mupoh Baroh, forcing out the 122 residents (<http://www.newsarawaktribune.com/news/42477/Four-landslides-occur-in-Betong-Saratok/>)

products and biofuels (5-10%; <http://www.forumpalmoel.org/en/ueber-palmoel.html>). Second only to hydrocarbons in the diversity of products derived from their fruits, the production comes with a heavy price.



Credit: Tom Iain White, 2016.

underlying organic rich material, producing a smoky ‘haze’ that blankets the area being cleared, and is transported across borders on monsoon-driven winds. Particulate concentrations in the peatlands of Sumatra approached 1,000 g/m³ in October of 2015- compared to New Dehli’s worst day in 2015 (470 g/m³; <http://time.com/4160858/india-new-delhi-pollution-record/>), this was declared a public health emergency by the Indonesian government, who later sent navy ships to evacuate people from the most affected areas. It is estimated that the latest bout of, “the haze” caused 19 deaths in Indonesia (<http://www.theguardian.com/world/2015/oct/28/indonesia-forest-fires-widodo-visit-stricken-regions-death-toll-mounts>), and potential economic losses exceeding \$120B in Singapore (<http://www.straitstimes.com/business/economy/singapore-gdp-will-take-hit-from-haze-as-countries-issue-travel-warnings>). A recent study suggests that the two-month long transboundary haze event in 2015 was responsible for over 100,000 excess deaths in Indonesia, Malaysia and Singapore (Koplitz et al., 2016).

After the land is cleared, it can be months before the oil palm trees are planted, and up to three years before these trees are productive

According to the CIFOR (Centre for International Forestry Research), 12% of the entire island of Borneo- 9.2 million hectares, almost the area of South Korea- is under industrial plantations (<http://www.cifor.org/map/atlas/>). The rise in palm oil production in this region coincides with an increase in demand for low trans-fat oils. Over 1 M hectares of land has been cultivated in Sarawak alone since 1973, with

annual production exceeding 125 M tonnes of oil, expected to *double* by 2020 (<http://www.recoda.com.my/priority-sectors/palm-oil/>). The remarkably dynamic oils are used by the food industry (80%), beauty

One hectare of oil palm can produce up to 4 tonnes per hectare (t/ha); its yield is five times higher than that of soy beans (0.8 t/ha), four times higher than sunflowers (0.9 t/ha) and three times higher than rapeseed (1.3 t/ha- <http://www.forumpalmoel.org/en/ueber-palmoel.html>). Vast swaths of forest in Malaysia, Indonesia and beyond have been turned from primary and secondary native forests and peatlands to monocultures of this West African crop. In places, the forests are first harvested for hardwood, and the ‘slash’ is

burned on the spot during the dry season. This practice is especially harmful in the peaty areas, where slash piles can ignite the underlying organic rich material, producing a smoky ‘haze’ that blankets the area being cleared, and is transported across borders on monsoon-driven winds. Particulate concentrations in the peatlands of Sumatra approached 1,000 g/m³ in October of 2015- compared to New Dehli’s worst day in 2015 (470 g/m³; <http://time.com/4160858/india-new-delhi-pollution-record/>), this was declared a public health emergency by the Indonesian government, who later sent navy ships to evacuate people from the most affected areas. It is estimated that the latest bout of, “the haze” caused 19 deaths in Indonesia (<http://www.theguardian.com/world/2015/oct/28/indonesia-forest-fires-widodo-visit-stricken-regions-death-toll-mounts>), and potential economic losses exceeding \$120B in Singapore (<http://www.straitstimes.com/business/economy/singapore-gdp-will-take-hit-from-haze-as-countries-issue-travel-warnings>).

(<http://www.forumpalmoel.org/en/ueber-palmoel.html>). During the time between deforestation and planting of the new plants, the soil is exposed to tropical downpours where rates can exceed 200 mm in 24 hours

(<http://www.thestar.com.my/news/nation/2015/12/31/thunderstorm-since-midnight-causes-floods-in-sarawaks-lowlying-areas/>). The resulting runoff is heavily laden with nutrient-rich sediment that is in turn, washed out to sea. There is a critical need to quantify the erosion rates over the lifecycle of the plantation in watersheds with palm production, and determine the fate of the sediment (Is it stuck in the river, does it make it to the coastal zone, or is it indeed washed



out to sea?). The loss of this layer of topsoil will have incalculable long-term effects for the sustainability of the palm industry, not to mention the populations that remain in this landscape.

Credit: The Author, 2016.

Food security?

Curiously, the role of palm oil and food security is not clear cut. On the one hand, palm plantations occupy land that could otherwise be cultivated with food crops. However, many small holders have profited from the planting of palm oil and in places like Columbia, fats from oil palm accounts for nearly a quarter of the fat in the national diet, and the homogenization of food supplies has led to increased overall security of food systems world wide (<https://wle.cgiar.org/thrive/2014/05/16/will-pursuit-food-security-weaken-resilience-global-food-systems/>). The role of pesticides and herbicides, fertilizers and topsoil loss must be further explored when considering the long-term sustainability of the industry.

Gains have been made toward more sustainable palm oil production. Large palm producers like Royal Golden Eagle and Wilmar are being pressured by stockholders to stop deforestation for palm production. When Wilmar, the world largest palm oil corporation signed on, others followed, but to varying degrees of efficacy (<http://grist.org/food/48-hours-that-changed-the-future-of-rainforests/>). Forests still burn. The RSPO (Roundtable for Sustainable Palm Oil) agreement between NGOs and the largest manufacturers has begun to address the key concerns with palm oil sustainability, however there is some work yet to be done (<http://www.eco-business.com/opinion/how-rspo-certification-meets-market-demand-sustainable-palm-oil/>)-

- **Deforestation.** RSPO bans logging in primary forests, customary forests (without community permission), and High Conservation Value (HCV) secondary forests, which is difficult to define
- The rules on **Greenhouse gas emissions** are vague, and focus on future emission reduction and more transparent reporting
- **Biodiversity** is addressed, but more attention needs to be paid to defining the HCV and emergent High Carbon Stock lands

- **Social issues**, including the rights of indigenous populations, and sharing of benefits and respect for human rights can be improved by including a broader base of stakeholders to ensure compliance

Increased attention on how fossil fuels are causing massive changes in the Earth's climate has focussed attention on renewable and 'carbon-neutral' power sources. Starting with corn-based Ethanol in the US as an additive to gasoline, there is a proposal in with the Malaysian government to add five percent palm oil to existing diesel fuel. The production, however, is hardly carbon neutral. It is estimated that 20 percent of Indonesia's carbon emissions are from palm oil cultivation, which includes the emissions from burning forests and peatlands (<http://www.nature.com/nclimate/journal/v3/n3/full/nclimate1702.html>), making it one of the world's largest carbon footprint industries.

The other renewable power source that is being exploited in Malaysian Borneo is hydropower. Large dams in Sarawak state account for 12% of Malaysia's total power production (https://en.wikipedia.org/wiki/List_of_power_stations_in_Malaysia, data from <http://www.st.gov.my/index.php/en/>). The massive Bakun Dam, completed in 2011, produces an excess of electricity in Malaysian Borneo, with a plan to export 70% to peninsular Malaysia (which also has excess capacity), Kalimantan (Indonesia), and perhaps to a proposed ASEAN grid (Sabah Electricity Supply Industry Outlook 2014, www.st.gov.my). While these earthen dams do not have the same carbon footprint of a concrete equivalent, they do not come without an environmental cost.

The large-scale erosion fuelled by clearing of forested landscapes for palm oil threatens to increase siltation rates in the reservoirs behind these massive dams, drastically reducing their lifespan. The Bakun Dam reservoir drowned over 700 km² of rainforest and farmland. Nitrogen-rich runoff from agricultural land (likely palm plantations) has caused the reservoir's pH to decrease (<http://www.internationalrivers.org/campaigns/bakun-dam>), and still waters have increased the prevalence of water-borne disease vectors (schistosomiasis, opisthorchiasis, malaria, and filariasis).

Furthermore, the dams are built to the detriment of the indigenous Dayak people that call the forested river valleys of Borneo home. These communities tend to be located near the rivers, which not only provides a resource for transportation, drinking water and fish, but also is the location where the best, nutrient rich soils accumulate. The communities are often centred on a longhouse, which can provide habitation for up to 30 families. The surrounding lands supply timber (fuel and building material), a shifting cultivation style of agriculture, and hunting grounds. While land tenure has not been formally granted by the Malaysian government, there exists an understanding of the boundaries between communities.



Credit: Tom Iain White, 2016

There is a strong need to delineate the boundaries and uses of the lands around several longhouse communities in the Baram River basin using a combination of Geographic Information Systems and community-based mapping. In the mapping process, efforts should be made to compile stories of the Dayak living in areas affected by landscape change- "story mapping. This narrative approach would

be nicely complemented by collecting water-quality data from the rivers and streams that the Dayak rely on. This would include the usual suite of pH, conductivity, temperature and dissolved oxygen, along with nutrient load and pesticide/herbicide content, and water sample collection to measure suspended sediment load. These data, tied in with overall land use both by the Dayak and the palm oil plantations upstream, provide an interesting view of the environmental health of the region, where there are reports of increased instances of communicable disease due to repressed autoimmune system response due to pesticide exposure (Nurulain M. U., Sharifah Norkhadijah S. I., Emilia Z.A., Vivien H., Dermal Exposure and Health Risk Assessment of Pesticide Use in Palm Oil Plantation in Malaysia: A Concept Paper, *Asia Pacific Environmental and Occupational Health Journal*, 1(1): 15 – 22, 2015).

“Climate Neutral” globalised industries such as hydropower and palm oil are not without environmental challenges. There are few places on earth where these problems are manifest more than in Malaysian Borneo. Over the last 30+ years, the landscape has been transformed first by hydrocarbon production, and later by deforestation for industrial hardwoods, land clearing for palm plantations, and construction of megadam projects that provide an excess of power to Malaysia (and beyond) along with profits to investors, but little for the indigenous populations. These dams flood hundreds of thousands of hectares rich in both natural and cultural resources. We need to take a radically interdisciplinary look at this on-going landscape transformation from environmental, cultural and economic perspectives with the aim of providing an interlinked narrative of the effects, both positive and negative, of this development on the people of the region. The discourse surrounding this project will be useful to policy makers that are in a place to make informed decisions by using the data we collect from this complex and interconnected system.