

Abstract:

The European Commission Renewable Energy Directive mandates that ten per cent of liquid fuels used in the European Union must be composed of plant-derived fuels by 2020. The directive claims that biofuels and bioliquids ‘help guarantee real carbon savings and protect biodiversity.’ The forests of Borneo, like those of other tropical regions, have and are being destroyed, their rich biodiversity and human cultures eroded, and the stored greenhouse gases in their biomass and soils released to the atmosphere, in order to generate short term profits from global, including European, primary resource markets for tropical timber, and tropical plantation products including EC mandated biofuels. ECRED promotion of biofuels based upon real world science indicates that far from saving carbon and protecting biodiversity, the promotion of these fuels has the opposite effects. The regulation, though well intentioned, was based on poor understanding of the functioning of global energy and primary resources markets, and in particular the way in which these markets interact with weak governance systems, and corruption, in developing countries to promote capital accumulation pathways that are exploited by economic corporations and political elites at the cost of the habitats of indigenous people and species, and of the resilience of ecosystems. From an ethical perspective the regulation on biofuels reveals an ontological misunderstanding of persons and other beings in time which puts short-term accumulation of economic value above longer term values such as ecosystem resilience, biodiversity, and long-evolved human traditions. The medium-term temporality of global climate governance, combined with the short-term utilitarian calculus, has through this regulation supplanted ancestral temporalities which have evolved over thousands of years and which traditionally governed the viability of tropical ecosystems and the ways of life that humans and other animals have developed to dwell in them energetically and sustainably.

In August 1987, while teaching in a theological seminary in Kuala Lumpur, I visited with two of my students the upper reaches of the Rajang River in the East Malaysian State of Sarawak, basing myself for some days at the logging town of Belaga in the fifth division. While there I saw evidence of extensive destruction of tropical forests at first hand. I also encountered native peoples whose homes and livelihoods had been destroyed by the destruction and pillaging of their ancestral lands. Many native peoples had been forced to move from the forest interior to long houses situated on the rivers since a small fringe of forest and garden land on river banks was left unmolested by the logging companies. In the long houses we visited we saw that the people were slowly being drawn into settled and town-based living with televisions, posters of Michael Jackson and other Western cultural paraphernalia in evidence. But nonetheless in the long houses many traditional practices were continued including cooking and eating communally, and swidden farming of wild rice and other plants that native peoples have domesticated as a way of supplementing wild food from hunting and gathering (Hong 1987).

A flying doctor working for a Christian missionary organisation whom I interviewed told me that she was visiting tribal communities in the highland interior, many miles from river-banks, and was finding children were suffering from malnutrition because the fish, mammals and plants they used to live off were no longer available to their parents to hunt and gather. The fish in the rivers had died as the quantity of soil displaced by logging activities had filled the rivers with silt, depriving the fish of oxygen. The mammals and plants the communities had once hunted and gathered, as had their ancestors for thousands of years, were either killed or destroyed by the clear-cutting practices of the logging companies. It is possible to remove the largest trees from tropical forests without destroying forest ecosystems and in such a way as to permit the forest to regenerate. However in Sarawak and Sabah, and in Kalimantan which is the Indonesian part of Borneo, the forest is cleared not only to remove tropical timber for sale but to convert the land into oil palm plantations.

Often when the largest and most valuable trees have been extracted the remaining forest is burned as this is a more economical way of clearing the land than removing the remaining trees and undergrowth before draining the land, and terracing it in preparation for oil palm plantation. So extensive is the burning of forests that the cities of Sumatra, West Malaysia, Borneo and Java - including Medan, Padang, Singapore, Malacca, Kuala Lumpur, Penang, Jakarta - are shrouded for days or even weeks at the height of the dry season in August and September by harmful smoke and smog. In the worst year on record for smog - 1999 - most of Southeast Asia was shrouded in smoke and this large-scale pollution incident occasioned a sudden down-turn in regional stock markets which precipitated a financial crash throughout Southeast and East Asia which impacted Korea and the Philippines as well as Myanmar, Cambodia, Vietnam, Laos, Thailand, and the Malay Archipelago (Swinbanks 1997).

Much tropical forest in Borneo and in Sumatra - the other large area currently being cleared for oil palm - grows on top of very deep peat and in some places the surface fires have led to subterranean peat fires which are impossible to extinguish. When the peat is not burned, it is dried out by drainage channels which are a common feature of oil palm plantations since the oil palm is not a native plant and needs drier soils than those left behind by tropical rainforests. The burning of the forest, together with the drying out of the methane-rich peat, produce vast regional greenhouse gas emissions. The quantity of greenhouse gas emissions from fires from land being cleared for oil palm plantations in Sumatra and Borneo in the period 2010-2016 was so great that Indonesia was the third largest national per capita greenhouse gas producer, behind China and the United States when land use change is included in the figures.

Oil palm is widely used in industrial products including as cooking oil, vegetable shortening, detergent, and as oil fuel. It is used to make tea lights and candles, and it is used to make liquid fuels - otherwise known as biofuels - for vehicular engines including biodiesel and bioethanol. The European Biofuels Directive claims biofuels are 'renewable' and mandates the aim that petroleum and diesel fuels sold in all European Union nations should contain ten per cent of biofuel by 2020. The EU Directive (2009/30/EC) mandates the use of biofuels in order to help the European Community 'meet its greenhouse gas reduction goals through the decarbonisation of transport fuel' and to reduce 'lifecycle cycle greenhouse gas emissions' from the fuel and energy supply of European vehicles. It acknowledges that 'the incentives provided for in this Directive will encourage increased production of biofuels worldwide', but it argues that 'increasing worldwide demand for biofuels, and the incentives for their use provided for in this Directive should not have the

effect of encouraging the destruction of biodiverse lands'. This means that biofuel provision must be subject to 'sustainability criteria' which in turn means that biofuels must 'not originate in biodiverse areas' or 'threatened or endangered ecosystems or species' and this means that 'primary forest' should not be used to grow biofuels.

Biofuels are derived from monocultural production of plants including sugar beet, wheat, sugar cane and oil rich plants such as oil palm, soya, rape and corn. Other plant sources are possible, including biomass waste from agriculture and forestry, but in the main food crops are used for biofuel, and oil palm is the largest single plant source for biodiesel in the EU. Within and beyond Europe the extent of land now devoted to such plants, and the widespread use of full spectrum pesticides and herbicides on the crops, is a major cause of habitat loss for species, and hence of biodiversity decline. The directive therefore provides a strong market incentive - since it is aimed at 10% of the large EU vehicular oils market - for companies and national agencies to grow more of such crops, and to continue to convert land areas to more production of crops with the potential to feed demand for biofuels, including forests and grasslands. The Commission argue that since primary forests are gazetted worldwide by government agencies that it will be possible to prevent the marketing of biofuels from land converted from primary forests. However the Commission failed to prove a mechanism or a certification scheme to ensure that biofuels, which are liquids refined mostly in the country of origin and shipped thousands of miles to European ports in oil tankers, do not originate from lands that were formerly primary forests and the 2009 directive led to a *fivefold* increase in the marketing of palm oil as biodiesel according to trade data (Transport and the Environment, 2016).

In recognition that there is an ongoing problem with the sustainability criteria in the 2009 directive, the European Commission published a revision in 2015 requiring that companies wanting their biofuels to become part of the EU liquid fuels mix should sign up to 'legal or voluntary schemes' to ensure their products are not from recently cleared forests (EC 2015). In the case of oil palm the only internationally recognised scheme for ensuring oil palm is not produced from land converted from primary forests is the Roundtable on Sustainable Palm Oil (RSPO). Begun at a meeting of oil palm company officers in Kuala Lumpur in the 1990s, RSPO was an attempt to underwrite the sustainability of palm oil given the strong scientific evidence that oil palm plantations are appearing on lands that were until recently gazetted as primary forests, in Borneo, in Sumatra, and as the industry extends its footprints in other parts of Southeast Asia. The sustainability production criterion RSPO introduced was that palm oil carrying the RSPO certification would be guaranteed not to be from lands converted from primary forests for this purpose (Schouten and Glasbergen 2011). But the code has proven difficult to enforce. This is in part because of the nature of the product: it is not possible to certify the liquid itself so it is not easy to enforce certification (Ruysschaert and Salles 2014). But there is also good evidence that companies that have claimed RSPO status for their palm oil have been involved in setting fires and clearing primary forest: in the summer of 2013 satellite data revealed that a large number of forest fires in Sumatra were set in areas adjacent to oil palm plantations which have attracted RSPO certification and it was evident they were begun purposefully to enlarge those plantations into new forest areas.

There is growing recognition that the European Biofuels Directive, far from reducing greenhouse gas emissions in Europe's vehicular fleet, has increased them because it has promoted tropical forest clearing and replacement with oil palm plantations. Advocacy from NGOs such as

Oxfam and Greenpeace, and related scientific studies (Pesqueira and Glasbergen 2013), led to a debate in the European Parliament in which MEPs passed a motion in 2017 calling on the European Commission to remove all vegetable oils including palm oil from European biofuels by 2020, but the Commission has not responded (EU Parliament 2017). Malaysia and Indonesia which are the principal producers of palm oil have said that they will raise a trade dispute with the European Union under World Trade Organisation rules if the EU bans vegetable oils. The plantation companies are closely connected with the governments of Malaysia and Indonesia, and in Malaysia the party that has governed continuously since independence in 1957 - the United Malay National Organisation - has extensive holdings of shares in plantation companies while a national Malaysian plantation agency - FELDA - is also a major producer of palm oil. This helps explain why when Malaysian cities including Penang, Ipoh, Kuala Lumpur, Malacca and Johor Bahru are shrouded in extremely unhealthy levels of particulate from forest fires in Sumatra and Borneo - such as in 2013 which saw a peak of burning in Borneo and Sumatra - the government makes very little fuss since the fires are set in many cases by sub-contractors acting for Malaysian-owned companies. A significant proportion of shareholder value on the Malaysian and Singaporean Stock Exchanges is therefore directly connected with oil palm plantations, including future projections of ongoing growth in conversion of forest lands.

The conversion of so much of Borneo from primary forest to oil palm has occasioned an ecological disaster on an unprecedented scale. And behind this disaster there is systemic political corruption, extensive criminal activity, and destruction of the habitats of native peoples and wildlife. In Sarawak the people most affected by the destruction of their forests are the nomadic Penan people. Though under the Malaysian customary law known as *adat* they ought to be considered as the owners of the forests of Sarawak since they have lived in them for generations, this customary ownership has not been recognised by the Sarawakian government. Instead the Sarawak State Government, under its Chief Minister Abdul Taib Muhamad, appointed itself the 'trustee' of the forests of native peoples for sixty years, after which in principle they could hand them back to native peoples but by then it is unlikely there will be many left since they have been forced out of their longhouses and nomadic dwellings into urban shanties in the growing cities of Sarawak and Sabah. In the meantime ninety per cent of the forests of Sarawak are now destroyed and replaced by oil palm plantations producing palm oil.

The chief beneficiary of the exported timber from Sarawak was one man - Abdul Taib Muhamad who was the Chief Minister of Sarawak from 1983 to 2014. Taib dominated the forest trade in Sarawak and amassed a vast personal and family fortune, much of it held by a company - Sakti International - registered in the State of California which owns and rents offices and residential buildings throughout the world, with significant concentrations in the cities of Adelaide, London, Ottawa and Seattle (Straumann, 2014). The devices for amassing this fortune were various. They included granting licenses to log forests to companies owned by family members; receiving bribes from other logging companies for logging concessions; and the receipt of export 'fees' to a Taib-family company called Regent Star registered in Hong Kong to which port most of Sarawak's timber was shipped, for onward shipping to timber importing nations in the region and most notably Japan, Taiwan, Korea and China. Finally in the wealth chain, much of the land, once logged, was turned into oil palm plantations which in many cases also became assets for members of the Taib family, which product ends up in European biodiesel (Straumann 2014, 108-9). A few other ministers in Taib's government also benefited. James Wong was the Minister for the

Environment in Sarawak from 1987 - 2001 and a company he controlled - Limbang Trading - logged 124,000 hectares in Limbang in northern Sarawak (Straumann 2014 111).

The destruction of the forests led to extensive protests and resistance by Penan and other native groups including logging blockades, and claims launched in Malaysian courts to recognise native land rights based upon extensive mapping projects undertaken by the Iban and Penan with help from the *Swiss Art for Rainforests Foundation* and the Bruno Manser Fund. Bruno Manser was a Swiss adventurer who lived extensively with the Penan in the 1990s and campaigned on their behalf internationally though the Sarawakian government then outlawed land surveying and mapping other than by government surveyors (Straumann 2014 167). Manser was also declared an illegal immigrant by the Malaysian government and he eventually disappeared in Sarawak in 2000, on land belonging to Samling, the largest Sarawakian timber company, though he had extensive knowledge of the forests and superb survival skills learned from the Penan. His remains have never been found, but it has long been supposed that he was murdered. Individual Penan who have led legal and non-violent protests against the logging companies have also been killed: these include Headman Kelesau Na'an of the Penan village of Long Kerong, who was a plaintiff in a legal land claim the Penan had raised in the Sarawak court in 2007: Kelesau met a violent death by persons unknown: Kelesau had been cajoled by an officer of Samling, the largest Sarawakian logging company, to give up the land claim and he was openly threatened by security personnel employed by Samling before he disappeared and his body found two months later (Straumann 2014, 174). A pastor from another village met a similar violent death in 1994 after encounters with Samling employees. Penan women, in the main young girls, were also regularly raped by Samling employees at the remote village of Middle Baram, and reports of sexual violence against women by logging company employees were investigated by West Malaysian journalist Hilary Chiew and published by *The Star* newspaper - at the time the largest selling English language newspaper in Malaysia - in 2008.

The interaction between criminality and corruption, primary forest exploitation and wealth accumulation is facilitated through international financial agencies and technologies (Tsing 2005). Hence Deutsche Bank, Goldman Sachs and other international agencies provide Taib and his family enterprises with international investment capital to grow their businesses further, and the financial means to move funds around. Deutsche Bank raised Taib and his businesses over \$700 million in investment capital in the form of bond issues and loans to fund the continued expansion of his family's, and cronies', tropical logging and land conversion activities (Straumann 2014 192-3). International capital also provides the means to launder the ill gotten gains of crony capitalism into internationally recognised wealth of the kind that means the FBI rents a building in Seattle from the Chief Minister's family company. But in addition to international finance funding and legitimating these activities, there is the role of international science, and science is on both sides of the story of the destruction of Borneo, in promoting biofuels as a response to climate change and hence providing capital opportunities for primary forest conversion to biofuel production.

First and foremost in the saga of the destruction of Borneo is climate science. Under the auspices of the United Nations Framework Convention on Climate Change nations agreed to monitor and publish inventories of national greenhouse gas emissions from their territories. But of course these inventories are in themselves sites of mediation and manoeuvring by national governments in pursuit of their national interests. So the Malaysian government in its inventory considers oil palm plantations as 'forest, thus reducing the emissions attributable to the drying out

of soils which the drainage of tropical forest land requires for the production of palm oil. In Sarawak official statistics in 2010 indicated that 64% of the land area was forest but this is a significant over-estimate. (Hon and Shibata 2013). Treating oil palm plantations as forest cover also reduces the public visibility of the gradual conversion of the forests both of East and West Malaysia from tropical rainforest to oil palm, though it is evident to anyone who flies over these lands, or drives from them on motorways since oil palm plantations stretch now stretch as far as the eye can see in lowland and parts of upland Sabah and Sarawak, and in large parts of West Malaysia. But the European Commission also uses the UNFCCC as legitimation for its promotion of biofuels arguing in ECRED that the Kyoto Protocol mandated the Commission to reduce greenhouse gas emissions from Europe's vehicle fleet and that this made the aim of 10% of fuels in Europe being derived from plants desirable and even necessary if the EC is to enable its constituent nations to meet their obligations under the Kyoto Protocol and the subsequent Paris Accord (2015). As with the Malaysian government, the European Commission uses greenhouse gas accounting mechanisms to make the claim that it can foster the continuing growth of European economies, and their still growing global ecological footprint, while 'decarbonising' their impact on the atmosphere.

The conventional account of climate change and its causes focuses on greenhouse gas emissions from coal, gas and oil extraction as both the driving force of the tremendous development and financial wealth which characterises modern capitalism and as the driving force behind 'climate forcing'. The European Commission uses greenhouse accounting modes of representation which make it seem as though the 'youthful' biofuel resulting from photosynthesis on present-day plants has a lower climate impact than the 'old' product of photosynthesis on ancient plants and shell fish whose long compaction in the earth's crust creates fossil fuels. But these modes of representation make assumptions which are not 'real world'. So for example, they assume that national inventories of primary forests are diligently kept by governments to prevent their destruction whereas in fact such inventories in the case of the government of Sarawak are viewed as a license to exploit. Science is also used on the other side of forest destruction to justify the new uses to which the land is put as 'climate friendly' and in particular the production of biofuels. The governments of Malaysia and Indonesia, and the plantation companies which they in part own, also use science in their modes of representation of the greenhouse gas emissions embedded in the biodiesel they produce which, like the European Commission's modes of representation, leave out the vast greenhouse gas emissions from land use change associated with expanding oil palm plantations. In both cases the mode of representation of greenhouse gas emissions in biofuels use science in their accounting but they both significantly under-estimate the climate forcing impact of biofuels because they leave out greenhouse gas emissions from land use change. When these are included climate forcing from biofuel is anything from 50-100% higher than from conventional fossil fuels. Far from reducing Europe's greenhouse gas emissions the biofuels directive has increased them. But when the customer buys diesel at the gas station, she is assured the product, because it contains plants, is more climate friendly, because it is partly 'renewable', than a purely fossil fuel based liquid, and so her conscience is assuaged as she fills up the tank. The European Commission is 'managing' the consumer's impact on the climate and by implication she should carry on driving and without the worry of managing her own 'carbon karma'. It is being taken care of 'upstream' as the energy industry would say.

Science is an ambiguous handmaiden in the biofuels saga. Science and technology facilitate the turning of primary forests and food crops into a substitute for fossil fuels. Science and technology facilitate the extraction of fossil fuels. Science and technology measure the climate forcing, and the impacts on creatures, ecosystems and human habitat, of climate forcing from fossil fuels and biofuels. The common culture of science and technology in all these activities facilitates an exchange of ideas and practices between them which helps explain how the European Commission legitimise its turn to biofuels by reference to global climate agreements, including the Kyoto Protocol and the Paris Accord. Malaysian and Indonesian governments, and their oil palm companies, also weigh in to this same exchange when they argue that their production and trade in biofuels is an appropriate response to climate change as well as an economic development opportunity for tropical economies. But it is only when environmental activists, and affected communities, protest the environmental injustice, and related corruption and crime, of the conversion of primary forest into biofuel plantations that the paradoxical role of science and technology in promoting biofuels as a replacement for fossil fuels is exposed. Hence the activists realised early on that it was not enough to protest in the forests, or even in the capitals and media of Malaysia and Indonesia. They had to take their case to Europe, to the European Parliament, to European capitals, and one of the key figures in helping to internationalise that case was himself a Swiss environmental activist - Bruno Manser - whom the Penan adopted as a spiritual

Also juxtaposed against cronyism, international finance capital, and science-informed accounts of greenhouse gas emissions from biofuels production, are the traditions, customs and beliefs of scientifically uninformed native peoples whose ancestral forests are being destroyed to grow the young plants needed for increased global production of biofuels. The shared assumption among Malaysian politicians and scientific foresters is that indigenous people are not good guardians or managers of forests. However this is contradicted by what has happened in Sarawak in the last thirty years. The only areas that have been saved from the destruction outside of the gazetted boundaries of National Parks, which constitute only 6.6% of the forested area of Sarawak (Hon and Shibato 2013), are areas protected from deforestation by the non-violent actions of native peoples, and in particular by Penan. Using logging road blockades of persons, posters and bamboo structures, while at the same time registering land claims in Sarawak courts, the Penan successfully saved 163,000 hectares of upland rainforest in the Baram District. Penan villages in this area have collaborated together to form the 'Penan Peace Park'. The ancestral lands and its ecosystem and living creatures are intact and now designated by the Penan as a self-governing nature reserve though it is not included on official maps of nature reserves in Sarawak. As a result the Penan are able to continue to hunt and fish there and plant small gardens and fruit trees (Straumann 2014 270).

The example of the Penan highlights a broader problem with what Agrawal calls 'environmentality' which is the tendency of environmental, atmospheric and species conservation science and agreements to be used to impose governance regimes on peoples, creatures and habitats in which agency is denied to the ancestral dwellers of such habitats both human and nonhuman (Agrawal 2005). The limited success of the Penan in resisting their ancestral forests being logged and then turned into biofuel plantations is an example of why Courtney Jung calls the 'moral force of indigenous politics' (Jung 2008). By resisting the postcolonial regime of a corrupt government and crony capitalists and forcibly blocking logging roads the Penan became subjects against the consensus in West and East Malaysia that indigenous peoples, and especially nomadic

indigenous peoples, are primitives who only acquire rights when they come out of the forests and live like normal modern 'citizens' in permanent long houses, or even worse cement and tin huts built by the government on the edge of rivers and near towns. Jung argues that through contestation and resistance to such a consensus indigenous people become agents, subjects, in the public sphere and hence contestation - and not only democratic governance and the law courts - is an essential source of justice in societies where there are groups who are excluded from full participation in normal legal and political processes (Jung 2008, 264-5)

Bruno Latour argues that the modern environmental science lacks sufficient purchase on the public sphere because it has not found ways to include creatures voices in public assemblies and courts (Latour 2004). However the Penan case indicates that the situation is even more complex. The Penan are not traditional 'environmentalists', and they are neither students nor agents of environmental science. They resist environmental science rather than advocate for it because environmental science colludes with crony capitalism in displacing them from their ancestral lands for the growing of biofuels to act as a fig leaf for European drivers. The Penan's environmentalism is an example of what Joan Martinez-Alier calls the 'environmentalism of the poor' (Martinez-Alier 2003). The Penan are not first and foremost protesting the destruction of the rainforests because they are a 'sublime wilderness', nor the impacts of this destruction on endangered species such as orang utan or pygmy elephants: they resist logging and the spread of biofuel plantations because the forests are their home, their livelihood, their indigenous capital and the modern turn of their habitat into capital, and even ecosystem services, leads to them becoming homeless, and excluded from the lands of their ancestors.

In his ground-breaking study of the Tsembaga people of Papua New Guinea, Roy Rappaport was among the first to argue that indigenous peoples, their customs and religious rituals, are the best guardians and keepers of ecosystems, forests, savannah and water catchments (Rappaport 1968). Rappaport gathered data from his field study of an annual pig sacrificial ceremony which he found demonstrated that the annual ritual sacrifice functioned in such a way as to limit the number of pigs kept by the group of 200 people whom he studied within the carrying capacity of their local ecosystem. Rappaport later developed a fuller theoretical account of the significance of this finding for understanding the role of culture and religion in both the making of humanity and in the governance of ecosystems by pre-modern peoples. Humans dwell both in the midst of linguistic and symbols systems of their own making, and in the midst of natural laws which they do not and have not made and which they never fully understand. The role of religion, Rappaport argues, is to mediate between what is made and what is not made so as to facilitate adaptation of human making, including the making of meaning, and natural laws and the 'unmade' (Rappaport 1999). When religion fails, or becomes pathological, and where ecosystems collapse because of overuse or misuse, this is because of a failure of adaptation. In Rappaport's terms the adoption of biofuels as a response to climate change is post-religious. But this saga can be understood as part of the larger tendency of science and technologies in late modernity to fashion meanings and symbol systems which come to displace the prehistoric and historic role of religions in mediating between the known and the unknown, the made and the mysterious (Noble 1999).

Alfred Russell Wallace formulated what has become known as 'the Sarawak Law' since it was his first published formulation of a theory of the long evolution of life on earth, and of the means of variation and distribution which drew a great deal from his observations in Sarawak. He summarises his theory as follows: 'Every species has come into existence coincident both in space

and time with a pre-existing closely allied species.' (Wallace 1855) Wallace's law however left out the influence of *Homo sapiens* on the process of the evolution and distribution of species. Like John Muir when he went to Yosemite, or the Amazon, Wallace preferred explanations of what he saw in the field that did not include persons, particularly when those other persons are non-Europeans lacking scientific education. But *Homo sapiens* had dwelt in Borneo at least 14,000 years before Wallace got there and the shape the rainforest and the distribution of species within it was in part due to human influence. Analogously when the indigenous peoples who have shaped and sustained the distribution of species in Borneo over 14,000 years lose influence over its forests and ecosystems it is unsurprising that their loss of influence coincides with the threat of extinction of many of Borneo's species and their replacement with one alien species - *Elaeis guineensis* from the forests of West Africa.

Robin Hanbury-Tenison led the 1977-8 Royal Geographical Society Expedition into Mulu in North Sarawak and was the first European to find the cathedral like cave, and cave system, in the Mulu upland forest. That discovery, along with the many endemic species the expedition identified, led to the gazetting of the area as Gunung Mulu National Park. Hanbury-Tenison early on in the expedition was befriended by a Penan - Nyapun - and his family who took him into many places he would never have found on his own and taught him the arts of living in the rainforest with little more than a blow-pipe, a machete, a cooking pot, and a few musical instruments. Hanbury-Tenison found that the Penan, including their older children, knew the names and medicinal and other uses of hundreds of plants in the rainforest and that they used this knowledge to live long and healthy and free lives in self-built structures which when they are abandoned are soon retaken by the forest since made from forest materials. He came to realise on his expedition and with his deep engagement with the Penan that 'the key reason there is so much biodiversity' in Sarawak and it is this

which makes the forests so valuable and worth turning into a park is the there have bene people looking after it in a symbiotic relationship for ages. And what is more, as we were increasingly to learn on our expedition, their knowledge and understanding of it far exceeded our own superficial scientific analysis (Hanbury-Tenison 2017, 64).

The role of indigenous peoples as guardians of biodiversity is only now being recognised and in so many places, including Borneo, it is mostly too late. Until now the global governmentality of the climate fostered by the UNFCCC and its treaty negotiations has assumed governments are the best guardians of forests. The agreement concluded at the Conference of the Parties 13 in Bali covering tropical forests resulted in United Nations Programme on Reducing Emissions from Deforestation and Forest Degradation (or REDD). Like ECRED, REDD is premised on the assumption that national governments are responsible for managing the carbon cycle in their terrains, including emissions from forests, and the agreement has enabled developing countries with tropical forests to access development funds under REDD, and previously such funds were available under the UNFCCC's Clean Development Mechanism, for development projects in tropical regions that produce biofuel or that use biofuels in development projects (Northcott 2013 128, 140). But far from slowing tropical deforestation, these development funds are being used for economic development projects which continue to displace the original guardians of the forests, and the myriad creatures whom they have guarded and sustained over many millennia

before the modern arrival of colonial regimes, and postcolonial regimes such as REDD. The connection between the European and North American use of biofuels grown on drained tropical forest soils and producing more greenhouse gas emission per kilojoule of net energy than conventional fossil fuels as ways to claim they are meeting their obligations under UNFCCC treaties rests upon an inter-temporal calculation, or an 'energy temporality'.

According to the scientific narrative of fuel production and use, burning fossil fuels extracted from the earth's crust results in a net-present increase in carbon in the atmosphere and the Earth System because fossil fuels are the results of ancient photosynthesis. Biofuels are said to not result in net increases in emissions to the atmosphere in present time since the energy comes from plants which photo-synthesise solar energy and it is this newly produced energy which is subsequently burned. However, the use of soils to grow fossil fuels on a planet with seven billion people needing food, and a similar number of domesticated birds and animals fed for human meat consumption, requires the displacement of other activities. Energy supply chains and markets are fungible: they facilitate the transformation of subterranean and surface derived liquid and electric energy from place to place, region to region, continent to continent and financial account to financial account. Biofuels arrive in EU ports in giant ocean tankers registered in low regulation nations such as Liberia and employing non-unionised non-European workers who are not able to step onto European land while they are unloaded. But there is no immigration test available which can determine whether the biofuels in the tankers come from lands recently cleared of tropical forests, or lands whose methane has leached into the atmosphere cancelling out any putative net-present carbon gains of biofuels over fossil fuels.

ECRED reveals an ontological misunderstanding of persons and other beings in time which puts short-term accumulation of economic value above longer-term values such as ecosystem resilience, biodiversity, and long-evolved human traditions including the ancestral guardianship of creatures and ecosystems. The short- and medium-term temporalities of global climate governance, combined with the short-term utilitarian cost benefit calculus of financialised capitalism, have combined in the recent past and present to supplant longer-term temporalities which have evolved over thousands of years, and which traditionally governed the viability of tropical ecosystems and the ways of life that humans and other animals have developed to dwell in them sustainably. The Penan and other indigenous peoples live by a temporality that I call 'ancestral time'. They govern their lands and raise their children and guard their fellow creatures as their ancestors have done for millennia. And do this from present-day photosynthesis since the materials they use to build their homes, to clothe, entertain and nourish themselves are derived from their local forests. Hence paradoxically their ancestral time also promotes a 'presentist temporality' in relation to energy production and use (Northcott 2018).

At the heart of the climate change conundrum is the way in which science and technology have enabled coal, gas and oil engineers to take the earth's carbon cycle to a deep time state of parts per million of CO₂ in the atmosphere that it has not been in the 200,000 year history of *Homo sapiens* by burning buried sunlight in the present-day atmosphere. But attempts to fix this error with biofuels reveal a misunderstanding of the temporal nature of the climate problem and of energy production, marketing and use, and a disconnection between present uses of energy and future planetary states (Shirani, Butler et al 2013). That misunderstanding is resulting in the ongoing destruction of tropical forests to fit UNFCCC mandated national terrain-based net-present greenhouse gas emission accounting mechanisms. Governments which turn to biofuels as

means to reduce their net-greenhouse gas emissions need urgently to end the biofuels error and instead invest in ways to reduce per capita energy use in the present and near future with present-day energy from the sun, wind, water flow, and hot rocks generated justly and ethically from within their own domains (Northcott 2007).

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