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Philip McMichael

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## Agrofuels in the food regime

Philip McMichael

The biofuels rush represents the continued externalisation of capitalism's costs, through the distraction of green fuel. This essay argues that the agrarian question has been posed as a distinctive problematic across the three so-called 'food regimes' associated with high colonialism, developmentalism, and neoliberalism – and that the third form of the agrarian question is revealing most visibly the contradictions of the commodification of food and fuel crops. These contradictions are clearest in their developmental (and climatic) effects in biofuel expansion at the expense of human habitats and ecologies; as well as in reducing ecological processes to a price metric to facilitate carbon trading, but revealing the incommensurabilities of carbon flows and, therefore, the shortcomings of market environmentalism as a proponent of greening accumulation with biofuels.

**Keywords:** metabolic rift; ecology; capitalism; farming practice; epistemic rift; agroecosystem; knowledge

### Introduction

The recent explosion of biofuels (a questionable response to the energy/climate crisis) is a blunt reminder of the extent to which capitalism externalises its costs. Cost externalisation is one clear consequence of commodity fetishism: wherein the social and ecological impacts of commodity relations are obscured by the price-form. Assigning a price to biophysical processes (as 'natural resources') objectifies them and conceals their socio-ecological relations. As indebted Southern governments compete for biofuel investment finance and Northern governments champion this 'green fuel', the social and ecological consequences of converting crop land and forest into a new profit frontier are hidden behind a façade of market environmentalism. What elsewhere I have called the 'agrofuels project' (McMichael 2008) is at the same time approximating a food-for-fuel regime. Through the lens of food regime analysis, the rush to agrofuels<sup>1</sup> can be seen to be the ultimate demystification of capitalism's subjection of food to the commodity form: deepening the abstraction of food through its conversion to fuel, at the continuing expense of the environment.

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<sup>1</sup>Social movement critics rename biofuels *agrofuels* in recognition of their problematic environmental and social consequences, whether first- or second-generation. Cf. Corporate Europe Observatory (2007).

Recognition of the contribution of agrofuels to the 2008 food crisis,<sup>2</sup> and the claim that a ton of palm oil produces 33 tons of CO<sup>2</sup> – ten times more per ton than petroleum (Rainforest Action Network 2007), emphasises the socio-ecological impact of agrofuels. Not only do agrofuels substitute fuel crops for food crops, but they are also a highly problematic alternative source of energy. As a ‘renewable’ energy source they represent an attempt to internalise externalities. But, as suggested, they compound capitalism’s externalities – in a combination of artificial offsetting of emissions, releasing more carbon from newly cleared land, and exacerbating food insecurity. Heralded as a form of ‘ecological modernisation’,<sup>3</sup> they have been revealed as a questionable development, especially insofar as they exacerbate the global food crisis, entwined as it is with the climate and energy crises. As such, the agrofuels phenomenon underlines the *breaching* of neoliberal claims to feed the world through the market via a corporate food regime premised on an unsustainable energy-intensive form of agro-industrialisation. The breaching has three dimensions: failure to deliver on these claims, enabling crossover investment from food to fuel crops, and a violation of trust, as feeding the world claims yield to energy security provisioning for a wealthy minority of humanity.

Accordingly, the agrofuels project reflects a material and epistemic crisis – dramatised by UN Human Rights *Rapporteur* Jean Ziegler’s claim in October 2007 that biofuels are a ‘crime against humanity’ (Borger 2008). It is this claim that anticipates the politicisation of biofuels, in their renaming by social movements and critics as ‘agrofuels’. Just as the unravelling of the US-centred food regime by a decade of unruly trade practices led to the renaming of food aid (subsidised food trade) as ‘dumping’ (Friedmann 2005, 234), so the resort to biofuels as a misguided response to the energy/climate crisis, intensifying the food crisis, is a latent expression of the unravelling of the recent corporate food regime, beginning with its representational crisis (McMichael 2005).

### Food regimes and development

The distinctiveness of the food regime concept is its attention to the significance of food production and consumption relations across historical periods (Friedmann and McMichael 1989, and see McMichael 2009c). These historical periods have been commonly associated with hegemonic moments in the world capitalist economy (British, US, and institutionalised neoliberalism),<sup>4</sup> embodying specific geo-political relations and modes of capitalist development, and accompanying development ideologies. For example, the difference between the first two periods is often characterised as British ‘outer-oriented development’ and American ‘inner-oriented

<sup>2</sup>US corn ethanol explains one-third of the rise in the world corn price according to the FAO, and 70 percent according to the IMF. The World Bank estimates that the US policy is responsible for 65 percent of the surge in agricultural prices, and for . . . the former USDA Chief economist, it explains 60 percent of the price rise’ (Berthelot 2008, 27).

<sup>3</sup>Cf. Martinez-Alier (2002).

<sup>4</sup>Just as Arrighi (1994) has argued, British and American hegemonies, backed with military/financial force, were founded in political-economic principles (e.g. freedom of trade, freedom of enterprise) adopted by rival states as relatively universal organising principles, so the WTO institutionalised a universally accepted organising principle (liberalisation), with military/financial/legal force standing behind adoption by member states, despite asymmetry of observance between North and South.

development' – distinguishing a colonial-imperial mode of development from a nation-centred form of development, respectively. Through these historic projects of rule – from the colonial, through the development, to the globalisation project – the ruling powers in each historical moment constructed a ruling *rationale*, whether it was 'civilisation', 'development', or 'globalisation', respectively. The accomplishment of rule in each moment required the construction of 'subjects', 'citizens', or 'consumers' – each social category serving as the ideal vehicle, and product, of development.

Within these moments, food regimes have underwritten projects of rule, whether via *agricultural social forms* animating particular divisions of labour within and across political boundaries (plantations, family farming on settler frontiers, petro-farming, contract farming and agro-industrial estates), or via the construction and reconstruction of *social diets* as sources of economic and cultural hegemony and political legitimacy. Much has been written about the material and symbolic role of beef, bread, hamburger, tomatoes, chicken, and Chinese noodles as expressing the articulation of cultural and class relations under changing hegemonic conditions (Morgan 1980, Mintz 1986, Rifkin 1992, Friedmann 2000, 2005, Dixon 2002, Pritchard and Burch 2003, Patel 2007, Barndt 2008). But *for the purposes of this essay*, in each project of capitalist development there has been a distinctive problematic regarding the 'agrarian question'. That is, what is the political-economic role of agriculture (and food) in each regime, and what residual and emergent contradictions drive the rise and decline of each food regime and its associated project of development?

As argued elsewhere, the British-centred regime combined residual and emergent contradictions in its juxtaposition of tropical and temperate agricultures, namely, a colonial division of labour and its initial supply of exotic foods for European consumers alongside an emergent nation-centred division of labour between farm and manufacturing sectors pioneered in the settler states (Friedmann and McMichael 1989). Settler farming continued the colonial practice of agro-exporting, focused now on wheat and meat as staple provisions for a formative European proletariat, via a characteristic colonial monoculture deploying an ecologically destructive form of 'soil mining' in developing specialised wheat frontier and livestock pastures (see Crosby 1986, and Friedmann 1978, 2000). Soil mining represented ecological degradation 'at a distance' during the height of this regime,<sup>5</sup> eventually resulting in a catastrophic 'ecological feedback' (Campbell 2009) in the form of the 1930s dust bowl, and its attendant social unrest (cf. Friedmann 2005). The outcome was a new US-centred food regime, based on agricultural subsidies, commodity stabilisation programs, and petro-farming (Walker 2004). The hallmark of this food regime was its political anchoring in the US farm belt and its agro-industrial form, exported first to Europe through the Marshall Plan, and then to the Third World via the green revolution (an ecological time bomb).

The intensive agricultural methods also had political origins insofar as the agricultural revolution of the 1950s depended on the conversion of wartime nitrogen production (for bombs) to inorganic fertilizer, which displaced the nitrogen-fixing legumes and manure used previously. Along with mechanisation, the use of inorganic fertilizer increased farm demand for fuel oils, gasoline, and electricity, 'thus increasing agricultural dependence on the energy sector and thereby converting

<sup>5</sup>Note that ecological degradation characterised the imposition of tropical export agricultures by imperial powers (cf. Davis 2001).

the latter more than ever into a part of agribusiness' (Cleaver 1977, 17). Subsequently, in the name of the UN's Freedom from Hunger campaign (1960), the Food and Agriculture Organization (FAO) provided extension services for the dispersal of surplus inorganic fertilizer across the Third World, deepening agricultural dependence on the energy sector (Cleaver 1977, p. 28), and deepening petro-farming's ecological degradation through soil mining via chemical fertilizer.

While the agrarian question in the initial food regime focused on the political implications of patterns of proletarianisation of European farmers, overdetermined by the international food trade (Kautsky 1988, McMichael 2009a, 290–3), the agrarian question in the second food regime concerned state pacification of First and Third World farmers via public support, land reforms, and technification. The former agrarian question viewed agriculture through the lens of progressive capital subordination as a backdrop to late nineteenth-century revolutionary politics, while the latter agrarian question focused on publicly managed agro-industrialisation for capitalist farmers, and peasantisation through American-style land reforms (Araghi 1995). The combined processes of industrialisation, proletarianisation and unionisation during the waning years of the first food regime, followed by world war and depression, imprinted a nexus of social reform displacing the question of agriculture's trajectory from First World revolutionary politics, even as post-colonial politics played out in Third World peasant insurgency – eventually undercut by repression, land reform and a 'green' revolution (Perkins 1997, Patel 2007) that were central tenets of the postwar development project (McMichael 1996).

Arguably, the agrarian question emerging during the current era of the corporate food regime has evolved as an agrarian question of food. Neither simply a question of the political impact of capital's subordination of landed property, nor of political pacification of struggling farmers and peasants in North and South, today's agrarian question concerns the implications of 'agriculture without farmers',<sup>6</sup> on a world scale (McMichael 2009b, Araghi 2009). While capital and labour relations continue to shape the contours of agrarian transition, the (neoliberal) institutional setting has shifted from a state-centric to a global social landscape. Not only has the scope of the question broadened in an age of increasingly unfettered capital mobility, but also the state system, as a relation of production (Sayer 1987), has been transformed via a combination of privatisation and liberalisation to accommodate transnational capital. This nexus between production *and circulation* relations has been identified by La Via Campesina as the essence of the early twenty-first century agrarian question in its observation that the 'massive movement of food around the world is forcing the increased movement of people' (2000).

In this statement, dispossession of small producers is linked to the political privileging of capital circuits to enhance market outlets for agro-industrial surpluses and agro-exports. That is, proletarianisation on a world scale for footloose capital is accomplished by agribusiness via a politics of de-peasantisation, expressed in the rise of a global peasant movement (Desmarais 2007, Borras *et al.* 2008). Today's agrarian question is not simply about political tendencies of capitalist development, rather it concerns the politics of constructing the means of 'accumulation by dispossession' (Harvey 2003) in the agrarian sector *for capital in general*, thereby promoting 'food from nowhere' at the expense of landed food cultures and the

<sup>6</sup>This term comes from La Via Campesina, an international coalition of peasant organizations.

natural environment (from soils and water through landraces to livestock species). And here is the point: that biofuels constitute another portal through which capital in general can profit from agriculture.

### The twenty-first century agrarian question

In generating a 'planet of slums' (Davis 2006), neoliberal capitalism has inverted the problematic of the original agrarian question. Because of the uncoupling of urbanisation and industrialisation and its attendant socio-spatial consequences (Araghi 2000), the agrarian question becomes less about the classical question – whether depeasantisation strengthens proletarian organisation, and more about the casualisation of labour worldwide (McMichael 1999), and the dismantling of cultures of social reproduction via small farming for the majority of the world's population. As noted elsewhere, the resulting peasant countermovement

involves developing a praxis premised on a critique of the conditions of global *movement* of capital at this historical moment. It is a class politics with an ethical, historical and ecological sensibility aimed at the machinations of the state system in converting agriculture to a world industry for profit. As such, it concerns questions of rights, social reproduction and sustainability, rather than the questions of teleology, class and accumulation deriving from a productivist understanding of capital and its historical movement. (McMichael 2009b, 308)

To reformulate the agrarian question as a food question is to acknowledge that the politics of agriculture today is less about chronicling transition than about addressing the crisis of small farming across the world.<sup>7</sup> The food sovereignty movement, combining peasant and farm organisations and associated environmental and urban-alliance movements, is the *political* form of this question. The *technical* form is that represented by the World Bank, in its 2008 *World Development Report*, which reveals a renewed interest in agriculture (after a 25-year hiatus in its reports), and in particular in bankrolling the small farmer as a key to enhancing food production.

What is intriguing here is the re-centring of agriculture from both directions: from peasant mobilisation to promote an 'agrarian citizenship', premised on land redistribution and co-operative forms of agro-ecology (Wittman 2009), and from corporate mobilisation, articulated in the Bank's vision of the 'new agriculture': 'led by private entrepreneurs in extensive value chains linking producers to consumers and including many entrepreneurial smallholders supported by their organisations' (World Bank 2007, 8). The Bank's 'new agriculture for development' is governed by market intensification, via publicly subsidised agribusiness: 'The private sector drives the organisation of value chains that bring the market to smallholders and commercial farms' (p. 8).

<sup>7</sup>Arguably, Henry Bernstein's (2008) plea to analyse the agrarian question today as a question of labour reproduces a classical, accumulation-centred episteme that is at odds with the reality of peasant *political mobilisation* as a new social class (class here because it is constituted as a political class via neoliberal capitalist process) – dedicated not to reproducing a traditional peasantry, but drawing on traditions (ecological knowledges, culture of the commons) of the 'peasant way' (as La Via Campesina names it) to reconstitute smallholder agriculture around land rights, local markets, labour/knowledge co-operation, agro-ecological methods and 'agrarian citizenship' (Wittman 2009).

In its *World Development Report*, the World Bank identifies ‘two major regional challenges’. The first, in sub-Saharan Africa, views growth in agricultural productivity as ‘vital for stimulating growth in other parts of the economy’, and the second, in Asia, focuses on generating ‘rural jobs by diversifying into labour-intensive, high-value agriculture linked to a dynamic rural, nonfarm sector’ (World Bank 2007, v). The Bank extrapolates future (unsustainable and inequitable) trajectories: ‘To meet projected demand, cereal production will have to increase by nearly 50 percent and meat production 85 percent from 2000 to 2030. Added to this is the burgeoning demand for agricultural feedstocks for biofuels . . . .’ (p. 8).

The world market for biofuels is currently centred in Southeast Asia, where Malaysia and Indonesia are the world’s largest palm oil producers, supplying about 85 percent of the world market. Meanwhile, Africa, referred to as the ‘Green OPEC’ because of its vast land reserves, is hosting finance from Brazil, Saudi Arabia and China, the World Bank, USAID, the European Commission, and private corporations to develop biofuels primarily for export. In other words, while the Bank’s *World Development Report* advocates biofuels, cautiously, noting that with current technology they have a marginal impact on energy security in particular countries, it nevertheless characterises them unproblematically as ‘agricultural feedstocks’ subject to ‘burgeoning demand’. That is, biofuels represent a logical extension (under peak oil conditions) of an agro-industrial future, in which small farmers are progressively incorporated into food-fuel value chains premised on global ‘agriculture without farmers’. These are the relations of subjection against which the food sovereignty movement mobilises, and through which the twenty-first century agrarian question of food emerges.

### Corporate food regime developments

As suggested above, food regimes condition projects of development with residual and emergent contradictions which govern trajectories of subsequent transitions. The corporate food regime is no exception. Bill Pritchard (2009) has argued that the World Trade Organization (WTO) is a hangover from the crisis of the preceding regime, by which he means the WTO emerged as a solution to that regime crisis, but retained some of its mercantilist relations. While his implication is that a ‘third food regime’ depends on the demise of this institution, arguably the WTO has simultaneously presided over a deepening of agribusiness power as a private regime behind the WTO’s multilateral façade (Cutler 2001, Peine 2009, McMichael 2009c). It is this publicly subsidised private regime that has been responsible for constructing the export-oriented ‘world farm’ (McMichael 2005) around which the new agrarian question revolves. And public subsidies for agribusiness are not going away. In fact this residual contradiction is deepening as a consequence of the combined food and climate crises – which represent the emergent contradictions in the corporate food regime. The most visible aspect of this is the ‘global land grab’<sup>8</sup> arising from a combination of *new* mercantilist food security practices, as governments sponsor offshore agriculture to ensure national food security, and offshore investment in land for biofuels production. As suggested, in context of this crisis and the stated

<sup>8</sup>See GRAIN (2008b). Roughly 20 percent of the global land grab is scheduled for agrofuel crops, which, alongside of projected export food crops, constitute a new investment frontier for food, financial, energy and auto companies (Vidal 2009, 12).

misgivings even by authorities<sup>9</sup> still bound to promote biofuels, critics rename them ‘agrofuels.’

Assisted by World Bank policy,<sup>10</sup> the land grab is represented as a form of development, insofar as indebted governments in the global South stand to receive foreign investment and hard currency from conversion of their land and forests into agro-export platforms. Biofuels in particular claim a new role in development. In 2001, for instance, President Andrés Pastrana of Colombia sought to lure Malaysian investors for a three million-hectare oil palm project on the grounds that ‘progress and social development can reach large areas of Colombia that are ready to join in the cultivation and processing of this primary commodity’ (quoted in Escobar 2008, 85).

Echoing the World Bank’s challenge to generate employment through rural diversification, Oxfam (2007, 5) concludes in its report, ‘Bio-fuelling Poverty’, ‘Biofuels need not spell disaster for poor people in the South – they should instead offer new market and livelihood opportunities. But the agro-industrial model that is emerging to supply the EU target poses little in the way of opportunities and much in the way of threats’. Oxfam’s solution is to propose a set of social principles governing the development of a biofuels industry, one of which is that ‘feedstock cultivation does not adversely impact on local communities or indigenous people’, without which the EU ‘must accept that the ten percent target will not be reached sustainably, and therefore should not be reached at all’ (p. 6). The UK Gallagher Report (2008) complements Oxfam’s social vision, cautioning against displacing food crops, but noting that alternative energy crops can simultaneously provide new employment and local development opportunities to rural communities.

Arguably, poverty alleviation serves as a proxy for an ‘agrofuels project’ as a new frontier of green accumulation geared to address the twin problems of peak oil and climate warming. Within the development paradigm, this project gains currency by appealing to an urgent need for alternative, sustainable energy sources. While the criterion of sustainability is open to serious question, and serious abuse, nevertheless it legitimises this project. At the same time, there is a more profound, ontological issue, namely the projection onto the world at large of a development model whose beneficiaries are a minority of the world’s population, most of whom consume energy unsustainably, whether they like it or not. In other words, biofuelling poverty, a polite term for the agrofuels project, also means deepening forms of rural dispossession in the name of the market, and on behalf of this minority and its dependence on agribusiness imperialism. It is, perhaps, the apogee of ‘global ecology’, whereby natural resources are incorporated into a market calculus to sustain unsustainable patterns of profit-making and consumption (cf. Sachs 1993). It is this very incorporation, however, that is revealing the ultimate shortcomings of the development paradigm, and the crisis of the corporate food regime.

The inclusionary reflex – of extending social development to the hinterlands via the biofuel industry – is not without benefits for some (already marginalised rural and forest-dwelling people).<sup>11</sup> And it is important not to assume that many of these

<sup>9</sup>E.g. the UK Gallagher Report (2008).

<sup>10</sup>The Bank promotes land legislation to enable land sales to foreign investors.

<sup>11</sup>Rist *et al.* (2009) note, for example, that oil palm production contributes over 63 percent of smallholder household incomes in two locations in Sumatra, and that there is evidence of oil palm alleviating poverty.



people are hapless victims, even when it is clear they have no choice in the matter. But this is not the point – rather it is to consider the cost of such inclusion in normalising a global process of uneven and combined development whose path-dependence undermines future possibility. Part of this process of erasure includes the elimination of tacit ecological knowledges upon which the survival of the human species might depend in the process of reforming our anthropocentric assumptions and practices. This is not to say that pre-industrial peoples, or those with light ecological footprints, are a necessary and sufficient corrective resource to save the planet. Rather, undermining ecological knowledge reinforces capital's attempts to overcome all barriers to accumulation, in particular the conversion of natural processes (and their discursive representation) into value relations.<sup>12</sup>

In acknowledging the environmental shortcomings of biofuels, the UK Gallagher Report (2008, 1) nevertheless proposed continued biofuels production, but only on non-agricultural land because of 'displacement effects':

Biofuels have been proposed as a solution to several pressing global concerns: energy security, climate change and rural development. This has led to generous subsidies in order to stimulate supply. In 2003 ... the European Union agreed to the Biofuels Directive ...

Five years later, there is growing concern about the role of biofuels in rising food prices, accelerating deforestation and doubts about the climate benefits. This has led to serious questions about their sustainability ...

We have concluded that there is a future for a sustainable biofuels industry but that feedstock production must avoid agricultural land that would otherwise be used for food production. This is, because the displacement of existing agricultural production, due to biofuel demand, is accelerating land-use change, and, if left unchecked, will reduce biodiversity and may even cause greenhouse gas emissions rather than savings. The introduction of biofuels should be significantly slowed until adequate controls to address displacement effects are implemented and are demonstrated to be effective.

The confusion in this report, and statement, is symptomatic of the developmentalist assumption that energy consumption follows an inexorable trend (either because it is political suicide for governments to break this habit, or because of assumptions about the rise of 'Chindia'). It clearly echoes the World Bank's advocacy of a 'new agriculture for development' – a development projection based on extrapolation of current trends in resource consumption. Embedded in these projections is the expectation of access to non-agricultural 'idle lands' for biofuel production. The new development discourse re-values such land as a resource for securing new energy supplies to sustain industrial accumulation at the expense of the value these lands have in both sequestering carbon and sustaining livelihoods of so-called 'marginal peoples'. Economic valorisation of hitherto 'unused' habitat represents an attempt to awaken the potential of idle resources through their development.

As the Colombian president claimed, oil palm would bring progress and social development to rural areas. For Colombia, the World Rainforest Movement reports, 'Vast stretches of land are given over to plantations for agrofuel; tropical forests are being cleared to plant thousands of hectares of oil palm, sugar cane and other

<sup>12</sup>For a development of this observation, see Araghi (2010).

crops ... In many cases, palm plantations are expanding over the territories of displaced communities' (quoted in Lohmann 2009). A recent report in *The Observer* noted that The Body Shop's main supplier of palm oil (90 percent) was part of a consortium that used legal and police force to evict over 100 *bona fide* peasant occupiers from land north of Bogotá to grow palm oil (Syal 2009). Not without resistance, hundreds of Afro-Colombians in the Choco coastal rainforests have been illegally dispossessed for oil palm agro-industrial projects administered by the Colombian company Urapalma. Colombian president Uribe Vélez represented palm oil development 'as a strategy for territorial control and paramilitary demobilisation' (FoodFirst 2007, 2). Human rights workers report,

Since the beginning of the decade, all the areas of expansion of palm plantations have coincided geographically with paramilitary areas of expansion and presence, to the extent that some of the new plantations being developed have been financed as farming projects for the same demobilised soldiers ... who had previously made incursions into these very areas. (Quoted in Smolker *et al.* 2008, 27)

Southeast Asia concentrates the agrofuels rush. Indonesian cultivation of oil palm has risen from 3.6 million hectares in 1961 to 8.1 million ha in 2009 (Rist *et al.* 2009). Indonesia is now the world's largest producer of palm oil, with 18 million ha of cleared forest for timber and future biofuel expansion (Colchester *et al.* 2006, 11–2). Oil palm is a key to rural development strategy, exercised mainly through Nucleus Estate and Smallholder schemes (NES), where farmers allocate a proportion of their land to an oil palm firm's estate plantation, with remaining land retained by farmers, but planted with oil palm by the firm (Rist *et al.* 2009). The Indonesian Department of Agriculture claims approximately 27 million additional hectares of 'unproductive forestlands' (post-logging and cultivation) available for conversion into plantations, and Sawit Watch reports almost 20 million ha proposed for biofuel development by local governments (Rist *et al.* 2009, 25).

Land laws are key to these projections. The land tenure system of indigenous (mostly Dayak) groups rests on communal ownership regulated by customary law (*adat*), whereby farmers gain land rights through land clearance and cultivation, 'originally through swidden agriculture although this system has almost ceased due to land shortage caused by the expansion of oil palms' (Rist *et al.* p. 104). While the Indonesian constitution recognises 'customary law communities' (a status weakened under the New Order, but potentially restored though inconsistently applied under Regional Autonomy laws since 1999), legally the State has the right to control and allocate natural resources in the name of its citizenry. But 'too often the law treats what are in reality indigenous peoples' lands as State lands ... considered to be unencumbered with rights or ... allocated to companies through a process that strips communities of the few rights that the government does recognise', allowing companies 90-year leaseholds (p. 14). And Rist *et al.* (2009) note that oil palm development agreements with communities are often concluded without commitment by the companies, with recurring problems of land grabbing, with lack of transparency and appropriate consent procedures, exacerbated by the absence of clear land rights.

A recent UN report noted,

Experience with existing and extensive oil palm plantations in other parts of Indonesia conclusively demonstrates that Indigenous peoples' property and other rights are disregarded, their right to consent is not respected, some are displaced, and they are left with no alternative but to become *de facto* bonded labourers

gathering oil palm fruit for the companies that manage the plantations. (Quoted in Smolker *et al.* 2008, 30)

The agrofuels project in Indonesia (in both compositional and contextual terms) is expressed directly by the Plantation Office Head in Sanggau District:

We believe that the oil palm estate has a good multiplier effect. The financial benefits from oil palm estates are by farmers on the estates, through wages for employment, as well as through the opportunities for the community to conduct business around the estate. These can contribute significantly to the development of the area. We are aware that the development of oil palm plantations can also impose high social and financial costs. Nonetheless, we still feel we are more fortunate compared with other districts [without oil palm]. *Due to the lack of financial support for [alternative] agricultural activities, particularly from the commercial banks, it is really hard to develop the agriculture sector in Sanggau District.* Therefore, the most feasible activities that can be conducted in Sanggau District are plantation activities especially oil palm estates. (Quoted in Colchester *et al.* 2006, 122; emphasis added.)

While in contextual terms the financial attraction of agrofuels for an expanding global market outbids funds for agricultural development, in compositional terms plantations are valued for their multiplier effect, represented as ‘financial benefits’. Such attention to the positive side of the ledger always underestimates the negative multiplier effects of industrial agriculture, in particular agrofuels. Ethnographic research on oil palm plantations in Kalimantan, Indonesia, confirms the combined negative social and ecological effect of agrofuel expansion:

Forest and land availability have been greatly reduced, making it more difficult for the local communities to obtain NTFPs [Non-Timber Forest Products] and leading to a lack of farming lands. As there are not enough farming lands, farming has become more intensive. The same lands are used continuously, so that the soil does not have enough time to regain fertility. As there is not enough arable land, many people have given up rice farming and a linear regression can be seen in the diversity of crops cultivated in relation to the proximity of the plantation . . . Availability of, and access to foods such as meat, vegetables and fruits has declined, so that more food has to be bought, leading to higher food expenses. (Orth 2007, 51)

Typically, *adat* communities diversify agricultural production with subsistence crops, rice, coffee, fruit trees and *damar* trees, which yield a valuable resin. Testimony by affected villagers notes that companies offering benefits to participate in plantations encourage (or compel) land transfers, undermining customary agricultures – including the greater variety and therefore value of *damar* products over palm oil – and degrading the environment as ‘changes in the vegetation cover have caused changes in species’ distributions and have led to uncontrolled pests booming’ – even though some smallholder oil palm producers improve their income and gain access to markets via new road systems (Colchester *et al.* p. 99). Social costs include alcohol abuse and breakdown in communality traditions via profit-seeking, leading to ‘everything being measured only in economic terms’ (Colchester *et al.* p. 100).

Malaysia signed the 2007 UN Declaration on the Rights of Indigenous Peoples, requiring states to ‘consult and cooperate in good faith with the indigenous peoples concerned through their own representative institutions in order to obtain their free and informed consent prior to the approval of any project affecting their lands or territories . . .’ (quoted in Colchester *et al.* 2007, 79), but the evidence suggests

patterns of routine disregard for the integrity of communal lands, community decision-making, and compensating loss or damage. Such patterns include unheralded occupation of territories, ignoring the fact that, as one resident observes, 'our livelihood is greatly dependent on the resources in our surroundings' (p. 47). As reported in *Land is Life*,

The people first found out about the oil palm scheme when workers started work on their lands, clearing the lands which included rubber trees and fruit trees belonging to the indigenous communities. As the oil-palm land clearing work continued, the rivers that supplied water to the people and the fish stock were affected. In addition to the crops, and polluted rivers, the people's burial ground and farm lands were also destroyed. People were then unable to hunt for the game which is an important element in their diet. There was no more rattan to harvest either, the raw material for handicrafts which had provided extra cash income to the communities. Jungle food sources, like vegetables, were also destroyed. (Colchester *et al.* 2007, 54)

Like Indonesia, Malaysia has a plural legal regime, including upholding custom under the constitution. Native courts are officially recognised in Sarawak, administering community affairs and local justice – and higher court judges do uphold native peoples' land claims. Nevertheless, the Sarawak government limits the exercise of native customary rights, refusing to reveal the location of lands actually subject to these rights and retaining the right to implement its policy of natural-resource-based development. Within this policy, native land owners must surrender their lands to the state for 60 years for development as joint ventures with private companies, despite the absence of clear principles regarding compensation to native landowners and reclamation of their lands when the leases expire (Colchester *et al.* 2007, pp. 1–2). Colchester and his colleagues report that,

As a direct result of its restricted interpretation of the extent of customary rights, companies are being given leases for oil palm development over supposedly 'vacant' and 'idle' State lands, which are, in fact, quite obviously inhabited, encumbered with customary rights and being actively used by local communities in their daily lives. The result is that most palm oil projects are contested by local communities. (pp. 77–8)

The invisibilisation of cultural systems of social reproduction not based on private property is endemic to histories of colonisation. It justifies the appropriation of territory and resources for commercial and security purposes, whatever the social and environmental cost. Ironically, under pressure to promote 'green accumulation', states and corporations identify 'idle' land for expansion of commercial agrofuels but 'growing evidence raises doubts about the concept of *idle* land. In many cases, lands perceived to be *idle*, *under-utilised*, *marginal* or *abandoned* by government and large private operators provide a vital basis for the livelihoods of poorer and vulnerable groups, including through crop farming, herding and gathering of wild products' (Cotula *et al.* 2008, 22–3). The FAO has highlighted the marginalising effect of agrofuels on women in rural areas – its 2008 report notes that marginal lands provide important subsistence functions to rural peoples and are often farmed by women, who are denied access to property (Gaia Foundation *et al.* 2008, 4). In India, for example, *Jatropha* production targets 'waste lands' which sustain millions of people as 'commons' and pasturelands. In addition to pastoralists, 'refugees from development projects, displaced persons, jobless labourers and small farmers facing crop failure often rely on these lands as places where they can put their cattle during

an emergency. If these lands are enclosed, the lifelines of many already disadvantaged people will be jeopardised' (GRAIN 2008a, 8). The irony of course is that such displacement processes displace ways of life potentially more important to planetary sustainability.

In transitional moments within food regimes, resistance and construction of alternatives express contradictory relations, sometimes offering a glimpse of new ways of organising social reproduction, even if those ways fail to materialise fully in that particular time and place.

Brazil offers one such example – in a possible alternative way of organising energy production. Brazil's biofuel project is subdivided into two sectors: first, a relatively unregulated agro-industrial ethanol program, centred in the São Paulo region, which has seen sugarcane expansion at the expense of dairy farming, orange groves and other staple crops; elsewhere agrofuel monoculture is 'uprooting local small-scale producers who become transformed into temporary labour often living in precarious conditions on the outskirts of local towns' (Wilkinson and Herrera 2008, 24). Lands assigned for agrarian resettlement projects are being accumulated via intense pressure on small farmers for sugarcane plantations worked by landless labourers under conditions of debt peonage. Once mined for ethanol, the lands revert to resettlement status, but in a degraded state (Smolker *et al.* 2008, 22).

Second, however, there is the government-regulated biodiesel program, decentralised and designed to promote regional development and social inclusion. The National Petroleum Agency organises auctions through which firms, on acquiring a Social Seal provided by the Ministry for Agrarian Development, gain access to the biodiesel market. These firms must 'demonstrate that a given percentage of their raw material or crude oil has been contracted with family farms in agreement with the rural trade unions' (Smolker *et al.*, 2008 p. 8).

In a detailed report, examining the operation of this Biodiesel Programme by region, Wilkinson and Herrera observe that the economic viability of this program is threatened by land access (particularly in the Northeast, where cattle ranching predominates) and low incomes from castor oil planting (pushing farmers to seek agro-ecological and niche farming), oil palm plantation preference in the north, and, in the centre-west, a preference for soybeans encourages an agribusiness takeover (2008, 60–1). The south, however, with its cooperative traditions, saw a recent surge of locally focused cooperatives and associations experimenting with ethanol from sugarcane (and manioc and sorghum) and biodiesel from *Jatropha* and tung (tree crops) via a variety of intercropping systems both with tree crops and short cycle food crops and joint processing and farming activities. Each producer is only allowed to plant two hectares of biofuel in order to ensure adequate food supply. Wilkinson and Herrera (2008, 57) view this program as a 'radical challenge to the dominant agribusiness model,' noting,

Within this perspective the combined food and energy production systems are seen as strategies for increasing the autonomy of the less favoured family farm sector, an important feature of which includes the production of ethanol for local consumption. These projects are still at an early stage of development and so definitive conclusions cannot be drawn as to their feasibility. Nevertheless ... they may well offer a complementary strategy for ethanol production in the family-farming context in other regions of the country. Regulatory adjustments permitting direct sales to the members of a producer cooperative thereby promoting decentralised distribution circuits increase the attractiveness of such a strategy.

This program, however marginal in the Brazilian landscape, models a decentralised, cooperative system integrating energy and food production as an alternative to monoculture and its displacement of foodstuffs. It also offers the possibility of substantiating the rural development claims of a biofuels program, but on a foundation of cooperative production relations (as opposed to simple commodity production). Contrary to the initial solution of 'biofuelling poverty' proposed by Oxfam, which sought sustainability standards in the global biofuels market, this program substitutes local markets as the goal and anchor of integrated rural development: the difference being that energy/food *sovereignty* retains and replenishes value, whereas the global market, even with principles, extracts and degrades value. Establishing such decentralised cooperative polycultures is the goal of the food sovereignty movement, and durability depends on farmer mobilisation to sustain such agricultures, even when supported by national states. The slogan of the food sovereignty movements – 'small farmers feed the world and cool the planet' – expresses such articulation between social justice and provisioning based on agro-ecological principles.

### Food regime ecology

Renaming biofuels 'agrofuels' not only reminds us of crop land competition and fuel displacing food,<sup>13</sup> but it also signals an ecological consequence whereby biofuel plantations displace biodiversity and, under the current agrofuels project, reproduce and deepen forms of greenhouse gas emission. As Campbell (2009) advocates, food regime analysis requires a political ecological perspective, founded in Marx's concept of the 'metabolic rift'. The concept refers to the separation of social production from its biological foundations and underlies the spatial separation of urban life from rural life as agriculture industrialises (cf. Foster 2000, Moore 2000). This, in turn, depends on manufacturing technologies, whose contribution to the metabolic rift involves expanding inputs of energy and natural resources, and industrial wastes – sometimes recycled today, but largely outside of natural cycles. Fossil fuel dependence is a fundamental consequence of this rift, contributing greatly to carbon emissions, and the associated agrofuels project. However, the metabolic rift is not only about a material transformation of production, with spatial consequences, it is also about an epistemological break (McMichael 2009c).

Following the separation of labour from its means of subsistence via the metabolic rift, productive relations, and social institutions, are increasingly embedded in the market, subordinated to value relations. The point is that *given* the metabolic rift, the ontological priority in social intercourse becomes capitalist value relations. Thus, the conversion of agriculture to a branch of industry privileges capital in its subordination of landed property in the name of value. But, in addition to a methodology that understands capital now as the dominant historical force (Marx 1973), the inversion is in the structure of thought as well, superimposing value relations on our understanding of the historical process. My point is that agrofuels symbolise this ontology, whereby meeting the unsustainable energy needs of a fossil-fuel dependent accumulation process is accomplished by subordinating agriculture

<sup>13</sup>The World Bank (2007) noted that the 'grain required to fill the tank of a sports utility vehicle with ethanol (240 kilograms of maize for 100 litres of ethanol) could feed one person for a year' (Policy Brief: 'Biofuels: The Promise and the Risks').

to a non-food crop, to maintain value, if not food security. The agrofuels ‘gold rush’ reveals the one-dimensionality of value relations as embodied in capitalism and its structures of thought. That is, the metabolic rift is not only assuming greater significance in how we analyse the historical moment,<sup>14</sup> but also both its material *and* epistemic consequences need to be overcome. Restoring the social/natural metabolism to promote ecological sustainability will only materialise when we transcend the value calculus through which capital rules the world. Renaming biofuels ‘agrofuels’ is part of this discursive shift stemming from the crisis of the food regime.

In general, the constraints on the material, and discursive, world assert themselves in a proliferating literature on, and growing public recognition of, ‘ecological feedback’ – most notably in climate warming. In particular, the literature on biofuels and carbon markets includes a growing scientific challenge to attempts to measure and value emissions via a market-based metric. Analogously, the proliferating food sovereignty movement proposes restoring natural metabolism through social knowledges anchored in agro-ecological practices. Each movement embodies recognition of the inability of modern science and its industrial processes to interpret and manage natural cycles through market mechanisms.

In articulating the development paradigm’s new market environmentalism, the EU Energy Commissioner stated in 2006, ‘Biofuels are the only known substitute for fossil fuels in transport today. They contribute to our security of energy supply, reduce greenhouse gas emissions and create jobs in rural areas’ (quoted in Gilbertson *et al.* 2007, 7). The EU of course has reconciled itself to new targets that can only be met by importing agrofuels from the global South. Accordingly, the UK Climate Change Minister claimed in 2007, ‘the global community must as a matter of urgency work towards the development of internationally recognised standards for biomass grown to produce biofuels’ (quoted in Gilbertson *et al.* 2007, 13). The subject of certification of course raises questions about how to standardise a sustainable biofuel metric. From a survey, Biofuelwatch claims a ‘majority of biofuel industry responses ... reject any mandatory safeguards ... Many responses suggest that not enough is known about life-cycle greenhouse gas emissions from biofuels, but nonetheless demand government support for rapid market expansion’ (quoted in Gilbertson *et al.* 2007, 15).

Ignoring the precautionary principle in this way is doubly problematic, as lack of interest in a sustainable biofuels industry is dwarfed by the lack of concern for longer-term effects of greenhouse gas emissions. Just as carbon emissions from transport have hitherto been omitted from the globalisation ledger – discounting such negative ‘externalities’ and enabling a false economy – so this false economy is extended by proponents of an agrofuels project. The conversion of rainforests, peatlands, savannas, or grasslands to produce agrofuels in Brazil, Southeast Asia and the US ‘creates a “biofuel carbon debt” by releasing 17 to 420 times more CO<sub>2</sub> than the annual greenhouse gas (GHG) reductions these biofuels provide by displacing fossil fuel’ (Fargione *et al.* 2008).

The problem of emissions is not simply that in most cases (other than perhaps sugarcane) agrofuels release more than they reduce in substituting for fossil fuel energy. The additional emissions produce side effects, or ‘externalities’, which are

<sup>14</sup>See for example, Foster (2000), Moore (2000), Clark and York (2005), McMichael (2008) and Wittman (2009).

now acknowledged in the scientific community. As the Transnational Institute (2007, 10) reports, ‘Much of the evidence presented for agrofuels to reduce greenhouse gas emissions ignores the larger picture of “land use change” (usually deforestation), soil erosion and nitrous oxide emissions’. Nobel Prize winner Paul Crutzen (2007) observes that biofuels raise rather than lower emissions, and from research with colleagues on nitrous oxide emissions from crop fertilisers, he concludes, ‘the replacement of fossil fuels by biofuels may not bring the intended climate cooling due to the accompanying emissions of N<sub>2</sub>O . . . depending on N content, the use of several agricultural crops for energy production can readily lead to N<sub>2</sub>O emissions large enough to cause climate warming instead of cooling by “saved fossil CO<sub>2</sub>”’ (Crutzen *et al.* 2007).

Despite acknowledgement of by-product emissions, there is also recognition that it is difficult to obtain invariant results from emission calculations. Biofuelwatch reports that the few calculations of agrofuel emissions from land use, deforestation and soil organic carbon loss have different methodologies and therefore substantial variation in their results (Gilbertson *et al.* 2007, 36). Servaas Storm (2009, 1020) notes, for example, that ‘carbon savings’ from offset projects are unmeasurable, because they are based on an unrealised counterfactual. For Larry Lohmann, offsets are a ‘fictitious commodity’, created by ‘deducting what you hope happens from what you guess would have happened’ (quoted in Storm 2009, 1020). As Storm notes, lack of verifiability leads to carbon imperialism, turning the South into a ‘carbon dump’ while sustaining Northern lifestyles. Joan Martinez-Alier (2009) reinforces this by noting that the Kyoto Protocol enabled the North to obtain property rights on carbon sinks in the South and the atmosphere in return for reduced emission targets.

While some argue for ecological restoration over land conversion for agrofuels as more likely to reduce carbon emissions, the point is that measuring emissions accurately for purposes of standardisation is impossible. Thus it was claimed by Berkeley scientists, ‘Including incommensurable quantities such as soil erosion and climate change into a single metric requires an arbitrary determination of their relative value’ (quoted in Gilbertson *et al.* 2007, 37). And this is the case for attempts to calculate emissions along production chains, as well as life-cycle analysis of emissions from the agrofuel complex. Gilbertson *et al.* (2007, 39) conclude,

Very few life-cycle greenhouse gas assessments are peer reviewed. There are currently no peer reviewed life-cycle greenhouse gas studies for biodiesel from palm oil, jatropha or soya, and peer review studies on sugar cane ethanol are limited to those looking at energy gains and fossil fuel displacement, rather than total greenhouse gas balances.

Further, the Intergovernmental Panel on Climate Change (IPCC) admits ‘CO<sub>2</sub> equivalences’ are gross oversimplifications: ‘the effects and lifetimes of different greenhouse gases in different parts of the atmosphere are so complex and multiple that any straightforward equation is impossible’ (Lohmann 2008, 360). In spite of the focus on getting the calculations as accurate, or comprehensive, as possible, the overriding point is that this controversy over certification methodologies is a proxy for a more significant issue, namely, the cognitive dissonance in attempting to certify via an economic calculus quite incommensurate with an ecological calculus. The incommensurability lies in the difference between a virtual fractionation of carbon units as a standardising means of regulating a



carbon-based economy, and the actual interactive complexity of carbon cycles, both natural and ‘unnatural’.<sup>15</sup>

One clear form of such interactive complexity is illustrated in the concept of ‘positive feedback’, used by climate scientists to describe the self-acceleration of climate change. In a new IPCC summary in 2007 the panel notes that ‘emission reductions . . . might be underestimated due to missing carbon cycle feedbacks’ (quoted in Monbiot 2007). The likelihood of such feedback is why climate scientists argue that global temperatures should not be allowed to rise more than two degrees above pre-industrial levels – otherwise, by 2040 ‘living systems on the land will start to release more carbon dioxide than they absorb’ (Monbiot 2006, 10). Under these conditions, plants shrivel and trees die, raising temperatures which, with decreasing rainfall (particularly in the tropics), kill more trees and plant life, the metabolism of soil microbes accelerates, releasing more carbon (already occurring in the UK: by the end of the twenty-first century ‘the world’s soils will eject the manmade carbon they have absorbed over the past 150 years’ [Monbiot 2006, 10–1]), permafrost melt in the far north can release methane, and so on. However this phenomenon, otherwise known as the ‘nemesis effect’, plays out is testimony to the self-organising character of natural cycles.<sup>16</sup>

Climate change emergency policy is in effect a Canute-like attempt to reduce emissions to stem warming and thereby head off ‘Gaia’s revenge’ (Lovelock 2007). But it is likely to fail precisely because of the inability to subordinate ecological relations to a singular economic calculus. The discourse of sustainability has reached perhaps a high point in the recent IAASTD Report (2008), which is critical of industrial agriculture. Stating that ‘business as usual is not an option’, given the combination of climate, energy, water and food crises, the IAASTD questions industrial agriculture and GM food as the solution to the social and ecological crises associated with global agribusiness, on the grounds that markets fail to adequately value environmental and social harm. The Report also questions the salience of a market-driven approach,<sup>17</sup> and its narrow focus on productivity, versus an integrative view of food, resource and nutritional security, which underlines agriculture’s multifunctional contribution to complex social reproduction issues. It advocates policies that ‘promote sustainable agricultural practices (e.g. using market and other types of incentives to reward environmental services) [and] stimulate more technology innovation, such as agro-ecological approaches and organic farming to alleviate poverty and improve food security’ (IAASTD 2009, 24). Further, the IAASTD recommends that monetary or other incentives for ‘performance-based ecological services’ recognise

<sup>15</sup>See Lohmann (2006) for an extended discussion of this.

<sup>16</sup>Analogously, agrofuels have distinct feedback effects through the mechanism of price as the value-form of capital accumulation. Thus certification schemes, focusing on ‘sustainable’ agrofuel production, are unable to address ‘leakage’ or displacement of production elsewhere. As TNI notes, ‘Future certified palm oil, for example, might be produced from land deforested several years previously, while forest continues to be cleared for palm oil *for other markets*’ (2007, 31, emphasis added).

<sup>17</sup>The IAASTD emphasises that reinventing ‘agriculture’ requires experts in agricultural knowledge, science and technology to work with local farmers, and other professionals such as social and health scientists, governments and civil society.

the importance of the multiple functions of agriculture and creates mechanisms to value and pay for the benefits of resource-conserving ecosystem services provided by sustainable agricultural practices, such as low-input and low-emission production, conservation tillage, watershed management, agroforestry practices, carbon sequestration, biological control and pollination, and conservation of agricultural biodiversity. (p. 24)

This report represents an attempt to straddle the boundary between market and non-market practices. The danger is of course that valuing nature and ‘ecological services’ performed by producers introduces a ‘global values’ language that abstracts from local particularities and practical knowledges. In fact, the concept of ‘ecosystem services’ is a proxy for a ‘global ecology’ discourse premised on market mitigation,<sup>18</sup> whereby compensation for services is an indirect form of consumption of the environment. Put another way, payment for ecosystem services ‘relies on creating market mechanisms that attract investment from areas *requiring* ecosystem services – including maintenance of biodiversity – to areas *providing* these services, e.g., from urban to rural areas, and from the global “north” to the global “south”’ (Sullivan 2008). A further danger is that through the economic calculus of scarcity, demand for environmental services increases their market value ‘in ways that *out-compete* other forms and practices of value for the landscapes providing them’ (Sullivan 2008). Thus a new industry of ecological accounting is born, which, through the development lens, establishes an offset industry (now formalised in the UN program, REDD: Reducing Emissions from Deforestation and Degradation).<sup>19</sup>

A case in point is the Yasuní region in Amazonian Ecuador, where oil reserves are offset by environmental values, and there has been a political standoff regarding whether or not President Correa can obtain carbon credits for preserving the forest. As Adam Ma’anit (2008, 19) notes, ‘The real danger is that once a dollar value has been assigned to something as arguably incalculable as a tree, a forest, or yes, even a human life, it allows the bean counters to start comparing costs and benefits. Economists can start to ask, when the price of oil hits \$200 a barrel: Does the benefit of extracting a billion barrels of oil outweigh the cost of destroying the Yasuní National Park and the communities of people that live there?’ Bean-counting is a powerful discourse, as one commentator views it:

The carbon dioxide emissions from extracting and burning the oil would be about 375 million tons, and emissions from deforestation would be 172 million a total of 547 millions tons. The World Bank has estimated the abatement cost for carbon dioxide at \$14 to \$20 per ton . . . The cost to the world to abate these emissions will be between \$1.7bn and \$2.4bn for the extraction and burning, and \$909m for deforestation, for a total between \$2.6bn and \$3.7bn.

Correa proposes that Ecuador issue bonds for the value of the carbon dioxide emissions avoided by preserving the forest. He promises to park the funds at a neutral bank and only spend them on social development and alternative-energy projects in Ecuador. If a

<sup>18</sup>For an extended treatment of this subject see McMichael (2009a).

<sup>19</sup>Hari (2009, 16) notes that Greenpeace investigated an initial REDD-like model in Bolivia, where The Nature Conservancy, British Petroleum, Pacificorp, and American Electric Power in 1997 established a protected forest called the Noel Kempff Climate Action Project, preserving 3.9 million acres of tropical forest (to prevent release of 55 million tons of CO<sup>2</sup>) allowing an equivalent release elsewhere from coal and oil operations. In addition, the money received for the offset was used to log a neighbouring forest.

future government of Ecuador decides to exploit the oil, they have to repay the bondholders plus interest.

Preserving Yasuní is a rare win-win situation. The rich world (that created the climate problem) can help mitigate it in a relatively low-cost manner. Ecuador obtains the funds to help grow its relatively poor economy. Far from radical populism, this is economic efficiency at its finest. (Gallagher 2009)

The omission in this argument, beyond the subordination of ecology to a carbon market, is the inability to view this issue spatially and temporally. *Spatially*, a carbon market abstracts from the players' location, and here a seemingly healthy exchange obscures a continuing process of emitting greenhouse gases in or by the 'rich world' elsewhere. And *temporally*, mitigation of this sort does not, under present arrangements and practices, reduce the continuing flow of emissions from fossil fuel use, which will continue to alter climates and compromise forests. Economic efficiency is a chimera insofar as it collapses the incommensurable into commensurable (and virtual) units of supply and demand.

Arguably, such dissonance provides the conditions for the scientific community, including social scientists of the food regime persuasion, to recognise the reductionism of assigning a market value to ecological processes and elaborate an ecologically relevant discourse which would begin to bridge the epistemic rift embodied in the market calculus. Henceforth, food regime analysis and its associated development and agrarian questions can no longer ignore 'ecological feedback'. The climate crisis, the intensification of 'biophysical override' via transgenic technologies (Weis 2007), and the biofuels 'revolution' – all expressions of the food regime, have made sure of this.

## Conclusion

This paper has argued that 'agrofuels' represent the crisis of the current food regime insofar as they breach the implicit rules of the neoliberal world order, by which food security is to be guaranteed through corporate stewardship of the global market, as the most durable and efficient allocator of agricultural resources. While 'peak soil' is locked in an embrace with 'peak oil' via chemical agriculture, intensifying climate change, the resort to biofuels is an artificial solution. It is artificial in two senses: first, biofuels (first and second generation) are increasingly recognised as ineffectual in reducing greenhouse gas emissions; and second, biofuels displace food and food producers – revealing the falsity of corporate agriculture's claim to 'feed the world' while an emergent food/fuel complex offers fungible possibilities for profitable investments via alliances between agribusiness, energy, automobile and biotechnology companies, and states (McMichael 2009d). The bait-and-switch tactic, whereby neoliberal shortcomings are papered over with attempts at 'ecological modernisation' via 'internalising externalities' in the agrofuels project, is increasingly recognised as such. It represents the bankruptcy of a development paradigm invested in a market calculus, increasingly exposed by food riots, a burgeoning global food sovereignty movement, and alarming 'ecological feedback'.

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**Philip McMichael** is Professor of Development Sociology at Cornell University. His PhD is in Sociology (Binghamton University, 1979). His current research applies food regime analysis to the food/energy crisis and transnational agrarian movements. He has co-edited *New directions in the sociology of global development* (2005), edited *Contesting development: critical struggles for social change* (2010), and authored *Settlers and the agrarian question* (1984), and *Development and social change: a global perspective* (2008). Email: [pdml@cornell.edu](mailto:pdml@cornell.edu)