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The neoliberal food regime in Latin America: state, agribusiness transnational corporations and biotechnology

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ABSTRACT Biotechnology has become the central technological form in agriculture since the neoliberal reformation of capitalism in the 1980s. The food-regime perspective introduced by Friedmann and McMichael (1989) anticipated a transition to a third regime from the second, nation-centered regime of the post-World War II years. This paper proposes and develops the concept of 'neoliberal' food regime which captures the regime's central dynamic components: the state, which promotes international and national neoregulation that impose the neoliberal agenda; large agribusiness transnational corporations (ATNCs), now the crucial economic actors in global capitalism; and biotechnology, the driver behind the modern agricultural paradigm.

RÉSUMÉ La biotechnologie est devenue la forme centrale de technologie dans l'agriculture depuis la réforme néolibérale du capitalisme pendant les années 1980. Le système agroalimentaire introduit par Friedmann et McMichael (1989) a anticipé l'avènement d'un troisième régime, dépassant celui centré sur l'État-nation durant les années d'après-guerre. Cet article propose et développe le concept d'un système agroalimentaire et ses composants essentiels et dynamiques: l'État, qui promeut la néorégulation nationale et internationale et qui impose l'agenda néolibéral; les grandes corporations agroalimentaires, les acteurs économiques clés dans le capitalisme global; et la biotechnologique, la force derrière le paradigme agriculturel moderne.

Key words: biotechnology; food regime analysis; agribusiness transnational corporations; neoliberalism; neoregulation

Transgenic crops, the product of advanced genetic-engineering techniques based on recombinant DNA, started to be commercialised in the mid-1990s. Since well before their commercialisation in the 1980s, biotechnology in general and transgenic crops in particular have been touted as miraculous technologies: if only given a chance, they would make deserts bloom and do away with world hunger. The intensity of these assertions has not been tempered by the fact that most transgenic crops are not even geared for direct human consumption. Transgenic soybeans, grown in huge industrial monocropping operations (which amount to two-thirds of global food production grown with biotechnology), corn (a fourth of global production), cotton and canola; all these crops are sold in volatile global markets as raw materials to produce livestock feed, agrofuels, cooking oil and sweeteners, among other products.

The purpose of this special journal section on the neoliberal food regime and agricultural biotechnology in Latin America is to offer English readers several new chapters from the forthcoming Spanish edition of *Food for the few* (Otero 2008). The English version of *Food for the few* was written prior to the onset of the 2007/2008 global food-price crisis, but it was the first

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book-length, empirically based assessment of the socioeconomic impacts of the deployment of agricultural biotechnologies in Latin America. The structural analysis to understand the roots of the food crisis was already contained in the book, so it was re-issued in paperback by the University of Texas Press in 2010. The present introduction and the three articles that follow are all new contributions for the Spanish version of the book, which will be published by M.A. Porrúa in Mexico as *La dieta neoliberal: globalización y agricultura en América Latina* by 2013. Given the centrality of these papers, we thought it appropriate to make them available to the English-reading public.

The next section discusses the neoliberal food regime and two of its chief dynamic factors: the state and neoregulation, on the one hand, provide the political and policy context, while agribusiness transnational corporations (ATNCs) are the principal economic agents. The following section offers an introduction to a third dynamic factor in the food regime: biotechnology as its central technological form. It is presented as a continuation of the modern agricultural paradigm and I show how this has played out in reshaping Latin America's agrarian structures with the neoliberal turn. The concluding section recapitulates the political consequences of naming the food regime *neoliberal*, offers ideas for future research on supermarkets and the neoliberal food regime and introduces the three articles on Colombia, Guatemala and Brazil that complete this special section of the *CJDS*.

The neoliberal food regime

The purpose of this section is to characterise the food regime that emerged with neoliberalism in the 1980s, and more specifically since the deployment of transgenic crops in the mid-1990s. A good starting point is the food-regime perspective, as conceptualised first by Harriet Friedmann and Philip McMichael (1989). A food regime is a temporally specific dynamic in the global political economy of food. It is characterised by particular institutional structures, norms and unwritten rules around agriculture and food that are geographically and historically specific. These dynamics combine to create a qualitatively distinct 'regime' of capital-accumulation trends in agriculture and food, which finds its durability in the international linking of agrifood production and consumption relations in accordance with global capital accumulation trends more broadly. Each food regime is thus grounded in relatively stable (albeit typically unequal) international trade relations.

Philip McMichael (2005) has elaborated the concept of the third food regime as part of a global political project and argued that its central tension is between the globalisation of corporate agriculture and counter-movements informed by food-sovereignty principles. This characterisation reflects, however, the broad brush of the regulation-school and world-systems theory in which the food-regime perspective was rooted. Such a macro view raised critiques by other scholars in regard to the original food-regime perspective's structuralism (Goodman and Watts 1994), suggesting the need for more nuanced investigation and calling for a meso-level analysis (Bonanno and Constance 2001, 2008). For instance, while the perspective does acknowledge the role of the state, especially in advanced capitalist countries in maintaining subsidies for their agricultures, there tends to be an overemphasis on the main beneficiaries of the food regime, corporations, and the South's dependency. McMichael's formulation is clear that corporate markets are politically constructed, via states as members of the World Trade Organisation (WTO). This means also that states are therefore subject to resistance from counter-movements, which are part of the food regime dialectic and transformation. The trouble is that McMichael's analysis remains at the level of the world economy. My goal is to provide a friendly amendment that introduces some nuance at the national level of analysis.

While there is no doubt that corporations have become the dominant economic agents, especially after the neoliberal turn of the 1980s, I argue that we must continue to take full and explicit account of the specific role of the state. In contrast to McMichael's characterisation of the "*corporate* food regime" (2005, 2009), therefore, this article subscribes to the naming of this regime as the "*neoliberal* food regime" (Pechlaner and Otero 2008, 2010). This characterisation takes into account national-level states and local or domestic-level resistance struggles. This contrasts, for instance, with the prominence that McMichael gives to one particular social movement, Vía Campesina, which is, admittedly, the most important grassroots organisation that wages struggle at the transnational level. What must be recognised, however, is that the struggles of constituent organisations of Vía Campesina are firmly rooted at the national level (Desmarais 2007, 2008): their objects of struggle are primarily their national state and the state's involvement in local-level legislation as well as in international regulations promoted and enacted by suprastate organisations.

While Vía Campesina and affiliated organisations have been quite successful in derailing the WTO's Doha Round of negotiations, the central goal of which has been further to liberalise agricultural trade, this sector was already substantially liberalised through the passage of the WTO's Uruguay Round in 1993. The extent to which such liberalisation is materialised in each country's agriculture largely depends, however, on domestic mobilisation and resistance.

Thus, it is not simply that the 'core principle' has been displaced from the state to the market with the move from the second to the third food regime, as McMichael (2009) posits. Rather, the state continues to play a central role, even if it has changed to favour the predominance of ATNCs in food production and distribution (i.e. supermarkets). Also, 'the market' does not exist in the abstract; it is constructed in large part by states that also deploy some minimal rules of the market game and legislate, among other things, intellectual property rights, which are critical to biotechnology development. Indeed, the most dynamic elements of the *neoliberal* food regime discussed in this paper are: the state, which promotes neoregulation, a series of international agreements and national legislation that impose the neoliberal agenda; large agribusiness multinationals, which have become the central economic actors; and biotechnology as the chief technological form that continues and enhances the modern agricultural paradigm contained in the earlier Green Revolution. Supermarkets are another key driver but are not discussed here. Let us turn to the first two dynamic elements. The following section discusses biotechnology and modern agriculture.

The state and neoregulation

Given that the state has been a key actor in promoting the set of new policies and regulations associated with neoliberal globalism, I use the term *neoregulation* rather than *de*regulation, as is common in the food regime and other literatures (Ó Riain 2000; Weiss 1997). In spite of the free-trade rhetoric, the US state has made concerted efforts to facilitate the development of its biotechnology-based industry (Kloppenburg 1988a). Although ATNCs have become the principal economic actors in the production and dissemination of agricultural inputs (see next subsection), this rise to dominance took place in close association with the US government through its Department of Agriculture and the Land Grant universities, heavily supported by the state (at both federal and state levels). The latter produced the science with public funds and private firms developed the inputs for modern agriculture, including biotechnology (Pavitt 2001). Similarly, as we will see in Christina Holmes's article on the International Centre for Research on Tropical Agriculture (CIAT), there has been an ambivalent relation between this publicly funded international research centre and ATNCs. The Green Revolution model of high-yielding varieties has been important in the international centres – they were, after all, deeply involved in the initial

Green Revolution approach. But transgenics are only a small part of what they do. Biotechnology as a wider suite of technologies – including, for example, the use of molecular markers – has seen a broader range of involvement at CIAT. ATNCs have been able largely to monopolise the research results of the publicly funded International Agricultural Research Centres; yet they cannot be patented. Although CIAT and other international centres use new intellectual-property rights to patent what they do, this is done so as to preserve the possibility that others in the public sphere use their research results. They have practiced this in keeping their germplasm/seed bank material available for use, while ensuring that it cannot be privately patentable. This is different from public university research, which is often funded by and then later patented by private entities for private benefit. This is a complex situation in which publicly funded or publicly preserved resources (such as germplasm in seed banks) can be tapped by ATNCs (Kenney 1986). CIAT's ambivalence is that, while these resources can be tapped, they cannot be privately patentable without significantly changing the variety involved – ATNCs have to sign a legal-material use agreement to this effect.

Government or public support has not been limited to research and development funding. It has included the issuing of new policy and legislation to protect intellectual-property rights, as will be discussed below. Although US farmers also participated in this alliance, they never played a determining role with regard to what technologies were to be developed or produced; they were simple recipients of technological innovations that responded to the profit-maximising logic of ATNCs (Pechlaner, forthcoming).

While other international agreements relevant to agricultural biotechnologies exist, to date the most significant supranational regulatory body remains the World Trade Organisation. Agriculture has featured prominently in WTO negotiations since it replaced and absorbed the General Agreement on Tariffs and Trade (GATT) in 1995 (Pechlaner and Otero 2010). The issue of reducing trade distortion in agriculture has become increasingly important in successive rounds of negotiation. Negotiations have not advanced, however, with developing countries arguing that agreements to date have supported the protectionist practices of developed countries, such as the United States, while 'development' goals fell by the wayside. Nonetheless, a number of agreements reached during the GATT's Uruguay Round of negotiations (1987–1993) have had a significant impact on agricultural biotechnology. Most notable are the Sanitary and Phytosanitary Measures Agreement (SPS) and the Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS), whose implementation began in 1995 along with the WTO (Pechlaner and Otero 2010).

The most relevant point for our discussion here, then, is that states continue to be central to the deployment of neoliberalism. Whether in agreeing (or not) to participate in suprastate agreements or developing national legislation, states have been the key actors implementing neoregulation. As James Klepek documents for Guatemala, even this small Central American state has been able to resist the adoption of transgenic corn, given the great biodiversity of maize residing within its borders. Such resistance comes from the bottom up in the form of peasant and indigenous social movements. As Elizabeth Fitting's work (2008, 2011) has shown, the Mexican anti-GM network has mobilised similar symbolism around maize. It has garnered much international media coverage and transnational NGO involvement because it is the first case of "genetic pollution" in a crop's centre of origin (see also McAfee 2008).

Until 2006, the Brazilian case was emblematic of a state that had resisted for years the marketing of transgenic soybeans (Hisano and Altoé 2008; Jepson *et al.* 2008). Eventually, under pressure from large landowners, who had in fact been smuggling transgenic seeds from Argentina, and Monsanto's lobbying efforts, the Lula government caved in to these top economic actors in 2006. Surprisingly, however, the large landowners, once the very promoters of the legalisation and adoption of transgenic crops (Herring 2007), are now in uproar against their resulting

dependency on Monsanto, one of the world's leading ATNCs. Such dependency has become economically disadvantageous, as Monsanto skims off the bulk of the profits. In her article, Karine Peschard documents this resistance from Brazil's traditionally very strong agrarian bourgeoisie.

Agribusiness transnational corporations (ATNCs)

Five agrochemical companies dominate biotechnology product development and production, while their customers are primarily mid- to large-size farms, well endowed with capital, whose main production logic is geared by the profit motive. As highlighted singly in McMichael's characterisation of the food regime, corporations are indeed the central economic actor. But states have regulated the markets even if such regulation has been mostly to the corporations' own advantage. Thus, corporations as an explicit feature of the neoliberal food regime have come to dominate such markets: there is an increasingly *limited* number of horizontally and vertically integrated corporations dominating agricultural production. This concentrated – oligopolistic – market structure squeezes producers between few input sellers, processers and food retailers, and also limits consumer options (Hendrickson and Heffernan 2007). As the US Agribusiness Accountability Initiative put it succinctly:

> This [ATNCs-controlled] system isn't working for farmers. The power of large agribusinesses on the buying and selling sides means that farmers have less and less control over what they produce, how they produce it, where they can sell it, and what price they can get for it. The system isn't good for consumers and rural communities either: we are all affected when agribusinesses squeeze the rural economy or put profit above environmental and health concerns, community values, or fair wages. (AAI, n.d., 1)

Furthermore, the pervasiveness of ATNCs in the agrifood system is important both with respect to their influence over neoregulation and with respect to their ability to deflect resistance to any socially undesirable features of the new regime – such as some groups consider agricultural biotechnologies. The lack of labelling for generically engineered (GE) content in North America is a case in point. It could be argued that farmers of all classes, including the agrarian bourgeoisie, have become subsumed under agribusiness capital.

Biotechnology, modern agriculture and neoliberalism

The fact that the biotechnology revolution coincided with the neoliberal reformation of capitalism has exacerbated and deepened the socioeconomic effects of the prior agricultural revolution, the so-called Green Revolution (1940s–1970s). This section briefly describes the Green Revolution as part of the modern agricultural paradigm and the impacts of the converging biotechnology revolution with neoliberalism. While 'biotechnology' may have a very broad definition to include any application of science and engineering to living organisms, such as breeding or fermentation, in this article I use biotechnology in the more specific form of high or modern biotechnology. As defined by the Canadian Food Inspection Agency, "'*Modern biotechnology*' is used to distinguish newer applications of biotechnology, such as genetic engineering and cell fusion from more conventional methods such as breeding, or fermentation" (CFIA 2012. Original emphasis). According to the same source, for instance, '*mutagenesis*' involves "the use of methods to physically change or 'mutate' the genetic sequence, without adding DNA from another organism." While we focus mostly on transgenic seeds, which do involve the introduction of foreign

genetic material into plant varieties, we acknowledge that there are other forms of modern biotechnology that do not involve such genetic alteration.

The Green Revolution was the incarnation of what had earlier emerged as the modern agricultural paradigm in US agriculture. The technological paradigm of modern agriculture involves a specific package of inputs made up of hybrid and other high-yielding plant varieties, mechanisation, agrochemical fertilisers and pesticides and irrigation. "Green Revolution" is the name given to this technological package when it was exported to developing countries. While the Green Revolution technically began in Mexico in 1943, with a program promoting high-yielding wheat varieties (Hewitt de Alcántara 1978), its origin and initial development were located in the agriculture of the United States, dating from the 1930s (Kloppenburg 1988a). This exported package then became the technological paradigm for modern agriculture throughout the twentieth century (Otero 2008).

The Green Revolution has been called a technological 'paradigm' (Otero 2008) in the sense that the range of solutions to problems emerging in agricultural production tends to be solved within a narrow variety of options shaped by the paradigm. In analogy with Thomas Kuhn's 'scientific paradigm', Giovanni Dosi (1984) suggested that technological paradigms move along technological trajectories shaped by the 'normal' solution to problems. Such technological paradigms not only select solutions but also have exclusionary effects on alternative solutions that do not pertain to the paradigm. The technological paradigm, then, defines both the agendas for research and development and the technologies that are excluded from the frame of vision and technological imagination of engineers and, in our case, plant breeders and other agricultural researchers.

Modern agriculture has thus 'normally' involved large areas of land, the application of heavy machinery, irrigation infrastructure, heavy doses of agrochemicals, monocropping practices, etc. Therefore, problems emerging in agriculture will likely be solved along the lines determined by this technological trajectory. It is not surprising, then, that the application of agrochemicals has increased dramatically with the extension of the modern agricultural paradigm from its place of origin, the United States, to most regions of the world that practice capitalist agriculture. It should not be surprising either that the agribusiness multinationals involved in their production have become dominant economic actors in world agriculture, as seen above.

In what ways is biotechnology part of the modern agricultural paradigm? From its start at the laboratory stage in the 1980s, proponents described agricultural biotechnology in general and genetic engineering in particular as potent tools for sustainable development and for ending world hunger, food insecurity and malnutrition. It is well known that these problems are disproportionately concentrated in developing countries, which also have larger proportions of their population dedicated to agriculture. But the technological profile of modern agriculture centres above all on improving the productivity of large-scale operations: those that are highly specialised on a single crop and are very intensive in the use of capital inputs rather than labour. Compared with this productive and technological model and bias, therefore, the majority of smallholder, peasant cultivators in developing countries has been rendered 'inefficient'.

In the FAO's calculation, 20 million to 30 million peasants were displaced by new policies and technologies in the 1990s (Araghi 2003). Some of these peasants were transformed into wageworkers for large, capitalised farms, while countless joined the unemployed. Many of these people have contributed to the growing trend toward internal and international migration, separating them from their communities and families for prolonged periods of time or permanently. Hence Castells and Miller (2003) have called neoliberal capitalism the age of migration. In Mexico, for instance, hundreds of thousands became redundant in agriculture (Corona and Tuirán 2006), while the rest of its macro economy was incapable of absorbing them (Otero 2004, 2011). As a result, Mexico became the number-one sending nation in international

migration: between 2000 and 2005, Mexico economically expelled 2 million people, mostly to the United States but also increasingly to Canada (González Amador and Brooks 2007). By comparison, as reported by the World Bank, China and India sent fewer migrants abroad during this period even though they are more than ten times bigger than Mexico in terms of population (González Amador and Brooks 2007).

The neoliberal reforms that started in the 1980s had deep consequences, many of them negative, for the agricultural sectors of Latin America for a large proportion of agricultural producers. The ideological preamble of these reforms is constituted by what has been called neoliberal globalism (Otero 2004, 2008). This ideology, which vilified state intervention and glorified the private sector and free trade, emerged during the almost simultaneous administrations of Margaret Thatcher in the United Kingdom and Ronald Reagan in the United States. For Latin America, economic liberalisation generally involved the unilateral end of protectionist policies; the opening of agricultural markets with the reduction or elimination of tariffs and import permits; privatisation or dismantling of government agencies for rural credit, infrastructure, marketing or technical assistance; the end or reversal of agrarian reforms; or the reorientation of food policies centred on domestic markets toward an agricultural economy geared toward exports. Yet, the neoliberal reform was implemented in advanced capitalist countries' agriculture only partially, as they continue to subsidise and protect their agricultural sectors with billions of dollars per year, placing Latin American producers at great competitive disadvantage.

'Neoliberal globalism' is considered an ideology in the sense that the thought and policies associated with it are not inevitable. They can be modified with a different perspective, which must be backed up by alternative social and political forces, such as bottom-up social movements targeting states and neoregulation. The following articles illustrate the key point that neoliberal globalism is not inevitable; there is emerging resistance in Guatemala and Brazil while there are clear dilemmas for public research in Colombia in a context dominated by private economic actors.

What is the problem, however, with the emerging domination of ATNCs, if they can produce food more efficiently for a growing population? But can they, really? For millennia, peasants have been directly responsible for the preservation of huge plant biological diversity. In fact, given the vagaries of nature, developing countries possess the greatest plant biological diversity on the planet (Fowler and Mooney 1990), as well as the greatest problems with soil erosion and ecological degradation (Montgomery 2007), some of which is related to global warming created mostly by the advanced capitalist countries since the onset of the industrial revolution (Foster 2000, 2009; Jarosz 2009). As Sreenivasan and Christie (2002, 1) put it, "All biodiversity is richer in the South than in the North. . .. This is as true for agricultural biodiversity as for wild or biological diversity."

Capitalised and intensive farmers cannot preserve biological diversity, given modern agriculture's monocropping bias toward high-yield, hybrid or transgenic plant varieties. That is to say, in order for large producers to stay viably in the market, they must specialise, devoting large areas of land to a single crop. Ironically, plant breeders, who require plant biological diversity as their raw material to keep the process of crop improvement going, depend on the availability of plant genetic diversity afforded by small peasant cultivators. It is in these materials that plant breeders find the desirable traits to improve crops. If peasants disappear, therefore, the same fate awaits the raw materials for future plant breeding (Kloppenburg 1988b; Fowler and Mooney 1990), a point also made by Vernooy (2003, 2–7). Combined with neoliberal globalism, agricultural biotechnology can only exacerbate the tendencies toward social polarisation and ecological degradation, given its immersion in the modern agricultural paradigm.

Beyond ecological concerns, the productive logic of modern agriculture contrasts with that of smallholder petty-commodity producers. Rather than producing to generate profits, petty-commodity producers are geared toward self-consumption and producing for local, regional and

national markets. By definition, petty-commodity producers are content to produce quality use values for human consumption that generate enough revenues for the simple reproduction of their household units. Such production may occasionally generate income above and beyond simple-reproduction needs. In this case, such income may contribute to improve their living standards or even set the conditions for bourgeoisification. Most of the time, however, petty-commodity producers are in economic-survival mode given the structural constraints under which they operate (Wolf 1966; Chayanov 1974; Otero 1999).

The point here is not to offer a dichotomous way of classifying agricultural producers. As I have argued elsewhere (Otero 1998), there is the possibility for petty-commodity producers to become peasant entrepreneurs, successfully incorporated into modern markets. These are family farms and farmers whose activities can include export-oriented monocropping as well as mixed farming oriented toward the national, regional or even local markets. These producers are clearly embedded in the market and not geared toward self-consumption, though without being capitalist corporations. Van der Ploeg (2008) has also offered a three-way categorisation of agricultural producers, which includes the category of 'entrepreneurial farming' between peasant and capitalist farming.

Capitalist farmers, by contrast, must produce primarily exchange values, for human use or otherwise, to produce a profit above and beyond their simple-reproduction needs in order to stay competitive. Thus, while capitalist farmers must also operate on a continuous economic-survival mode, their productive logic allows them – indeed compels them – to look beyond producing use values for human consumption. To the extent that ATNCs increase their domination of agricultural research and production, the exchange-value and profit logic has come to prevail, whether it is to produce food or agrofuels (Bello 2009, 15).

The capitalist mode of producing food crops is thus not the most adequate to fulfil human needs. It is neither ecologically nor socially sustainable. Nevertheless, the global food price inflation that started in 2007 unleashed a return to the rhetoric that places all faith in biotechnology and transgenics. This technology has been posed once again as the necessary solution to the food crisis (Cage 2008; Harvey and Parker 2008; Lee 2008). According to this perspective, world hunger can be eradicated in poor countries only with greater yields and cheaper and more efficient crops, and transgenics are supposed to bear out this promise. A particularly relentless observer said that it would be criminal to sidestep the hope offered by biotechnology to the worse-fed people in the world (Lomborg 2009). Critics of the position that biotechnology offers a solution to the world's poor, however, have multiplied their voices with empirically based research in the social sciences (Scoones 2002, 2008; Hisano 2005; Jansen and Gupta 2009; Glover 2010a, 2010b, 2010c, 2010d).

The idea that we can solve the food crisis simply by increasing yields is problematic in a world in which hunger is present in the midst of plenty: the world produces enough food for everyone on the planet but the hungry simply cannot afford it. The core issue is one of inequality and lack of access to food, rather than that of not producing enough of it. Since the 1960s, the world has seen a reduction in the number of people affected by famine even as the number of food insecure has risen relentlessly. We thus have the phenomenon in which obesity is combined with hunger on a planetary scale (Patel 2007). Importing transgenic crops produced at low cost failed to protect Mexicans from high corn prices once the crisis struck, given Mexico's inequality: when price inflation for corn was 15 percent in December of 2007, consumption plummeted by 30 percent (Notimex 2009).

Whatever level of transgenic crops is adopted in Mexico or other Latin American countries, it is doubtful that this will help feed the people in their countries. On the contrary, US-based ATNCs sell their seeds to farmers each agricultural cycle, always as part of a technological package that includes herbicides and other agrochemicals and all under contract (see Karine Peschard's article).

More direct adoption of transgenic crops leads to greater dependency on the import of capital-intensive inputs, lowering demand for labour and thus further threatening peasant agriculture. This trend will exacerbate the socially polarising effects brought about by the Green Revolution (Hewitt de Alcántara 1978; Pearse 1980).

Adopters of transgenic crops to produce soybeans or corn for the export market, which may be more lucrative than the domestic market in Latin America, are large-scale farmers with substantial capital endowments. Export agriculture will, of course, take agricultural land away from production for the domestic market. Hence we had the Argentine paradox at the turn of the twenty-first century (Teubal 2008): having been the second-largest soybean exporter after the United States (until it was displaced by Brazil), and one of the leading agricultural exporters in the world, Argentina nonetheless saw substantial growth in the number of people going hungry.

Although peasant agriculture is not highly productive in economic terms – that is, in terms of generating profits for producers – at the very least it can produce food and subsistence for those who depend on it for their livelihood, for local, regional and national markets. On the other hand, peasants have scarce alternative job opportunities in an economy that does not offer sufficient or adequately paid employment to urban migrants, or the rights or dignity to international migrants (Cypher and Delgado Wise 2010; Otero 2011). Therefore, substituting peasant farming for export-oriented industrial agriculture forces many in the rural population to depend on dollar remittances from migrant relatives and thus increases food insecurity at the family level, even if the nation's total agricultural production is increased. Besides producing subsistence, peasants offer gratis to society the service of plant biological conservation, as they do not focus on monocropping as large-scale cultivators (Bartra 2004).

The social polarisation trends brought about by the Green Revolution, and then by biotechnology and the neoliberal reform, were exacerbated with the food-price inflation crisis of 2007/2008, which resurfaced in 2010. Excluding a process of bottom-up technological innovation, one that builds on the actual needs of smallholder farmers, the reaction of some suprastate institutions like the World Bank has been to promote industrial agriculture (Akram-Lodhi 2012). Based as it is on the profit motive, this approach can hardly help mitigate the food crisis, which was created primarily by the presence of new economic actors in agriculture: finance capital in agricultural-futures markets and the US and EU public policies geared to expand the production of agrofuels, which divert land from food production (Bello 2009; McMichael 2009; Otero, forthcoming). Several studies have shown the limits of ATNC-promoted biotechnology, including its doubtful economic performance, a strong bias in favour of ATNCs and the limited benefits for smallholder producers or the hungry (Otero and Pechlaner 2005, 2009; McAfee 2008; Otero *et al.* 2008; Pechlaner and Otero 2008, 2010; Friends of the Earth International 2009).

Conclusions

In this article, I have argued that the chief dynamic factors of the neoliberal food regime are the state, ATNCs and biotechnology. States continue to be the chief agency to implement neoregulation; ATNCs clearly dominate the markets shaped by the state; and biotechnology is the central technological form, enabling the continuation of the modern agricultural paradigm.

The state is posited to be a central agent in the neoliberal food regime. Even if neoliberalism has involved a withdrawal of the state from direct intervention in the economy, it continues to play a critical role in setting up the conditions under which the private sector enters the market through what has been called 'neoregulation.' Having a fuller picture of the key dynamic factors puts us in a better position to develop strategies to resist and perhaps transcend the neoliberal food regime. Thus, emphasising only its 'corporate' aspect detracts from a more dialectical engagement with the analysis of the state and how it operates not just to impose the logic of capital but also to

respond to mobilisation and pressure from below. Subordinate groups and classes, and even the agrarian bourgeoisie, would benefit from having a clear picture of where to put their mobilisation efforts; not just against corporations but also against the state.

While ATNCs are the key economic agents, they are not almighty. States can control them. Even a small state like Guatemala can keep them and their technologies at bay if they face sufficient pressure from organised social movements.

Biotechnology emerged in the 1980s as an industry in its own right, driven as it was by the association of venture capitalists and academics with promising products based on molecular biology and genetic engineering (Kenney 1986). Yet, biotechnology was eventually absorbed by the pre-existing giants in the chemical and pharmaceutical industries and turned into an 'enabling' technology (Otero 2008). Biotechnology thus enabled these industries to extend the technological paradigm represented by modern agriculture.

While the technology itself may indeed theoretically contain unsuspected promise to alleviate human and ecological problems, the question is who actually drives technological development, as a function of what and whose technological problems, and in whose interests. The research agendas driven by the modern agricultural paradigm and their main economic actors – large ATNCs – have primarily served the goal of maximising these actors' own profits. It is not clear that even large capitalised farmers can benefit from the technology, let alone peasant or entrepreneurial farmers. Given the role of the ATNCs in agrifood production, it would seem that the vast majority of cultivators who come into the orbit of biotechnology have become contract managers to deploy biotechnology products. Even the agrarian bourgeoisie is becoming subsumed under agribusiness capital.

As for future research on the food regime, supermarkets have become a major driver since the late 1980s (Reardon *et al.* 2003; Burch and Lawrence 2005, 2007; Brunn 2006), a phenomenon which has not been addressed here. It remains to be seen whether supermarkets will have any influence in reorienting ATNCs in a more sustainable direction. Their direct relation with consumers could make supermarkets more responsive to consumers' health and food-quality concerns. Although many of the transgenic crops end up on supermarket shelves, many others end up being distributed at gas stations as agrofuels.

The three articles that follow nicely illustrate the operation of the neoliberal food regime and highlight the relevance of national-level analysis and some points of struggle for resistance. Our concrete case studies put these dimensions into play in powerful ways, giving grounded content to the theoretical framing of the neoliberal food regime idea. Christina Holmes's article addresses the challenges for a publicly funded international agricultural research centre in Colombia to set its research agendas in the midst of a privately dominated market. James Klepek documents the successful resistance struggle against transgenic maize in Guatemala. Finally, Karine Peschard describes the unexpected discontent and turn-around by large Brazilian farmers: having been key defenders and adopters of transgenic crops, they are now leading the resistance against Monsanto.

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