The Third Food Regime: Neoliberal Globalism and Agricultural Biotechnology in North America

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The agricultural sector is currently being shaped by two powerful dynamics as many nations reorganise their national agriculture according to free trade and other supranational agreements while new agricultural biotechnologies are increasingly adopted. This interrelationship between regulatory change and genetic engineering appears set to form the basis of a new food regime. In this article, we compare the role of national and international regulations relating to the technology, and the impact of local resistance to it, in the advanced capitalist countries of Canada and the USA and the developing country of Mexico. Similar to food regime perspectives, our study concludes that neoliberal regulatory reorganisation is an important component of the evolving food regime. Further, Mexico bore the brunt of the technology's negative social impacts, demonstrating how it exacerbates existing inequalities between developed and developing nations. Resistance movements in the country have been sufficient to call into question the inevitability of a homogenous reorganisation of agriculture, however. Evidence suggests that such resistance could modify, or even derail, this technology's role in individual nations, and consequently, in the unfolding food regime as a whole.

One of the chief features of post World War II agriculture was its nation-centredness. Yet agriculture has a strong history in global trade, despite the counter appearances raised by its contentiousness in WTO negotiations at the turn of the twenty-first century. A more novel aspect of agriculture's position in international trade, however, is its thorough incorporation under supranational trade agreements and national neo-regulation initiatives, spurred by the ideology of neoliberal globalism. The resulting regulatory dynamic is accompanied by the implementation of new agricultural biotechnologies, which are being adopted at a dramatic rate. While it is still too early to be assured of the stability of the technology's growth, particularly given the setbacks that have already occurred, biotechnology has nonetheless provided significant empirical indications that it could be transformative for capitalised agriculture (Otero and Pechlaner 2005; Otero 2008). Facilitated by the evolving regulatory structures, agricultural biotechnology could, in fact, form the basis of a new food regime.

As conceptualised by Harriet Friedmann and Phillip McMichael (Friedmann and McMichael 1989; Friedmann 1992, 1993), a 'food regime' is a temporally specific

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dynamic in the global political economy of food. It can be characterised by particular institutional structures, norms and unwritten rules in international food production and consumption that are geographically and historically specific. A key component of this geographical and historical specificity is the relative stability of the trade relations that develop between unequal nations. Essentially, these dynamics combine to create a qualitatively distinct regime of capital accumulation trends in agriculture and food. Frederick Buttel said that the Friedmann–McMichael regime-type theorisation has proved to be one of the most durable perspectives in agrarian studies since the 1980s, 'in large part because it is synthetic and nuanced' (Buttel 2001, p. 9). Hence, we take this as our starting point. Food regime scholars posit that, since the inception of neoliberal globalism as the dominant ideology in the mid-1980s, we are transitioning into a third regime. This transition follows the collapse of the 'surplus' regime of the post-war era that was based on the US model of highly regulated national agricultures.

While the anticipated third regime is still finding its point of stasis, supranational regulation and national neoregulation of the agricultural sector have already been identified as highly important features (McMichael 2004). Given that the state has been a key actor in promoting the set of new policies associated with neoliberal globalism, and consistent with Karl Polanyi's (1944) perspective, we use the term 'neoregulation' rather than 'deregulation', as is common in the food regime literature and other literature. We argue that the inter-relationship between regulatory change and genetic engineering (GE) are integral to the emerging third food regime: national neoregulation and supranational regulation around important aspects of the technology (such as intellectual property rights, IPR) provide the means for biotechnology's ascendancy as a central technology for capitalist agriculture (Mascarenhas and Busch 2006), while the technology itself provides a means for further corporate concentration and integration of the food regime.

We further hypothesise that the role of biotechnology in the evolving food regime will be to entrench and exacerbate existing inequalities between nation states, particularly between developed and developing countries. With respect to this hypothesis, however, we question whether it is inevitable that neoregulation and the introduction of corporate agri-biotechnology will, in fact, widely reorganise agricultural production relations in the somewhat homogenous manner suggested by food regimists. While there is significant speculation as to how power struggles over international regulations will affect the global development of biotechnology and its allies, the USA–WTO challenge of the European Union being a case in point, little attention has been paid to the influence of implementation decisions in individual nation states.

The mitigating impact of resistance to agricultural neoregulation on the food regime is acknowledged to some extent. McMichael (2005), for example, considers the potential impact of the international organisation Via Campesina, but we believe the greatest effect will be the result of cumulative neoregulatory decisions in individual nation states. These decisions, in turn, will be highly influenced by the force of local resistance. Consequently, we argue that, despite the prevailing trends, sufficient local resistance to the technology could modify, or even derail, the technology's role in individual nations, and, accordingly, in the unfolding food regime as a whole. Given the preliminary evidence suggesting that the negative impact of both biotechnology

and the neoregulatory restructuring in agriculture is likely to be greater in less developed countries, the potential for resistance in these countries is also greater, and consequently they represent an important component of the evolving food regime.

With respect to the above hypotheses, therefore, we compare and contrast the experiences of using agricultural biotechnology products in Canada and the USA as advanced capitalist countries and Mexico as a developing country. We do this through two main points of comparison: the role of national and international regulations and how they affect the development and adoption of the technology, and local resistance to the technology, and its effect.

In the first section we provide a brief overview of the global adoption of agricultural biotechnology and where our case-study nations fit in this schema, supplemented with a discussion of the supranational regulation context. We then outline biotechnology regulation and resistances in each of our three case-study countries. Lastly, we conclude with some considerations of what these cases reveal for the role of biotechnology in the evolution of the third food regime: how it differently affects the incorporation of nations into the regime and, consequently, how it affects this food regime more generally.

Agricultural biotechnology and its supranational regulatory context

North America provides a unique opportunity for an empirical study of the role of agricultural biotechnologies. Agricultural biotechnology is a US-dominated project and the USA has considerable influence on the global stage. Consequently, the way in which the technology unfolds in that country will determine its further global dissemination and adoption. Canada provides an example of the introduction of the technology into another developed country that has some interest in a domestic biotechnology sector, but whose level of involvement and international influence is far weaker than that of the USA. Canada, therefore, falls in the middle between being a 'taker' and 'promoter' of agricultural biotechnology. Lastly, Mexico is a developing country that can provide insight into how nations with little influence on the technology's development are affected by its dissemination. Through this three-country comparison, we investigate the differential impact of the new technology's introduction in nations with contrasting power relations. We further investigate how this impact has been received in these countries with respect to the extent and type of social resistances that have emerged. This comparison will provide valuable empirical insight into the technology's broader role in structuring the evolving food regime.

Agricultural biotechnologies were commercialised in the mid-1990s. Currently, the production of transgenic crops predominantly refers to two key traits – herbicide tolerance (HT) and insect resistance (IR) (with HT accounting for 68 per cent, IR 19 per cent and HT and IR combined, 13 per cent of global traits) – and four key agricultural crops: soybeans, maize, cotton and canola (with soybeans making up 57 per cent, maize, 25 per cent, cotton, 13 per cent and canola, 5 per cent of global biotechnology) (James 2006). While the number of transgenic agricultural crops is still relatively limited, adoption of these crops has been dramatic. It increased 60-fold since 1996 (James 2006) from 1.7 million ha in 1996 to 90 million ha in 2005 (James 2004, 2005).

Early adoption of the technology occurred primarily in developed countries. While adoption in these countries is still increasing, since approximately 2000 adoption in developing countries has been steadily catching up. In 1999, of the 12 countries that had adopted some form of genetically engineered crop, four were developing countries, and they accounted for 18 per cent of the global area of transgenic crops (James 2000). By 2006 22 countries had adopted the technology, and 11 of these were developing countries that accounted for 40 per cent of transgenic crop area (James 2006). Despite the growing number of countries, most of the production area actually occurs in just a handful of countries. Ninety-five per cent of the global transgenic crop area is in six countries: the USA (53.1 per cent), Argentina (17.5 per cent), Brazil (11.2 per cent), Canada (5.9 per cent), India (3.7 per cent) and China (3.4 per cent) (calculated from James 2006).

While the USA remains the undisputed leader with respect to the development and adoption of biotechnology, we can see that its dissemination is increasingly important in both developed and developing countries. The number of adopting countries and the amount of crop area dedicated to these crops are both on the increase. While certainly not proceeding free of impediments – the six year de facto moratorium in the EU is a case in point – adoption of the technology has nonetheless proceeded sufficiently rapidly for proponents to claim it to be 'the fastest adopted crop technology in recent history' (James 2006).

Given the capital intensity and the novelty of biotechnology, two regulatory factors feature prominently with respect to the technology's adoption in addition to those that affect agriculture and food more generally: the intellectual property regime in place to protect the technology developer's interests, and the regulatory regime that oversees any GE crops, once adopted. These legal and regulatory frameworks are found in both national and supranational laws.

While other international agreements relevant to agricultural biotechnologies exist, to date the most significant supranational regulatory body remains the WTO. Agriculture has featured prominently in WTO negotiations since it replaced the General Agreement on Tariffs and Trade (GATT) in 1994. The issue of reducing trade distortion in agriculture has become increasingly important in succeeding rounds of negotiation. Disagreement over the topic led to the ultimate failure of the 9th round of negotiations, the 'development round' in July of 2006. This round brought to a head tensions over agriculture between developed and developing countries, with developing countries arguing that agreements to date had supported the protectionist practices of developed countries, such as the USA, while 'development' goals fell to the wayside. Nonetheless, despite this heated controversy and the failure to date of the next wave of agricultural trade liberalisation strategies, a number of agreements that were reached during the GATT's Uruguay Round of negotiations (1987–1993) are already in place, many of which have 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).

The SPS agreement is concerned with issues of food safety and animal and plant health standards. Given the controversy over the safety of the novel GE technology, this agreement is key for its dissemination. The purpose of the SPS is to provide a means for member states to regulate the safety of food products at the same time as

establishing guidelines to prevent these same regulations from acting as non-tariff trade barriers. The primary means of striking this balance is to insist on scientifically justifiable safety regulations and to apply them 'only to the extent necessary' for the protection of human, animal or plant life or health (Codex Alimentarius (n.d.) Article 2.2). Given that what is considered scientifically justifiable in one nation is not in another, members are encouraged to use international standards – such as those set by the Codex Alimentarius of the Food and Agriculture Organisation – wherever possible:

> To harmonise sanitary and phytosanitary measures on as wide a basis as possible, Members shall base their sanitary and phytosanitary measures on international standards, guidelines or recommendations, where they exist, except as otherwise provided for in this Agreement (Codex Alimentarius n.d., Article 3.1).

Through the TRIPS agreement the WTO aims to establish a regime of minimum IPR protection common to all its members. With respect to plant life, however, this protection does not necessarily have to be in the form of patents, but can be provided for 'either by patents or by an effective sui generis system or by any combination thereof' (WTO 1994, Article 27.3b). Seemingly even more open to debate than what constitutes a sufficient scientific justification for safety regulation is the question of what would be a sufficiently suitable sui generis system of IPR protection. Once again, where members can subscribe to international standards this reduces subjectivity and the potential need for dispute resolution.

With respect to agricultural biotechnologies, the Convention for the International Union for the Protection of Plant Varieties (UPOV) provides a framework for acceptable IPR protection, the strength of which depends to a certain extent on which year's Convention a member adopts. Like the Agreement on Agriculture itself, the TRIPS agreement presides over similar tensions between developed and developing countries, given the protection that it offers to the technology developers (mostly in developed countries) and the lack of protection it offers for genetic source material (primarily originating in developing countries). A number of developing countries are agitating for amendments to the TRIPS agreement, such that patent applications 'relating to genetic resources and traditional knowledge' should provide evidence of benefit sharing with countries of origin or face revocation (Third World Network [TWN] 2005; Concheiro Bórquez and López Bárcenas 2006).

Other international organisations and agreements affecting agriculture and biotechnology exist, of course. The above proposal for amendments was presented (by Bolivia, Brazil, Colombia, Dominican Republic, Ecuador, India, Peru and Thailand) at the TRIPS council meeting in 2005 under the agenda item of the relationship of TRIPS to the UN Convention on Biological Diversity (CBD) (TWN 2005). The CBD and its supplementary Cartagena Protocol on Biosafety are international agreements regarding the conservation, sustainable use and fair and equitable sharing of benefits of genetic resources that provide greater credence to precautionary conduct and also support the exchange of science and information.

At the time of its inception in 1992 the CBD had over 150 signatories. However, there is significant debate as to how it meshes with the agreements of the WTO, and which takes precedence in cases of conflict. Further, the CBD is less appealing to

those who have the most to lose from the equitable sharing of genetic resources. Consequently, the USA signed but never ratified the CBD and did not sign the Protocol on Biosafety. Canada and Mexico both signed and ratified the CBD and both signed the Protocol, with Mexico ratifying in 2002. In short, while there is evidence of developing countries lobbying for the incorporation of CBD values into the TRIPS agreement, as it currently stands, the latter appears to remain the dominant and most influential agreement with respect to the international regulatory context for agricultural biotechnology.

Biotechnology and neoregulation in the USA, Canada and Mexico

As should be obvious, the adoption of GE crops needs to be looked at in the context of the role that agriculture plays in each country. While only about 2 per cent of the economically active population (EAP) in the USA and Canada are engaged in agriculture, the comparable figure is almost 20 per cent in Mexico. Furthermore, the ratio of agricultural GDP to agricultural EAP (in US dollars) is $39,993 in the USA, $48,557 in Canada and only $2,692 in Mexico (Zahniser *et al*. 2005, p. 5). In other words, while a much greater percentage of Mexico's population is engaged in agriculture, the incomes of those so engaged are far lower than in the USA and Canada.

These differences also reflect the much greater capital intensity of US and Canadian agriculture, compared to Mexico's, in which most producers are small peasant farmers with very limited capital endowments. Such differences need to be kept firmly in mind when considering the different context in which these countries have made their regulatory decisions.

The USA

As noted, the USA is the top global producer of transgenic crops, accounting for over 53 per cent of the global GM crop production area. The country grows a number of transgenic crops: soybeans, maize, cotton, canola, squash, papaya and, since its 2006 approval, alfalfa (James 2006). The country not only is the top adopter, but it has a huge investment in the technology itself. In fact, the USA has undisputed global dominance in biotechnology. For example, 75 per cent of publicly traded biotechnology companies are based in the USA (Erosion, Technology and Concentration (ETC) Group 2005a). US spending on biotechnology research and development is vastly greater than that of any other country, reaching a record $44.825 billion (in Canadian dollars) in 2002 (Munn-Venn *et al*. 2005, p. 4, with data from the National Science Foundation). For a further example, the Monsanto Company – a US-based life sciences company and the world's largest seed seller – accounted for 88 per cent of the total seed sold for the GE crop area in 2004 (statistics compiled by ETC Group, from International Service for the Acquisition of Agri-Biotech Applications and Monsanto: ETC Group 2005b). Therefore, the USA has a significant economic stake in the dissemination of transgenic technologies. Agricultural biotechnologies are a key component of this economic stake.

The success that the USA has enjoyed in its agriculture sector under a highly favourable international regulatory context for trade liberalisation appears to be

undergoing a complementary success in agricultural biotechnology under a number of highly favourable WTO agreements, such as that related to intellectual property – the TRIPS agreement. Given the country's early involvement in the development of biotechnology, securing worldwide patent protection was critical. Once the TRIPS agreement was in place the USA adopted the most stringent version of intellectual property protection available under this agreement for its agricultural biotechnologies: patents. This approach is consistent with the country's long history of support for the patentability of life forms, as evidenced by court rulings through the last half of the twentieth century. As early as 1952 the Congressional approach to the Patent Act was that patentability could be extended to 'anything under the sun that is made by man' (Vaver 2004, p. 158). Not to overstate the case, the patentability of life forms was subjected to a number of challenges over the years, and only in 1980 – in the Supreme Court case of Diamond v. Chakrabarty, over an oil-eating bacterial culture – did it find unambiguous judicial support for the patentability of life. This support extended to multicellular organisms a few years later in subsequent court cases.

Specifically with respect to agricultural biotechnologies, the USA adopted UPOV 1991 as the framework for its intellectual property protection. This version of UPOV provides intellectual property protection on plants for 20 years, but it does not strictly require the use of patents, which would restrict seed saving. Rather, UPOV 1991 leaves it to national prerogative whether to adopt patents on plants or another system that would still allow for farmers and plant breeders to be exempted from restrictions on seed saving. The USA chose to adopt patents and forgo the continuation of these exemptions. Consequently, the traditional rights of farmers to save and reuse their seed from year to year are now voided where they adopt such patented agricultural biotechnologies, and they must purchase new seed for every crop.

The country's position on patents is consistent with its overall regulatory approach to the technology: both patents and regulation are to maximise the potential for growth in the sector. Despite the fact that citizen opposition had already risen in the 1980s against the first open release of a GE organism – 'ice minus' potatoes and strawberries – into the environment (Marchant 1988), the US administration ultimately decided against creating a separate regulatory agency to oversee agricultural biotechnology applications. Rather, the *Coordinated framework for the regulation of biotechnology* was created in 1986 to designate the roles that different existing agencies – notably, the USA Department of Agriculture (USDA), the Food and Drug Administration (FDA) and the Environmental Protection Agency (EPA) – would play with respect to regulating the new technology.

The regulatory thrust with respect to the technology in all these agencies is based on the concept of 'substantial equivalence', which assumes the products of agricultural biotechnology to be substantially equivalent to conventionally bred products. Consequently, the products of biotechnology are given no special consideration for the process in which they were developed (and for any potential deviations that might arise specific to this process), but are essentially judged on the basis of their face value. The FDA, for example, requires that GE foods 'meet the same rigorous safety standards as is required of all other foods' (EPA 2003) and the agency does not require pre-market approval for most GE crops, which fall into their category of substances

that are 'generally recognised as safe'. This approach is consistent across the agencies under which biotechnology regulation occurs.

There have been clear indications of the regulatory weaknesses that have resulted from the highly pro-biotechnology development stance of the USA. In 2005 the USDA Office of the Inspector General cited the USDA's Animal and Plant Health Inspection Service's lax regulatory approach and overall failure to adequately regulate. Despite a previous audit over a decade before this, the Inspector General's report found that 'the agency continued to lack an effective, comprehensive management information system to account for all inspections and their outcomes' (USDA 2005, p. iii). There has also been practical evidence of this regulatory failure. The Starlink Corn incident occurred in 2000, when GE corn that was not approved for human consumption (but only for animal feed), failed to be properly segregated. The resulting contaminated food products brought a plethora of lawsuits which Aventis ultimately paid approximately $120 million to settle (Gunther 2007).

The health repercussions of this failure were uncertain. Yet, subsequent failures of containing GE pharmaceutical crops in 2002 (Wright 2005) and unapproved Bt10 corn in 2005 have shown that the regulatory laxity persists. In January 2006, despite the fact that no GE rice was yet commercially sold in the USA, GE rice was found to have contaminated rice shipments to Europe (Gunther 2007). Once again, the legal machine is rolling, with estimates of hundreds of millions of dollars in damages having resulted from the contamination (Gunther 2007). While the Animal and Plant Health Inspection Service has yet to determine how the rice managed to escape from a rice research station where apparently very good preventative measures were taken (e.g. a 120 ft buffer zones rather than the contracted 30 ft ones), the agency has nonetheless already granted another company's application for 3,200 acres of pharma rice to be grown in Kansas (Gunther 2007).

For the most part, the country's seemingly lax regulatory approach appears to have had the desired effect on biotechnological development. Agricultural biotechnology is reported to be one of the fastest adopted agricultural technologies, and the USA has a significant share in the profits of that adoption globally. The Monsanto Company, for example, has posted only one year of losses since 1996. While profits have been variable since then, as can be expected from a capital-intensive new technology, particularly a highly political one, they have stabilised and increased from 2003 to 2007. Monsanto's posted profits (in US $ million) have been $68 in 2003, $267 in 2004, $255 in 2005, $689 in 2006 and $993 in 2007 (compiled from data in Monsanto 2005 and Monsanto 2007). Indications are that the 2007 drive for corn ethanol is only helping to increase Monsanto's sales in its corn technology, and hence its profits (Gillam 2007).

The rapid adoption, strong intellectual property protection, and weak regulatory oversight of agricultural biotechnologies in the USA have not gone without challenge. No doubt largely due to the lack of labelling, consumer opposition in the country appears weak. Nonetheless, opposition to the technology has appeared in the country over the transition to strong intellectual property protection on life forms, over marketing issues related to the technology and over the environmental and health implications of the technology, exacerbated by the weak regulatory oversight of the 'substantial equivalence' policy approach.

With respect to intellectual property protection, the prohibition of seed saving that accompanies the patentability of agricultural biotechnologies has created a number of conflicts with farmers and with non-governmental organisations concerned about the traditional rights of farmers and concentration of ownership over the food supply. The latter essentially concerns food security. By 2004 the Monsanto Company had filed 90 lawsuits against farmers across the country for infringing its patent rights (Centre for Food Safety [CFS] 2005, p. 31). While many of these farmers have signed settlement agreements with the company, a number of them have chosen to fight their case in the court system, and in doing so have had some limited successes in curtailing the rights of biotechnology companies (Pechlaner 2007). Even when such cases have not led to these limited successes in the legal forum, many of them have garnered significant publicity around these issues and consequently fortified the resistance efforts of those opposed to the technology. Organisations such as the CFS and Farmer's Legal Action Group work to publicise the effects of patents on plants in the country, and the impacts on farmers who have been caught in litigation.

Perspectives regarding the impact of the technology on US producers in general are mixed, and are highly dependent on the crop and the GE event at issue. Roundup Resistant cotton, for example, is a production aid, but its higher input costs create added financial pressure for farmers. A pharmaceutical crop, on the other hand, has a potentially higher income for its producers but creates a greater risk for non-pharmaceutical producers of the same crop. Whichever the case, crops that are destined for sensitive international markets (with respect to their aversion to GE), such as the EU or Japan, are likely to garner much greater resistance over genetic engineering.

Contamination issues, such as the Starlink Corn and the GE rice incidents already noted, have had huge economic impacts on producers because of these market issues, and have garnered further resistance over contamination fears. The prospect of GE wheat, ultimately pulled by Monsanto due to organised opposition, is an example of resistance that was successful prior to commercialisation. While federal support for the industry is high, some sub-national governments have also resisted the technology, in part due to such marketability concerns. The state of Maine, for example, proposed a ban on the use of the technology and Mendocino and Marin Counties in California have successfully banned GM crops. The resolution of the marketing issue has yet to be determined, and the ultimate place of GE crops will depend to a certain extent on changes in the acceptability of these crops in foreign markets. The introduction of pharmaceutical crops will create a further hurdle, however, and improvements in containment will need to be assured before marketability issues cease to be a point of resistance.

Another significant form of resistance in the country arises from non-governmental organisations (NGOs) concerned about the environmental and health impacts of these crops, with some interesting local experiences (Hendrickson and Heffernan 2002). This sort of resistance is rampant on the Internet, and an international campaign of resistance to the technology (its environmental and health impacts and to the lack of labelling) is clearly evident in the proliferation of anti-GE information and propaganda available. Protests and various forms of resistance are evident across North America, as well as beyond, spearheaded by organisations such as

Greenpeace, the Sierra Club, Friends of the Earth International, Grain, CFS, the Organic Consumers Association and the Council of Canadians. Many campaigns have been organised by these and other organisations (see, for example, the homepages of The Campaign n.d. and the Organic Consumers Association n.d.).

Given the particular legal culture of the USA, lawsuits have provided another resistance venue for these groups. The CFS, for example, on its own behalf and that of a number of other organisations (Common Dreams Progressive Newswire 2006) filed a lawsuit requesting the court to rescind the USDA's approval of Roundup Ready (RR) Alfalfa. In March 2007 a US district court judge vacated the agency's 2005 approval of the alfalfa, agreeing that the agency 'failed to abide by federal environmental laws when it approved the crop without conducting a full Environmental Impact Assessment' (Heller 2007). While such suits may not ultimately prevent the further commercialisation of GE crops they could go some way to changing the rate and the manner in which they are commercialised.

Canada

Canada does not have the same significant crop area dedicated to agricultural biotechnology production as does the USA (contrast its 6 per cent of total production area with the USA's of 53 per cent) and Canada is not as quick to adopt the range of transgenic crops that are increasingly commercially available in the USA. The main transgenic crops grown in Canada in 2005 were canola, maize and soybeans (James 2006), although GE alfalfa also received approval in Canada in that year (Canadian Food Inspection Agency n.d.). Relative to its international context, nonetheless, the country is still very important with respect to the technology. As noted earlier, Canada is the fourth highest producer by production area. It also has a significant stake in the development of its biotechnology sector. Eight per cent of publicly traded biotechnology companies are based in Canada (ETC Group 2005a).

Further, while the investment was nowhere near as high as the almost CA $45 billion the USA invested in 2002, Canada still invested a highly significant CA $695 million into biotechnology research and development (Munn-Venn *et al.* 2005, p. 4, with data from Statistics Canada). Canada therefore invests 1.5 per cent of what the USA does. Given that Canada's population and GDP are about 10 per cent the size of those in the USA, however, this level of investment is comparatively low. Consequently, while Canada comes nowhere near challenging the dominance of the USA, it is nonetheless a significant player in the sector, globally speaking, more for its adoption then for its development of biotechnology.

The regulatory context for agricultural biotechnologies in Canada has some distinct similarities with that of the USA, particularly in the most recent past. This applies to both its approach to IPR and to regulation more generally. In compliance with its WTO TRIPS obligations Canada has also chosen to become a member of UPOV, however it is a signatory to the 1978 version of the Act. This is consistent with the country's overall history of weaker IPR protection than the USA. UPOV 1978 retains exemptions for farmers and plant breeders to save seeds for their own use. While industry groups lobby for an upgrade to UPOV 1991, to date this has not yet occurred. Nonetheless, other methods of restricting seed saving are employed in

Canada, such as the use of contracts, that critics charge make a 'mockery' of the right to save seed (Beingessner 2004).

Further, Canada has had a long history of legal struggles over whether life forms are patentable. The chronology of patenting life forms is not as unambiguously pro-patenting as that of the USA. In 2002, for example, the Supreme Court of Canada denied a patent on a cancer-prone mouse (the 'Harvard mouse') on the basis that higher life forms were inappropriate subject matter for patents. This same mouse had already received a patent in the USA in 1988. In part due to the uncertainties around the strength of patents in Canada, and in part due to the drastically smaller size of its industry, the country has had nowhere near the incidence of litigation between farmers and biotechnology developers over seed saving that occurred in the USA. Nonetheless, one landmark case in Canada, Monsanto v. Schmeiser, changed the context for patenting life forms in the country. In this case the Supreme Court of Canada ruled that, while life forms were not patentable, the genes within a life form are patentable. The practical outcome for a farmer wanting to save his seeds does not differ from that in which life forms are patentable. Once again, as in the USA, the impact on farmers is that they must purchase seeds anew each year, which increases their overall input costs in those crops where biotechnologies have become the dominant input.

With respect to the regulation of agricultural biotechnologies in general, Canada again shows a number of similarities to the US system. The Canadian regulatory framework for biotechnology was slower to develop than the American one, ultimately being manifested in the 1993 Regulatory Framework for Biotechnology. As in the American system, this framework designated the regulation of biotechnology under existing agencies and legislation. The three main agencies responsible for biotechnology regulation in Canada are Health Canada, the Canadian Food Inspection Agency and Environment Canada. Despite claims by the Canadian Biotechnology Advisory Committee (CBAC) that regulatory oversight in Canada is triggered by 'novelty,' the policy approach to biotechnology in the various agencies reveals an implicit concurrence with the same concept of substantial equivalence that underwrites the US policy approach. Further, assessments of biotechnology are again conducted on the basis of a product, rather than a process. Hence, for example, Health Canada's assessment strategy is premised on comparing the biotechnology product with its conventional counterpart, in order to compare it with 'traditional foods that have an established history of safe use' (CBAC 2002).

Given the similarities between the American and the Canadian regulatory system it is not surprising that there is similar evidence in the Canadian system of regulatory failure and critiques as in the American one. In Canada public pressure led to the 2001 Royal Society of Canada review, which resulted in 33 recommendations for strengthening biotechnology regulation. In 2002 the CBAC issued another report with recommendations. Yet despite these recommendations to strengthen the regulatory stance, the CBAC complained in a 2004 follow-up memorandum that there was 'little evidence of government action to implement recommended improvements' (CBAC 2004).

While it is not on the same scale as the American one, Canada's biotechnology industry has a strong IPR framework and relatively lax regulatory regime around

agricultural biotechnology. This fact is likely to be attributable to the substantial economic interests the country has had in developing its biotechnology sector. As in the USA this emphasis on development appears to be quite successful. According to the Hon. Maxime Bernier, Canada's Minister of Industry, Canada has one of the highest biotech S&T expenditures in the OECD. In addition, its global ranking is 'third in the number of biotechnology firms, third in biotechnology revenue and R&D spending, and fifth in inventions' (Bernier 2007).

Once again, however, this neoregulated biotechnology scenario has not gone unchallenged. While there are some differences in the resistance efforts between Canada and the USA – there appear to be less sub-national government initiatives against GE in Canada, as well as fewer legal challenges by NGOs and environmental NGOs – there are more similarities than differences. Consistent with the USA, an enormous amount of the resistance occurs through NGO lobbying, campaigns and other initiatives that are designed to put pressure on governments. Some of this pressure can involve producer groups as well. As in the USA (regarding alfalfa, for example), organic producers are a reliable source of opposition to the technology. They are not the only source of opposition, however. Resistance efforts with respect to the attempted introduction of RR wheat in Canada included organic farmers, conventional farmers, producer organisations and environmental organisations. Resistance was so widespread that it eventually forced Monsanto to withdraw its application, despite the fact that the Canadian federal government was a partner in its development (Scoffield 2004). While this opposition was a communal effort, the robust resistance by wheat producers on the basis of marketing considerations was a large factor.

One of the greatest opponents of RR wheat, the Canadian Wheat Board [CWB], has been under attack from the neoliberal restructuring pressures on the agricultural sector. The CWB is a farmer-controlled marketing co-operative that has monopoly control over wheat and barley marketing in western Canada. Consequently, it is accused, particularly by American farmers, of lending an unfair trade advantage to Canadian farmers and of distorting fair trade practices (CBC 2006). Producer factions in Canada, such as the National Farmers Union (NFU) and the CWB, are struggling to retain the protections that supply management and single desk marketing offer farmers in products such as wheat, dairy and eggs (NFU 2007). While they are not explicitly associated with each other, the linkages between neoliberal neoregulation, international marketing and corporate biotechnology are becoming increasingly evident. These linkages become even more explicit when considering the case of Mexico.

Mexico

In comparison to the USA, and even to Canada, Mexico is as yet a small player in the global adoption and development of transgenic crops. Mexico ranks 13th out of the 22 countries that have adopted the technology on 0.1 million ha (0.1 per cent of global crop area). Transgenic cotton and soybeans are grown in Mexico (James 2006), and one transnational corporation located there, Grupo Pulsar, has a huge biotechnology arm. Pulsar has bought several smaller US biotechnology firms and its detractors call

it 'Mexico's Monsanto', as it tries to push its seed and trees south of the central state of Puebla. Using the Plan Puebla Panamá, a free trade type of agreement with Central American countries, it also wants to tap the vast biological resources on indigenous communities' land (Carlsen 2004, p. 68).

While Mexico's intellectual property protection has evolved significantly towards convergence with the USA since the 1980s, it stops short of affording patent protection for biological processes, plants, animals and humans, yet microorganisms, proteins, genes, cellular lines, antibodies, pharmaceutical products and microbiological processes can be patented. Furthermore, property over plants may be protected through the 'Ley Federal de Variedades Vegetales' or 'Federal law of plant varieties' (Lazard n.d.)

While playing a relatively minor role in biotechnology development and adoption, Mexico was nonetheless one of the first adopters of recombinant bovine growth hormone, a milk productivity-enhancing drug for lactating cows in the early 1990, even before it was approved for use in the USA (Otero *et al.* 2008). Further, this minor role does not change the fact that GE technology has made a huge indirect impact in its agrarian social structure by liberalising its farm trade (Fitting 2008). Moreover Mexico has keenly engaged in the process of neoregulating its farm structure, joining its two northern neighbours in the North American Free Trade Agreement, (NAFTA) and regulating biotechnology according to the same corporate-driven impetus described above for the USA and Canada. Yet, the Law of Biosecurity of Genetically Modified Organisms, derisively called 'Ley Monsanto' (Monsanto's Law) by its detractors, is guided by a combination of North American and European-style principles: it articulates both the precautionary principle that is central to the EU legislation and also the 'substantial equivalence' to natural products that inspires US and Canadian law, as will soon be evident.

After joining GATT in 1986, the first major legislative transformation in Mexico was the New Agrarian Reform Law of 1992. This law ended the state's obligation – set in the post-revolutionary 1917 Constitution – to redistribute land through an agrarian reform process. The agrarian reform sector, formerly inalienable, amounted to about 50 per cent of all agricultural, forestry and grazing land in the nation. The 1992 law allowed the sale of the formerly inalienable landholdings in order to open up all these lands to the market and promote their concentration. Nonetheless, the actual sale of this highly fragmented land into small plots has been minimal. By 2007 no more than two per cent has been sold. In the logic of small peasant households, access to land is the only resource at their disposal that can help minimise food insecurity, given that the rest of Mexico's macro economy has been unable to offer secure jobs with living wages.

Mobilisation against the 1992 Agrarian Law was widespread, but it was passed very swiftly nonetheless (Cornelius and Myhre 1998; Otero 1999). Two years later, however, on 1 January 1994 – the day of NAFTA's official start – the Zapatista National Liberation Army (EZLN) launched an armed insurrection in the south-eastern state of Chiapas (Harvey 1996, 1998; Gilbreth and Otero 2001). NAFTA would subsequently always be linked to the main oppositional cries by the peasant movement. After the insurrection, Subcomandante Marcos, the noted EZLN spokesperson, said that NAFTA amounted to a death sentence to Mexico's indigenous people. It is on the

heels of this very specific and volatile context that the new agricultural biotechnologies and further neoregulation were introduced.

Between 1995 and January 2005 31 agricultural genetically modified organisms (GMOs) for human consumption were approved for commercial use in Mexico. The products included one variety of alfalfa, two of soybeans, three of tomatoes and potatoes, four of canola and nine of cotton and maize. Although a total of nine companies developed these varieties, Monsanto alone accounted for 16 of the 31 varieties. Not surprisingly, eight of the varieties developed by Monsanto were resistant to its Roundup® herbicide (Comisión Federal para la Protección contra los Riesgos Sanitarios 2005). Because Mexico is a centre of origin of corn, the country holds an important reservoir of biological diversity of this crop. While the Mexican government initially had a very cautious approach towards the release of transgenic corn, by 2002, the Secretary of Agriculture started awarding permits for its commercial use. Presumably these were for use in northern Mexico, away from the central and southern regions of greatest biodiversity.

In view of the haphazard approach to awarding permits, the Mexican Congress finally issued the Law of Biosecurity of Genetically Modified Organisms (LBOGM for its Spanish acronym) on 18 February (LBOGM 2005). The law's goals include establishing an 'adequate and efficient' level of protection of human health, the environment, biological diversity and animal and plant health; defining principles and national policy; defining the competencies of various government agencies and initiating a permits regime and control measures. Salient among these goals is singling out maize as a crop to be treated as a special case, which clearly contrasts with the government's practice of liberally awarding permits since 2002.

Permits for commercial release also imply import permits for the same GMO, thus introducing a clearly market-oriented criterion of economic feasibility: interested parties must be better off producing a GMO in Mexico compared with importing it, as there is no protection for GMO production against foreign trade. Imports must be submitted to the same permit process as domestically produced GMOs, and in most cases, one of the requirements is that the relevant GMO is permitted for commercial release in its country of origin.

A special section of the LBOGM is devoted to restricted zones, concerning the protection of centres of origin and biological diversity, as well as to GMO-free zones, which may be designated at the request of local communities. The latter may involve, for instance, communities that seek to protect organic farming practices and markets. Such community requests, however, must be backed both by state and municipal governments. This raises the question of the extent to which such governments have sufficient autonomy from local ruling classes and large transnational corporations.

With respect to labelling GMOs, the law takes a combined approach between the 'precautionary' (European) and the 'substantial equivalence' (North American) approaches, with the latter ultimately prevailing. For direct human consumption, labelling is required only if the product is 'significantly different' from conventional products. With regard to seed, however, the law follows a stricter labelling approach, as Mexico must honour its free-trade agreement not only with the USA and Canada, but also with the European Union. In order to comply with this commitment, Article 101 entrusts the secretaries of agriculture and economy with following general

labelling rules and specifically mentioning that such products contain GMOs, their features and implications. In the case of GMO imports, the law leaves it up to the various secretaries involved as to labelling requirements, but these must include their final destination (e.g., human food or animal feed).

As in the USA and Canada, biotechnology adoption in Mexico has garnered significant resistance. While resistance in the USA and Canada has focused on legislative and judicial systems, however, in Mexico it has also spilled into the streets in the form of social movement protests and even armed insurrection. Two key reasons explain this difference. Firstly, as mentioned, biotechnology and neoliberal globalism have not had as grave an impact on the agrarian social structures of either Canada or the USA. In contrast, the neoliberal turn has been significantly more devastating for Mexico's agrarian social structure than for its northern neighbours. This has much to do with the sheer numbers of people whose livelihoods depended on agriculture in Mexico, and who have been made redundant since the mid-1980s when the country entered the GATT. This was the first major indication that Mexico was moving from an inward-looking country, focused on its internal market, to one newly attempting to focus its economic growth on exports. In 1990 when the then President, Carlos Salinas, proposed to start discussions towards building a NAFTA, close to 30 per cent of Mexico's labour force worked in farming. By NAFTA's 14th year in 2008 that proportion had decreased to less than 20 per cent.

A second reason that explains the different oppositional responses in Mexico regard its democratic institutions: they are much weaker and less well-developed than those in the north. The courts have a rather insignificant presence in adjudicating contentious issues and have shown little, if any, political independence from those who hold executive power. For its part, the legislative process has been readily dominated by pro-neoliberal, pro-agribusiness concerns or their lobby groups have exerted determining pressure when new laws are issued.

Corporate-friendly biotechnology regulation and agrarian reform detrimental to peasants have thus created a conspicuous double attack on peasant agriculture. Resistance movements in Mexico have consequently explicitly linked the issues of agricultural biotechnology and neoliberal agricultural restructuring to NAFTA's agricultural chapter and in their opposition statements demand that it is renegotiated. This has been the case since 1994, but this demand came to a head at the end of 2002, just before most crops were about to be opened to free trade with Canada and the USA at the start of NAFTA's eighth year. At that time the largest peasant movement – measured by the number and political colours of peasant organisations – was mobilised into an oppositional coalition called 'El campo no aguanta más,' or 'The countryside can take no more'. While this movement initially achieved a promise from Vicente Fox's administration (2000–2006) to renegotiate NAFTA's agricultural chapter or introduce some compensatory measures, the movement eventually became fragmented as some organisation leaders accepted short-term promises for their constituencies (Bartra and Otero 2005; Celis 2005).

While massive mobilisation and even armed insurrection had not managed to modify neoliberal policies to any significant extent by 2006, Mexico's political system was shaken to its roots in that year's highly questioned presidential elections (Otero 2008). Illegal campaigning by President Fox and the Entrepreneurial Co-ordinating

Council – the organisation of the capitalist class – against the left-of-centre candidate, and a series of communication errors by the Federal Electoral Institute, lent themselves to a widespread belief that electoral fraud had occurred. While there was hope that the Electoral Tribunal of the Federal Judicial Power would rectify the situation by ordering a recount or even nullifying the election, it ultimately only ordered a vote recount for a little over 9 per cent of the balloting boxes, setting off a tremendous amount of uncertainty in the entire institutional process. Despite considerable irregularities found, the Electoral Tribunal of the Federal Judicial Power decided that they had not significantly modified the final results. According to public opinion polls at the time, 46 per cent nonetheless believed that the elections were fraudulent.

Consequently, it is no surprise that substantial mobilisation has taken place since the 2006 elections. One significant issue in this mobilisation is the preservation of Mexico's food sovereignty around maize, which involves a keen opposition to the use of transgenic crops. The battle cry of these movements is: 'Sin maíz no hay país' (without corn, there's no country). (Otero, fieldnotes of the National Democratic Convention March 2007). This movement has been exacerbated with the end of NAFTA's phase of protection period for the last four agricultural commodities: maize, beans, sugar and milk. A massive demonstration of 200,000 peasants, workers and other sympathisers took place in Mexico City on 31 January 2008 to protest against NAFTA's full opening of agricultural trade. Whether this mounting resistance will successfully alter the current trajectory is uncertain, but this is certainly possible.

Conclusion: tying the case studies together

All in all, it is the less developed and less economically powerful country in this trio that suffers the brunt of negative social impacts with the introduction of this new technology. The policy expressions of neoliberal globalism – trade liberalisation, neoregulation and corporate-friendly IPR – have provided the means for important linkages between the neoliberal regulatory thrust and biotechnology. In sum, the 'third food regime' could aptly be named the 'neoliberal food regime,' centrally characterised by biotechnology and 'life science' transnational corporations as key economic actors operating in a neoregulated international context. The neoliberal food regime shows significant evidence of becoming entrenched. Yet it is still dependent on state support for trade liberalisation and new regulations important to the new technology, such as IPR. Resistance efforts directed specifically at biotechnology (as in the USA and Canada) or at the conjunction of biotechnology and the neoliberal paradigm (as in Mexico) will affect its future shape.

With specific respect to agricultural biotechnology, we can see how in Canada and the USA the drive to develop and disseminate the technology has taken precedence over more cautionary approaches. While this official pro-biotechnology stance has not been free of negative impacts, the development drive has clearly outweighed these considerations. In Mexico, which has a much weaker biotechnology sector, the indirect effects of biotechnology via trade liberalisation have been more devastating, and social resistance is much greater (Poitras 2008). While there is resistance to biotechnology in Canada and the USA, excepting the issue of IPR, it is not as explicitly linked to

neoliberal restructuring or international trade rules as it is in Mexico. There is a marked qualitative difference in the nature of resistance in these countries. No doubt this is in part due to the fact that, while livelihoods for some may indeed be in danger in the small percentage of the farming population in Canada and the USA – specifically considering the case of organic producers, for example – it is certainly not as detrimental as in Mexico, and the repercussions of these compromised livelihoods are not as dire.

The neoliberal food regime threatens to reinstate a form of neocolonialism by external economic agents – hence the more vigorous resistance to it in Latin America. While in Mexico social resistance has been confined mostly to civil society and to a more limited extent to the political challenge of the left coalition in the 2006 elections, the situation is markedly different in some Latin American countries. In these nations strong indigenous movements have been among the most vigorous opponents of the privatisation and commodification trends involved in neoliberal globalism, and they are also ones that have a considerable plant biological diversity to defend (Otero and Jugenitz 2006). In Bolivia, Ecuador and Venezuela, opposition to neoliberal globalism actually reached state power by 2007, and it could spread to other nations such as Nicaragua. Middle-of-the road countries like Argentina, Brazil and Uruguay, while they have left-of-centre social-democratic governments, have for the most part continued to work within the confines of an overall neoliberal perspective. Hence Argentina and Brazil, for instance, are two large adopters of biotechnology, namely transgenic soybeans (Hisano and Altoé 2008; Jepson *et al*. 2008; Teubal 2008).

Generally speaking, the new regime arising from neoliberal globalism is already increasing the inequality between North and South, although the presumed or implied inevitability of the neoliberal food regime by food regimists is questioned by resistance in Mexico and beyond. One empirical question that future research could tackle is: to what extent will resistance in Mexico be successful, given its geographical proximity to the USA and the strength and authoritarian tendencies of its right-wing ruling class and politicians? This will depend on the extent to which the democratic transition, started in 2000 and interrupted in 2006, may regain its course. If the left-of-centre coalition were eventually to gain state power, with the current impetus of reversing or substantially modifying NAFTA's agricultural chapter and its neoliberal underpinnings, then the course of the neoliberal food regime could be altered in a popular democratic direction.

Note

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