

Cheap Food & Bad Money

Food, Frontiers, and Financialization in the Rise and Demise of Neoliberalism

*Jason W. Moore**

It is now widely understood that the “end of cheap food” has arrived. It is much less clear what this means for the ongoing crisis of neoliberalism, and for the future of capitalism. In what follows, I speak to this lack of clarity.

The “end of cheap food” is more than a populist slogan. From the rosy dawn of capitalist production in the “long” sixteenth century, cheap food has been pivotal to capitalism’s golden ages. Neoliberalism has been no exception. The cheapest food in world history was realized after the crises of the 1970s. In concert with strategies that re-stabilized cheap energy, raw materials, and labor power, cheap food was decisive to the restoration of profitability in the global North after 1983. The commodity boom of 2003–11, initially peaking in 2008 with another in progress for 2011–12, signals the erosion of these “Four Cheaps,” and the cascading collapse of investment opportunities created by them. For this reason, the commodity boom represents the *signal crisis* of neoliberalism—which I use as shorthand for the accumulation regime that emerged in the 1970s.¹ A signal crisis announces the tipping point in the regime’s capacity to deliver strategic inputs in a way that reduces, rather than increases, the system-wide costs of production. What remains to be seen is whether the present *conjuncture* is exclusively a tipping point of neoliberalism, or if the exhaustion of the Four Cheaps

* Correspondence is encouraged: Jason W. Moore. Email: jasonwsmoore@gmail.com, website: <http://www.jasonwmoore.com>. For discussions on the themes explored in this essay, special thanks to Diana C. Gildea, Henry Bernstein, Carole Crumley, Harriet Friedmann, Andreas Malm, Jessica C. Marx, Phil McMichael, Jeff Sommers, Dale Tomich, and Richard Walker.

¹ One could just as easily call this era “structural mercantilism,” amongst a handful of reasonable candidates (e.g., Gee, 2009).

also signals the exhaustion of capitalism's *longue durée* regime of "cheap ecology" (Araghi, 2010).

What are commonly regarded as a "food crisis" and a "financial crisis" are more effectively understood as expressions of neoliberalism's signal crisis, when prices for strategic commodities (the Four Cheaps) begin to tick upwards (or spike!) rather than decline. We might think of this reversal as the first signs of a definitive breakdown of value relations within the neoliberal accumulation cycle.² This tipping point is a reversal of the system's capacity to produce more and more food, energy, and raw materials with less and less labor. Although this reversal is often attributed to resource depletion, the reality is at once more complex, and more intractable. The reversals of cheap food, energy, and raw materials (if not—*yet*—labor power) find their taproot not only in rising costs of production owing to resource depletion, but also in the hegemony of finance capital over the accumulation process as a whole. This hegemony has undermined the possibilities for a renewal of the Four Cheaps by discouraging productive investment in favor of asset-stripping and outright plunder (the middle-run), and by favoring speculative activities that have produced unprecedented volatility in commodity markets (the short-run). These tendencies have, moreover, linked up with a new wave of extra-human nature's revolt against the disciplines of capital—the Superweed Effect. From glyphosate-resistant weeds to spiraling antibiotic resistance, ours is an era marked by the rising capacity of extra-human natures to elude capitalist control. Neoliberalism's recent history therefore highlights a world-historical rupture in the *longue durée* relation between resource depletion, capital accumulation, and financialization. In addition to the tendencies for soil exhaustion and resource depletion to fetter labor productivity and drive up costs—as in eighteenth-century England—today the hegemony of finance capital has led to a massive flow of capital into commodity markets, African "land grabs," and a mosaic of obscure financial instruments. This effectively mimics, amplifies, and diffuses across all sectors of the world-system the inflationary impact of the slowdown in labor productivity growth, in agriculture especially.

² Value in Marx's sense is not reducible to price (*pace* Foster, 2009) but rather signifies "the broader negotiation of [socio-ecological] values. . . . [It] names the work of social relationality" in a historical system driven toward the commodification of everything (Haiven, 2011: 97; also Moore, 2011a; 2011b).

For this reason, I am not so sure that finance capital *today* is best viewed as a “superstructure” (Foster & Magdoff, 2009: 124). Given neoliberal financialization’s penetration of everyday life, it strikes me as more productive to view it as constitutive of capitalism’s socio-ecological contradictions as a whole. Wall Street, in other words, becomes a way of organizing all of nature, characterized by the financialization of *any* income-generating activity (Leyshon & Thrift, 2007).

By crisis I refer to an irreversible decline in the effectiveness of the strategies that revived world accumulation in the early 1980s. Nearly all discussions of neoliberal crisis have refrained from placing it within long-run patterns of evolution and recurrence in the modern world-system. I would therefore distinguish neoliberalism from neoliberalization, and the middle-run of neoliberalism from the long-run of historical capitalism. Neoliberalization, as a set of practices and thought-structures, has surely survived. But these are not creating the conditions for a new long wave. Neoliberalism as accumulation regime took shape in the 1970s, consolidated in the 1980s, and entered a period of crisis after 2003.

What, then, of historical capitalism? This is a world-system that weaves together human and extra-human nature on the basis of endless accumulation. Capitalism is therefore not a social system, much less an economic one. It is, rather, a *world-ecology*. Capitalism does not “have” an ecological regime; it *is* a world-ecological regime—joining the accumulation of capital and the production of nature as an organic whole. While *ecology* is often used interchangeably with nature and environment, my redeployment is to offer the concept as a relation of human and extra-human natures, the *oikeios*. Relations between humans are messy bundles of human and biophysical natures, and are bound, at every turn, with the *rest* of nature (Moore, 2000; 2003; 2007; 2009; 2010a; 2010b; 2010c; 2010d; 2010e; 2011a; 2011b; 2011c). When I say that capitalism is an ecological regime, I am saying that capitalism is a world-historical matrix that knits together humans with the rest of nature in specific ways, above all operating within a gravitational field of endless accumulation. This world-ecological approach allows a view of financialization and the food regime since the 1970s as two specific crystallizations of the capitalist *oikeios*. This dialectic, then, is not one of a “social” process and its “environmental” consequences,

but rather a dialectic of two bundles of human and extra-human nature—the agro-food and financial systems of the neoliberal era.

PRODUCTIVITY AND PLUNDER: FINANCE, FRONTIERS, AND THE END OF THE WORLD-ECOLOGICAL SURPLUS

Historically, the resolution of “great depressions” in capitalism has been achieved through world-ecological revolutions that created opportunities for windfall profits. These new opportunities derive from the restoration of the “Four Cheaps,” the core of what I call the world-ecological surplus. It is a “surplus” relative to the average costs of production in capitalism, which take many forms but are ultimately rooted in the productivity of labor. Marx once observed that the fertility of the soil could “act like an increase of fixed capital” (1973: 748), without all the nasty side effects of rising capital-intensity—like the falling rate of profit (Moore, 2011a). I am arguing, in effect, that Marx’s observation holds for the long history of enclosure and exhaustion of forests, peat bogs, oil fields, aquifers, peasant societies, and yes, soil fertility in the modern world. Cheap food is especially crucial, as it is strongly related to price of labor power.

When the ecological surplus is very high, as it was after World War II, productivity revolutions occur and long expansions commence. Naturally, this is not merely a story of appropriation, but also of capitalization and sociotechnical innovation. The ecological surplus emerges as new accumulation regimes combine plunder and productivity, joining the enclosure of new geographical frontiers (including subterranean resources) and new scientific-technological revolutions in labor productivity. Great leaps forward in labor productivity, expressing the rising material throughput of an average hour of work, have been possible through great leaps forward in the world-ecological surplus. The assembly line of classic Fordism, for instance, was unthinkable without cheap steel, rubber, and oil.

It is impossible to overstate the irreducibly socio-ecological character of this surplus, which comprise not only food, energy, and raw materials but also human nature as labor power.³ The ori-

³ The appropriation, capitalization, and exhaustion of human nature as labor power in the rise and demise of neoliberalism merits further investigation but is beyond the

gins of the long twentieth century were found not only in the mass production systems of the “second industrial revolution,” but also in multiple appropriations of human and extra-human natures: of the soil and water resources of the American Midwest; of eastern European and south Asian peasantries; of the forests, fields, and resource veins of the colonial and semi-colonial worlds (Moore, 2010c; 2011a; 2011b).

Neoliberalism broke with this world-historical pattern of productivity and plunder. Accumulation revived by the early 1980s, but it did so on a much different basis than during the postwar golden age, or the mid-nineteenth-century zenith of British industrialization. The frontiers that could yield a cornucopia of nature’s free gifts were fewer than ever before, and the scientific-technological revolution in labor productivity, greatly anticipated in the 1970s, never materialized (Gordon, 2010; Moore, 2010c).

What did materialize was a middle-run strategy of financialized asset-stripping, a poor but functional compensation for the closing of frontiers, the historic basis of windfall profits. On its own, however, finance capital could go only so far. “Without protection from some non-bourgeois group,” it was “politically helpless” (Schumpeter, 1950: 138).

The revival of accumulation has always been linked to new forms of territorial power and geopolitical leadership, not least because world markets and the Four Cheaps are politically constructed and coercively sustained. Successive eras of accumulation have consequently emerged through state-capital compacts whereby the leading territorialist power secures, protects, and otherwise facilitates the conditions for revived accumulation. In the neoliberal era, finance capital could make its hegemony only by entering into a shifting mosaic of alliances with states large and small, from the United States to Chile, although of course strategically dependent on the former. This was the “armour of coercion” (Gramsci, 1971: 267) in finance capital’s hegemonic project. The powerfully coercive-intensive character of accumulation since the 1970s is an important break with previous waves of financialization (Harvey, 2003; Arrighi, 1994; Moore, 2010b). The epochal rupture of neoliberal dispossessions has gone largely unnoticed—the marked failure of primitive accumulation to restore the conditions for expanded

accumulation. This break has everything to do with the closure of frontiers. As opportunities contracted for attenuating contradictions within a more expansive global container, capital turned to extract as much wealth as possible as quickly as possible from inside the existing container.

The end of the frontier that opened with the rise of capitalism is therefore central to the specificity of finance capital in the neoliberal era. We are dealing with long- and middle-run processes here. The cumulative moment of financialization is a “pattern of accumulation in which profits accrue primarily through financial channels, rather than through trade and commodity production” (Krippner, 2005: 174; also Arrighi, 1994). Since the 1970s, however, a quantity-quality shift has occurred.

This transition is defined by the *hegemony* of finance capital over industrial and all other forms of capital. It explodes the firewall between the financial and productive circuits of capital, reproduced successfully for five centuries. Finance capital’s hegemony is revealed in its capacity “to define norms, visions, and even fashions, which become decisive for business strategies” in general (Kädtler & Sperling, 2003: 55). These norms and visions—dramatically expressed by the transition from “stakeholder” to “shareholder” capitalism and the privileging of market-price over reproduction cost accounting—shaped a peculiar expansion of profit maximization. Faced with dramatically fewer possibilities for expansion across space, finance capital pioneered an extractive strategy across economic sectors. It was a functional, if anemic, analogue to previous movements of global conquest.

Instead of looting the gold and silver of the Americas, as in the classic era of primitive accumulation, finance capital in the neoliberal era worked to extract maximal wealth from the “real economy.” The financial circuit of capital, M-M+, became a gravitational field to which capital as a whole was compelled to respond. Productive capital was locked into the pursuit of a rate of profit established in the financialized universe of symbolic equivalents, a paper chase from which followed the rapid exhaustion of the webs of *all nature* that sustained the historic accomplishments of industrial capital and the cyclical renewal of expanded accumulation (Blackburn, 2006; Aglietta, 2008). That this was a matter of capital developing through the web of life, rather than simply acting upon it, can be seen in the unprecedented ways that financialization penetrated

the structures of everyday life, from pension funds to university educations to consumer credit (Moore, 2011a; Haiven, 2011).

Financialization presented a remarkable solution to the withering marriage of productivity and plunder marked by the end of the frontier and its low-hanging fruit. This solution was found in an extractive strategy that discouraged long-term investments by states and capitals, and encouraged socio-ecological “asset stripping” of every sort—pension funds were raided, state enterprises privatized, water and energy sources depleted. In the process, neoliberalism accelerated not only turnover time (Harvey, 1989), but also rapidly exhausted the conditions that permitted capital to overcome systemic crises during the previous six centuries.

Of these conditions, perhaps none is more pivotal than cheap food. Neoliberal accumulation strategies realized what no other regime had accomplished: the creation of a cheap food regime *without* a corresponding agricultural revolution. Indeed, the era has been characterized by the progressive deceleration of yield growth. Agricultural biotechnology has made little progress on this pivotal issue (Gurian-Sherman, 2009). The biotech regime has redistributed wealth and power from cultivators to capital, but has not realized the kind of yield boom that facilitated a dramatic expansion of the world proletariat and a significant cheapening of food for these workers. And as if to move from the frying pan to the fire, by 2010 it also became clear that agricultural biotechnology is contributing to a new set of constraints, further limiting the space for a new agricultural revolution: the “superweed effect” (Moore, 2010c). The superweeds’ dramatic, if still-regional, negative impact on labor productivity points toward a broader set of erosive forces undermining not only neoliberalism’s, but also historical capitalism’s, cheap food regime.

Neoliberalism’s financialized and coercive strategies of redistribution are now looking like a case of killing the goose that laid the golden eggs. There are, it seems, few golden eggs left to appropriate. This extractive strategy revived accumulation, but it did so by cannibalizing the accomplishments of the Fordist-Keynesian order. On the one hand, finance capital achieved its hegemony at a moment when the system’s capacity to restore the Four Cheaps was weaker than ever. On the other hand, the hegemony of finance capital has exhausted capitalism’s greatest source of dynamism, found in successive scientific-technological revolutions that have

dramatically advanced labor productivity, and subordinated extra-human nature in its pursuit. This double exhaustion of productivity and plunder strategies is not coincidental with the hegemony of finance capital, but the condition of its birth. Neoliberal capitalism, it seems, has been cooking goose for dinner.

THE NATURE OF CHEAP FOOD: NEOLIBERALISM AND THE FOUR CHEAPS IN THE CAPITALIST WORLD-ECOLOGY

While neoliberalism survives, its dominant strategies have begun to falter. The turning point was reached in 2003–2008, dramatized by the longest, most inflationary, and most inclusive commodity boom of the twentieth century (Hache, 2008; IMF, 2008). It was followed by the near-meltdown of the world's financial system (Mason, 2009). This was the *signal crisis* of the neoliberal order. A terminal crisis awaits us.

The revival of world accumulation in the early 1980s consolidated two ruptures in the history of capitalism. The one reinforced the other. First, finance capital emerged as hegemonic within the accumulation process, and also, as a political force, within the states of the Global North. The hegemony of finance capital at the commanding heights of power was part and parcel of its penetration of everyday life, from pensions to new prison construction.

Finance capital's emergent hegemony contributed heavily to a second rupture. This was, as we have seen, the exhaustion of capitalism's capacity to realize a new great leap forward in labor productivity. There was an epochal shift from technological *revolution* to technological *redistribution*, reinforced by finance capital's alliance with state machineries to redistribute wealth and power from the poor and producing classes to the very rich. Hence financialization, stagnating labor productivity in the productive circuit, and wide-ranging brutality of redistributive politics formed a world-historical unity.

Have these strategies (financialization), processes (technological exhaustion), and projects (accumulation by dispossession) established the basis for a new era of capital accumulation? Or do they represent the last gasp of historical capitalism? Is the present crisis, in other words, a *developmental* ecological crisis, one that can be resolved through further commodification? Or are we wit-

nessing an *epochal* ecological crisis, one whose resolution is found in the transition to a new mode of producing wealth, power, and nature?

The revival of world accumulation has always relied on the Four Cheaps—food, energy, raw materials, and labor. This essay focuses on the first of these, while recognizing that all four moments have become progressively intertwined over the past five centuries, and especially in recent decades.

“Cheap” is a way of expressing the low value composition of these commodities—roughly corresponding to what Marx calls abstract social labor, the average labor-time necessary to produce the average commodity (1976). Capitalism’s dynamism owes much to this value form, manifested in strategies to advance labor productivity by appropriating nature as a “free gift.” For example, coal, oil, forests, and other energy sources have been extracted much faster than their replacement rates, because labor productivity (value) is the decisive metric of competitive fitness in historical capitalism. Capitalists who appropriate nature most effectively are rewarded.

Successive great eras of accumulation have emerged through this dialectic of productivity and plunder. New socio-technical innovations in production, and new innovations in the appropriation of nature’s free gifts (labor power included) have generated revolutions in labor productivity. British-led industrialization, for instance, was unthinkable without cheap calories (sugar, and later, imported cereals) and cheap energy (coal). Their cheapness resulted from the wealth of soils and coal seams that could be freely appropriated with very little labor power. Calories and coal, in other words, had a *low value composition*. The quantum of abstract labor involved in their production was low, relative to commodity production in general. While there is much more to the story, the successive, punctuated reduction in the value composition of the Big Four inputs has been central to successive revivals of expanded accumulation. This reduction in the value composition of the Big Four inputs is necessary for the revival of world accumulation. The crises that bring these upsurges to a halt find their taproot in the erosion of these Four Cheaps.

The Four Cheaps have been pivotal for a very good reason. All things being equal, a decline in the costs of production favors a higher rate of profit. This is because labor costs fall (because cheap food strongly influences the reproduction costs of labor power) or

because the costs of machinery and inputs fall (Marx, 1967: III; Moore, 2011a; 2011b). In both instances, the gap between production costs (value) and sale price can be widened. The neoliberal era has diverged from this *longue durée* pattern. After three decades of seemingly breakneck technological innovation, there is little prospect of a new labor productivity revolution. Indeed, given the progressive erosion of the Four Cheaps, a significant increase in labor productivity might well drive up input costs and fetter profitability. The upshot? The cheapness of these vital commodities in the neoliberal era has relied less on rising efficiencies in production and much more upon the coercive dispositions of the state-finance nexus.

The erosion of the Four Cheaps invariably signals a contraction of investment opportunities. Hence, financial expansions typically coincide with new and ruthless initiatives to appropriate extra-human nature (resources), which entail new and ruthless initiatives to exploit human nature (labor power). These initiatives establish new conditions for a revival of profitability in the productive circuit. This was as true for the “Age of the Genoese” in the century after 1557 (Moore 2010a; 2010b) as it has been for the neoliberal era.

At its core, neoliberalism’s socio-ecological project reordered the global relation between humans and the rest of nature through financialized mechanisms of redistribution from poor to rich—“backed, as ever, by state powers” (Harvey, 2003: 152). This tendency is captured in discussions of the neoliberal debt regime (e.g., George, 1993; Bello, 1994). But neither a North- nor a South-centric story will suffice. The new logic of finance capital permeated much more than core-periphery debt relations. It extended into the very heart of productive capital and household reproduction in North American and other core zones.

Finance capital after the 1970s no longer depended *directly* on the vitality of the “real economy.” The productive circuit of capital (M-C-M+) was subjected to a rate of profit determined in the world of fictitious commodities (M-M+). This favored asset-stripping and the progressive dilapidation of the sources of productivity revolutions. On a system-wide basis, the rise of finance capital to hegemony within the accumulation process amplified the difficulties faced by productive capital on the ground in launching a new scientific-technological revolution in labor productivity. This amplification

turned on finance capital's notorious impatience, "short-circuiting flows of production and trade, garnering an immediate profit at the expense of what might have been long-term social surplus" (Blackburn, 2006: 67). This rupture between financialization and productivity revolution would lend the revival of world accumulation from the early 1980s a distinct character.

FOOD AND FINANCE IN THE RISE OF NEOLIBERALISM

The neoliberal era was characterized by the cheapest food in the history of humankind—with the unhappy caveat that no less than forty percent of humanity suffered from some form of malnutrition (Weis, 2007). World food prices dropped 39% between 1975 and 1989, and still further in the decade that followed (McMichael, 2005: 278; FAO, 2009). This period was brought to an end, as we know, by 2006, and food commodity prices peaked in 2008. By 2011, it became clear that the commodity boom of 2003–08 must be extended, with food prices exceeding the 2008 peak in January 2011 (FAO, 2011).

The sharp fall in food prices after 1975 reflected a peculiar sort of agricultural revolution. Historically, such revolutions had been made through transformations of class structures and property regimes that compelled cultivators to "sell to survive." The result was a series of market-driven (if juridically enforced) productivity revolutions that distinguish the capitalist era from pre-modern booms (Brenner, 1976). Insofar as metropolitan capital and states pioneered a new global order that delivered cheap food as the basis for the revival of accumulation after 1983, the neoliberal agricultural revolution fits the historical pattern. The rise of the Dutch, British, and Americans to world hegemony was made possible through agricultural revolutions that yielded cheap food to a growing layer of the non-agricultural workforce (Moore, 2010c). But in contrast to previous agricultural revolutions, there has been no great leap forward in productivity since the 1970s. Indeed, quite the opposite. Yield growth, and labor productivity with it, has progressively slowed, despite the introduction of new agronomies (biotechnology) and the unprecedented deployment of fertilizers and other inputs.

How, then, was cheap food realized?

One pillar of neoliberalism's cheap food regime came from another era. Essentially, neoliberal accumulation rode the wave created by the Fordist sensibilities of the Green Revolution. Often regarded as a product of the 1960s, the Green Revolution emerged first in the United States during the 1930s. Its core synthesis brought together the nineteenth century's dynamic family farm model with hybrid corn (maize), the biological pivot of a new property regime. The new corn would raise yields more than four-fold between 1935 and 1980 (Kloppenburger, 1998: 89), and spending on food dropped from 24% to 14% of average household income (Elitzak, 1999: 20). This hybrid revolution was won at heavy cost to farmer autonomy. Because hybrid crops, in contrast to open-pollinated ones, produce seed of inferior quality, hybridization "uncouples" seed from grain. This compelled farmers to make an annual pilgrimage to seed firms, where they purchased new seed for planting (Kloppenburger, 1988: 93). Hybridization was a strategic wedge, opening new opportunities for the capitalization of farming. The result was a radical extroversion of farming, as purchased inputs more than doubled, and chemical inputs soared nearly 20-fold in the four decades after 1935 (Kloppenburger, 1988: 33).

This model would be progressively globalized after World War II, at first in Mexico and then famously in South Asia (Sonnenfeld, 1992; Perkins, 1997). Not only was it a pillar of American world leadership, the Green Revolution achieved an unprecedented yield revolution. In South Asia, wheat and rice yields increased between 100 and 200% in the period between the mid-1960s and mid-1990s, with the lion's share of the boom coming before 1985. Between 1950 and 1990, global cereal output nearly tripled, propelled by a rise in "grain yield per hectare . . . by roughly 2.4 times" (Weis, 2007: 17; Kendall & Pimentel, 1994). Meanwhile, the real price of rice, corn, and wheat dropped 60% between 1960 and the end of the last century (FAO, 2002: 11). Even after the crisis of the Fordist-Keynesian world order in the 1970s, the vitality of the national farm sectors created through the Green Revolution provided strong yield growth for another decade (Tilman, et al., 2002; IMF, 2008).

From the mid-1980s, agricultural productivity growth slowed worldwide. The slowdown was especially pronounced in capital-intensive zones (Fuglie et al., 2007; Hazell, 2010: 3483). Delayed by a few years relative to the North, the experience of Indian wheat yields was hardly exceptional: per hectare yield growth averaged

3.4% annually between 1982 and 1992, falling to a paltry 0.6% over the next decade (Matuschke & Qaim, 2006: 2). Nevertheless, food commodity prices continued to fall until 2002–03. In the absence of a new agricultural revolution, the gap between falling prices and stagnating productivity was in part filled by the bellies of the world's poor. This is the dietary moment of Araghi's "forced underconsumption" (2009). "Per capita foodgrain absorption, *taking direct and indirect absorption together*," declined in India from the mid-1980s, and China from the mid-1990s (Patnaik, 2011). Even before the food price spikes of 2003–2008/11, somewhere between one-third and one-half of all humans experienced nutrient deficiencies (Scoones, 2002; Weis, 2007). Meanwhile, food expenses in the Global North as a share of income declined between 1980 and the end of the century, from 13.4% to 10.7% in the United States (Elitzak, 1999: 20)—even as median income stagnated and a fast-food revolution came to the rescue of the temporal reproduction squeeze faced by two-income households.

This dietary moment of combined and uneven development was hardly novel. Baltic grain flowed into Amsterdam during the mid-seventeenth century as Polish peasant diets were squeezed—and soil fertility exhausted—under the Dutch-led "system of international debt peonage" (Wallerstein, 1974: 121–22; Moore, 2010b). But Poland's crises led to its relative de-linking from world trade by the eighteenth century; although hardly prosperous, its exposure to agro-extractive dispossession, dietary immiseration, and resource exhaustion was greatly relaxed. No such relaxation occurred at the dawn of the neoliberal era. The financial-imperial power that fused in the early 1980s as the "Washington Consensus" was directed at preventing the South's relative withdrawal from the world market. This had long been the pattern, as world-economic contractions provided room for peripheral and semi-peripheral zones to develop home markets and pursue "core-like" capitalist development—Mexico during the seventeenth century, British North America after 1763, Latin America in the 1930s. But such relative withdrawal was precisely what could not be tolerated by an emergent accumulation regime that was *not* in the midst of a new productivity revolution.

This was all the more crucial at the dawn of the 1980s, after a decade of very low productivity growth on a world scale. For neoliberalism to succeed, there had to be a way to keep cultiva-

tors locked into a treadmill that ramped up commodity production even as world market prices fell. The flood of cheap capital loaned to the South in 1970s, spearheaded by New York banks (in a shift from the older dominance of multilateral loans), established the conditions for sustained overcapacity in agro-extractive sectors in the neoliberal era. These conditions were partly realized through infrastructure projects—such as the trans-Amazonian highway expansion—and partly through capital goods imports. But the tendency was not limited to the South. Indeed, the South's agro-extractive overcapacities were sustained in the 1980s and '90s by grain farmers in the North. Their relations were joined through the debt regime. American farmers saw their debt burden triple in the 1970s (Strange, 1988: 21–22). In a dramatic break with the postwar pattern, U.S. farmers financed expansion largely through “outside debt capital,” fueling an asset boom that reinforced overproduction tendencies in the early 1980s (Barnett, 2000: 371). The “*new* agricultural countries” in the South and the *old* agro-industrial complexes in the North were differentiated moments within a world-historical unity (Friedmann, 2004).

The world recession of 1980–82 was “even more severe than that of 1974–75” (Kolko, 1988: 43), and it threatened to fracture the neoliberal order just as it consolidated power in the North and realized counterrevolution in key zones of the South. The recession was initiated by the Volcker Shock in October 1979, as the U.S. Federal Reserve suppressed inflation—finance capital's greatest fear—by nearly tripling the real interest rate over the next two years, relative to the 1965–79 average (Kolko, 1988: 41–42; Engdahl, 2008). Mexico's interest bill, for example, tripled between 1979 and 1982 (Schaeffer, 2003: 101). As we have seen, the trend was not limited to the periphery.

The resulting debt crisis, not just in Mexico but across the South, had two possible outcomes. The danger was that Mexico and other heavily indebted states would default, refusing to pay their debts without significant restructuring. This would have devalored loan-capital on a massive scale and reflat primary commodity prices, transforming the severe recession of 1980–82 into a prolonged depression for the North. American banks would have been especially hard hit (George, 1990). As we know, this did not happen. The debtor states of the South acceded to the new debt regime—which included the rapid liberalization of domestic finan-

cial sectors—following the fiscal turbulence of 1982. Among the decisive consequences was a system of debt peonage that reinforced the “export glut” of primary commodities (McMichael, 2008: 130). “Land and natural resources in general [became] the objects of enhanced export strategies to generate foreign exchange, often to service debt” (McMichael, 1999: 26–27). Far-reaching transformations of earth and bodies ensued across the South, as deforestation advanced, toxification intensified, and diets suffered (Bello, 1994; George, 1993; Wright, 2005).

The consequences were immediate. In the periphery, negative “price shocks”—any decline in real prices by 10% or greater relative to the previous year—grew from 25 to 90 between 1981–83 and 1984–86; the severity of these deflations was 25–50% greater (IMF, 2003: 37). Worldwide, non-energy raw materials prices fell by nearly half between 1980 and 1992 (Schaeffer, 2003: 103). As Peter Gowan wryly observes, within the North, the new debt regime worked for rentiers, who “[got] their debts paid,” and industrial capital, who got “cheaper imports for the inputs needed for production,” not to mention cheaper food for workers (1999: 42).

The new debt regime compelled the radical extroversion of the South’s tenuous national farm sectors that had emerged in the postwar golden age. This made “global distress-sellers” of nearly all the world’s cultivators, especially but not only within the South (Patnaik, 2003: 3). In sub-Saharan Africa, we find the most dramatic expressions of two system-wide compulsions: to maximize production for the market even in the face of falling prices and absent technical innovation; and to suppress incomes for the producing classes, manifested across the South in declining per capita food consumption. It was, in short, a macabre combination of forced overproduction and forced underproduction. Patnaik puts her finger on the basic logic of the situation. During the 1980s,

[Sub-Saharan Africa’s] six most populous countries, all under structural adjustment, experienced a 33 percent fall in cereals output and a 20 percent fall in food staples output per head in the 1980s, while at the same time cash crops in volume terms were being exported at an annual rate of 6.5 percent (Kenya) to 13.9 percent (Sudan), despite falling unit dollar prices, while the competitive export thrust ensured a 35–50 percent fall in unit dollar price for primary exports, so that no increase in exchange earnings took place at all

for countries expanding exports at 6–8 percent or less every year. World Bank documents on Africa urge these countries to redouble their efforts to export . . . selling more and more at falling prices, which means that they will continue to be global distress-sellers. All except one country suffered declines in average calorie intake even after food imports were taken into account (Patnaik, 2003: 3).

This regime was anchored by a new web of relations between finance capital, state power, and agribusiness in the construction of world agriculture as a “world farm” (McMichael, 2009b). Structural adjustment’s encouragement of “export glut” was quickly reinforced by a further decoupling of world market prices and regional production costs. This was realized through the “political determination of world agricultural commodity prices [that] emerged through the Uruguay Round negotiations” of the General Agreement on Tariffs and Trade, and continued into the World Trade Organization era after 1995 (McMichael, 2005: 282).

The force of such political determination was not unprecedented. During the late nineteenth century’s financial expansion, the British-instituted global market succeeded in compelling peasant producers throughout the new peripheries to sell “without regard to price of production,” as Engels observed in the midst of the process (in Marx, 1967: III, 726). But finance capital remained subordinated to a system driven by industrial capital. Hilferding, in his classic statement, saw banks becoming “to a greater and greater extent *industrial* capitalists” (1910: 225). The late nineteenth century was an era of profound productive dynamism, what we now call the second industrial revolution. What is unprecedented in the neoliberal era is the depth of finance capital’s penetration and subordination not only of industrial capital but also, *in so doing*, the reproduction of capitalism’s vital commodities. Finance capital’s structural short-termism was therefore at once advantageous and disadvantageous for the accumulation process. For a time, this worked quite well. Rapidly redistributing and extracting wealth from poor to rich and from agriculture and industry to finance, neoliberal financialization allowed accumulation to revive after 1983. By 2003, however, the bloom was off the rose. The financialization of everything began to generate serious contradictions for world accumulation.

Neoliberalism's radical decoupling of world price and production costs created major new opportunities for the geographical concentration of production, and centralization of capital, in the agro-food sector. By 2008, just five firms controlled 90 percent of the global cereals trade, three countries were responsible for 70 percent of exported maize, and a third of world grocery sales went through 30 food retailers (McMichael, 2009a). By the end of the 2000s, however, these dominating agribusinesses were no longer the more-or-less equal actors alongside finance capital that they appeared to be in the late 1980s. This rippled down through the agro-food "chain" as both food processors and input providers were disciplined by global finance, which, directly and indirectly, "extract[ed] surplus value through the imposition of contracts, unequal financial agreements, or economic dependencies of various kinds" (Pritchard et al., 2007: 79). By the dawn of the new century, the reduction of farmers to "propertied laborers" set in motion during the 1930s (Kloppenborg, 1988: 34) had become a pillar of financialized accumulation. Increasingly subordinated to the logic of shareholder value and its iron law of "at least 13 percent return on capital employed" (Williams, 2000: 6), transnational agribusiness reproduced the new rules of the game under the hegemony of finance capital:

Mainly financed by credit (and partly consolidated through shares), the food empires have contributed considerably to the making of . . . the financial crisis. The dependency on credit (and the requirement to enlarge stockholder value) introduces the need to generate a large enough cash flow to pay redemption and interest rates as well as to co-finance further expansion. Thus, these structures that link the production and consumption of food have a strong inbuilt need to "squeeze out" as much value as possible, by exerting a permanent downward pressure on the prices received by primary producers and an upward pressure on food prices paid by consumers, allowing for considerable accumulation. This explains why massive levels of chronic undernutrition coexist with persistent trends toward de-activation of primary production (van der Ploeg, 2010: 102; also Burch & Lawrence, 2009).

Finance capital's impatient drive to "squeeze out" as much value as possible within the shortest amount of time helps to account for two successive transformations. First, neoliberal financialization, married as we know to the institutions of the Washington Consensus, effected a historic deflation of food commodity prices (Patnaik, 2003). Second, once the bloom was off the rose in other key spheres of financialization (e.g., subprimes, tech stocks), this was followed by the spectacular inflation of food prices after 2003. One spectacular peak was reached in 2008, and another in early 2011, with little relief for Southern consumers in between (Ghosh, 2010; FAO, 2011). This second movement, exerting "a permanent upward pressure on food prices paid by consumers," is expressive of an epochal shift in the historical pattern of food regimes. This is the transition from a regime that drives down the price of wage-foods to one premised on a "price assault on vulnerable consumers" (McMichael, 2009a: 284). Here agro-food transnationals reproduce the logic of finance capital, seeking to "capture profits through price inflation" rather than through productivity advances (McMichael, 2009a: 284). Naturally, this price inflation is reinforced by speculative activities, but more significant is agribusiness' internalization of finance capital's internal logic, which says, in effect, *take first, and make second*. Financialization, in other words, is undermining the conditions for a new capitalist boom every bit as much as is faltering productivity fueled by soil and resource exhaustion; they are two sides of the same world-historical coin.

Here we return to Wall Street as a way of organizing nature. In part, this is the role played by the "centrality of short-term financial results . . . [in] provok[ing] a long-term decay in biophysical productivity within the industrializing poles" of world agriculture (van der Ploeg, 2010: 100). Profitability was sustained through an agro-ecological asset-stripping that was homologous to private equity firms' asset-stripping in industry (Bellofiore & Halevi, 2009), rather than revolutionizing production from within. This entailed a profit squeeze on petty commodity producers, a key source of agribusiness profitability. The average Iowa farmer saw his rate of profit drop from 35% to 9% over the second half of the twentieth century (Halweil, 2000). Median farm income has stagnated from the mid-1980s, as the farm-to-retail price spread dramatically widened, and as input prices rose sharply relative to farm commodity prices from the mid-1990s (Elitzak, 1999; Glenna, 2003).

But the centrality of short-term financial results, reinforcing a longstanding “technological treadmill” in agriculture (Kloppenburg, 1988: 119), is only part of the story. The hegemony of finance capital also subordinates all commodity production:

to the competitive logic of global financial markets. Food companies, for example, are no longer simply competing in yoghurt, or carbonated drinks or processed meats. They are competing on financial markets to deliver the fastest and biggest possible rates of return to “impatient” financial capital (Rossman, 2007: 5).

These “fastest possible rates of return” were realized by undermining the middle-run conditions of profitability in the productive circuit. As finance capital gained hegemony over the accumulation process—punctuated by the emergence of private equity firms and funds—it entrained a shift from “stakeholder” to “shareholder” capitalism (Seccombe, 1999). The hegemony of M-M+ reworked the “hierarchy of management objectives,” through which share price and market-value accounting was to be privileged across *all* sectors of the economy (Williams, 2000: 6). Through private equity firms and the principle of shareholder value, there emerged a rapacious “extraction of value” that progressively undermined the opportunities for productive investment (Froud & Williams, 2007). The point is the expansive sphere of influence exerted by private equity firms rather than their direct activities, however significant, which seek to “bypass the stock market while keeping the short term notion of capital gains of financial markets” (Bellofiore & Halevi, 2009: 8). This sphere of influence relies on cost-cutting, and only when absolutely necessary, investment to serve “simple” rather than “expanded” reproduction (Bellofiore & Halevi, 2009: 8; Foster & Magdoff, 2009). Focusing on Europe’s food processing sector, deeply subordinated to finance capital, Rossman points to a “declining rate of real investment” (2007: 5). Rising profitability in short-run was achieved through outsourcing, casualization, the degradation of working conditions, and “inducing competition between individual units within the firm on the basis of existing plant and equipment” (Rossman, 2007: 5).

Such asset-stripping as a systemic tendency explains something of the ongoing erosion of the productivity/plunder dialectic that has been central in renewing accumulation since the sixteenth cen-

tury. The synchronicity of financial expansion and sociotechnological innovation at the birth of the long twentieth century was distinctive but not exceptional. The Dutch-led financial expansion (c. 1740–80) overlaid the early phases of steam engine development in England. And the Genoese-led financial expansion (c. 1557–1620s) saw the emergence of standardization in shipbuilding, new milling and refining technologies in sugar processing, and a new wave of agricultural innovation in northwestern Europe.

But it is precisely the *absence* of a scientific-technological revolution—one that advanced labor productivity and reduced the costs of production—that characterizes the history of neoliberalism. Annual labor productivity growth in the OECD declined from 4.6% in 1960–73 to 1.8% in 1973–79 and just 1.6% in 1979–97 (Crotty, 2000: 6). In the core, most of this growth occurred outside basic industry and agriculture, compounding the problem still further. Labor productivity growth in agriculture slowed across the Global North after 1980, in the United States falling by more than one-third in 1980–2004, relative to the postwar era (Fuglie, McDonald & Ball, 2007: 5). Worldwide, agricultural labor productivity ticked upwards slowly after 1990, rising to just 1.36% through 2005, over the 1.12% average of 1961–90 (Alston, Babcock & Pardey, 2010: 461). The modest increase was largely attributable to Chinese agricultural reform, which has yet to provide a kind of hegemonic model for the world-system along the lines of the Dutch, British, and American agricultures in their golden ages. Indeed, for all the remarkable accomplishments of the Chinese “miracle,” labor productivity in industry and agriculture both remain one-quarter (or less) the average obtaining within the Global North (Jefferson, Hub & Su, 2006; Jin, Huang & Rozelle, 2010). There are few signs that China’s ascent, however successful on its own terms, offers the kind of hegemonic model for industry and agriculture that might be emulated by our era’s rising powers.

CHEAP FOOD AND THE CLOSURE OF THE GREAT FRONTIER: SUPERWEEDS AND OTHER BARRIERS TO A NEW AGRICULTURAL REVOLUTION

Between 2001 and 2007, the cheapest food in world history collapsed. At the end of 2007, world food prices were the highest since *The Economist* began tracking such movements, in 1846 (Buntrock, 2007). And from there it grew worse still. Food prices peaked in the summer of 2008, with a new high reached in the early months of 2011 (FAO, 2011).

What accounts for this dramatic reversal? The short answer turns on the rise and demise of the world-ecological surplus enabled by the enclosure of modernity's last frontiers. Neoliberal capitalism emerged, and sustained itself, by appropriating what free gifts remained for the taking: the oil frontiers of the North Sea, Alaska, West Africa, and the Gulf of Mexico; the crest of Green Revolution agriculture in South Asia, appropriating and exhausting fertile soil and cheap water; the integration of the old Soviet Bloc into the world market, allowing cheap metals and oil to drive down production costs in the 1990s; the appropriation of the Chinese peasantry as a vast labor surplus; the privatization of state and quasi-state firms and public services. These free gifts will not recur.

This marks the closure of the "Great Frontier" (Webb, 1964). This frontier, opened in the "long" sixteenth century, provided an astounding wealth of nature that reduced production costs, increased profitability, and generally greased the wheels of accumulation for many centuries. Its exhaustion is a turning point in the history of capitalism.

The closure of the Great Frontier removes the central way that capital has dealt with the rising costs of production. *Today's* frontiers are but drops in the bucket relative to the demands of value accumulation. But frontiers are not merely geographical places. They are socio-ecological relations that unleash a new stream of nature's bounty to capital: cheap food, cheap energy, cheap raw materials, and cheap labor. No phase of capitalism has emerged in their absence.

If capitalism confronts definite limits to the present configuration of accumulation, this is hardly unprecedented. Indeed, the history of capitalism is a long series of revolutions—bourgeois, in-

dustrial, agricultural, and otherwise—that transcended seemingly insuperable limits to accumulation. From this perspective, we can rightly ask: Does biotechnology constitute the basis for a new agricultural revolution? In one sense, agro-biotechnology fits the classic model. Backed by a new intellectual property regime, agro-biotech has redistributed income amongst farmers and provided some outlet for the absorption of surplus capital. In another sense, agricultural biotechnology has been an epochal failure on the terms that matter most to capital. No yield revolution has been forthcoming, even after 15 years of diffusion and experimentation. Without a yield revolution, cheap food is done for, and with it the promise of a significant revival of world accumulation.

The Biotech Revolution and its Thermidor: The Superweed Effect

Biotechnology has not halted, much less reversed, faltering productivity growth in world agriculture. The slowdown became evident in the second half of the 1980s, and the trajectory has not been altered by the widespread introduction of GMOs (genetically modified organisms) in the mid-1990s (Tilman et al., 2002; Fuglie et al., 2007; Hazell, 2010: 3483). Indeed, agricultural biotech has done little to improve intrinsic yields—“intrinsic” in the sense of raising the yield ceiling, in contrast to raising operational yields, the amount harvested (Gurian-Sherman, 2009; Benbrook, 2009). The mounting research on this question even prompted Monsanto to respond that “the main uses of GM crops are to make them insecticide- and herbicide-tolerant. *They don’t inherently increase the yield.* They protect the yield” (quoted in Ritch, 2009, emphasis added).

Alas, RoundUp Ready crops are not doing so much to *protect* yield lately, either. “Superweeds” have evolved to survive the onslaught of the famed herbicide (Benbrook, 2009). Soy is a particularly revealing case. Considering that GMO soybeans already constitute 57% of world output, and that the United States remains the leading soy producer (37%), the rise of the superweed is something of a world-historical event (Pechlaner & Otero, 2008; Masuda & Goldsmith, 2008). In the United States, especially in soy regions, ten weed species, on millions of acres in 22 states, are now immune to the familiar herbicide (MCT News Service, 2010). The American superweed frontier expanded four-fold between 2008 and 2011, to

10 million acres (CFS, 2011). Even allowing for exaggeration, some projections point to a superweed explosion that would engross 38 million acres by 2013 (Syngenta, 2009). This amounts to one of “every four row crop acres” in U.S. agriculture (Freese, 2010).

The superweed frontier has also advanced rapidly in the GMO soy zones of Argentina and Brazil (Villar & Freese, 2008). The Latin American dimension is all the more suggestive as the soy revolution has been realized not only through conversion of existing arable land, but also through massive forest clearing and other forms of agricultural expansion (Altieri & Pengue, 2006). This is the classic model of the commodity frontier, which has always served to attenuate agro-ecological contradictions within cash crop agriculture. When weeding became too great a drag on productivity in seventeenth century Barbados, for instance, the sugar frontier moved to bigger islands such as Jamaica (Moore, 2007). But the soy commodity frontier in Latin America has enjoyed little of the historic “yield honeymoons” that accompanied these previous episodes; the superweeds are advancing faster than agro-capitalism can run.

The problem is that biophysical natures evolve faster than the capacity of capital to control them—a “Darwinian evolution in fast-forward” (Neuman & Pollack, 2010). Can capital continue to innovate enough to stay ahead of this decidedly non-linear treadmill? The experience of 2008–2010 suggests otherwise, as herbicide resistance developed so powerfully in the United States, the global heartland of GMO agriculture, that even the national media came to feature the growing family of superweeds (Gillam, 2010; Kilman, 2010).

Monsanto’s vaunted RoundUp Ready crops are at the center of this socio-ecological fast-forward. While it would be unwise to give Monsanto too much credit, the underlying superweed tendency is nevertheless crystallized nicely by the firm’s GMO soy (Gurian-Sherman, 2009). The promise of GMO crops was to reduce herbicide and pesticide use and to increase operational yields. That promise is now quickly turning sour, with rising toxicity and diminishing returns (Benbrook, 2009). Notwithstanding the claims of Monsanto and other Big Ag boosters (e.g., Monsanto, 2009), it appears that glyphosate-resistant (GR) crops such as RoundUp Ready Soy are bound up with ominous implications for human health (Benachour & Séralini, 2009) and that GR root systems

are susceptible to fungal invasions (Kremer & Means, 2009). Add to this an apparent exhaustion of operational yield gains—“We’re back to where we were 20 years ago,” Tennessee soy farmer Eddie Anderson told *The New York Times*, as he prepared to revert to older ploughing techniques and chemical regimes (Neuman & Pollack, 2010)—and we have a real problem for capital.

This bundle of contradictions, pivoting on the accelerated evolution of herbicide-resistant weeds, is the cutting edge of the *superweed effect*. At its core is the tension between capital’s efforts to control and commensurate extra-human nature, and the latter’s co-evolutionary capacity to elude and resist that control: “the more [capital] ‘tames’ natural processes, the more they spin out of control, provoking new and more aggressive taming measures with increasingly disastrous outcomes” (Wallis, 2000: 505).

The superweed effect speaks to the wildly proliferating and increasingly unpredictable responses of extra-human nature to the disciplines of capital, above all to what McAfee aptly calls “neoliberalism at a molecular scale” (2003). The short-run promise of RoundUp Ready crops was to maximize operational yield by reducing costs and weeds simultaneously. The middle-run yield is not only more weeds and more herbicide, but a tendency toward combining glyphosates with “more toxic weedkillers” such as atrazine, an endocrine disrupter, and 2-4D, a powerful carcinogen—all of which would be acceptable (to capital) if it produced a new yield boom, producing more food with less labor. But this boom has not materialized.

To be sure, some group of capitalists will find a profitable and short-lived fix to the yield-suppressing manifestations of the superweed effect. Some group of capitalists always finds a profitable response to one or another of capitalism’s contradictions. But capital *as a whole* does not benefit from the rising cost of food implied by the superweed effect. In an era of generalized wage stagnation or worse, rising food prices promise to squeeze working class incomes and raise reproduction costs for proletarian households, developments hardly favorable to a new expansion.

The superweed effect represents a quantity-quality shift in the history of an enduring contradiction. The long history of agroecological control regimes began with the monocultures and highly-regimented work disciplines of early modern plantations and has today crossed a world-historical threshold with molecular and

other disciplinary projects. This shift is a new era of extra-human nature's resistance, in which the short-run fixes not only become progressively shorter-run, but also progressively more toxic. In previous eras, capital's need for totalizing control, however significant, was less extensive, for the sound reason that faltering labor productivity in one zone could be "fixed" through a new round of global expansion. Problems with English agricultural productivity in the eighteenth century, for example, were never resolved within England, but rather through successive frontier movements, especially in North America. And recall that the rise of England as an agricultural superpower was bound with falling yields and the progressive exhaustion of "free gifts" in Poland, the breadbasket of Dutch hegemony (Moore, 2010b; 2010c). The accessibility of sizeable frontiers of appropriation in previous eras meant that capital's pursuit of control was more relaxed, its capacity to achieve rising productivity greater, and its toxification tendencies weaker.

The superweed effect overlays, and amplifies, the resource and soil depletions of capital-intensive agriculture. Capitalist agriculture exhausts the soil, demands energy-intensive inputs, and slakes its thirst by exhausting groundwater (Weis, 2010). This is what Marx describes as the tendency for the "overproduction" of machinery to outrun the system's capacity to supply energy and raw materials. This leads to the "underproduction" of these inputs (Marx, 1967, III; see Moore, 2010c; 2011a; 2011b). While there is an important cyclical moment to this tension between overproduction and underproduction, there is also a cumulative moment—the superweed effect and its non-linear amplification of a longstanding tension between the overproduction of machinery and the underproduction of inputs. This is not because labor-productivity innovations have been crucial, but rather because the reproductive (land/energy/water) foundations have been progressively cannibalized. This was revealed in the 2003–2008 commodity boom, as rising energy prices propelled rising fertilizer and food prices. Neoliberal financialization had suppressed the investment mechanism that might have prolonged the cheap energy regime, manifested in the reorientation of Big Oil's supermajors away from exploration and toward stock buybacks (Moore, 2011a).

Capitalism today confronts the exact opposite of its early modern bounty. The rise of capitalism was greatly facilitated by a series of "yield honeymoons" (Dark & Gent, 2001). These honeymoons

offered a great advantage: very little labor power could produce very large amounts of food, without large outlays of capital. The introduction of Old World crops into the New World (sugar), and New World crops into the Old World (potatoes), provided massive yield windfalls (Moore, 2007). Today, we are looking at the reverse of the yield honeymoon—the superweed effect.

Food and the Crisis of Neoliberalism: Toward a New Golden Age?

If agro-biotech is going to come to the rescue, it had best do so immediately. The timing is crucial, for we are now at the beginning of a “long depression” (Shaikh, 2010). This depression cannot be resolved without a world-ecological revolution that delivers a significant reduction in food prices while feeding a significantly expanded world proletariat.

In the late nineteenth century—also an era of long depression and financialization—wrenching famines throttled the periphery as the world proletariat grew prodigiously and world cereal prices declined by 27% (Arrighi, 1994; Davis, 2001; O’Rourke, 1997). But the contours of the present conjuncture appear favorable to the first of the conditions, which is helpful to capital only to the degree that such dietary immiseration frees up a significant (not incremental) expansion of the surplus. Given that half of humanity lives with nutrient deficiencies, it is difficult to see how a further squeeze could be accomplished in the face of a new wave of proletarianization.

This puts us face-to-face with the future of cheap food. Tellingly, it is not only radical critics who are putting a fork in the era of cheap food (*It’s done*). In 2008, the OECD forecast real inflation of 10–35% over the next decade for a basket of key food commodities. The 2008 projection was grounded on the assumption that yield growth would follow the “historical trend” of 1960–2000 (OECD, 2008; OECD/FAO, 2008: 47). Two years later, the FAO revised upwards its earlier estimate to 15–40% real price hikes for cereals. And this was the *good* news: “vegetable oils real prices are expected to be more than 40% higher” (OECD/FAO, 2010: 11). In a qualification scarcely designed to promote confidence, the FAO’s estimates “assume normal average weather conditions . . . [and] long-term productivity trends” (OECD/FAO, 2010: 11).

The challenges to a new agricultural revolution are extraordinary. This is true even if we bracket the geopolitical tensions that have stalled agro-food liberalization, and class struggles from below that have challenged market-dependent “food security” in the name of food sovereignty (McMichael, 2005; Weis, 2007). The list of prominent biophysical challenges surely begins with global warming, already implicated in the yield suppression of major cereal crops. Every 1°C increase in minimum growing temperature for wet rice cultivation yields a 10% decline at harvest (Peng et al., 2004). A strong relation between warming and yield suppression has been found for wheat, maize, and even soy (Cerri et al., 2007; Cline, 2007; Lobell & Field, 2007; Kucharik & Serbin, 2008). The UN’s Environmental Programme sees “an absolute decline” in net primary productivity “across 12 percent” of the planet (Nellemann et al., 2009: 40) by 2050, but declining NPP is not merely a hypothesis. While global NPP increased between 1982 and 1999—was this merely coincident with the neoliberal golden age?—it declined between 2000 and 2009 (Zhao & Running, 2010: 940–43). With global impacts concentrated in the South (Indonesia’s NPP declined nearly 20%), the decade was punctuated by a series of severe droughts (Zhao & Running, 2010: 940–43). These have continued, with Russia’s in 2010 accompanied by the “worst drought in six decades” in the North China Plain in 2010–11 (Anna, 2011). To climate change we can add rising energy costs; escalating competition for arable land from agrofuels; the proliferation of invasive species; the superweed effect; the end of cheap water, as global warming melts glaciers, rearranges precipitation patterns, and drives aquifer depletion; and the declining effectiveness of fertilizers on yield growth.

If the crisis of neoliberalism today is in fact a *developmental crisis*, one open to resolution within the capitalist mode of production, we would expect to see an agricultural revolution taking shape in the most dynamic new center of accumulation, China. But following the burst of productivity and output growth in the 1980s, there is little to suggest that China is on the brink of an agricultural revolution that will not only feed the world, but *lead* capitalism to a new golden age. True, after 1979 there began a “*de facto* privatization of agriculture” in China, accompanied by skyrocketing fertilizer use, which boosted yields and output considerably (Wen & Li, 2007; Lin, 1992). Cereal production rose from about 300 to 500

million tons a year between 1979 and 1996 (Wen & Li, 2007). But yield growth in wheat—China is the world’s largest wheat producer—has stagnated, and output declined by eight percent between 1998 and 2004 (Lohmar, 2004). In rice, by the 1990s yield growth had slowed to less than half the pace of the 1960s, and output declined by four percent. China’s soy imports exceeded domestic production for the first time in 2003 (Defeng, 2000; People’s Daily, 2004; Brown, 2009). However one cuts it, China does not appear poised to launch an agricultural revolution of the sort we have known in the history of capitalism—one that not only feeds the ascendant power, but *leads* the system to a new expansion. Nor does China appear to be initiating the kind of “external” agricultural revolution that characterized Dutch power in the Baltic, or British power in the Caribbean and South Asia (Moore, 2007; 2010a; 2010b; 2010c).

CONCLUSION

Cheap food has always been central to the renewal of vigorous accumulation in the modern world-system. It was no coincidence that the Dutch, British, and Americans pioneered epoch-making agricultural revolutions that not only fed domestic proletariats cheaply, but provided a model for advanced capitalist agriculture in general. Today, capitalism’s capacity to re-establish the conditions for cheap food in the present conjuncture has reached an all-time low. Neither the agencies of the corporate food regime, nor Chinese farmers, are poised to effect one of these quantum leaps in the food surplus that would feed the world’s laboring classes at lower cost.

We can be sure of one thing. The conditions that underpinned neoliberalism’s signal crisis in 2008 have not gone away. To paraphrase Rupert Murdoch, the solution to the crisis is \$20/barrel oil, and its functional analogues in food and raw materials (quoted in Harvey, 2003: 150). But this solution does not appear to be forthcoming. This has everything to do with the hegemony of finance capital—the primacy of the circuit M-M+ as the gravitational field for (non-fictitious) commodity production. The issue is therefore only secondarily one of speculation. Rather, it is primarily one of financialization’s appropriation and exhaustion of modernity’s last

frontiers. These frontiers were the basis for productivity revolutions, and therefore also meaningful reforms within the capitalist order (Araghi, 2009). This appropriation has unfolded through the equalization of profit-imperatives across *all* sectors of the capitalist world-ecology, driving socio-ecological asset stripping to such an extent that it has undercut the world-historical basis for a Polanyian counter-movement toward the self-protecting society (1957). Finance capital's drive to make all parts of the capitalist world-ecology commensurable with one another has reshaped the global determination of profitability—Nebraska corn farmers now compete not against other farmers so much as they do against Goldman Sachs, ExxonMobil, and Microsoft, but above all, against Goldman Sachs.

We have noted that one pillar of the neoliberal golden age (1983–2007) was a series of appropriations—oil frontiers in the 1970s, deruralization in China, and above all, cheap food from the Green Revolution and later, debt-driven trade liberalization. These were not huge frontiers relative to past eras, but finance capital made good use of them. This was accomplished through a quantum leap not only in turnover time but also in an extraordinary project to commensurate all of reality into generic income streams (Bryan & Rafferty, 2006; Leyshon & Thrift, 2007). As a project immanent to neoliberal financialization, commensurability was so useful because it allowed capital to *control* production more rigorously and therefore to extract rising surplus value even in the absence of a productivity revolution. Time-space appropriation and time-space commensuration were dialectically joined.

This was the conjuncture that compelled and enabled neoliberalism to burn through its paltry inheritance of uncommodified energy, water, resources, and labor. These appropriations have riveted the attention of Green thought and activism, captured in the neo-Malthusian language of “overshoot” (Catton, 1982). But it is possibly misplaced. We have entered a new era in which capital's *longue durée* strategies of radically simplifying nature are generating uncontrollable diversity. The superweed effect, propelled by financialization as the vanguard of a new phase of radical commensurability, is the world-ecological foundation for the spiral of unpredictable responses that we see today from extra-human nature—superweeds, MRSA staph infections, manifold cancers and autoimmune disorders, avian and swine influenzas.

Since the 1970s, capital has moved so rapidly to appropriate and exhaust the conditions of its reproduction that it is far from clear that capitalism can survive the crises that neoliberalism is provoking. Just to take the most spectacular instance, climate change will so dramatically constrain the possibilities for rising labor productivity in agriculture that cheap food will not return. There are few indicators that finance capital will invest the \$45 trillion necessary to halve greenhouse emissions by mid-century (IEA, 2008a: 3); for that matter, it is unclear if finance capital will allow historically low investment levels in the metal and oil sectors to revive (IEA, 2008b; Hache, 2008). What Charles Bowlus once remarked about the crisis of European feudalism could well apply to the crisis of late capitalism (1980). To paraphrase, after nearly four decades of using nature as collateral for its debt-financed expansion, the bills came due in 2008 with the interlinked commodity boom and financial crash. Finance capital now appears to be doing what Europe's seigneurs tried to do at the end of the thirteenth century: finding new ways of extracting wealth from the productive economy, removing the surplus necessary for reinvestment, and in the process killing the goose that laid the golden eggs!

REFERENCES

- Aglietta, Michel (2008). "Into a New Growth Regime," *New Left Review*, 2nd ser., LIV, 61-74.
- Alston, Julian M.; Babcock, Bruce A. & Pardey, Philip G. (2010). "Shifting Patterns of Global Agricultural Productivity," in J. M. Alston, B. A. Babcock, and P. G. Pardey, eds., *The Shifting Patterns of Agricultural Production and Productivity Worldwide*. Ames, IA: Midwest Agribusiness Trade Research and Information Center, 449-82.
- Altieri, Miguel A. & Pengue, Walter A. (2006). "Roundup Ready Soybean in Latin America," Montevideo: RAP-AL Uruguay. <http://www.rapaturuguay.org/transgenicos/Prensa/Roundupready.html>, accessed March 24, 2011.
- Anna, Cara (2011). "China to Spend \$1 Billion to Alleviate Drought," *Associated Press*, February 10.
- Araghi, Farshad (2009). "Labor in Nature," unpubl. paper presented to the conference, "Food, Energy, Environment," Fernand Braudel Center, Binghamton University, October 9-10.
- Araghi, Farshad (2010). "The End of 'Cheap Ecology' and the Crisis of 'Long Keynesianism,'" *Economic and Political Weekly*, XLV, 4, 23 January, 39-41.
- Arrighi, Giovanni (1994). *The Long Twentieth Century*. London: Verso.
- Balakrishnan, Gopal (2009). "Speculations on the Stationary State," *New Left Review*, 2nd ser., LXI, 5-26.

- Barnett, Barry J. (2000). "The U.S. Farm Financial Crisis of the 1980s," *Agricultural History*, LXXIV, 2, 366–80.
- Bello, Walden F. (1994). *Dark Victory*. London: Pluto Press.
- Bellofiore, Riccardo & Halevi, Joseph (2009). "A Minsky Moment? The Subprime Crisis and the 'New' Capitalism," Working Paper 2009–04, International Economic Policy Institute, Laurentian University, Ontario, Canada.
- Benachour, Nora & Séralini, Gilles-Eric (2009). "Glyphosate Formulations Induce Apoptosis and Necrosis in Human Umbilical, Embryonic, and Placental Cells," *Chemical Research in Toxicology*, XXII, 97–105.
- Benbrook, Charles M. (2009). *Impacts of Genetically Engineered Crops on Pesticide Use in the United States: The First Thirteen Years*. The Organic Center. www.organic-center.org/reportfiles/GE13YearsReport.pdf.
- Blackburn, Robin (2006). "Finance and the Fourth Dimension," *New Left Review*, XXXIX, 39–70.
- Bowlus, Charles R. (1980). "Ecological Crises in Fourteenth Century Europe," in L. Bilsky, ed., *Historical Ecology*. Port Washington, NY: Kennikat Press, 86–99.
- Brenner, Robert P. (1976). "Agrarian Class Structure and Economic Development in Pre-Industrial Europe," *Past & Present*, LXX: 30–75.
- Brown, Lester (2009). "Could Food Shortages Bring Down Civilization?" *Scientific American*, CCC, April, 50–57.
- Bryan, Dick & Rafferty, Michael (2006). "Financial Derivatives," *Competition & Change*, X, 3, 265–82.
- Buntrock, Gerrit (2007). "Cheap No More," *The Economist* (Dec. 6). http://www.economist.com/node/10250420?story_id=10250420.
- Burch, David & Lawrence, Geoffrey (2009). "Towards a Third Food Regime," *Agriculture and Human Values*, XXVI, 267–79.
- Center for Food Safety (CFS) (2011). "Farmers and Consumer Groups File Lawsuit Challenging Genetically Engineered Alfalfa Approval," <http://www.centerforfoodsafety.org/2011/03/18/farmers-and-consumer-groups-file-lawsuit-challenging-genetically-engineered-alfalfa-approval/>, accessed March 27, 2011.
- Cerri, Carlos Eduardo P.; Sparovek, Gerd; Bernoux, Martial; Easterling, William E.; Melillo, Jerry M. & Cerri, Carlos Clemente (2007). "Tropical Agriculture and Global Warming," *Scientia Agricola*, LXIV, 1, 83–99.
- Cline, William R. (2007). *Global Warming and Agriculture*. Washington, D.C.: Center for Global Development; Peterson Institute for International Economics.
- Crotty, James (2000). "Slow Growth, Destructive Competition, and Low Road Labor Relations," Working Paper Series 6, Political Economy Research Institute, University of Massachusetts, Amherst.
- Dark, Petra & Gent, Henry (2001). "Pests and Diseases of Prehistoric Crops: A Yield 'Honeymoon' for Early Grain Crops in Europe?" *Oxford Journal of Archaeology*, XX, 1, 59–78.
- Davis, Mike (2001). *Late Victorian Holocausts*. London: Verso.
- Defeng, Zhu (2000). "Bridging the Rice Yield Gap in China," in Minas K. Papademetriou, Frank J. Dent, Edward M. Herath, eds., *Bridging the Rice Gap in the Asia-Pacific Region*. Bangkok, Thailand: Food and Agriculture Organization of the United Nations, 69–83.
- Elitzak, Howard (1999). "Food Cost Review, 1950–97," Agricultural Economic Report No. 780. s.l.: U.S. Department of Agriculture, Economic Research Service, Food and Rural Economics Division. <http://www.ers.usda.gov/publications/aer780/>.

- Engdahl, F. W. (2008). "The Financial Tsunami: The Financial Foundations of the American Century, Part II," *globalresearch.ca*. <http://www.globalresearch.ca/index.php?context=va&aid=7813>, accessed January 18, 2011.
- Food and Agricultural Organization of the United States (FAO) (2002). *World Agriculture: Towards 2015/2030*. Rome: FAO.
- FAO (2011). "Food Price Index." <http://www.fao.org/worldfoodsituation/wfs-home/FoodPricesIndex/en/>, accessed February 22, 2011.
- Food and Agricultural Organization of the United States (FAO) & UNEP/GRID-Arendal Maps and Graphics Library (2009). "FAO Food Price Index (FFPI)." <http://maps.grida.no/go/graphic/fao-food-price-index-ffpi>, accessed November 10, 2009.
- Foster, John Bellamy & Magdoff, Fred (2009). *The Great Financial Crisis*. New York: Monthly Review Press.
- Freese, William (2010). "Testimony before the Domestic Policy Subcommittee of the House Oversight and Government Reform Committee," U.S. House of Representatives, September 30. <http://truefoodnow.files.wordpress.com/2010/09/oversight-hearing-9-30-2010-freese-oral-final.pdf>, accessed February 28, 2011.
- Friedmann, Harriet (2004). "Feeding the Empire," in Leo Panitch & Colin Leys, eds., *Socialist Register 2005: The Empire Reloaded*. London: Merlin.
- Froud, Julie & Williams, Karel (2007). "Private Equity and the Culture of Value Extraction," *New Political Economy*, XII, 3, 405-20.
- Fuglie, Keith O.; MacDonald, James M. & Ball, Eldon (2007). "Productivity Growth in U.S. Agriculture," Economic Brief 9 (September). s.l.: U.S. Department of Agriculture, Economic Research Service.
- Gee, Thomas (2009). "The World System is Not Neo-Liberal," *Critique*, XXXVII, 2, 253-59.
- George, Susan (1990). *A Fate Worse than Debt*, rev. ed. New York: Grove Weidenfeld.
- George, Susan (1993). *The Debt Boomerang*. Boulder, CO: Westview Press.
- Ghosh, Jayati (2010). "The Unnatural Coupling: Food and Global Finance," *Journal of Agrarian Change*, X, 1, 72-86.
- Gillam, Carey (2010). "Special Report: Are Regulators Dropping the Ball on Bio-crops?" *Reuters*, April 13.
- Glenna, Leland (2003). "Farm Crisis or Agricultural System Crisis?" *International Journal of Sociology of Agriculture and Food*, XI, 15-30.
- Gordon, Robert J. (2010). "Revisiting U.S. Productivity Growth over the Past Century with a View of the Future," Working Paper 15834. Cambridge, MA: National Bureau of Economics Research.
- Gowan, Peter (1999). *The Global Gamble*. London: Verso.
- Gramsci, Antonio (1971). *Selections from the Prison Notebooks*. New York: International Publishers.
- Greider, William (2000). "The Last Farm Crisis," *The Nation*, published online November 20. <http://www.thenation.com/article/last-farm-crisis>.
- Gurian-Sherman, David (2009). *Failure to Yield*. Cambridge, MA: Union of Concerned Scientists.
- Hache, Emmanuel (2008). "Commodities Markets: New Paradigm or New Fashion?" *Les cahiers de l'économie*, 69. Rueil-Malmaison: Centre Économie et Gestion, Institut Français du Pétrole (Ifp).
- Haiven, Max (2011). "Finance as Capital's Imagination?" *Social Text*, XXIX, 3, 93-124.

- Halweil, Brian (2000). "Where Have All the Farmers Gone?" *World Watch*, XIII, 5, 12–28.
- Harvey, David (1989). *The Condition of Postmodernity*. Oxford: Basil Blackwell.
- Harvey, David (2003). *The New Imperialism*. Oxford: Oxford Univ. Press.
- Hazell, Peter B. R. (2010). "An Assessment of the Impact of Agricultural Research in South Asia since the Green Revolution," in *Handbook of Agricultural Economics*, IV. Amsterdam: Elsevier, 3469–530.
- Hilferding, Rudolf (1981). *Finance Capital*. London: Routledge & Kegan Paul (orig. 1910).
- International Energy Agency (IEA) (2008a). *Energy Technology Perspectives*. Paris: International Energy Agency.
- IEA (2008b). *World Energy Outlook 2008*. Paris: International Energy Agency.
- International Monetary Fund (IMF) (2003). "Fund Assistance for Countries Facing Exogenous Shocks." <http://www.imf.org/external/np/pdr/sustain/2003/080803.pdf>, accessed March 11, 2011.
- IMF (2008). *World Economic Outlook*. Washington, D.C.: International Monetary Fund.
- Jefferson, Gary H.; Hu, Albert G. Z. & Su, Jian (2006). "The Sources and Sustainability of China's Economic Growth," *Brookings Papers on Economic Activity*, II, 1–47.
- Jin, Songqing; Huang, Jikun & Rozelle, Scott (2010). "Agricultural Productivity in China," in J. M. Alston, B. A. Babcock & P. G. Pardey, eds., *The Shifting Patterns of Agricultural Production and Productivity Worldwide*. Ames, IA: Midwest Agribusiness Trade Research and Information Center, 229–77.
- Kädtler, Jürgen & Sperling, Hans Joachim (2003). "Globalization and Financialization as Triggers for Enterprise Reorganisation and the Impact on Industrial Relations," *SOFI-Mitteilungen*, Nr. 31, 53–65.
- Kendall, Henry W. & Pimentel, David (1994). "Constraints on the Expansion of the Global Food Supply," *Ambio*, XXIII, 3, 198–205.
- Kilman, Scott (2010). "Superweed Outbreak Triggers Arms Race," *Wall Street Journal*, June 4.
- Kloppenburg, Jack R., Jr. (1988). *First the Seed*. Cambridge: Cambridge Univ. Press.
- Kolko, Joyce (1988). *Restructuring the World Economy*. New York: Pantheon.
- Kremer, Robert J. & Means, Nathan E. (2009). "Glyphosate and Glyphosate-Resistant Crop Interactions with Rhizosphere Microorganisms," *European Journal of Agronomy*, XXXI, 153–61.
- Krippner, Greta (2005). "The Financialization of the American Economy," *Socio-Economic Review*, III, 2, 173–208.
- Kucharik, Christopher J. & Serbin, Shawn P. (2008). "Impacts of Recent Climate Change on Wisconsin Corn and Soybean Yield Trends," *Environmental Research Letters*, III, 3, 1–10. doi:10.1088/1748-9326/3/3/034003.
- Leyshon, Andrew & Thrift, Nigel (2007). "The Capitalization of Almost Everything," *Theory, Culture & Society*, XXIV, 7–8, 97–115.
- Lin, Justin Yifu (1992). "Rural Reforms and Agricultural Growth in China," *American Economic Review*, LXXXII, 1, 34–51.
- Lobell, David B. & Field, Christopher B. (2007). "Global Scale Climate–Crop Yield Relationships and the Impacts of Recent Warming," *Environmental Research Letters*, II, 1, 1–7. doi: 10.1088/1748-9326/2/1/014002. <http://iopscience.iop.org/1748-9326/2/1/014002>.

- Lohmar, Bryan (2004). *China's Wheat Economy*. s.l.: U.S. Department of Agriculture, Economic Research Service.
- Marx, Karl (1967). *Capital*, 3 vols., Frederick Engels, ed. New York: International Publishers.
- Marx, Karl (1976) *Capital*, Vol. I. New York: Penguin.
- Mason, Paul (2009). *Meltdown*. London: Verso.
- Masuda, Tayadoshi & Goldsmith, Peter D. (2008). "World Soybean Production," working paper, National Soybean Research Laboratory, University of Illinois at Urbana-Champaign.
- Matuschke, Ira & Qaim, Martin (2006). "Adoption and Impact of Hybrid Wheat in India," paper presented to the International Association of Agricultural Economists Conference, Gold Coast, Australia, August 12–18.
- McAfee, Kathy (2003). "Neoliberalism on the Molecular Scale," *Geoforum*, XXXIV, 203–19.
- McMichael, Philip (1999). "The Global Crisis of Wage-Labour," *Studies in Political Economy*, LVIII, 11–40.
- McMichael, Philip (2005). "Global Development and the Corporate Food Regime," in F. H. Buttel & P. McMichael, eds., *New Directions in the Sociology of Global Development*. Oxford: Elsevier, 265–300.
- McMichael, Philip (2008). *Development and Social Change*, 4th ed. Thousand Oaks, CA: Sage.
- McMichael, Philip (2009a). "A Food Regime Analysis of the World Food Crisis," *Agriculture and Human Values*, XXVI, 281–95.
- McMichael, Philip (2009b). "The World Food Crisis in Historical Perspective," *Monthly Review*, LXI, 3. <http://www.monthlyreview.org/090713mcmichael.php>, accessed December 12, 2009.
- MCT News Service (2010). "Roundup-Resistant Weeds Gain Strength," *MCT News Service*, May 13.
- Monsanto (2009). "Monsanto, Dow AgroSciences Complete U.S. and Canadian Regulatory Authorizations for SmartStax Corn," <http://monsanto.mediaroom.com/index.php?s=43&item=729>, accessed October 11, 2010.
- Moore, Jason W. (2000). "Environmental Crises and the Metabolic Rift in World-Historical Perspective," *Organization & Environment*, XIII, 2, 123–58.
- Moore, Jason W. (2003). "Capitalism as World-Ecology: Braudel and Marx on Environmental History," *Organization & Environment*, XVI, 4, 431–58.
- Moore, Jason W. (2007). "Ecology and the Rise of Capitalism," Ph.D. diss., Department of Geography, Univ. of California, Berkeley. <http://www.jasonwmoore.com>.
- Moore, Jason W. (2009). "Madeira, Sugar, & the Conquest of Nature in the 'First' Sixteenth Century, Part I: From 'Island of Timber' to Sugar Revolution, 1420–1506," *Review* XXXII, 4, 345–90.
- Moore, Jason W. (2010a). "'Amsterdam is Standing on Norway' Part I: The Alchemy of Capital, Empire, and Nature in the Diaspora of Silver, 1545–1648," *Journal of Agrarian Change*, X, 1, 35–71.
- Moore, Jason W. (2010b). "'Amsterdam is Standing on Norway' Part II: The Global North Atlantic in the Ecological Revolution of the Seventeenth Century," *Journal of Agrarian Change*, X, 2, 188–227.
- Moore, Jason W. (2010c). "The End of the Road? Agricultural Revolutions in the Capitalist World-Ecology, 1450–2010," *Journal of Agrarian Change*, X, 3, 389–413.

- Moore, Jason W. (2010d). "This Lofty Mountain of Silver Could Conquer the Whole World": Potosi and the Political Ecology of Underdevelopment, 1545–1800," *Journal of Philosophical Economics*, IV, 1, 58–103.
- Moore, Jason W. (2010e). "Madeira, Sugar, & the Conquest of Nature in the 'First' Sixteenth Century, Part II: From Regional Crisis to Commodity Frontier, 1506–1530," *Review*, XXXIII, 1, 1–24.
- Moore, Jason W. (2011a). "Transcending the Metabolic Rift: Towards a Theory of Crises in the Capitalist World-Ecology," *Journal of Peasant Studies*, XXXVIII, 1, 1–46.
- Moore, Jason W. (2011b). "Ecology, Capital, and the Nature of Our Times: Accumulation and Crisis in the Capitalist World-Ecology," *Journal of World-Systems Analysis*, XVII, 1, 108–47.
- Moore, Jason W. (2011c). "The Socio-Ecological Crises of Capitalism," in Sasha Lilley, ed., *Capitalism and its Discontents: Interviews with Radical Thinkers in a Time of Tumult*. Oakland: PM Press, 136–52.
- Nellemann, Christian; MacDevette, Monika; Manders, Ton; Eickhout, Bas; Svihus, Birger; Prins, Anne Gerdien & Kaltenborn, Bjorn P., eds. (2009). *The Environmental Food Crisis*. Arendal, Norway: United Nations Environment Programme, GRID-Arendal. <http://www.unep.org/pdf/FoodCrisis%5Flores.pdf>.
- Neuman, William & Pollack, Andrew (2010). "Farmers Cope with Roundup-Resistant Weeds," *New York Times*, May 3.
- Organization for Economic Cooperation & Development (OECD) (2008). *Rising Agricultural Prices*. Paris: OECD.
- Organization for Economic Cooperation & Development/Food and Agriculture Organization of the United Nations (OECD/FAO) (2008). *OECD-FAO Agricultural Outlook 2008–2017*. Paris & Rome: OECD; FAO.
- OECD/FAO (2010). *Agricultural Outlook 2010–2019*. Paris & Rome: OECD; FAO.
- O'Rourke, Kevin H. (1997). "The European Grain Invasion, 1870–1913," *Journal of Economic History*, LVII, 4, 775–801.
- Patnaik, Prabhat (2011). "The World Food Crisis," *People's Democracy*, XXXV, 9, 27 Feb. http://pd.cvim.org/2011/0227_pd/02272011_10.html, accessed March 18, 2011.
- Patnaik, Utsa (2003). "Global Capitalism, Deflation and Agrarian Crisis in Developing Countries," United Nations Social Policy and Development Programme Paper, 15. Geneva: UN Research Institute for Social Development.
- Pechlaner, Gabriela & Otero, Gerardo (2008). "The Third Food Regime," *Sociologia Ruralis*, XLVIII, 4, 351–71.
- Peng, Shaobing; Huang, Jianliang; Sheehy, J. E.; Laza, R. C.; Visperas, R. M.; Zhong, Xuhua; Centeno, G. S.; Khush, Gurdev S. & Cassman, Kenneth G. (2004). "Rice Yields Decline with Higher Night Temperature from Global Warming," *Proceedings of the National Academic of Science* (PNAS), CI, 27, 9971–75.
- People's Daily Online (2004). "Last Year Saw China's Soybean Import Hit a Record High in History," *People's Daily Online*, 14 February. http://english.peopledaily.com.cn/200402/14/eng20040214_134838.shtml, accessed November 12, 2009.
- Perkins, John H. (1997). *Geopolitics and the Green Revolution: Wheat, Genes, and the Cold War*. Oxford: Oxford Univ. Press.
- Ploeg, Jan D. van der (2010). "The Food Crisis, Industrialized Farming and the Imperial Regime," *Journal of Agrarian Change*, X, 1, 98–106.
- Polanyi, Karl. 1957. *The Great Transformation*. Boston: Beacon.
- Pritchard, Bill; Burch, David & Lawrence, Geoffrey (2007). "Neither 'Family' nor 'Corporate' Farming," *Journal of Rural Studies*, XXIII, 75–87.

- Ritch, Emma (2009). "Monsanto Strikes Back at Germany, UCS," Cleantech.com, April 17. <http://www.gmfreeireland.org/news/2009/apr.php>, accessed July 18, 2009.
- Rossmann, Peter (2007). "The Impact of Leverage Buyouts in the European Food Industry," unpubl. paper delivered at the seminar, "Private Equity Funds: The Harsh Realities," European Parliament, Brussels, April 19.
- Ruttan, Vernon W. (2002). "Productivity Growth in World Agriculture," *Journal of Economic Perspectives*, XVI, 4, 161–84.
- Schaeffer, Robert K. (2003). *Understanding Globalization*. Lanham, MD: Rowman & Littlefield.
- Schumpeter, Joseph A. (1950). *Capitalism, Socialism and Democracy*. New York: Harper & Row.
- Scoones, Ian (2002). "Agricultural Biotechnology and Food Security: Exploring the Debate," IDS Working Paper 145, Institute of Development Studies, University of Sussex.
- Secombe, Wally (1999). "Contradictions of Shareholder Capitalism," in Leo Panitch & Colin Leys, eds., *Socialist Register 1999: Global Capitalism vs. Democracy*. London: Merlin, 76–107.
- Shaikh, Anwar (2010). "The First Great Depression of the 21st Century," in Leo Panitch, Greg Albo & Vivek Chibber, eds., *Socialist Register 2011: The Crisis This Time*. London: Merlin, 44–63.
- Sonnenfeld, David A. (1992). "Mexico's 'Green Revolution,' 1940–1980," *Environmental History Review*, XVI, 4, 28–52.
- Strange, Marty (1988). *Family Farming*. Omaha: Univ. of Nebraska Press.
- Syngenta (2009). "Leading the Fight against Glyphosate Resistance," <http://www.syngentaebiz.com/DotNetEBiz/ImageLibrary/WR%203%20Leading%20the%20Fight.pdf>, accessed March 11, 2011.
- Tilman, David; Cassman, K. G.; Matson, P. A.; Naylor, Rosamond & Polasky, Stephen (2002). "Agricultural Sustainability and Intensive Production Practices," *Nature*, CDXVIII, 671–77.
- Villar, Juan Lopez & Freese, Bill (2008). *Who Benefits from GM Crops?* Amsterdam: Friends of the Earth International.
- Wallerstein, Immanuel (1974). *The Modern World-System, I: Capitalist Agriculture and the Origins of the European World-Economy in the Sixteenth Century*. New York: Academic Press.
- Wallis, Victor (2000). "Species Questions," *Organization & Environment*, XIII, 4, 500–07.
- Webb, Walter Prescott (1964). *The Great Frontier*. Austin: Univ. of Texas Press.
- Weis, Tony (2007). *The Global Food Economy*. London: Zed.
- Weis, Tony (2010). "The Accelerating Biophysical Contradictions of Industrial Capitalist Agriculture," *Journal of Agrarian Change*, X, 3, 315–41.
- Wen, Dale & Li, Minqi (2006). "China: Hyper-Development and Environmental Crisis," in Leo Panitch & Colin Leys, eds., *Socialist Register 2007: Coming to Terms with Nature*. London: Merlin, 130–46.
- Williams, Karel (2000). "From Shareholder Value to Present-Day Capitalism," *Economy and Society*, XXIX, 1, 1–12.
- Wright, Angus (2005). *The Strange Death of Ramón González*, rev. ed. Austin: Univ. of Texas Press.

Zhao, Maosheng & Running, Steven W. (2010). "Drought-Induced Reduction in Global Terrestrial Net Primary Production from 2000 through 2009," *Science*, CCCXX-IX, August 20, 940-43.