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## The Long Green Revolution

Raj Patel

To combat climate change and hunger, a number of governments, foundations and aid agencies have called for a ‘New Green Revolution’. Such calls obfuscate the dynamics of the Green Revolution. Using Arrighi’s analysis of capital accumulation cycles, it is possible to trace a Long Green Revolution that spans the twentieth and twenty-first centuries. Such an analysis illuminates commonalities in past and present Green Revolutions, including their bases in class struggles and crises of accumulation, modes of governance – particularly in the links between governments and philanthropic institutions – and the institutions through which truths about agricultural change were produced and became known. Such an analysis also suggests processes of continuity between the original Green Revolution and features of twenty-first-century agricultural change, while providing a historical grounding in international financial capital’s structural changes to help explain some of the novel features that accompany the New Green Revolution, such as ‘land grabs’, patents on life, and nutritionism.

**Keywords:** Green Revolution; Cold War; financialization; biopolitics; land grabs; Foucault; Arrighi; food regimes

### 1. Introduction

During his state visit to the US in July 2005, Indian Prime Minister Manmohan Singh thanked his hosts’ historic generosity, and bravely pointed to the future. ‘We owe our green revolution to America’, said Singh. ‘Now we can herald a second green revolution with American assistance’ (Mishra 2006). On a return visit a year later, President George W. Bush sketched out the history, and the future, a little more:

The United States worked with India to help meet its food needs in the 1960s, when pioneering American scientists like Norman Borlaug shared agriculture technology with Indian farmers. Thanks to your hard work, you have nearly tripled your food production over the past half-century. To build on this progress, Prime Minister Singh and I are launching a new Agricultural Knowledge Initiative. This initiative will invest US \$100 million to encourage exchanges between American and Indian scientists and

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promote joint research to improve farming technology. By working together the United States and India will develop better ways to grow crops and get them to market, and lead a second Green Revolution. (applause)... The great Indian poet Tagore once wrote, 'There's only one history – the history of man'. The United States and India go forward with faith in those words. There's only one history of man – and it leads to freedom. (Rao 2006)

There's something unsettling about one of America's most unlettered Presidents quoting Tagore and waxing Hegelian. Scholars of agrarian change, however, are likely to be galled by deeper issues within this exchange. Between them, Singh and Bush raise questions about the history of the first Green Revolution, the role of the state in international agricultural development, and the importance of knowledge for capitalist transformation in ways that matter for the future of food not just in India, but across the planet.

To both parse and address these issues, the world needs more histories of the Green Revolution. This essay, unfortunately, is not such a history. Many analysts have toiled in the Revolution's archives, to great effect (Feder 1976, Perkins 1997, Ross 1998b, Cullather 2010), and it would be unkind to suffer the reader to retell other peoples' arguments with less archival dust on my hands than my predecessors. Rather than recycle previous work, this paper builds the case for more research on the Green Revolution by setting the recent calls for a second or a 'New Green Revolution' in historical context. Using ideas from Braudel (1982a), Clark (1999), Foucault and Senellart (2008), and Arrighi (2010), this paper attempts to trace a trajectory of accumulation, legitimation and development from the first Green Revolution to the present, and to outline a research agenda for further enquiry.

The scope of the research agenda is betrayed by this paper's title. Although the Green Revolution is commonly understood to have run from the early 1940s to 1970, the periodization is unsatisfactory. The processes of state reconfiguration, capitalist accumulation, concentration of power, disenfranchisement, agricultural investment and innovation – which only came to be called 'the Green Revolution' two years before it is said to have ended – both predate the standard history and continued long after 1970. In finding a porousness in the standard periodization, I draw on insights from British Marxist historians in the vein of Eric Hobsbawm's Long Nineteenth (Hobsbawm 1996) and Short Twentieth centuries (Hobsbawm 1994) whose work, in turn, draws on Fernand Braudel's Long Sixteenth Century and the notion of cycles of capitalist accumulation (Braudel 1982a). A rigorous *longue durée* analysis of agricultural change under millennia of capitalism is outside the scope of this paper, although Moore's (2010) world historical project moves in some ways toward this bigger goal. The aim in this paper is more modest: it is to examine the origins and consequences of the idea of a 'Green Revolution' in the twentieth and twenty-first centuries. In this task, a *longue durée* analysis helps in understanding the transformations at hand as a decades-long complex of discourse, technology, state power, class politics, national and international relations, private investment, cultural intervention, education and ecological change.

As ever, class matters. The who, what, when, where, why questions offered by C. Wright Mills (1959) as guides to the sociological imagination have recently been updated for agrarian studies by Bernstein (2010a). In setting about answering these questions, Arrighi's (2003) examination of the creation of value within the global food system is as sound a point of departure as any. He points to the structures through which international value relations consolidated and reconsolidated first as

a condition and then as a consequence of the rise of industrial capitalism in Europe. We might look further back and see Enclosure as the original depeasantization (Araghi 1995), and the originary moment of the creation of capitalist value (Wood 2000, though see also Allen 1999).

Yet, while I find the arguments around the logic of value creation necessary, they are not sufficient to explain the reason that the Green Revolution looks the way that it does. Peasants, even the Iranians who become components 'of the global food regime and of capital and the world historical value relations of the late nineteenth century' (Araghi 2003, 57), have resisted and continue to resist the great enclosure (Holt Giménez and Shattuck 2011). The possibility of resistance suggests that, at the very least, an attempt to map the trajectory of global value chain analysis needs to look at wider social context. The Green Revolution was itself a moment in struggles around the creation of value, altering the balance of class forces, reconfiguring relations to the means of production, and setting the processes of production and reproduction on a new trajectory. The authors of the Green Revolution could not make history as they pleased, but did so against the often collectively organized resistance of the poor, using the tools of the state against a rural majority. Although this was sometimes achieved through brute force, even state violence needs legitimation – and the logic of value creation is, by itself, insufficient to understand how the state's actions are explained, why they look the way they do, and what this enables and prevents.

For this task, McMichael and Friedmann's idea of 'food regimes' is useful. A food regime itself is a 'rule-governed structure of production and consumption of food on a world scale' (Friedmann 1993, 30). The institutional arrangements of power and property aren't, however,

... sufficient for a food regime analysis. Are tensions stabilized? What institutions provide the pivot and give meaning to a stable constellation of relationships? For instance, is there a counterpart in a financialized food regime to food aid as a pivot of the 1947–73 food regime? Legitimacy of food aid depended on both of the following: (1) convergent interests and expectations among diverse and highly unequal actors, including US farm commodity groups and legislators, Third World governments, grain trading corporations, consumers who benefited from falling grain and meat prices; and (2) an ideological framework that defined these as humanitarian, developmental, or anything but a trade relation, even though the scale of food aid shipments dominated world price formation for three decades. By the 1980s subsidized exports are universally seen as a bad trade practice (with regime crisis, aid came to be done differently), and continuing to do it is not legitimate. (Friedmann 2009, 337)

Friedmann's questions are mine too. One needn't be a card-carrying Althusserian – and many are not (Goodman and Watts 1994) – to find questions of legitimacy, institutions and ideology important. It is certainly true that a thorough Marxist analysis of value would necessarily examine these questions. Food regime analysis urges that such questions be foregrounded. This is sensible in considering the Green Revolution because it so clearly relied on institutions to corral and maintain a cocktail of coercion and consent within the dominant hegemonic bloc (Gramsci 1971). A Braudelian method urges a wider historical sweep, but Marxist history also demands an understanding of contingent and temporary historical class compromises. Food regimes offer a way of understanding the structure and internal logic of those compromises in a way that a logic of value creation by itself might not.

Specifically, in legitimizing the Green Revolution, knowledge matters. It is striking that the central plank in George Bush's speech is the transfer and exchange

of *knowledge*. The importance of knowledge isn't simply restricted to ways of cultivating and propagating, nor even to the genetic information within India's biodiversity, although it includes that too. The knowledge that matters here extends to ways that the government knows how to support and invest in agriculture – as Friedmann suggests, one of the things that is now *known* among international development policy elites is that subsidized exports are foolish. The domain of this knowledge is a battlefield (Long and Long 1992), and the conflict extends not just to economic policy, but to the history of the Green Revolution itself. In pushing for a 'second Green Revolution', the first Green Revolution needs to be sold as a success. To do that requires the first Green Revolution be considered completed, and that it be considered unequivocally effective. But if the Green Revolution is still unfolding, as I argue it is, and if its results have been ambiguous, as we shall see they have been, then the foundational knowledge required to refashion the Green Revolution project requires continuous and ongoing work to legitimize the actions carried out in its name.

Finally, to argue that the Green Revolution has been long is not to argue that it has remained constant. On the contrary, one of the most striking features of the calls for a 'New Green Revolution' is the deployment of terms like 'nutrition' in novel ways. To understand this transformation, Michel Foucault's work on biopolitics is helpful. In a series of lectures between 1978 and 1979, Foucault explored some of the central concerns around the idea of 'biopolitics', suggesting that

'biopolitics,' [means] the attempt, starting from the eighteenth century, to rationalize the problems posed to governmental practice by phenomena characteristic of a set of living beings forming a population: health, hygiene, birthrate, life expectancy, race ... We know the increasing importance of these problems since the nineteenth century, and the political and economic issues they have raised up to the present. It seemed to me that these problems were inseparable from the framework of political rationality within which they appeared and took on their intensity. This means 'liberalism', since it was in relation to liberalism that they assumed the form of a challenge. How can the phenomena of 'population', with its specific effects and problems, be taken into account in a system concerned about respect for legal subjects and individual free enterprise? In the name of what and according to what rules can it be managed? (Foucault and Senellart 2008, 317)

The liberalism Foucault mentions is, to be clear, not the same as the part of the political spectrum occupied by social democratic parties in Europe or even the Democrats in the United States. Rather, it is the broader term for the kind of political arrangements – legal personhood, markets and private property foremost – conducive to modern capitalism. These arrangements can be found in states across the Global North and South, whether these states claim they are liberal or not. With this in mind, it makes sense to understand the Green Revolution as a biopolitical as well as a geopolitical (Perkins 1997) process. The original Green Revolution emerged as a result of thinking about populations and the problem of hunger in very particular ways. Capitalism and the liberal state meet these problems pre-constrained by the sanctity of private property and the desirability of 'individual free enterprise' (Scott 1998, Angus and Butler 2011). The Green Revolution was a solution to a problem framed by the geopolitics and ideologies of the early part of the twentieth century. The framing has changed in the twenty-first century, which is why the New Green Revolution appears distinct from the first. But underlying concerns around control, management and property remain the same and, crucially, the ambitions of

those pushing the New Green Revolution reveal a project that is *more* biopolitical – more focused on the management of individual bodies – than the original Green Revolution. This happens precisely, I suggest, because of changes in cycles of accumulation over the past century. To see this, we ought to begin with specifying exactly what the Green Revolution was, is, and wants to be.

## 2. What was the Green Revolution?

It is possible to pull a dominant narrative of the Green Revolution from those who, on balance, saw it as a good thing (Gaud 1968, Borlaug 1970, Alcantara 1973, Glaeser 1987, Conway 1997, Borlaug 2000, Davies 2003, Evenson and Gollin 2003). Their story runs like this: The seeds of revolution were planted in early 1941, when the Rockefeller Foundation sent a team to survey Mexican agriculture. This resulted in the development of the Mexican Agricultural Program (MAP), to which in 1944 a young biologist named Norman Borlaug was hired. As a result of his dedication and ingenuity, he developed ‘miracle wheat’ in 1954, which was spread by the Rockefeller and Ford foundations through the world, in the 1950s and 1960s, with other crops – notably rice – added to the menu, with the help of the US government toward the end of that period, and for which Norman Borlaug won the Nobel Peace Prize in 1970, soon after which the Green Revolution can be said to have come to an end (Dowie 2001, 114).

The term ‘Green Revolution’ was coined by William Gaud late in its unfolding, at a meeting of the Society for International Development in DC in 1968, in which he described what had happened as a result of US and philanthropic funding for fertilizer, irrigation, improved hybrid seeds, state support and credit:

These and other developments in the field of agriculture contain the makings of a new revolution. It is not a violet Red Revolution like that of the Soviets, nor is it a White Revolution like that of the Shah of Iran. I call it the Green Revolution. (Gaud 1968)<sup>1</sup>

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<sup>1</sup>Note that Dowie dates the genesis of the term fully a decade earlier, attributing it to W.H. ‘Ping’ Ferry, a Vice President at the Ford Foundation, based on information found in the Rockefeller archives (Dowie, personal communication, 2011). That may well be the case. The media frenzy surrounding the adoption of this term isn’t one, however, for which I’ve been able to find evidence, and Gaud seems the most widely accepted minter of the term when it comes to international agricultural development. In passing it is worth noting that, although William Gaud may have coined the term ‘Green Revolution’, he wasn’t the first person to use it. The idea of a ‘Green Revolution’ in opposition to a communist one finds its origins in the left-leaning Catholic Worker movement in the United States. Peter Maurin, who co-founded Catholic Worker with Dorothy Day, suggested that:

The only way to prevent a Red Revolution is to promote a Green Revolution. The only way to keep people from looking up to Red Russia of the twentieth century is to make them look up to Green Ireland of the seventh century. (Maurin 1949, 55)

An urban instruction in Catholic history, a return to the land, and public forums for discussion would, Maurin argued in the 1920s and 1930s, provide ‘the best antidote to Marxist materialism’ (Maurin 1949, 98, Novitsky 1975). This is consonant with, and predates, Gaud’s formulation of the Green Revolution. Although in this case the ‘Green’ refers to Ireland rather than plant leaves, both uses are animated by a desire to fend off communism, and both involve the construction of a rural idyll of one kind or another, in order to achieve that.

The figures that Gaud, and his intellectual descendants, gave to support the claim are impressive. Record harvests were achieved in many countries that adopted the new technology, with certain countries experiencing spectacular successes. Total food production in the developing world more than doubled between 1960 and 1985 (Conway 1997). Rice production in Indonesia for instance increased by 275% between 1966 and 2000 (Khush 2003). Increases in production were often the outcome of higher yields. Chile, for instance, witnessed a 200 kg/ha per year growth in its maize production after 1964 – the highest sustained growth rate of any cereal so far (Conway 1997). By the 1990s, close to 75% of Asia's rice and half of the wheat in Africa, Latin America and Asia were grown with the new varieties (Rosset 2000). The Green Revolution, for instance, doubled food supply in Asia in 25 years with only a 4% increase in net cropped area (Lipton 2007).

Meanwhile, food production successfully outstripped population growth. The global population increased by 110% between 1950 and 1990 but global cereal production increased by 174% over the same period (Otero and Pechlaner 2008). In 2000, world food supplies were 20% higher per capita than in 1961 while the number of people going hungry decreased by 16% between 1970 and 1990, from 942 to 786 million (Borlaug and Dowswell 2003). Greg Page, the Chairman and CEO of the food, agriculture and financial services giant Cargill, recently observed that 'we live in a time where the world is the furthest it has ever been from caloric famine. . . the number of calories that the world's farmers are producing per inhabitant of the world are at all time record levels' (BBC 2011). Perhaps it is true, as Norman Borlaug claimed in his Nobel Prize speech, that 'to millions of these unfortunates, who have long lived in despair, the green revolution seems like a miracle that has generated new hope for the future' (Borlaug 1970).

Yet while true that hunger has decreased over the Green Revolution decades, removing China from the equation – where the Green Revolution was decidedly Redder - the number of hungry people increased by more than 11% (Rosset 2000). Despite the lofty rhetoric of feeding the world attending the Green Revolution then and now, current data on hunger suggest a different story. Today, there are around one billion undernourished (see FAO 2011b and subsequently Ivanic *et al.* 2011). In spurring agricultural capitalism, the Green Revolution seems to have succeeded amply in producing more food. Yet the vast availability of calories has not represented an 'escape from hunger' (Vanhaute 2011).

In response to recent widespread malnutrition, higher food prices, the threat of climate change and an increased global population, there have been calls for a new, second Green Revolution. In Africa, Kofi Annan heads the Alliance for a Green Revolution in Africa. The Bill and Melinda Gates Foundation has reportedly spent USD 2 billion from 2007 to 2012 to combat hunger (Blankinship 2012). At the World Food Prize Ceremony in 2010, in a symposium called – without irony – 'Taking It To the Farmer', Jeff Raikes, the CEO of the Gates Foundation, offered that

What's required of us is our unfailing commitment to the cause of agricultural development. It's the same commitment that drives . . . farmers in the developing world to wake up each morning and do their part to feed the world. (Raikes 2010)

The World Bank has called for investment to support smallholder agriculture both to alleviate poverty and increase food production (World Bank 2007a).

It is only possible for the Bank, assorted development agencies and philanthropists to push for this conclusion if the Green Revolution is represented in a particular way, with certain features occluded or ignored, and others distorted (Amanor 2009, McMichael 2009a, Oya 2009a, 2009b, Woodhouse 2009). A central argument in this paper is that the historical reconstruction of the original Green Revolution in contemporary debates over agriculture in the Global South is far from innocent. In order to marshal the consent required for new dreams to 'feed the world' to proceed, history has been revised. Which is why it is worth returning to Mexico to ask Bernstein's distributional questions, and deepen his analysis of the Green Revolution (Bernstein 2010a). This is not to indict the good intentions of those who, throughout its progress, saw the Green Revolution as a potent weapon in combatting the social ills of its time. But to wonder why Mexico was chosen for the Rockefeller Foundation's generosity is to begin to unravel the standard narrative a little, and to peel back the social construction of the ills that the Green Revolution was intended to remedy.

### **2.1 Mexico**

Many of the features that would come to characterise the Green Revolution were in place by the 1920s. International grain markets were concentrated in the hands of a few corporations (Murphy 2006). Fertilizers produced through the Haber-Bosch process had been manufactured in the US since the end of the First World War (Brand 1945).<sup>2</sup> National governmental systems for agricultural research and innovation had existed for decades (Macconnell 1953), as had the technologies of plant breeding. Through Andrew Carnegie's endeavors, the apparatus of large-scale philanthropy had been established (Carnegie 1901). Foremost among US philanthropic enterprises was the Rockefeller Foundation, which had been interested in agricultural technology since 1906 when it funded a science-driven 'crusade against the boll weevil in the southern USA' (Fitzgerald 1986, 460). The Foundation had a modest agricultural program in China, which in 1933 gave USD 1 million to the Kuomintang for rural reconstruction in their ongoing battles against the Communists (Perkins 1997, Ross 1998a). But the place that was to launch the Green Revolution was closer to the Rockefeller Foundation's home, because it was also closer to the United States.

The US government had long been involved in the affairs of its southern neighbor, from the Mexican-American war of 1846–8 to, more recently, the ongoing US involvement in the 1910 Mexican revolution and subsequent responses to peasant insurgency (Wolf 1999). Discussions for an agricultural research program in Mexico began at the Rockefeller Foundation in 1933 too, but were put on hold by the election of a new Mexican president, Lázaro Cárdenas. Cárdenas instituted wide-ranging land reform in the country – redistributing 47% of all cultivatable land (Alcantara 1973, 25) – and began to nationalize the assets of the oil industry, including the refineries of the Standard Oil company, the gushers of Rockefeller Foundation money (Perkins 1990).

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<sup>2</sup>It is often noted that fertilizers were produced by repurposed munitions factories after WWII (Pollan 2008). Less widely known is that this transformation, from military to civilian agricultural production, had happened first in the late 1910s and 1920s. See (Brand 1945, Russell 2001) for more.

At the end of the 1930s, Mexican agriculture was pinched with under-supply. Cárdenas' conservative political opposition called for the military to be deployed to the fields. Although Cárdenas' critics blamed his land reform policies for the turmoil, 1938 saw pest outbreaks, unfavourable weather and poor distribution networks that played havoc with Mexican agricultural production and consumption. It was this complex political ecology that set the stage for the Green Revolution to follow (Cotter 2003). In 1940, amid internecine fights within his party (the PRM – the Party of the Mexican Revolution) Cárdenas endorsed the conservative presidential candidate Ávila Camacho. While consolidating some of Cárdenas' changes, Camacho signaled his class allegiances soon after assuming power, instituting electoral reform to prevent communists from running for elected office (Jennings 1988, 45–61). It was a position that pleased Mexico's northern neighbor. The US vice-president and founder of the Hi-Bred (now Pioneer Hi-Bred) seed company, Henry Wallace, took a road trip in November 1940 to attend Camacho's inauguration. On his return, he discussed the possibilities of agricultural research and intervention in Mexico with Raymond Fosdick, the President of the Rockefeller Foundation. It was in this context that the Rockefeller Foundation's interest unfolded.

Although history suggests that the Green Revolution began as a joint venture between Rockefeller and the Mexican government, the Foundation was in the driving seat from the outset. As Jennings observes by citing Warren Weaver, director of the Division of Natural Sciences at the Rockefeller Foundation, the Mexican government was largely ignorant of the Foundation's goals in its creation of the Mexican Agricultural Program:

We customarily refer to this program as a collaboration between the Mexican Government and the Rockefeller Foundation, this collaboration having been undertaken at the request of the Mexican Government. Although formally accurate, this statement is actually very misleading. . . it must be realistically admitted that they had little or no idea as to what we were talking about, or what we intended to do. . . The Rockefeller Foundation wanted to try an experiment. Mexico offered a favorable location. In the first instance this project is going to produce more and better corn and beans for Mexicans but from a much larger and important point of view, it is a basic experiment in international technical cooperation. (Weaver cited in Jennings 1988, 58–9)

Mexicans would be beneficiaries of this experiment, even if it were never imagined that their government would meaningfully set its direction. Instead, the program was intended to be one 'consistent with U.S. government policy yet independent of Washington's control' (Perkins 1990, 9). The 'cooperation' envisaged by the Foundation, in which local and international resources would be used to transform local production techniques, faced resistance even with the community of agricultural development experts. Carl Sauer, a geographer at the University of California at Berkeley, made repeated calls to the Rockefeller Foundation to desist, arguing that the approach of US agronomists (while matched to their technocratic Mexican counterparts (Cotter 2003)) was ill suited to the ecological and social systems well established in Mexico:

A good aggressive bunch of American agronomists and plant breeders could ruin the native resources for good and all by pushing their American commercial stocks. . . And Mexican agriculture cannot be pointed toward standardization on a few commercial types without upsetting native economy and culture hopelessly. The example of Iowa is

about the most dangers [sic] of all for Mexico. Unless the Americans understand that, they'd better keep out of this country entirely. That must be approached from an appreciation of native economies as being basically sound. (Sauer cited in Jennings 1988, 51)

Indeed, Sauer went further, pointing to the instrumentalization of the countryside as an unstated assumption of the Foundation's approach:

The agricultural situation in Mexico is an exaggeration of that which we have in our experimental work in California; the interest is directed away from subsistence or village agriculture to the needs of city and factory with the attendant emphasis on standardization and on yield. . . . and on the commodities which the privileged fraction of the population can absorb. (Sauer cited in Jennings 1988, 52–53)

Despite the fact that Mexican government policy had clearly swung toward an urban-centric development model under Camacho and his successor Miguel Aleman (Alcantara 1973, 29), Sauer and others were rebuffed. A 1949 letter from Paul Mangelsdorf, a Harvard professor of Plant Genetics and Breeding, and one of the original Rockefeller survey team, to Weaver captures the spirit with which Sauer's concerns were treated:

If the program . . . does 'succeed', it will mean the disappearance of many ancient Mexican varieties of corn and other crops and perhaps the destruction of picturesque folk ways, which are of great interest to the anthropologist. In other words, to . . . Sauer, Mexico is a kind of glorified ant hill which they are in the process of studying. They resent any effort to 'improve' the ants. They much prefer to study them as they now are. (Mangelsdorf cited in Jennings 1988, 55)

At the outset, then, there were debates within the Rockefeller Foundation's walled garden. Sauer perceived correctly that the Rockefeller Foundation wanted to bring knowledge accumulated in large-scale US agriculture, and apply it where such experience was relevant only to a minority of producers. The terms in which he was rebuffed speak both of the contempt with which Sauer's deep respect for peasant knowledge was viewed, and also of the transcendent power to improve this knowledge that industrial agriculture, and US philanthropy, might bring (Li 2007).

The facts vindicate Sauer. Recall that Mexico's Green Revolution program is famed for its production of wheat. The conventional narrative suggests that Norman Borlaug 'realized that Mexico's traditional wheat-growing highland areas could not produce enough wheat to make the country self-sufficient in wheat production'. (Dubin and Brennan 2009, 21). For the majority of Mexicans, however, corn was a far more important crop. Nearly ten times more land was planted with corn in 1950 (4,781,759 hectares) than wheat (555,756 hectares) (Dirección General de Estadística 1955). But wheat tended to be grown by commercial farmers with models and resources more comparable to their US counterparts than corn production.<sup>3</sup>

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<sup>3</sup>Ironically, there were actual foreign revolutionaries engaged in plant breeding in Mexico before the arrival of the Rockefeller Foundation, and they were keen on corn. Indian revolutionary Pandurang Khankhoje was one of many breeders involved in corn research in Mexico's Instituto Biotécnico, a research institute founded in 1934 by the Cárdenas government as part of a strategy to improve peasant maize cultivation through improved knowledge (Matchett 2006, Ramnath 2011). The Instituto Biotécnico was closed after Camacho took office.

It is because of the poor match between the kinds of farming the Rockefeller Foundation was ready to support and the kind most relevant to Mexican peasants that the corn program floundered. Even as late as 1963, 12% of corn acreage in Mexico was planted with hybrid seed (Fitzgerald 1986, 467). By contrast, in 1957, 90% of Mexican wheat acreage was planted with hybrid and improved seed, and while 'fertilizer use increased over twenty five times from 1949 to 1966 overall in Mexico, only 15% of the area harvested received treatment' (Fitzgerald 1986, 469–70). Hicks notes that 'wheat yields in 1960 were 50 percent higher on private properties (larger than five hectares) than on *ejidos* and small private properties while in 1940 this margin was only ten per cent' (Hicks 1967, 397). It was on these terms that the MAP succeeded; it matched the needs of a particular group of farmers, whose resources were greater and who tended to be located in Northern Mexico. Between 1941 and 1952, for example, 90% of the entire agricultural budget (18% of the federal budget) was spent on large irrigation projects in the northwest (Alcantara 1973). Concerns within the Foundation for perhaps a more equitable distribution of resources were rebuffed by Borlaug himself, who felt that the technology would be better received by wealthy commercial farmers. There was, of course, resistance. Some peasant communities consciously rejected the Green Revolution (Clawson and Don 1979). These were the Green Counter-Revolutionaries who swiftly earned themselves the label 'peasant conservative' by way of explanation for their lack of enthusiasm for the agricultural program (Ross 2005).

Here, then, are a few themes that recur in the long history of the Green Revolution. First, the occasion for the intervention was a moment in struggles over productive resources within Mexico. The Rockefeller Foundation's decision to initiate a program in Mexico happened after a revolution, peasant uprising, and nationalization of resource wealth, and during a period of elite consolidation (Gilly 2005). Second, there were debates about the kind of knowledge necessary for agriculture to 'succeed'. Those debates were hushed by the program administrators' scorn for what they perceived to be backward farming methods, and their contempt for academic colleagues' romantic attachments to peasant agriculture. Technocratic concerns trumped considerations of power and knowledge. The apparatus of the Green Revolution was an anti-politics machine (Ferguson 1990). Third, the intervention involved the blessing and, to some extent, the resources of the Mexican state, but was also removed from mechanisms of democratic oversight: the Foundation was essentially a law unto itself. Fourth, the model used by the Foundation was that of US agriculture, intensive in capital and expert training. Finally, the Foundation consciously aligned its interests with those of the US government. Yet these are not the only, nor even the most important, trends to recognize in today's iteration of the Long Green Revolution.

John Harris notes that the term Green Revolution

was deliberately coined to contrast with the phrase 'red revolution', and the notion that 'developing' countries were to undergo far-reaching changes as a result of an agricultural revolution, rather than because of radical political transformation, gives a clue to the political interests involved in the generation of the new agricultural technology. (Harris 1988, 229)

The scale of this transformation can be glimpsed in the Mexican context, but more clearly seen in subsequent Green Revolution projects elsewhere. After the MAP,

Rockefeller initiated a smaller program in Colombia, but soon moved to create perhaps its most enduring success stories – its programs in Asia.

## 2.2 Asia

Before examining the Rockefeller Foundation's programs in India and the Philippines, it's worth noting two factors that pushed the Rockefeller Foundation in different directions from its Mexican program, both of which stemmed from concerns within the United States that had their origins earlier in the century (Cullather 2010). First, the Foundation had through the late 1940s come under media scrutiny for its public health improvements. Critics suggested that such improvements as the Foundation had achieved would likely be undone by increased population growth. Second, the Foundation was sensitized to the concern – voiced most often, though not exclusively, by John D Rockefeller III during his tenure on the Foundation's board from 1946 to 1956 – that impoverished and hungry people might be more amenable to communism.

In a strategic document issued by the Foundation entitled *The World Food Problem, Agriculture, and the Rockefeller Foundation*, produced by Warren Weaver, Elvin C. Stakman, Richard Bradfield, Paul Mangelsdorf and George Harrar, the themes of insurgency, population and food were crystalized:

whether additional millions . . . will become Communists will depend partly on whether the Communist world or the free world fulfils its promises. Hungry people are lured by promises, but they may be won by deeds. Communism makes attractive promises to underfed peoples. Democracy must not only promise as much, but must deliver more. (Advisory Committee for Agricultural Activities 1951, 4, cited in Brinkman 2009)

This was a view that resonated with US foreign policy. Rieff notes the emergence of a new post-war development catchphrase: 'Where hunger goes, Communism follows' (Rieff 2011). That there should be an alignment between US foreign policy and the Foundation's world is unsurprising. A shared ideological distaste for communism and an abiding faith in US capitalism – petrochemical, agricultural, military-industrial and otherwise – flourished through the personal elite networks that spanned the philanthropic and governmental worlds. There were ample connections between the Foundation and the government, through the Council on Foreign Relations, and directly through the US government itself. As Oasa notes,

Nelson Rockefeller became Assistant Secretary of State at the end of the war. In 1946, David was secretary of the Council of Foreign Relation's study group on post-war recovery in Western Europe. Out of this group emerged the Marshall Plan study group, to which the Rockefeller Foundation granted \$50,000 in 1948. Finally, John Rockefeller became a special consultant to John Foster Dulles in 1951. (Oasa 1981, 108)

The priorities of the US government itself were bent toward managing domestic as well as international crises. The crisis of agricultural overproduction within the US was, for example, fixed in part through the US Agricultural Trade and Development Assistance Act (PL 480) in 1954, which allowed the US to export surplus production as aid on US carriers to the Global South. Japan emerged as a primary recipient of US surplus wheat, but India was soon to become a major recipient, concerned as India was by its loss of large areas of the Punjabi grain basket to Pakistan, and with Nehru also worried about the destabilizing effect of high food

prices (Perkins 1990, Friedmann 1993). This occurred just over a year after the Rockefeller Foundation sent a team to investigate its potential role in replicating its Mexican model in India, and a year before the Foundation endowed USD 1.38 million to begin a joint agricultural program there (Lele and Goldsmith 1989, 309).

India offered an environment in which the Foundation might address its new concerns. As one Rockefeller Foundation trustee – Karl T. Compton, the President of the Massachusetts Institute for Technology – pointed out to the Foundation in 1951, ‘I suspect that India may be fertile ground for activity in this field. The overpopulation, the low living standards and the threat of communism are of course well known’ (Perkins 1990, 11).

The imagery of overpopulation (Angus and Butler 2011) found its way into the Foundation’s ‘Notes on Indian Agriculture’ (in language strikingly similar to that used to describe Mexican villages in previous Rockefeller documents, and in teeming piles of development literature since) thus:

The villages. . . within a region. . . are as uniform as so many ant hills. Indeed, from the air, where a number of villages may be seen simultaneously, they have the appearance of structures built by creatures motivated largely by inherited animal instincts, and devoid of any inclination to depart from a fixed hereditary pattern. The inheritance in this instance, of course, is social. (Perkins 1990, 10–1)

Although the ‘anthill’ description of villagers is similar to Mexican experiences, the Foundation had learned a great deal from its Mexican forays. The Foundation had honed its mission and also the techniques it was to bring to bear on the problems of Indian agriculture. The Foundation saw its role not just in developing the knowledge necessary to improve agriculture, but in the architecture necessary to embed, transmit and propagate this knowledge in government policy-making. The plant breeding pioneered by the Foundation in the 1940s was being supported both by other foundations and by the US Department of Agriculture a decade later. It was not in the generation of knowledge that the Foundation saw its niche, but in the planting of its priorities and knowledge in the sometimes infertile ground of public policy (Perkins 1990). Because the kinds of agricultural knowledge brought by the Foundation required an institutional home within the Indian government, because it was the kind of knowledge that benefitted commercial rather than subsistence farmers, and because the Foundation had been informed by both the experience and ‘success’ of its US-land-grant-inspired techniques in Mexico, the Foundation undertook a longer campaign of training directed not at improving the lot of ‘the ants’, but of university-trained agronomists. The Foundation oversaw the development of a strong cadre of Indian agronomists and agricultural experts, who had been flown to see at first hand the benefits and abundance of US industrial agriculture, and who would be cost-effective ‘force multipliers’ within Indian agriculture for the Foundation’s approach.

It is for this suite of reasons that in 1956, the plant selected for the Rockefeller Foundation’s research was the commodity crop least relevant to most Indians: maize. Accounting for only 3% of Indian crops, it had the merit of being an agricultural ‘sandbox’ in which the Foundation could experiment in ways similar to its forays in Mexico, whilst building institutional support for its approach. It was a full eight years later, in 1964, that wheat was funded by the Foundation, and only in 1965, during India’s food crisis, did rice join the program (Lele and Goldsmith 1989, 318). Recall that the Green Revolution is remembered largely as an intervention in

rice and wheat production (Pinstrup-Andersen and Hazell 1985). Yet in Mexico its greatest success was with wheat. In India, the Revolution began with corn. So why is the received narrative so wildly at odds with the actual unfolding of the Green Revolution as an extra-governmental process of public policy transformation?

That India has been remembered as a place in which the Green Revolution was successful is worth examining, especially given the fairly modest overall funding for the project. Over the period of Rockefeller's engagement in India, expenditure ran to USD 7.9 million – around USD 56.6 million in 2012 dollars, using Lele's data from 1951–1975 (Lele and Goldsmith 1989, 309). It is hard to square such limited funding with the claims made for the Green Revolution, such as this 1970 press release from the US Agency for International Development:

What has happened in less than three years is revealed in a few statistics. . . overall food production has risen 14 percent in the period 1967–69. And, in South Asia alone – the crucial countries of India and Pakistan – the increase has been 27 percent. AID worked with foundations, universities and others in developing new farming methods, including the most efficient use of 'miracle' wheat and rice seeds that have brought about the Green Revolution. (Paddock 1970, 897)

Certainly, the funding of the initiatives by state and donor organizations can account for some of the return, but the success of the wheat program had less to do with the virtues of the crop itself, and much more to do with ecology and politics. The Indian climate was variable in 1965–6, with drought and unseasonable rain. This was supplemented by downward pressures on commodity prices occasioned by US food aid and then, in response to the Indian government's political wavering around US foreign policy in South East Asia, US President Lyndon Johnson announced a 'short-tether' policy around food aid, making its monthly renewal contingent on recipient support for broader US policy goals (Cleaver 1972). Hunger in India, poor weather, the economically depressive effects of food aid, and the bouncing recovery after the poor weather made it possible to tell a story of US success in feeding the world. Yet, as Paddock notes of the period 1967–70, Indian production of barley, tobacco, jute, chickpeas, tea and cotton all increased by 20–30% without the benefit of Green Revolution investment, and without similar self-congratulatory narratives of surplus and bounty (Paddock 1970).

Jervens's (2012) research complicates this observation yet further. Not only are the data about other crop yield increases ignored, the data themselves are part of a broader political economy of data. Jervens, citing Chambers (1984), notes that Green Revolution data were themselves the subject of manipulation, with 'the official statistics for some areas with high-yielding varieties. . . overstated by 3 to 5 times' (Jervens 2012, 11). These trends continue today, leading Jervens to conclude that 'The catchphrase "evidence based policy" assumes that evidence and policy are somehow independent. . . [but] The "data" are themselves a product of agricultural policies' (2012, 17).

This representation of success abetted both a quieting of land reform debates in India (Patel 2007b), and the entry into its market of US agricultural multinationals (Cleaver 1972, Kloppenburg 1988). In India, the new agricultural strategy was 'an attempt by the government to solve the food problem of the country without upsetting existing land relations. It relied heavily on those who had to lose most from a policy of radical land reform' (Dasgupta 1977, 373). This state of affairs matched a shift within India away from Nehruvian socialist economics to an import-

substitution-industrialization strategy, one whose domestic critics were overcome in part by the momentum of external forces pushing India's elites to adopt policies more consonant with free market capitalism (Varshney 1998). The combination of weather-induced poor harvests, empty granaries, month-to-month food aid shipments, and local political jockeying was that, in 1966, the Indian government, with the help of the Rockefeller Foundation, purchased 18,000 tons of Mexican high-yielding wheat seeds under its High-Yielding Varieties Programme. It was the largest single seed transaction in history (Lele and Goldsmith 1989, Djurfeldt *et al.* 2005). India's Green Revolution was officially underway. Think of it as a political-ecological 'shock doctrine' (Klein 2007).

The power of the Green Revolution to take an anti-communist position on local politics, particularly in the politics of land, was certainly at work in India but is more easily seen in the Philippines. The Foundation had entertained the possibility of a rice research institute in 1950 when Placido Mapa, the Philippine Secretary of Agriculture and Natural Resources, invited John D. Rockefeller III to begin a project similar to the Mexican one (Oasa 1981, 124–5). By the end of the 1950s, with the Ford Foundation joining forces with the Rockefeller Foundation, and with some urging by the State Department and CIA to take action to head off famine in Asia, the International Rice Research Institute (IRRI) was on the drawing board (Cullather 2004). The reasons to place it in the Philippines, according to Oasa's report of J. George Harrar's thinking, were:

Production figures were low and cultural practices 'primitive'. Furthermore, the American contacts were substantial at the College of Agriculture at Los Banos; many agricultural scientists from Cornell were teaching there under a grant between the U.S. International Cooperation Agency and Cornell University. Lastly, the Philippines had a healthy attitude toward 'the principle of international cooperation'. (Oasa 1981, 147)

But geopolitical concerns, expressed directly to Oasa, also played a role:

A former Ford Foundation official said that the Philippines was away from the main continent where instability was brewing due to the 'communist threat'. He also said, 'If we gave up on Asia, Japan and the Philippines would be the last place we'd leave'. The Philippine elite also viewed the selection of its country in openly political terms. President Macapagal was quoted as saying that IRRI would 'save' the Philippines and other rice-producing countries the 'time, expense, and efforts' in solving technical problems of rice production. He also wrote President Kennedy and said, 'We consider this Institute as a potent weapon in the struggle against poverty and communism in Asia'. (Oasa 1981, 147–8)

IRRI opened its doors in Los Banos in the Philippines in 1961. The severe modernist buildings in which IRRI were housed, as Cullather observes, were intended to be 'miracles of modernity' no less than the IR-8 rice that would soon emanate from the facility. Modern plumbing, air-conditioning and upholstery projected 'the power and richness of American life' (Cullather 2004, 233). An introductory film announced the intentions of the new building: 'Can modern science help these people grow more rice? Two American foundations think that it can' (Cullather 2004, 237).

For the ambitions of modernity to be realized, however, there needed to be order. Again, the unstated goals of the Foundations, and the interventions in agriculture

from the US, were to bring that order, especially to questions around the distribution of land. The egalitarian principles of land reform offered by Nehru – and prompted by domestic insurgency – had been suspended by the Indian government after Nehru's death in 1964. Yet throughout Asia, demands continued to be articulated by peasants for more substantive agrarian reform and redistribution than the state was prepared to entertain. In the Philippines, the Communist Party of the Philippines attempted to emulate the Chinese experience in the formulation of its own 'Revolutionary Guide to Land Reform' (Putzel 1992). The Philippine governments of both Macapagal in the early 1960s, and Marcos from 1965 onwards, were vexed by questions of land reform, and the revolutionary politics that made such demands thinkable. The US, meanwhile, deeply concerned about the regional implications of any perceived slide towards Communism, was opposed to any kind of redistributive land reform – undoubtedly also since it would threaten US agri-business interests if larger land owners, with their ties to global chains of agricultural inputs and primary commodity exports, were to be expropriated (Feder 1983).

Despite the state's wishes, it proved impossible to ignore the issue of land reform. This was an issue that, at the very least, needed to be deflected. As Putzel notes, this happened through the land reform programs of both the Macapagal and Marcos administrations. By offering a conservative interpretation of land reform, and by obfuscating any aspirations to change the existing rural power relations, both governments aimed to maintain rural order through an appropriation of the rhetoric of revolution, but without its trappings of substantive redistribution on terms set by the disempowered. Putzel argues that

the rapid adoption of [high-yielding varieties] HYVs throughout the country, and the accompanying increase in rice production, would provide ammunition over the next two decades to those who argued that the agrarian problem in the Philippines and Asia could be solved by technology without a direct challenge to existing landownership patterns. (Putzel 1992, 118)

In cementing rather than dismantling the status quo, some critics have termed what actually happened in the Philippines a 'land reform in reverse' (Feder 1983).<sup>4</sup> The Philippines' elites had a different revolution in mind – one that looked decidedly neoliberal. Putzel describes the conservative approach towards land reform:

The conservative perspective is based on the proposition that a healthy economy requires the operation of land, labour and capital markets free from state intervention, including state initiated land redistribution. From the conservative perspective, the problem of poverty is not founded in unequal distribution of assets, but rather in low productivity. It is traceable to population growth which has also made redistributive reform all but irrelevant. (Putzel 1992, 10)

If the conservative prescription for a healthy economy means that markets don't require state intervention, what *do* markets require? To answer this, Polanyi offers the best guide to the myths of self-regulating markets, and the transformations of market society required so that these myths might be told (Polanyi 1944). Central to the idea of a Great Transformation is the work done by the state to create and

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<sup>4</sup>The Philippine land reforms between 1992 and 2000 are an aberration to the much longer historical concentration of land, and government reluctance to engage in anything other than 'land reform in reverse'.

manage markets at the same time as the myths of market independence propagate. In the Philippines as elsewhere, policies that favoured market-led approaches to food production required state support. In order to fight communist uprising and peasant insurgency through a healthy economy, the state need to be intimately involved to administer two of the Green Revolution's most potent tools: subsidies and violence.

### **2.3 Authoritarian states, the development establishment and AID**

Although it is the technological triumphs that are declaimed the loudest in received accounts of the Green Revolution, the Green Revolutionaries were as explicitly concerned about the circulation of capital as they were about seeds. To put it plainly, the Green Revolution would not have succeeded without subsidies. Within a year of a food self-sufficiency program beginning in the Philippines in 1966, price supports for rice increased by 50%. In Mexico, the government purchased domestically grown wheat at 33% above world market prices. India and Pakistan paid 100% more for their wheat (Paddock 1970, 898).

In order for the Green Revolution to succeed, funds were required not only to invest in the development of agricultural technology and the further inculcation of this technology within the habits of government and farmers, but also to sustain the large and ongoing subsidies required by the programme in order to create and generate surpluses. Resources of this magnitude were beyond the reach of Foundations – this was the domain of larger and more powerful organizations. The US government increasingly supplanted philanthropic foundations in assuming the Green Revolution's fiscal commitments over through the 1960s – amounting to USD 3 billion a year in the mid-1960s (Dowie 2001, 113). The importance of these fiscal commitments was broadly understood. Paddock, quoting a 1963 speech by the US Department of Agriculture's Director of Economics Don Paarlberg,<sup>5</sup> points to a sentiment widely acknowledged:

This is the inescapable fact that a price artificially held above the competitive level will stimulate production, retard consumption and create a surplus. . . . It is the product of human institutions, not simply a consequence of rapid, technological advance. It may or may not be accompanied by a scientific revolution. We could create a surplus of diamonds or uranium or of avocados or rutabagas simply by setting the price above where the market would have it and foregoing [sic] cost production control. A surplus is not so much a result of technology as it is a result of intervention in the market. (Paddock 1970, 898)

Testimony in the US Senate in February 1968 on the US AID program demonstrated a widely shared understanding that more fertilizer and 'sounder government policies' were needed because:

new seeds, more fertilizer, better water management, improved pesticides and insecticides – these are important weapons in the fight to achieve self-sufficiency in food production. But they will not do the job alone. Not only must these be available to the farmer, but he must have credit to buy them, he must know how to use them properly, he must be able to get a decent price for his crop and he must be able to get it to market. (United States of America 1968, 51)

<sup>5</sup>A little trivia: Don is father of Robert Paarlberg, author of the misleadingly entitled *Food politics: What everyone needs to know* (Paarlberg 2010).

In the 1968 hearings on USAID, Thomas Morgan, Chair of the Committee, chided Gaud, reminding him that

in the past, members of this committee have found that there were cases where assistance was applied to agriculture... but the operation was frustrated because the farmers... had no inducement to adopt improved methods because they derived very little from their increased production. (United States of America 1968, 57).

Gaud responded by citing the Philippines, India, Pakistan, Chile and Brazil as examples where higher prices given to farmers gets 'primary credit for providing the incentive' to grow more.

The states Gaud held up as success stories had built a social market infrastructure to match the Green Revolution's technology (Winner 1986), and subsequently used local and international resources to telegraph through its new marketing boards and national markets prices that would induce high levels of production from farmers. It is not accidental that these states shared a second common feature: they were all, at some point during the Green Revolution within their borders, dictatorships.

The Philippines was a hotbed of agrarian rebellion even before Marcos, Pakistan's military complex was well established by the time Gaud announced the Green Revolution's success there (Jalal 1995), the curtains on Chile's democracy were drawn by Pinochet's 1973 coup and Brazil's military ran the country from 1964 to 1985. It is often forgotten that India under Indira Gandhi experienced an 'Emergency Period', which ran from June 1975 to March 1977. Ironically, rural land reform and the liquidation of indentured labour were specifically announced as government objectives during the suspension of normal democracy and imposition of police rule, though '[n]one of these reforms was undertaken in more than a rhetorical way, except in the governmental propaganda offices' (Blair 1980, 256). Instead, unions were attacked, strikes were banned and labour leaders incarcerated. Indira Gandhi's son, Sanjay, took it upon himself to address concerns about insurgent urban populations and population growth directly, by managing a program of slum clearance and forced sterilization, the latter justified in the name of the national interest (Blair 1980, 259, Henry 1976).<sup>6</sup>

The argument here is not that the Green Revolution itself caused authoritarianism. The ideas of agricultural transformation that were part of international and domestic struggles around communism and, ultimately, property featured in a larger set of political processes. Nonetheless, the extension of the state and its forces into rural affairs in the particular way that it did is hard to imagine absent the technics of the Green Revolution. By technics, here, I draw on Lewis Mumford's work, in which he contrasts ideal-types of democratic and authoritarian social systems, and the technologies affine with them (Mumford 1964). Tracing the origins of centralized technologies that necessitated the use of force in their promulgation and maintenance to Roman history, he suggest that

...totalitarian technics was tolerated, perhaps even welcomed, in home territory, for it created the first economy of controlled abundance: notably, immense food crops

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<sup>6</sup>In the continuum of concerns over security, population and agriculture, and the necessity for a strong state to implement policy, readers will note much that connects past and present developmentalist states (Duffield 2010).

that not merely supported a big urban population but released a large trained minority for purely religious, scientific, bureaucratic, or military activity. (Mumford 1964, 4–5)

In other words, Mumford urges us to think about the ancestry of the technics of the Green Revolution even before Enclosure, as Braudel encourages us to do, to see the origins of surplus as intimately bound to forms of production that encourage and demand authoritarian social systems. Although it is beyond the scope of this essay to investigate it further, this is an area that warrants further study. Nonetheless, the suggestion here is that the state made the Green Revolution, and that the Green Revolution remade the state and society in particular ways. In India, the Emergency period was a moment in which rich peasants' power was rearticulated as a result of the Green Revolution (Kaviraj 1986). Absent the state's underwriting and enforcing a particular formation of surplus agricultural production, the seeds that became the Green Revolution's emblem often rotted for want of farmers' interest. This narrative sits poorly with one powered by the miracles engineered into the seeds themselves, but is consonant with the geopolitical and Malthusian tale of the Green Revolution (Perkins 1997, Ross 1998b, Cullather 2010).

### 3. Appraisal

At this point, rather than trace the Long Green Revolution further, it's important to ask a question of assessment. Part of this paper's argument is that contemporary knowledge that 'a New Green Revolution is necessary' rests on the foundation that 'the original Green Revolution was successful'. The Green Revolution's basic technologies and philosophy were well articulated by the end of the 1960s and it is to the period between WWII and 1970 that advocates of a New Green Revolution point, as a history of success to be emulated. To suggest that the Green Revolution 'succeeded' is to broach the question 'Successful for whom?' Perkins' summary is a useful one here:

If success means an increase in the aggregate physical supply of grain, the green revolution was a success. If success means an end to hunger, then the green revolution was a failure. People without access to adequate land or income, regardless of their country of residence, remain ill fed. (Perkins 1997, 258)

The concerns with overpopulation and Communism were certainly met in the minds of policy makers, but the mechanisms by which Communism was prevented, and in which predominantly urban populations were pacified by access to food, had less to do with plant genetics than with a strong state.

The terrain of the debate is, however, wider than simply the question of whether hunger has been banished, or whether yields have increased. A central contention has been that the Green Revolution at best overlooked the rural poor, and at worst exacerbated their plight. This is of keen relevance today, because, as we shall see, it is in the name of fighting rural poverty (a concern that was secondary to the need to increase food production and yield in the original motivations for the Green Revolution) that the Green Revolution has been lauded.

Among the claims made for the Green Revolution (Hazell *et al.* 2010, Griffin and Boyce 2011), three are central in the argument that the intervention supported smallholders. These are:

- **Scale neutrality:** Green Revolution technology is scale-neutral and was widely adopted by smallholders as well as by large farmers.
- **Scientific improvement:** Plant science has improved enormously since the early days of the Green Revolution to become more suited to the needs of poorer farmers living in marginal areas. (Borlaug 2000)
- **Smallholder self-interest:** Green Revolution technology was adopted by small-scale farmers because they saw the benefits in terms of higher yields which reduced their risk and raised their material and physical wellbeing, demonstrating how smallholder agriculture can drive economic growth.

In this section I'll deal with each of these in turn, before analyzing other consequences of the Green Revolution, and comparing the legacy to contemporary debates over a New Green Revolution. It's worth adopting this approach, and sacrificing a little analytical parsimony, both because the spread of the three arguments above obfuscates contemporary debates around the Green Revolution, but also because the appearance of these arguments in historical and contemporary literature is itself a sign, and a battlefield, in today's hegemonic reconstruction of the original Green Revolution.

First, then, is the claim, found in Mosley (2002), Birner and Resnick (2010) and Hazell *et al.* (2010) that the Green Revolution technology was scale neutral, with divisible inputs, and therefore of benefit to both smallholders and larger farm owners. It is true that a seed cares not whether the ground on which it is planted belongs to a commercial farmer or a subsistence one. Other things being equal, given appropriate support, its yield will be the same in both contexts. As Harris (1988) and Bernstein (2010a) argue, however, scale neutral doesn't mean 'resource neutral':

India's Green Revolution provides a clue to this aspect of differentiation. The promise was that its biochemical package of improve inputs was 'scale neutral', meaning that it could be adopted, with benefit, on any size of farm – unlike mechanization, for instance, which requires minimum economies of scale. However, 'scale neutral' – an attribute of a given technology – is not the same as 'resource neutral', a social attribute connected with the question 'who owns what?' and that requires asking about differentiation and its effects. (Bernstein 2010a, 105)

Wealthier farmers risked less in adopting the seeds, because they had better access to controlled irrigation, a higher ability to obtain cheap credit and fertilizer, easier access to the kinds of extension services that the Green Revolution had invested in with them in mind, and easier access to labour when required. Beyond the observation that wealthier farmers were better able to adopt the technology, Palmer (1972) argues that the technology was, in fact, not divisible – in some cases, it was packaged by corporate agri-business into bundles of fertilizer-and-seed that were beyond the means of smallholder farmers.

A more generalized observation returns to the history of the Green Revolution itself: the scientific breeding strategy was not geared towards the requirements of poorer peasants, but instead produced seeds requiring irrigation and an intensive use of material inputs. Indeed, the Green Revolution varieties were trialed in far better conditions than experienced by the majority of smallholder farmers, leading to a persistent 'yield gap', a gulf between conditions that might be achieved with access to capital and high quality land, and that observed in the real world of poorer farmers (Licker *et al.* 2010). In practice, the best agricultural land was most likely to be

controlled by richer peasants, entrenching unequal land ownership and increasing social differentiation. Griffin concludes that ‘the new technology is discriminatory... it is neutral neither as regards geographical area nor as regards social class’ (Griffin 1979, 213).

Particularly among more recent proponents of the Green Revolution, these criticisms have been heard, and the role of the state acknowledged. The scale neutrality of the technology can only be assured if there are accompanying interventions in government policy: ‘The rationale for public policies that support small farmers is based on the insight that they are affected by a variety of market failures’ (Birner and Resnick 2010, 1442). Note here the characterization of pre-existing inequality and entrenched class structure, particularly in the holding of land, as that of ‘market failure’. We shall have cause to return to this later. Yet the public institutions that are intended to redress the balance inherent in the technology are not themselves neutral. Griffin captures this well:

Extension agents concentrate on the large farmers; credit agencies concentrate on low risk borrowers; those who sell fertilizers, pesticides and other chemical inputs concentrate on cultivators who are likely to buy the largest quantities. State organizations tend to provide services to those from whom the government seeks approval, and in most instances these are the large landowners. Unless there is ‘scale-neutrality’ in the institutions which support the ‘green revolution’... unless small peasants have equal access to knowledge, finance and material inputs, innovation will inevitably favour the prosperous and the secure at the expense of the poor and the insecure. (Griffin 1979, 236)

In response to this comes a second claim about the Green Revolution. It deflects concerns about a state’s class bias by suggesting that even if the structures around the Green Revolution tended to favour the minority of commercial farmers, the scientists involved in plant breeding research, while initially constrained by the parameters of the Green Revolution project, soon found themselves attending to the needs of smallholder farmers.

In the shift from philanthropic research funding to public sector institutions came the possibility of public input and accountability. This meant that plant breeding was steered toward greater pest resistance and adaptability to more marginal areas. Both of these developments are seen as positive for smallholder farmers. For example, in Sri Lanka the rice breeders’ emphasis switched from the Dry Zone to the neglected Wet Zone around 1975. Lipton argues that ‘research policy response is key’ in helping poor farmers outside initial target areas to benefit from the Green Revolution (Lipton 2007). In later years plant science has been geared towards the development of more ‘defensive’, i.e. more pest-resistant, varieties as the emphasis was placed on reducing farm-level risk, especially for poorer peasants. For example, IRRI shifted from an initial focus on the high-yielding but more vulnerable IR-8 variety, to the more robust IR-20 variety (Lipton 2007). Genes for resistance to stem, leaf, and stripe rust meanwhile have been bred into wheat, while new varieties of rice are claimed to be resistant to ‘as many as four diseases and three insects’ (Khush 2003). New varieties are also said to be less sensitive to moisture stress and adverse temperature and soil conditions.

In this, there is merit. Even Griffin, a harsh critic of the Green Revolution, acknowledges that over time, the needs of poorer peasants featured more prominently on the research agendas of crop scientists, despite the exclusively

commercial launch path of the Green Revolution: ‘The scientists have responded to their critics...there has been a change in the research strategy of plant breeding: more emphasis is now placed on the search for “peasant-biased” technical change’ (Griffin and Boyce 2011, 10). This is important, though it is worth remembering the point of departure – the ministrations of plant breeding scientists could hardly have become *less* focused on the needs of smallholders than the original Green Revolution had been.

There is a third argument in favour of the Green Revolution’s beneficial impacts on smallholders: that it was adopted by poorer peasants as both a rational calculation and a sound one, which lifted them out of poverty. Thus, William Gaud was able to announce:

... [i]n Pakistan where they have never before paid a premium for seeds, they are now doing so. They want the high-yield varieties. There have been reports of seed riots in India. At times the demand for fertilizer in India has been strong enough to create a black market. (Gaud 1968)

Evenson and Gollin use more contemporary economic language to cast farmers as rational actors (2003): ‘When a farmer chooses to adopt a new variety to replace an older variety, it reflects the farmer’s judgment that the new variety offers some net benefit or advantage’ (Evenson and Gollin 2003, 758). Recall that farmers who did not adopt these innovations were, by contrast, deemed peasant conservatives, or possessed of a ‘peasant psychology’ (Yapa and Mayfield 1978). Yet a range of different studies of adoption in India, for instance, corroborate studies elsewhere (Clawson and Don 1979) that political economic considerations also influenced the choice of whether to adopt. Access to factors of production, particularly water, as well as the cost of seed and a lack of education, also constrained the adoption of these varieties. Insofar as adoption occurred, Palmer (1972) suggests that this was a rational response to the availability of cheap credit, and the result of deliberate discriminatory intervention by governments in factor markets. It was rational to adopt the Green Revolution in the way that it is rational to take an envelope of cash sitting on a table with your name on it.

As the adoption data in Section 2 suggest, the technology did indeed spread in Asia (Birner and Resnick 2010). It has come to represent ‘how agricultural growth that reached large numbers of small units could transform rural economies and raise enormous numbers of people out of poverty’ (Wegner and Zwart 2011). Similarly, Djurfeldt and Jirstrom state that ‘The Green Revolutions were small-farmer based, i.e. they were not based on the large-scale mechanized farming’ (2005, 3). With the winds of revised history at their backs, the question asked by proponents has become ‘is it still possible to drive agricultural growth through small farms as happened in the green revolution?’ (Wiggins *et al.* 2010).

With a platform for future agriculture based on such assessments of the past, it’s worth taking the time to ask whether the foundations are solid. Evidence from Punjab suggests that the Green Revolution increased the concentration of land ownership, with the smallest-scale farmers displaced from their land (Griffin 1979, Evenson and Gollin 2003). The logic here is that as capitalist expansion in the countryside made land more profitable, wealthier peasants had a greater economic incentive to adopt the technology (‘differential adoption’) and acquire more land (resulting in ‘land alienation’), at the expense of poorer smallholders. In India this led to a process of ‘partial proletarianization’ (Byres 1981).

Osmani responds with evidence that leads him to ‘conclude, contrary to conventional wisdom, that the growth process engendered by the green revolution has enhanced rather than eroded the entitlements of the small peasantry, despite the constraints imposed by existing socioeconomic structures’ (Osmani 1998, 198). He suggests that the Green Revolution has not increased land alienation of small-scale farmers, because the adoption of Green Revolution technology by small-scale farmers has reduced the incidence of distress sales and that ‘[t]he case for smallholder development as one of the main ways to reduce poverty in low-income countries remains compelling’ (Hazell *et al.* 2010, 1358). Of course, the case for smallholder development is not the same thing as the Green Revolution – one can accept, as the World Bank has reluctantly and recently done (World Bank 2007a), that support for poor rural communities is an important part of efforts to eradicate poverty, without accepting that the Green Revolution is a poverty-reducing strategy.

So where does the evidence lie? That the Green Revolution spread is not in doubt. But we need to know who benefited. Osmani relies on Shergill’s analysis of land prices in the Sangrur district in Punjab (Shergill 1986). Bhalla *et al.* argue that benefits were spread throughout Punjab, with ‘the most crucial element in making this possible [being] large public investment in irrigation and power, scientific research, extension services, roads, markets, and other rural infrastructure’ (Bhalla *et al.* 1990, 9). As a result, ‘the new technology was first adopted by large landholders who had the initial wherewithal and capacity to take risks, but was soon extended to peasants with smaller holdings’ (Bhalla *et al.* 1990, 22). It appears that in the case of the Punjab, the Green Revolution was an unqualified success, and that after a period of uneven adoption, everyone benefitted. As regards the claim of land alienation, Shergill shows that land prices were low and the volume of land sales was high until 1965–66, after which prices tripled between 1966–67 and 1978–79 and volume of sales fell. This is consistent with the idea that the Green Revolution started with large farmers and moved over time to smaller ones, and that poor smallholders soon found themselves sitting on goldmines after the Green Revolution took off in India, which meant that they had to sell less of their land in the event of a distress sale.

It is unsurprising that Punjab is chosen as a key site of rhetorical contention: 76% of the increase in wheat production was located in just two states, Punjab and Uttar Pradesh. A study of the output of 19 major crops during 1962–65 and 1970–73 showed that rapid agricultural growth was restricted to just 17% of the districts in India (Prahladachar 1983). To allow the Sangrur district to represent Punjab, and Punjab to stand as a metonymic case study of the Green Revolution in Asia, is problematic, and not merely because the idea of the case study is flawed (McMichael 1990). Sangrur may not have been representative of Punjab, and Punjab certainly wasn’t representative of India. We can put Shergill’s data in context by looking at more inclusive national survey data, as Sharma (1994) does, to find out a little bit more about who did the adopting of the Green Revolution, and who didn’t.

Note that Sharma’s are national survey data which do not reflect local arrangements for land tenure other than ownership, and changes in survey methodology between the 1953–54 survey and its subsequent round (1961–62) reduced the number of landless households by allowing in later surveys for ‘ownership-like’ arrangements to put those households in other categories of land ownership. With these provisos in mind, Sharma covers a period from 1953–5 to 1982, and shows that in Punjab and Haryana – the epicenters of the Green Revolution – from 1953–54, when the bottom 50% of the smallholders owned 0.47%

Table 1. Percentage of households landless and very land-poor in Punjab and Haryana.

	Households operating no land (percent of all Indian households)	Sub-marginal households (percent of all Indian households)	Total
1953–54	28.97	16.24	45.21
1961–62	39.55	7.99	47.54
1971–72	54.24	1.96	56.20
1982	33.50	28.02	61.52

Source: Sharma (1994, A19).

of the land, the figure increased to 0.52% in 1961–62 and then fell to 0.28% by 1971–72 before increasing over the next decade to end at 0.32% by 1982 (Sharma 1994, A15). The number of households in Punjab without land or on sub-marginal land holdings (<0.99 acres) maintained a continuous upward trajectory.

In other words, landlessness increased in Punjab and poorer farmers saw their share of the land fall. But so did the very top landholders see their share of the land ownership fall. In Punjab and Haryana, the top 1% of landholders owned 16.86% of the land in 1953–4, which fell to 13.95% by 1982. This is still, of course, disproportionate, but it points to a bloc of winners from Green Revolution policies that is often ignored – those ‘middle peasants’ in the 40% to 80% range who saw their share of land holdings rise from 22.69% to 34.19% of total land held over the same period. So, the poorest residents of rural areas – landless and extremely land-poor – might have been ignored by the Green Revolution, but a tranche of other smallholders did well. As Byres notes, ‘The adoption rate evidence is by no means inconsistent with increasing economic and social differentiation among the peasantry’ (Byres 1981, 427).

There is, beyond adoption, the question of growth coming from that adoption. Again, the rise in land prices was beneficial to those who were able to command it. But having assets isn’t the same thing as escaping poverty. The evidence on this score is ambiguous, even from agencies predisposed to a more favourable review. A survey of the ‘East Asian Miracle’ by the Asian Development Bank, for instance, argues that ‘While agricultural growth [based on Green Revolution policies] was a palliative for pervasive poverty in pre-miracle days, its role in initiating and sustaining rapid economic growth has been limited’ (Quibria 2002, 54).

So, of the three arguments in the Green Revolution’s favour – that the technology was neutral and available to all, that the technology became more amenable to the needs of smallholder cultivators, and that the adoption of the technology by such cultivators led to growth – perhaps the strongest claim is that plant breeders came to align their efforts more with needs of smallholder farmers than purely those of commercial farmers. The seeds themselves were, however, only part of a broader political economy, of public and private finance and support, with concomitant winners and losers – the latter particularly among the poorest rural residents.

There is a great deal of sensitivity today around the issue of justice hidden in these debates. Centrally there is a question of minimal Pareto optimality, the weakest of all criteria of fairness which demands that, at the very least, no one be made worse off by a change, and that at least one person be better off. That some were better off

as a result of the Green Revolution is clear. The sore point is clearly whether anyone was harmed by it. The evidence seems to suggest, at least insofar as landlessness increased, that at least one person was. Which perhaps explains why Pinstруп-Anderson and Hazell, in a rebuttal to critics of the distributive effects of the Green Revolution, offer this assurance:

A number of early studies ... concluded that the rural poor did not receive their fair share of the generated benefits ... recent studies have produced a sizable body of evidence which proves beyond a reasonable doubt that they are wrong. Recent evidence clearly shows that, although exceptions exist, as a general rule the Green Revolution has resulted in a very significant improvement in the material well-being of the poor. Where did early studies go wrong? First, the studies failed to distinguish between early and subsequent adoption of new technology. ... second, the benefits to the poor as consumers of rice and wheat through lower prices was largely overlooked. Third, little or no attention was given the multiplier effects of the Green Revolution. ... Fourth, the impact of the Green Revolution was frequently confused with the impact of institutional arrangements, agricultural policies and labour-saving mechanization. (Pinstруп-Anderson and Hazell 1985, 8)

Recent models suggest prices would indeed have been 35–55% higher than they were in 2000 without the Green Revolution (Evenson and Gollin 2003), though the extent of the consumer impact isn't clear from the sources they cite (see e.g. Pinstруп-Anderson 1979). Yet even acknowledging the Green Revolution's effect on prices (particularly important in the urban population centers intended to be quelled by the Revolution), the question over inequality and fairness persists. The availability of 60% cheaper rice would be little consolation to someone who had lost 100% of their income as a result of the Green Revolution. And while Pinstруп-Anderson and Hazell have been widely cited, in a review of 307 articles, Freebairn finds that

Over 80% of the sample of published studies ... concluded that greater inequality resulted. Notwithstanding this preponderance of evidence, the overwhelming conviction of operating agencies, from local to international, has been that the improved technologies offer the best solution to the problems of agricultural and rural development and growth. Indeed, a significant number of scholars join in this very positive view of the impact the new technology has on agricultural and rural regions. (Freebairn 1995, 277)

In other words, findings at the time of the Green Revolution suggested that inequality increased, as did findings after the diffusion and adoption of the Green Revolution, yet there is a persistent belief that inequality did not, in fact, result. Perhaps Pinstруп-Anderson and Hazell mean that the poor received a share, rather than a fair one. They might be on slightly firmer footing, if by 'poor' they don't mean the very poorest landless and semi-landless, but instead refer to the stratum of middle peasants who benefitted. The use of the word 'fair' does, however, suggests some notion of equality unsupported by data.

This raises a question about the role of social science in the manufacture of the Green Revolution. Recall that the Green Revolution, as a story about technological triumph over hunger, is already mythic – it has largely written out the supporting role of the state, ignores the creation of new landless and therefore hungrier poor people, and ignores the question of whether increased yields led to reduced hunger. Yet the Green Revolution is, among a certain development establishment, still *known*

to have succeeded. Foucault's work on knowledge is informative here. He argues that

Truth is a thing of this world: it is produced only by virtue of multiple forms of constraint. And it induces regular effects of power. Each society has its regime of truth, its 'general politics' of truth: that is, the types of discourse which it accepts and makes function as true; the mechanisms and instances which enable one to distinguish true and false statements, the means by which each is sanctioned; the techniques and procedures accorded value in the acquisition of truth; the status of those who are charged with saying what counts as true...[T]he 'political economy' of truth is ...produced and transmitted under the control, dominant if not exclusive, of a few great political and economic apparatuses (University, army, writing, media); lastly, it is the issue of a whole political debate and social confrontation ('ideological' struggles). (Foucault 1980, 31)

The making of truth around the Green Revolution implicates a range of institutions, including universities, foundations, governments, and NGOs. The Green Revolution has its own 'regime of truth'. It is in this sense that it can be said that there is a 'battlefield of knowledge' around the Green Revolution (Long and Long 1992), a political economy of knowledge (Jessop 2005) that stretches beyond the foundations that originally sponsored the plant-breeding research, and involves governmental aid agencies, seed companies, NGOs and departments of agriculture within recipient host countries (Kloppenborg 2004; see also Glenna *et al.* 2011).

The motivation behind adopting a 'myth-busting' approach in the discussion so far has been, first, to show that even on their own terms, the arguments clustering around the Green Revolution are porous and, on key points, baseless. Second, the disjunction between the data and the weight of academic citation and historical memory around the Green Revolution points to institutions that make truth about it. Third, to accommodate a discussion of the Green Revolution on the terms set by its defenders is to disavow historical, ecological or political economic analysis into the conditions in which the intervention took place. Recall that the term used to describe capitalism's inability to provide agricultural services for the poor is 'market failure'. Yet when markets fail to provide goods below cost, this is, of course, market *success*. Markets would be theoretically inconceivable were they to ration scarce goods at any other than the market-clearing price. The euphemizing of rural poverty, class and relations to the means of production are, however, central to the advance of the Green Revolution's language, and the parameters of that language are in turn part of the structures of legitimation that constitute the Long Green Revolution.

The political economy of truth becomes easier to see when one is able to discuss the Green Revolution in ways that deviate from the terms set by its proponents. Consider how Green Revolution policies raised the value of land more than wages, as the gains of technical change accrued in the largest proportion to the factor of production with the most inelastic supply. In a comparison between agricultural wages and land values in the Punjab region of India between 1960 and 1978, Kerr and Kolavalli track almost constant wage rates against more than fourfold increases in land prices (Kerr and Kolavalli 1999). This conforms to a pattern across Green Revolution regions in which 'employment of labour goes up somewhat, the real wage does not go up a lot, and the rewards (price, rent) of land go up a good deal, probably reducing labour's share in income' (Lipton and Longhurst 1989, 110). Labour's share of farm income has declined in most Green Revolution regions (United Nations Research Institute for Social Development 1974, Conway 1997, Kerr and Kolavalli 1999).

Yet we ought to be cautious in assuming we understand why labour and land markets behave the way they do. Markets are not natural (Polanyi 1944). In the case of labour, an abundant pool of landless people does not necessarily lead to lower wages. Contrasting agricultural wages in 1956–7 and 1964–5 in Punjab and Kerala, Bardhan (1970) found increases of 17% and 92%, respectively. These wage increases happened despite the fact that ‘30.90 per cent of Kerala’s rural households were landless, whereas for Punjab and Haryana together it was only 12.33 per cent’. (Bardhan 1970, 1242). In other words, despite having more landless labourers than Punjab, wages for farm labourers increased in Kerala far more than in Punjab. Bardhan attributes this to the power of peasant movements in Kerala compared to Punjab, and a similar responsiveness of the government in supporting these movements. In other words, the important variables aren’t supply or demand, but the extent to which movements were able to prevent the enforcement of capitalist free markets in labour by the state. Which is to say that the markets in which labourers sell their labour power are fought over, not naturally given. And in the epicenters of the Green Revolution, those markets were systematically tilted in favour of the buyers of labour power – the owners of land. The state made these markets as part of its making the Green Revolution.

A similar logic applies to the political economy of land. Land prices do not ‘naturally’ increase. They were driven higher both by government subsidies for their owners, political assurances, and capital within land markets to acquire land, and by mechanisms – ranging from the courts to police – to enforce property laws. In fostering an environment in which money might be turned into commodities and back again, and increasing surplus value by quelling labour protests and constraining wage rates (Araghi 2003), the Green Revolution presented a framework not only for the rebuffing of Communism, but staunchly for the advance of capitalism. Part of that advance is the naturalization of markets and commodification. Explaining land price rises compared to labour prices on the grounds of comparative factor scarcity is to beg a question that requires deep historical and political economic decomposition. Yet it is precisely this analytical rigour that cannot be thought when running a critique of the Green Revolution within the terms set by present-day celebrants of the Green Revolution.

### **3.1 Gender**

If the Green Revolution succeeds, through analytical obfuscation in naturalizing terms like ‘small farmer’, perhaps its most potent naturalization lies in the unit of analysis used in its discourse: the household. In ceding analytical ground to the terms presented by those supportive of the Green Revolution, one of the most fundamental losses is the ability to analyse relations of social reproduction.

Bakker (2007) reworks Braudel to help understand how this naturalization is possible, and also points toward the kinds of thinking that help us understand how the Green Revolution might be considered ‘long’. While Marx sees the origins of capitalism at the moment of workers’ alienation from their own labour power at the time of Enclosure, Braudel sees capitalism as a force ‘potentially visible since the dawn of history ... that ... has developed and perpetuated itself down the ages’ (Braudel 1982a, 620). It inserts itself at the top of a hierarchy of production and reproduction, parasitic on it.

capitalism  
market economy  
material life/civilization

What one loses in Marx's specific historical formulation, one gains both in an understanding of the historical relations of exploitation, and in the persistence of structures of production and reproduction over lifetimes. Braudel suggests that relations of exploitation are far more persistent, because normalized, than we suspect:

I think mankind is more than waist-deep in daily routine. Countless inherited acts, accumulated pell-mell and repeated time after time to this very day, become habits that help us to live, imprison us, and make decisions for us throughout our lives. (Braudel 1977, 7)

Normalized exploitation lets capitalism draw its lifeblood through the everyday workings of society. This is not, however, to suggest that change never happens. Indeed, Marx's understanding of the commodification of labour points to the mechanisms of parasitism that contemporary capitalism has used to draw value from the bases of the economy, particularly – suggests Bakker – through the restructuring of social relations within the household (Bakker and Gill 2003, Bakker 2007, Federici 2004).

This matters to an analysis of the Green Revolution in a range of ways. The changes wrought by the Green Revolution were ones that 'financialized' everyday life. Cullather notes the arrival of 'brazenly acquisitive values to rural life and work, demanding tractors and tubewells as marriage dowries and enforcing strictly contractual relations with tenants' (Cullather 2010, 241). Just as there are everyday forms of resistance, the Green Revolution takes its quotidian form (Scott 1985).

But even as these transformations were happening, as Hart argues powerfully, the locus of resistance was invisibilized in the Green Revolution's literature. Analyses of change in rural areas naturalize the household as a unit, yet:

... the household is more usefully seen as a political arena constituted by particularly dense bundles or rules, rights, and obligations governing relations between men and women, and elders and juniors. The rules defining property rights, labor obligations, resource distribution, and so forth are potentially subject to contestation, and must be constantly reinforced and reiterated. (Hart 1992, 811)

The analytical merits of teasing apart household relations can be seen in Hart's work on the Muda Agricultural Development Authority. She studies the application of mechanization to harvesting and transplanting tasks traditionally been carried out by women. In the context of escalating labour conflicts in the 1970s, these women's work groups collectively mobilised to resist efforts by large landowners to break up these groups in order to pay wages on an individual daily basis. Perceiving the increased insecurity and diminution in their wages that this would entail, women's groups organised against these plans with the slogan that they would not 'eat shillings'. Hart argues that this explains the rise in the price of labour rather than any inelastic supply in labour or a preference for leisure time. Men did not organise in this capacity because they enjoyed a more favourable position in various forms of political, social and religious patronage relations. Faced with such resistance from women's groups, one can interpret the shift to labour displacing mechanization in

the later phase of the Green Revolution as one way of reducing the effectiveness of this mobilisation. Again, a naturalized approach to markets, in which supply and demand are assumed magically to equilibrate, will mask these ongoing relationships. Hart concludes that ‘From this perspective, mechanization was not simply a price-induced response to relative factor scarcities; it was also part of an effort by large landowners and the irrigation authorities to bring recalcitrant women under control’ (Hart 1992, 810).

Yet the epistemic closure of the household allows ‘much that passes for objective socio-economic research and technology development . . . to be based on a priori assumptions: what is measured is determined by researchers’ fields of observation and perception of what is important to record’ (Jiggins 1986, 7–8). By systematically occluding gender from discussions of the Green Revolution, women were rendered ‘invisible farmers’ (Satyavathi *et al.* 2010, 442). In India, 74% of the female workforce is involved in agriculture. Sobha (2007) details the extent to which, as a result of Green Revolution activities, women have borne a disproportionate physical burden of the consequences and, as Agarwal has argued, been involved in gender-specific attempts to resuscitate the environment (Agarwal 1992). Deforestation means longer trips to gather firewood, or using fuels that burn less cleanly, resulting in higher rates of respiratory disease. Agricultural runoff matters to women, who are often responsible for fetching water and cooking, both activities that lead to chemical exposure. Women who are exposed to pesticides such as DDT suffer from hypothyroidism while leukaemia in children and Parkinson’s disease have also been linked to high pesticide exposure. Furthermore, there is evidence that pregnant women can pass on the toxins in the womb to their children, resulting in lower birth weight and smaller head size (Sobha 2007, see also Behrman *et al.* 2012).

Women’s agricultural knowledge has also been discounted and devalued (Feldman and Welsh 1995). The International Assessment on Knowledge, Science and Technology for Development points to the importance of such knowledge in the creation of sustainable food systems (IAASTD 2008). A purely instrumental evaluation of the loss suggests that, without any appeal to ecofeminism (Shiva 1989), it is likely to be harder to nurture a sustainable food system without this knowledge.

### 3.2 Ecology

Braudel’s logic also points us to think about the ways that the exploitation of the natural world has been seized by capital. Questions about sustainability and the environment do in fact feature in the original rhetoric of the Green Revolution. One of Norman Borlaug’s strongest claims, the so-called Borlaug hypothesis (Angelsen and Kaimowitz 2001), is that the Green Revolution prevented land from falling under the chainsaw and the plough. As a result of improved production technology between 1950 and 1998, Borlaug argued, over 1200 million hectares of land were spared from deforestation (Borlaug 2000, Borlaug and Dowswell 2003, 22).

To suggest that three times as much land might have been used to feed the world than is currently utilized is quite a claim, and one that deserves evaluation. We can certainly note that the terms of the question, couched in a Malthusian language of scarcity and demand, fits the contours of the original Green Revolution’s rhetoric. But the claim remains that as a consequence of incentives, investment, state violence, improved seeds and industrial chemicals, less forest was destroyed than might otherwise have been the case. There are three ways of responding. First, one might

observe that, even if true, the ecological costs of the Green Revolution have been substantially underestimated. Second, one ought to evaluate the amount of land saved by the Green Revolution. Third, one can flip the counterfactual on its head. Borlaug's claim is that without the Green Revolution, environmental catastrophe would have followed. The appropriate way to respond is to estimate the opportunity-cost of the Green Revolution, thereby suggesting that the alternative to the Green Revolution was not to do nothing, but to do things in a radically different way.

First, then, the unstated environmental costs. Pimentel and Pimentel (1990) cite a report observing that despite a sevenfold increase in pesticide use, loss to pests remained at 27% because more pest-susceptible rice was planted (Subramanian *et al.* 1973). One study cited by Pimentel and Pimentel points to a curious consequence of treating plants with 2,4-D: rice stem-borers grew 45% larger on treated plants (Pimentel 1971, 179), with the borer caterpillars consuming 45% more rice as a result. Outbreaks of pests are also less controlled, because their natural predators have been killed by the pesticides. Furthermore, soil erosion rates from the spread of Green Revolution technologies range from 10 to 100 t/ha/yr, which 'exceed soil formation rates by at least tenfold' (Pimentel *et al.* 1987, 277). Shiva points to the thirst of Green Revolution crops, some three times higher than conventional systems, leading to water tables dropping by  $\frac{1}{3}$  m per year (Shiva 1991). In 1992, it was found that close to a quarter (24%) of all irrigated lands suffered from salinization (Otero and Pechlaner 2008). Global fertilizer consumption also increased by 4.1% per year between 1961 and 1998 (Otero and Pechlaner 2008). Where fertilizer has entered into lakes and streams, eutrophication has occurred, resulting in the death of aquatic plants and animals (Pimentel and Pimentel 1990).

The consequences for the integrity and resilience of ecosystems are also profound. In sacrificing the 'agronomic resilience' of traditional varieties for the yield enhancing but more vulnerable Green Revolution seeds, the balance between crop and environment is undermined (Pistorius 1997, Kloppenburg 2010). As Frisson notes, 'in its ability to buffer yields from season to season and to deliver improved nutrition, and to do so when few other options are available, agricultural biodiversity is perhaps at its most useful in precisely the kinds of marginal and fragile environments that are occupied by the poorest farmers' (Frisson 2008). Claims for the merits of the Green Revolution abide by a narrow definition of agricultural productivity in which concerns for sustainability are largely absent.

Environmental myopia is a systemic feature of the Green Revolution. Hugh Campbell argues that the food regime underpinning the Green Revolution invisibilised the ecological impacts to effect what Marx had once described as 'an irreparable metabolic rift that increasingly disrupted the interaction between human beings and nature' (Campbell 2009, 312). That is, capitalism involves a distancing of humans from the ecological consequences of their actions. This appears similar to Sachs' claim that

It is only by externalizing these costs [the depletion of the nature] and then assuming them away as if they did not exist that some agricultural operations are presented as a success story, while in reality they should be considered as nothing short of a catastrophe. (Sachs 1987, 196)

Campbell's is more than a simple externality argument, however. Such processes of externalization can be effected by what Campbell identifies as social/cultural legitimacy of food regimes. Environmental degradation happens beneath a cloak of legitimacy provided by narratives of development and modernisation. 'Food from Nowhere' food regimes such as that underpinning the Green Revolution 'create enormous consequences both socially and ecologically at a global scale, but generally appear to consumers to have no consequence but price' (Campbell 2009, 315). Throughout this process, as Kloppenburg has noted, the biological realm has been increasingly commoditized, through a process of accumulation by dispossession (Kloppenburg 2010). The ownership of global seed supply has become increasingly concentrated, such that the top four companies control more than half the global proprietary seed supply (for more on concentration in industrial agriculture see, *inter alia*, ETC Group 2008, Bernstein 2010b, Moore 2010, Weis 2010, Wield *et al.* 2010).

In other words, the Borlaug hypothesis can be disputed on a number of grounds – the full ecological and social impact has yet to be tallied, but partial calculations point to a more fraught arithmetic than Borlaug's claims suggest. Further, evidence suggests that the technological innovations that Borlaug wrought matter less than the character of government that stewards the environment: environmental degradation is worse under authoritarianism (Kaimowitz 1996, Utting and UN 1993).

There is, further, a second response to the Borlaug hypothesis, examining quite how much land has been spared by the Green Revolution. Rudel *et al.* (2009) find increased land use with increased yields. Evenson and Gollin (2003) suggest that between 1960 and 2000, without hybrid seeds, per capita land use would have increased in developed and developing countries by 2.8 to 4.9%, and without the CGIAR system, by 1.6 to 1.9%. Over the same period, per capita calorie consumption would have fallen in developing countries by 13.3% to 14.4% without the use of hybrid seeds, and without the CGIAR, it would have fallen by 4.5% to 5.0%. These figures are certainly more modest than Borlaug's hypothesis, though significant. But this isn't the *opportunity cost* of the Green Revolution. This is merely an examination of what might have happened had the resources deployed in the Green Revolution not been deployed. A better response is to accept Borlaug's invitation to consider counterfactuals, and ask not what would have happened had the Green Revolution not occurred, but rather what might have happened had the substantial resources used in the Green Revolution been deployed in a different way. In the final section of this essay, I examine the rise of the New Green Revolution, locating it as a completion of, rather than an alternative to, the original Green Revolution. Only after that, and an assessment of the Green Revolution's persistence, can we offer a deep rebuttal to Borlaug's hypothesis.

#### 4. A new hope: The New Green Revolution

Historical eras rarely begin or end conveniently. Although Borlaug's 1970 Nobel win is often considered the Green Revolution's capstone, in many countries where improved seeds were introduced, changes in government support for agriculture and multilateral funding for it continued through the 1960s and 1970s. Even at the zenith of a Green Revolution motivated by concerns around feeding the potentially insurrectionary poor, other forces and transformations were at work. By examining

those forces, we can understand why it helps to consider the Green Revolution a 'long' process, and situate contemporary trends in a useful historical trajectory.

The rise of sorghum in Mexico's 'second Green Revolution' hints at the problem of hermetically sealing the original Green Revolution within a (1942–1970) bracket. In response to the growing demand for meat by Mexico's growing middle and upper class and the growing profitability of meat as an export product, the Mexican government shifted its fiscal support from staple food crops towards the production of sorghum to serve as a high-protein animal feed. As early as 1964, the Mexican government ended its 250 million pesos annual subsidy for wheat production and instead offered a guaranteed price of 625 pesos per ton for sorghum (DeWalt 1985). Mexico's commercial farmers responded to these price signals and switched from wheat and maize to sorghum production. Mexico's per capita domestic production of food staples steadily declined, while sorghum soared. Sorghum production was too insignificant to warrant a mention in early 1950s government data but increased between 1958 and 1980 by 2772% to become Mexico's third largest crop in terms of value and hectares sown. This increase, spurred by concerns of middle class consumption and export return to commercial farming, and lifted by government subsidy, won itself the moniker of 'Mexico's second Green Revolution'. As Barkin notes, by 1989, Mexico had become one the largest food-deficit countries in the developing world, having to import 40% of its grain requirements (Barkin 1990). The transformation in Mexican state agricultural priorities, toward an export-oriented agriculture policy, was of course incipient within the agricultural technics of the Green Revolution. But what makes the change striking is its abandonment of concerns with feeding the hungry, or concerns about equity, years before it became fashionable to do so (see also Mitchell 2002).

Mexico's internal transformations pre-dated larger, global shifts in the funding, approach and philosophy of the Green Revolution. Structural financial forces – debt and the departure from the gold standard precipitating a transformation of US power at the end of the 1960s and early 1970s – meant that other agencies were called upon to support the Green Revolution (McMichael and Reynolds 1994, McMichael 2009b). The financial crisis that began at the end of the 1960s was to inaugurate a seismic neoliberal shift in approaches to agriculture. The 1947–73 food regime was reconfigured as the crisis of US surplus post war grain production morphed into a far larger systemic financial crisis (McMichael 2009b). Part of the international structural reorganization of agriculture that followed the US inability to finance international agricultural ventures was an increasing prominence in the role of the World Bank.

It was under these circumstances that Robert McNamara, President of the World Bank, unveiled in a September 1973 address to the Board of Governors a new credit scheme to help the 100 million poor smallholder farmers around the world. The World Bank had previously been involved in agricultural support at a country level – providing, for instance, a USD 5 million loan to the Philippines in 1965 for credit to purchase agricultural equipment. But with the US reluctant to finance these ambitions directly and solely, the Bank vaulted into position as the Revolution's predominant funder in the 1970s.

With an aim to increase smallholder output at a growth rate of 5% per year, the World Bank would make credit available to the smallholder, without which 'he cannot buy improved seeds, apply the necessary fertilizers and pesticides, rent equipment, or develop his water resources' (McNamara 1973 cited by Feder 1976,

538). McNamara announced that in its next five-year lending period from 1974 to 1978, the World Bank would increase its agricultural lending activity from USD 3.1 billion to 4.4 billion, 70% of which would contain a 'component' for the smallholder. This 'small green revolution' aimed to propel the smallholder sector to the forefront of the Green Revolution, to serve as a direct rebuttal of critical claims that the Green Revolution only served larger, commercial farming units.

Of the range of criticisms garnered by McNamara's announcement, Ernest Feder's neglected yet systematic dismantling of McNamara's arguments is a *tour de force*. Feder observes that McNamara dispenses with any concern for the landless – whose numbers had increased as a result of the Green Revolution. Instead, McNamara's largesse was directed at poor peasants dealing with 'land scarcity'. Here McNamara assumes land scarcity when, as Feder points out, 'there are no countries where there is at the present time any scarcity of land whatever for the big landowners who control most of the farm land as well as access to virgin land. Land is scarce only for the poor peasants' (Feder 1976, 535).

While garnering little support from Feder, McNamara's approach found favour with governments ready to conflate an increase in production with a reduction in poverty. Many states were ready to follow a logic which stipulated that 'the poverty problem revolves primarily around the low productivity of the millions of small subsistence farms' (McNamara 1973), because in framing the problem in this way, productivity and efficiency, rather than access to the means of production, would be the biopolitical mode for an agricultural policy that could contribute to output but also to the power of the liberal state. The Philippines is a case in point. State-subsidized credit schemes legitimized the state by telegraphing a rural development that, on closer inspection, served only to maintain the status quo. As Feder points out,

...the mere existence of a credit programme offering low-cost loans to farmers conveniently provides its sponsoring government the means of gaining political and ideological support by publicizing its concern for the rural poor, without necessarily altering the prevailing structure of asset ownership, which is the main source of inequality. (Feder 1983, 144)

Under the guise of 'targeting' the poor, the Bank supported – through the credit, marketing and support services - the large-scale farmers favoured by the technics of the Green Revolution. Land reform, though mentioned by the Bank, on closer inspection took the form of suggesting that 'where much potentially productive land in the hands of big landowners lies uncultivated there may be widespread support for measures to turn it over to small farmers without a hint of an attack on rights to property' (World Bank 1974, cited by Feder 1976, 533).

The World Bank's funding of the public infrastructure needed to sustain the Green Revolution did not, however, survive the 1970s. The financial crisis of the 1960s, reinforced by the oil crisis that broke a month after the World Bank's small green revolution, became powerful constraints on the existing model of agricultural development. From the foment of the 1970s emerged neoliberal economic policies that could not countenance the interference of states in agricultural markets (Harvey 2005). These policies were – with exceptions (Kelsey 1995) – ones that met resistance from agricultural interests in the Global North. The US Farm Bill and EU Common Agricultural Policies are reminders of the limits to free market policies in a time of market triumphalism (Fukuyama 1992).

These policies were, however, transmitted through development policy to the continent that had become most dependent on international development loans following the petro-dollar fuelled credit boom and subsequent bust in the 1970s: Africa.

Although many African states were in the front line of the Cold War, the continent attracted a different kind of donor and multilateral aid agency attention from the Global North than did Asia or Latin America (Moyo 2008). In a 1981 assessment (the Berg Report, after US economist Elliot Berg, its principal author) the Bank suggested that the problems on the continent lay not in its attempt to recover from the horrors of European colonialism, nor from ongoing European, US, Chinese and Russian intervention, nor from crippling indebtedness, but from the failure of African governments adequately to manage their countries (World Bank 1981). African countries were among the most indebted and, as a result, multilateral institutions had considerable power in shaping the domestic policy agendas of these countries (McMichael 1996). The imposition of structural adjustment policies reshaped the government, and governance, of African states (Bromley 1995, Harrison 2004), with profound impacts in agriculture (Gibbon *et al.* 1993). The devaluation, systematic defunding of agriculture, and focus on export-oriented growth stalled African per capita food production, and substantially harmed the prospects of African agriculture, according to a recent independent World Bank evaluation (World Bank 2007b).

This is not to say, however, that agricultural research didn't happen. It did, and does. Two months after the Berg Report, a New York Times article suggested that 'a second Green Revolution, one that could provide custom-designed crops to meet specific emergencies quickly, would be a welcome event' (Steinhart 1981). Although lacking the science-fiction quality of 'custom-designed crops', research had been underway on more pedestrian varieties for Africa for quite some time. The Consultative Group on International Agricultural Research had, since its formation at the Rockefeller Foundation's behest in 1971, coordinated and organized research into Africa's cereal staples. Indeed, since at least 1991, when the CGIAR started explicitly to disaggregate the destinations for its research funding, Africa has been the continent toward which the largest slice of the budget has been directed (see CGIAR 1992 and other years).

Africa's experiences of restructuring were, then, the result of one of the central institutions responsible for funding the Green Revolution, at the beginning of the 1980s, wielding sufficient power to impose a neoliberal package of policies on the continent's governments. There has been sustained investment in agricultural technology in Africa. Yet narratives of African agricultural development, as we shall see below, consistently represent Africa as the continent passed over by the Green Revolution, a place lacking in the knowledge imparted by modern development institutions. It is true that African agricultural growth in the 1980s–1990s was achieved by increasing cultivated area, rather than through the use of Green Revolution technologies (Evenson and Gollin 2003). Green Revolution seed technologies were not beyond the ken of African departments of agriculture – but the Green Revolution subsidies of the 1960s were beyond the budgets available in the 1980s for most African departments of agriculture.

The language of development knowledge remains an important refrain in the development project. It is no accident that the World Bank now sees itself as a knowledge bank (Mehta 2001, Stone 2003). Beyond the Bank's being a central site of

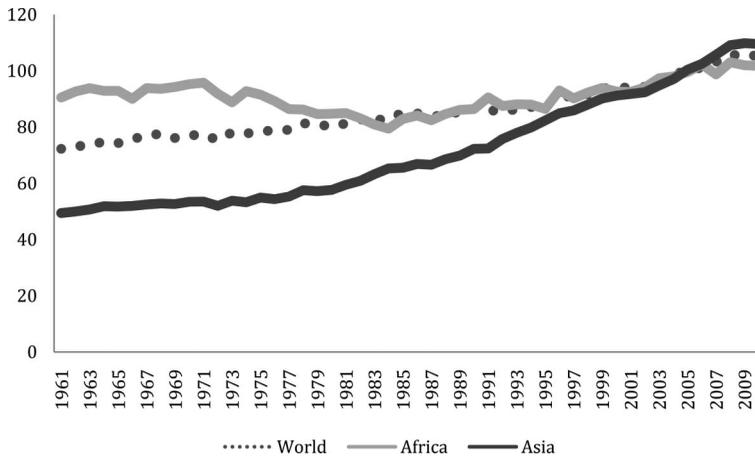


Figure 1. Comparative Net per capita Production trends for Africa, Asia and World (2004–2006 = 100)

the Green Revolution's truth regime, there is another reason for this shift. Under neoliberal economic policy, the kinds of state support that the original Green Revolution demanded were no longer thinkable uses of Bank funds. Within a decade, the idea that development assistance might be used for input subsidy, cheap credit or marketing boards had become almost comic within the community of development economists (Friedmann 2009). While funds for subsidies were scarce, money for restructuring advice was abundant. Knowledge about how governments might be scaled back, how property regimes pushed forward, how markets might be created was readily available as were loans to projects ready to exploit those markets (Weaver 2008).

The Bank's transformation in lending philosophy and practice over the course of the 1970s and early 1980s, from Keynesian to neoliberal, paralleled broader transformational change in flows of capital. Such transformations, it should be noted, are an inherent feature of capitalism. As Braudel notes:

the quality that seems to me to be an essential feature of the general history of capitalism: its unlimited flexibility, its capacity for change and *adaptation*. [...] [T]he essential characteristic of capitalism was its capacity to slip at a moment's notice from one form or sector or another. (Braudel 1982b, 433, emphasis in original, cited by Arrighi 2010, 4–5)

Arrighi points out that these capitalist transformations have appeared in historic cycles, with similar underlying features.

Marx's general formula of capital (M C M') can therefore be interpreted as depicting not just the logic of individual capitalist investments, but also a recurrent pattern of historical capitalism as world system. The central aspect of this pattern is the alternation of epochs of material expansion (M C phases of capital accumulation) with phases of financial rebirth and expansion (CM' phases). In phases of material expansion money capital 'sets in motion' an increasing mass of commodities (including commoditized labor-power and gifts of nature); and in

phases of financial expansion an increasing mass of money capital ‘sets itself free’ from its commodity form, and accumulation proceeds through financial deals (as in Marx’s abridged formula  $MM'$ ). Together, the two epochs or phases constitute a full *systemic cycle of accumulation* ( $M C M'$ ) (Arrighi 2010, 6).

Arrighi outlines the character of these cycles over time, and suggests where we might look for similar features today:

It can thus be seen that the expansion of capitalist power over the last five hundred years has been associated not just with inter-state competition for mobile capital, as underscored by Weber, but also with the formation of political structures endowed with ever-more extensive and complex organizational capabilities to control the social and political environment of capital accumulation on a world scale. (Arrighi 2010, 15)

The 1980s, argues Arrighi, were the moment of just such a transformation. Rather than see the emergence of an era of ‘flexible accumulation’ as radically new, Arrighi points to Braudel to understand “‘financial expansion’” as a symptom of maturity of a particular capitalist development’ (Arrighi 2010, 6). The phase of capitalism in which post-war Keynesianism was supplanted by neoliberalism ought not, then, to be seen as two distinct periods, but as features of one long cycle of accumulation, with political structures developing new organizational capacities over time to manage global capital accumulation.

This matters for a consideration of the Green Revolution. The heart of the this paper’s hypothesis is this: if Arrighi is correct, then the phase of the Green Revolution characterized by state support and investments to facilitate the transformation of money into commodities and back into money might more usefully be seen as a precursor for a financialized phase of agriculture which, it must be argued, characterizes the New Green Revolution. The state remains central in both moments, albeit in a different relation to agriculture and finance in a reconfigured hegemony. But, crucially, both original and New Green Revolutions only appear distinct – they are much more fruitfully understood as one Long Green Revolution.

This paper can only begin to outline the argument of continuity between the two phases of the Long Green revolution. To build the case, the rest of this paper will show the extent to which financialization matters in current pushes for agricultural development, and then will set the calls for a New Green Revolution in a context that shows both the continuities and the effects of a more financialised and biopolitical turn of the Long Green Revolution.

To do this, it’s worth returning to a signal moment in agriculture, contemporary with the Berg Report and the *New York Times*’s call for a second Green Revolution. In October 1981, Goldman Sachs paid an estimated USD 100 million for J. Aron and Company, a billion-dollar-revenue commodities trading firm. Many banks had made similar moves – Goldman Sachs’ was the fifth such merger involving banks and commodity traders in the preceding two months. The recession had dropped the price of commodities, and so the firms trading in them were relatively undervalued. At the same time, high interest rates had made attractive to the trading firms the access to capital that a bank could provide (Maidenberg 1981). Banking and commodity trading were well matched in the economic crisis of the late 1970s and 1980s. Over the ensuing decade, trading and associated financial product engineering would become the heart of the finance industry. But not only was

Goldman Sachs to buy in Lloyd Blankfein, a future CEO of the company, but they were to purchase a model for building the firm's power that would result, in Kaufman's words, in 'the history of food [taking] an ominous turn in 1991' (Kaufman forthcoming). In 1991, traders developed the Goldman Sachs Commodity Index. Although well over half the index is dominated by an energy component, it also tracks Chicago wheat, Kansas City wheat, corn, soybeans, coffee, sugar, cocoa, cotton, lean hogs, live cattle and feeder cattle (Standard and Poors 2012). In 1991, the Commodity Futures Trading Commission (CFTC) also increased the number of future contracts that selected financial institutions could hold, from 5000 to 130,000 contracts. In so doing, they reversed legislation dating from 1936, which restricted the trading of agricultural futures contracts to agricultural, rather than financial, entities (Kaufman forthcoming). As Ghosh has observed, the financialization of food deepened with the passing in 2000 of the 'Commodity Futures Modernization Act [which] effectively deregulated commodity trading in the United States, by exempting over-the-counter (OTC) commodity trading (outside of regulated exchanges) from CFTC oversight' (Ghosh 2010). The deeper point amid this shift can be easy to miss. In the rise of commodity markets and financial instruments as tools for managing uncertainty, and in the retreat of the state's responsibilities for social insurance, both the terms and the guarantors of the social contracts around food have changed.

This process of financialization in agriculture, noted by a range of commentators, proceeded through the 1980s and 1990s (Lohmann 2009, Clapp and Helleiner 2010, Tang and Xiong 2011, Magdoff 2012, UNCTAD 2011). The dismantling of international marketing agreements, such as the International Coffee Agreement in 1989, preceded the full liberalization and subsequent financialization of a range of commodities under the Uruguay Round of the General Agreement on Tariffs and Trade (Newman 2009). The World Trade Organization's Agreement on Agriculture cemented neoliberal doctrines in agriculture, even if in the Global North these doctrines sat uneasily with ongoing transfers to agribusiness. While the US continued many of these transfers through arcane evasions of international law so as to appear compliant with the WTO (Bello 1994), the 1996 Farm Bill ended government responsibility for domestic grain reserves. The result was that, by the time of the second Gulf War, 'the United States was holding eight hours worth of soybeans and five hours worth of corn' (Kaufman forthcoming). The political regimes of public property ownership, insurance, and risk management were being transformed to allow for greater capital accumulation. The result can be gauged by a recent opinion offered by Rajiv Shah, the current administrator of USAID:

We are never going to end hunger in Africa without private investment. There are things that only companies can do, like building silos for storage and developing seeds and fertilizers. (Strom 2012)

This is an almost wholesale reversal of the views about the role of the state argued above by Willam Gaud, Shah's predecessor, half a century earlier, and a view that – given recent experiences around international food prices – suggests a triumph of ideology over necessity (for more on grain storage see the instructive Bruins and Bu 2006). The role of the private sector in this phase of the Long Green Revolution is parasitic on the accumulated resources of the previous phase. The privatization of grain reserves involves the transfer of power over the food system from public to

private hands, over the control of resources built and sustained by state management of the food system. This is reflected in the wider ‘power grabs’ associated with everything from grain reserves to land grabs (Borras *et al.*, 2012).

These power grabs have been accelerated by events such as the war on terror and war on drugs, which have been alibis for an increased concentration of power in private hands (Kerssen 2012). Yet note, too, that even something as abstruse as the process of financialization was characterized by resistance. Although often forgotten today, a 1995 proposal within the Organization for Economic Cooperation and Development (OECD) to push financialization to new heights, the Multilateral Agreement on Investment, was foiled partly through its own internal political failings, but also because of successful international mobilization against it by a range of NGOs (Kobrin 2012). By April 1998, the proposal had been abandoned. But the push for a reconfigured approach to agricultural development, and a re-imagining of the roles of property and finance within agriculture, has continued.

#### **4.1 The New Green Revolution in context**

By century’s end, the world had changed dramatically since the original Green Revolution’s conception. Most significantly, the threat of communism had been extinguished with the fall of the Soviet Union. Net per capita food production was continuing its rise. The number of undernourished in 1995–97 had fallen below 800 million for the first time since records began in the 1960s (FAO 1999, 2011a). Nonetheless, 1997 saw the publication of a book arguing that the original Green Revolution had ‘bypassed’ small farmers (Conway 1997, 44), that environmental setbacks had been serious, and that nonetheless a new generation of agricultural technology was necessary to meet the food needs of future generations. Gordon Conway’s call in *A Doubly Green Revolution* was for an ecologically-sound replay of the first Green Revolution, but one that held firm to the promise of uplifting small farmers. It was a call that resonated within the development community, even spurring a rhetorical arms-race: Ismail Seregedin, then head of the CGIAR, called in 1997 for a ‘thrice green revolution: green for productivity, green for environmental sustainability, and green for increased income as the entry point to improved living conditions’ (Holt-Giménez 2002, 1). Daño (2007) helpfully explains the reasons for the resonance of the call for a New Green Revolution by observing who the author of *A Doubly Green Revolution* was. The book was published a month after Gordon Conway was elected to the post of President of the Rockefeller Foundation, and five months before he started his duties there.

Conway’s success in nurturing a program for agricultural research in Africa at the Rockefeller Foundation, and in normalizing the history and rationale behind it, can be seen in a more recent 2006 text from the Rockefeller Foundation entitled *Africa’s Turn: A New Green Revolution for the 21<sup>st</sup> Century*. After presenting a potted history of the Green Revolution remarkably similar to that at the beginning of Section 2 above, the Foundation offers this summary of the first Green Revolution:

It was, at its origins, a strategic act of philanthropy, enlisting experts, government, and ultimately local scholars and farmers in a carefully wrought partnership that grew geometrically – and deliberately – over many years. Science, donations, and market

forces all played an indispensable part; but all were guided, in the first instance, by a philanthropic plan. (Rockefeller Foundation 2006, 4)

That plan, according to the Foundation, though not according to its archives, was hatched thus:

The idea started with a casual comment in 1941 by Henry Wallace, then Vice-President of the United States [and founder of the Pioneer Hi-Bred seed company, now a subsidiary of DuPont], to Rockefeller President Raymond B. Fosdick: Increase the yield per acre of corn and beans in Mexico, and you would do more for the country and its people than by any other means. (The same might now be said, 60 years later, about crops in Africa.) (Rockefeller Foundation 2006, 2)

Note the absence of history, the misremembering of the Rockefeller Foundation's initial interest in Mexico and the erasure of the Foundation's anti-communist, pro-US-state thinking in the original Green Revolution. Even within today's updated history, there is an elision; increased yields, and the technologies used to produce them, were aimed not at the small farmers celebrated by Conway, but at commercial ones. There was never a suggestion of a compact between small-scale farmers and philanthropists at the outset of the Green Revolution. The goal, tiresome though it is to restate, was the management of class tensions through an increase in the food supply and the management of this food supply to suppress urban hunger. Presenting the Green Revolution as the successful and sole-minded attempt to eradicate hunger is simply untrue. In this misremembering, foundations try to cloak themselves in a blanket of, for want of a better word, philanthropy. This is redolent of the first Green Revolution, of course. But there are reasons to see the second time as farce.

To be fair, not everyone in the world of philanthropy is delighted with the resurrection of the Green Revolution. In a 2009 interview Roy Steiner, the deputy director of agricultural development at the Gates Foundation, winced at the choice of name for AGRA, feeling that it didn't adequately capture the lessons learned from the failures of the first Green Revolution (Patel *et al.* 2009). When one reads the language of some of those involved in the New Green Revolution, it sometimes appears that in fact lessons have been learned. The crass language of *Africa's Turn* isn't entirely representative of the philanthropic genre. At the 2009 World Food Prize, an award founded through a partnership between Borlaug and General Foods in 1986, the following remarks were offered by Bill Gates:

The fact is, we need both productivity and sustainability – and there is no reason we can't have both. Many environmental voices have rightly highlighted the excesses of the original Green Revolution. They warn against the dangers of too much irrigation or fertilizer. They caution against a consolidation of farms that could crowd out small-holder farmers. These are important points, and they underscore a crucial fact: the next Green Revolution has to be greener than the first. It must be guided by small-holder farmers, adapted to local circumstances, and sustainable for the economy and the environment. Let me repeat that. The next Green Revolution must be guided by small-holder farmers, adapted to local circumstances, and sustainable for the economy and the environment. The last thing anyone should do is create short-term gains for poor farmers that have long-term costs for their children. That's why our foundation works closely with local farmers' groups. And that's why we are one of the largest funders of sustainable approaches such as no-till farming, rainwater harvesting, drip irrigation, and biological nitrogen fixation. Our approaches are customized for diverse crops,

different climates, and small plots of land. We're responsive to the needs and recommendations of the farmers themselves. And we respect the expertise of women farmers, who do most of the farming in Africa. The second principle – the value chain – guides our overall strategy. Farmers need new seeds, of course. But they tell us they also need new tools and training; they need access to new markets to sell their surplus; and they need stronger organizations that can represent their interests. (Gates 2009)

This does rather sound as if key criticisms have been heard, yet much is unsaid. It is striking that Gates calls for stronger organizations to represent farmers' interests. Such organizations exist worldwide, such as the International Federation of Agricultural Producers (IFAP) and La Via Campesina, and have for decades (Desmarais 2003, Edelman 2003, Martínez-Torres and Rosset 2010). Not all farmers' organizations are the same, however. As Borras observes, the class allegiances of farmers, and the preponderance of smallholder farmers within La Via Campesina, leads to distinct politics:

IFAP tends to form alliances with similar minded entities that are committed to the same issues of productivity, agribusiness, trade and the like. For example, IFAP works closely with agencies within the Consultative Group on International Agricultural Research (CGIAR) network, while Via Campesina stays away from CGIAR and works with independent alternative research institutions such as those promoting agroecology. (Borras 2010, 789–90)

The kinds of policy that La Via Campesina advocates are not consonant with those of a second Green Revolution. So, while smallholder farmers are asked to guide the second Green Revolution, it seems as if they are asked to do so in ways that conform to an agenda that has already been written. Their voices matter, but only when they say what they ought.

This schizophrenic representation of smallholder farmers, as both vocal stakeholders and mute victims, both pioneers of the frontier of agricultural development and antiquated remnants of a nineteenth-century agrarian economy, is common to the philanthropic and development establishment. The tension is most visible in the World Bank's 2008 World Development Report on Agriculture for Development, in which smallholder farmers, and the resources they deploy, are presented as a missed opportunity for investment for development (World Bank 2007a). The report acknowledges the high social return on agricultural development assistance, while decrying the inefficiency of smallholder farms compared to larger-scale commercial farming (Patel 2007a, Amanor 2009, McMichael 2009a, Oya 2009a, b, Woodhouse 2009).

Those most connected to the value-chain principle that Gates celebrates are the private sector, and in particular the large-scale private sector. In the New Green Revolution, the role of the private sector is far more central than that of the state or of the gifts of science shared by philanthropic investment. The Rockefeller Foundation expanded its Green Revolution in Africa program under Conway, supporting hybrid rice efforts but also helping to implement biosafety regulations for the use of biotechnology on the continent. By building and nurturing its own agricultural technology program, the Rockefeller Foundation was in a position, in 2006, to partner with the Bill and Melinda Gates Foundation. The offspring of this philanthropic encounter was The Alliance for a Green Revolution in Africa, born later that year, incorporated as an NGO in the US, but operating out of Nairobi (Food First 2009). The board of the Alliance initially included Raj Shah, a Gates

Foundation executive who now fills Gaud's shoes as USAID administrator, with AGRA presided over by Gary Toenniessen, then Director of the Rockefeller Foundation's Food Security programme. At the time of this writing in early 2012, the 10-person board is a mix of two African telecommunications entrepreneurs, two African agricultural research civil servants, two Gates Foundation employees (one of whom now runs the Walmart Foundation), two Rockefeller representatives, a professor from Wageningen, and Kofi Annan, who has been the Chair of the Board since 2007.

As Daño notes (2007), the personnel drawn to implement AGRA's vision were drawn largely from the private sector, and the world of proprietary biotechnology in particular. As I have argued elsewhere, it is perhaps unsurprising that such a model of privatized knowledge-driven change should appeal to a man who built Microsoft with similar tools (Patel 2009). In inculcating such a model on an entire continent, Gates found allies in the international development banking community, the New Partnership for Africa's Development (NEPAD), and other foundations, notably the Yara Foundation – associated with the Norwegian fertilizer giant Yara. But none have been so ready to reap the rewards as the private sector, and this private sector couldn't have imagined a better builder of bridges between its needs and the philanthropic infrastructure required to support it than William Gates III.

#### 4.2 *The private sector*

Just like the previous Green Revolution, tropes of population play in current debates. McMichael (2000a, 26) cites a caption on Monsanto's homepage: 'Guess Who's Coming To Dinner? 10 billion people by 2030'. *Guess Who's Coming to Dinner* is a 1967 film concerning a white daughter bringing her black boyfriend home to meet liberal parents whose racial tolerance has never been tested (Kramer 1967). Monsanto use the phrase, together with ideas of migration and teeming populations of people of colour, to stoke racially inflected concerns over the urgency of action in increasing food production (rather than, for example, distribution) (Patel *et al.* 2005). Again, such concerns aren't new. The first Green Revolution was concerned with fecund people of colour, too. The firms named in 1968 Senate testimony around the Green Revolution were not agricultural but pharmaceutical, because they were the vendors of birth control needed to reduce the number of hungry mouths in the Global South. The differences today lie in the role of the state, and the kinds of enterprise interested in transforming the food system in search of profit (Bereano and English 2010, McMichael 2000a).

Consider, as an example of the New Green Revolution, the model for the dissemination of technologies sold by Monsanto (another key partner in AGRA, and one whose stock is held by the Gates Foundation). It doesn't simply involve a revolving door between the corporations and public bodies tasked with rural development. There is very consciously an attempt to bring the private sector in at a meso-level that was once the provenance of the state. One of AGRA's earliest commitments was to an 'Agro-Dealer Development Programme', which involved the training of at least 10,000 'well-functioning agro-dealers', with the hope of instigating a capitalist farming revolution in Africa. By 2009, AGRA reported that it had trained 9200 such dealers, who had sold over USD 45 million worth of seed, fertilizer and pesticide (AGRA 2012).

The broadbased spread of market capitalism is an explicit goal of the project of the Green Revolution in Africa. One of the original entities spawned by AGRA was a USD 120 million loan facility, administered by KPMG Development Services Limited and funded by a range of European development agencies together with Australia, with a goal to 'encourage private sector companies to compete for investment support for their new and innovative business ideas' (AECF 2012). The Africa Enterprise Challenge Fund has faced some challenges. One project in Ghana has followed Gates' twin principles of 'public-private partnership' and 'value chain development', but achieved poor results. Farmers were reluctant to participate in an association the membership of which involved clearing virgin land on which to farm, and poor weather and waterlogged soil meant that output was at half the expected levels. But a central problem, the project team reports, was that 'the majority of farmers in the project locations viewed agriculture as a way of life and not a business. One of the main objectives of the Association is therefore to reorient the farmers to business. It is doing this by providing quality inputs and extension services' (Guyver and Maccarthy n.d., 5). Yara Ghana, a subsidiary of the Norwegian giant, did indeed provide these services, yet farmers clung to pre-capitalist notions of their lives and economic activity. The attempt to correct this is ongoing.

There are entities keen on making this happen. Consider the connection of a Washington DC-based organization called the Citizens' Network for Foreign Affairs (CNFA), a pro-market NGO with extensive experience in bringing markets to the former Soviet Union. They won a three-year USD 13.1 million grant from the Agro-Dealer programme to work in Kenya, Malawi and Tanzania. At the same time, in a joint public-private partnership project with USAID, AGRA, Monsanto, and DuPont, CNFA was tasked with managing the commercial seed and distribution networks of the West African Seed Alliance, a USD 60 million programme, funded until October 2012. In 2009, CNFA described their new agricultural work in Uzbekistan as complement[ing] USAID's strategic objectives of developing value chain linkages' (CNFA 2009).

What emerges from this examination are the increasingly tight links between philanthropic foundations, the private sector, and the state in international agriculture in a world in which US neoliberalism has done its best to install itself as the only viable mode of economic and political organization (Fukuyama 1992). Yet the US is not the only economic power, nor possessed of the only economic model. Although there is no longer a Cold War in which a New Green Revolution might be an alternative to a Red one, the Pentagon, State Department and US Capitol still think geopolitically in a multipolar world. There remains an intensification of the search for surplus value simultaneous with the management of crisis, if no longer directly in service of quelling urban social discontent in US client countries. Certainly the logic of food production, population and unrest matters today – former President Ben Ali's last act before fleeing Tunisia was to drop the price of bread. In the absence of the war on communism, the main legitimation for the New Green Revolution is humanitarian and, explicitly, pro-smallholder. Note that the sincerity brought to the task of fighting hunger in Africa, deeply felt by all who set themselves the task, doesn't alter this analysis. No one wants more hunger. Yet the moral purity of its goal masks the sordid means by which the New Green Revolution seeks to achieve it.

Further, the humanitarianism obfuscates a question posed by Arrighi's analysis. Recall that the historic cycles of capital accumulation are spurred by competition

between corporations, but also by that between states. An appeal to feeding the world appears to transcend concerns of statehood, yet the New Green Revolution remains tied to geopolitics. Perhaps most telling, concerns about unrest and food prices now come from the US's economic competitors. The Chinese government, for instance, is concerned about food price inflation, and its domestic consequences (McBeath and McBeath 2010), and is one among many states aggressively looking at ways to secure food for its citizens by 'opening up' markets in hitherto untapped territory. Herein lies an important continuity from original to New Green Revolution. The Green Revolution always involved the creation and shaping of markets with the geopolitical involvement of nation-states. Although couched in philanthropic terms, the New Green Revolution represents a new attempt, largely through the instruments of U.S. based hegemony, to control the power to commodify. The rising global importance of China, whose EXIM bank lends more to Africa than the World Bank (Cohen 2011) – though see Brautigam (2011) for broader analysis of aid data – prompts deeper questions about the character of agricultural technology and development aid at a time of waning US hegemony. An enquiry beyond the scope of this particular essay, though within the scope of the research agenda proposed by it, is the extent to which international agricultural development and private sector investment in agriculture is linked specifically to national priorities as the first Green Revolution was. Anecdotal evidence suggests a 'new scramble for Africa', in which the interests of states and of private sector firms with some attachments to that nation often align. In response to Chinese investment, the US is advancing soft power in Africa and building AFRICOM, a combined joint-forces headquarters with particular interests in protecting new finds of mineral and oil wealth (Keenan 2008).

Suffice it to say, however, that the New Green Revolution provides philanthropic reasons for renewed commodification. This cuts both ways: commodification also transforms philanthropy. In a recent opinion piece by the CEO [sic] of The Nature Conservancy, an environmental NGO with assets in excess of USD 6 billion (The Nature Conservancy 2012), Mark Tercek offered a vision of a 'smarter world food system' developed in partnership with Cargill and General Mills (Tercek 2012). An example of this partnership is the NGO's role in ensuring Brazilian soy farmers' compliance with forestry laws. The poor performance of civil society monitoring around 'responsible soy' has been noted by Dauvergne and Neville (2010) and is best understood as what Logan and Wekerle (2008) term the 'neoliberalization of environmental governance'. The transformation of environmental NGOs from petitioning governments for change to becoming the toothless goads for less rapacious behavior, from state advocacy to state surrogacy, can be understood through Arrighi's analysis as 'extensive and complex organizational capabilities to control the social and political environment of capital accumulation on a world scale' (Arrighi 2010, 15). NGOs are not the only entities reconfigured by increased financialization. States themselves are subject to similar pressures to provide managed opportunities for capital accumulation, as evinced by the rise in prominence of land markets as a central issue in contemporary agricultural development.

### **4.3 Land markets and land grabs**

History counts neither the dropped jaws nor raised eyebrows at the 2000 anniversary Nobel lecture in Oslo when Norman Borlaug praised a country for adopting the

Green Revolution that had a principal target of that revolution: China (Borlaug 2000). Yet, in successive comparisons, China was lauded for its increased production, its hunger abatement and its economic growth. Borlaug was untroubled by the historic threat of communism as the motivation for the Green Revolution. And while increased production in China, like proper Green Revolution countries, relied on state subsidy and coercion, it also rested on land reform, a feature avoided by the Green Revolution. World Bank economists Ravallion and Chen argue,

It would not be unreasonable to presume that the [Chinese] agrarian reforms around 1980 accounted for the bulk of rural poverty reduction in the first half of the 1980s, which ... accounted for roughly three-quarters of the total decline in the national poverty rate over 1981–2001. (Ravallion and Chen 2007, 25)

Similar reports from Zimbabwe tell of rural lives improved without market, but with state, forces (Moyo 2011, Scoones *et al.* 2011). What makes China and Zimbabwe anomalous is, of course, the prominence of state-led agrarian reform against market-led agrarian reform (Borras 2003). And what characterizes neoliberal agrarian change is precisely an insistence on the fungibility of land as a *sine qua non* of agricultural progress.

A confidential version of the Gates Foundation Agricultural Development Strategy Executive Summary points to a vision of agricultural change that Carl Sauer would recognize from the Rockefeller Foundation's adventures in 1940s Mexico:

In order to transition agriculture from the current situation of low investment, low productivity and low returns to a market-oriented, highly-productive system, it is essential that supply (productivity) and demand (market access) expand together... [this] involves market-oriented farmers operating profitable farms that generate enough income to sustain their rise out of poverty. Over time, *this will require some degree of land mobility* and a lower percentage of total employment involved in direct agricultural production (Gates Foundation 2008). (AgraWatch 2011, emphasis added)

The call, in the name of efficiency and productivity, to reduce the rural population involved in agriculture is one echoed by the World Bank with the same Orwellian language of 'land mobility' – Orwellian because it isn't the land that moves, but the people working on it. The role of the nation-state in this context has shifted from the first Green Revolution. In the Philippines, for instance, conservative land reform required local markets in land. In India, such markets functioned too. In Mexico, land reform had been a galvanizing concern for the seeding of the Green Revolution there. In all cases, however, there are restrictions on the ownership of agricultural land by foreign nationals (Mexico being the least stringent of the three examples). The opening of land markets to international buyers is a novel feature of this phase of international agricultural development policy. Internationalizing markets by suspending nationality as a concern in the state's calculus of property management, although consistent with the liberal economic philosophy behind international trade treaties, has brought controversy. Spurred by the 2008 food crisis, international investment in land has increased dramatically. GRAIN (whose data provided the data for subsequent World Bank analyses) has detailed land grabs

involving 56.6 million ha worldwide (Cotula 2012, 3). Land is a frontier not only for commodification, but also its subsequent financialization. Perhaps one of the greatest contradictions in the new era of capital accumulation, and one that raises questions around the inter-state character of capitalist competition, is that the investment within state borders increasingly comes from sovereign wealth funds. These are investment portfolios run for profit by states themselves, and are an important driver of ‘land grabs’ (Cotula *et al.* 2009).

The World Bank has equivocated on the issue of ‘land grabs’. Its 2010 report on the issue is entitled *Rising Global Interest in Farmland: Can it Yield Sustainable and Equitable Benefits?* (Deininger *et al.* 2010). The authors do their best to bend the data to the report’s subtitle. Although the record of land grabs has to date been one of rarely mitigated disaster, the report’s authors *can* imagine a paradise in which land grabs might yield sustainable and equitable benefits – in the same way one can imagine the moon is made of cheese – and so the authors answer their question in the affirmative. Yes, rising global interest in farmland *can* yield sustainable and equitable benefits, even if it doesn’t at the moment.

Bill Gates himself has shared his views on the land reforms, engaging in almost Clintonian wordplay with the idea of land grabs, pointing out that:

It’s not actually possible to grab the land. People don’t put it on boats and take it back to the Middle East. If we could have clear guidelines there could be more land deals and overall it could be very beneficial. . . The truth is the person who is most at risk on a land deal is the person who is putting the money in. (Thuburn 2012)

A range of commentators have, in the pages of this journal, suggested reasons why Gates’ logic might not be as robust as he hopes. The greatest risks will likely be borne by the women displaced from and threatened by denial of access to resources associated with the newly grabbed land. As Behrman and colleagues note, throughout the process of acquisition, gender inequities in bargaining power, access to information, public goods and resources can leave women worse off from the moment the land beneath their feet is sold, to the period of building new homes and livelihoods in the areas to which they are displaced by investment (Behrman *et al.* 2012). Of the groups most affected by land grabs, women rank highest, even in the World Bank’s own attempts to analyse and justify these markets (Deininger *et al.* 2010). Behrman *et al.* summarise:

The available evidence thus far indicates that large-scale land deals have tended to overlook the rights, needs and interests of women and as a result have tended to aggravate gender inequalities in affected communities. Whether or not women and men will benefit from future land deals depends in part on the rights and responsibilities women and men have prior to the land deal and in part on how the implementation of the land deal will build upon, improve, or distort these roles and responsibilities. (2012, 73)

That the real world has failed consistently to live down to World Bank economists’ expectations over the benefits of these exchanges partly explains why in a more recent report, Klaus Deininger, Lead Economist in the World Bank’s Development Research Group, together with his colleagues suggests that rather than prevent foreign acquisition of land (a policy that might be skirted by savvy foreign investors using locals as intermediaries),

A more appropriate policy response would place priority on efforts to improve land governance – by recognizing local rights and educating local populations about the value of their land, their legal rights, and ways to exercise those rights. . . . Also, given the size of the phenomenon and the dangers it can pose, a global effort is needed to document cross-national investments in coordination with domestic authorities. . . . which should be led by a suitable multilateral. (Arezki *et al.* 2012, 49)

Thus will the perils of land grabs be dodged: not by the decommodification of land, but by the capitalization of the peasantry. In its logic, the World Bank takes Hernando De Soto's 'Mystery of Capital' out of the city, and brings its many flaws to the countryside (De Soto 1989, Skidelsky 2000).

Again, central in this discussion is the orchestration of the state, development institutions and philanthropists in support of a regime of accumulation by dispossession, achieved through the creation of markets in land. Yet the World Bank's moves toward a generalized peasant capitalism resonate well with Gates' thinking. In *Creative Capitalism* – a title that critics have mocked for what it implies about ordinary the lack of creativity in more everyday varieties of capitalism – Gates argues that:

The world is getting better, but it's not getting better fast enough, and it's not getting better for everyone . . . Why do people benefit in inverse proportion to their need? Market incentives make that happen . . . We have to find a way to make the aspects of capitalism that serve wealthier people serve poorer people as well. . . . To make the system sustainable, we need to use profit incentives whenever we can. At the same time, profits are not always possible when business tries to serve the very poor . . . The challenge is to design a system where market incentives, including profits and recognitions, drive the change. I like to call this new system creative capitalism – an approach where governments, businesses, and nonprofits work together to stretch the reach of market forces so that more people can make a profit, or gain recognition, doing work that eases the world's inequities. . . . our greatest impact is . . . when we show how to use technology to create solutions. This kind of creative capitalism matches business expertise with needs in the developing world to find markets that are already there but are untapped. . . . this is a worldwide movement . . . (Gates in Kinsley *et al.* 2008, 9–15)

In a yen for capitalism, and an abnegation of analysis of how it operates, the process of accumulation of dispossession is legitimated.

#### 4.4 Gender

As previous work suggests (Patel *et al.* 2009), the Gates Foundation has foundered in its thinking about women and, in this, follows broader failures in the international development establishment (Razavi 2012). A recent update to its agricultural development strategy, the Gates Foundation offered this observation:

In sub-Saharan Africa, and South Asia, women are vital contributors to farm work, and typically in charge of selecting food for, and feeding their families. Yet compared to their male counterparts, women farmers are less productive and unable to reach their full potential. Yields on women's plots are typically 20 percent to 40 percent less than men's, putting rural families and communities at risk of not having enough nutritious food to eat or any extra to sell at the market. (Gates Foundation 2011, 3)

Setting aside the productivist ideas here (Burton 2004), we might ask why it is that women's full potential isn't reached (Folbre 2009). An answer involving power

and patriarchy, and its consequences for rural women and girls' lives, might be put forth, but instead the foundation offers this:

The reason for this gender gap is that women have less access to improved seeds and other inputs, training, and markets. This gap has real consequences: households are less productive, new approaches and technologies that could increase the amount of food they grow are less likely to be adopted by women, and children in poor household are undernourished. (Gates Foundation 2011, 3)

Few analysts of gender would vouchsafe that gender gaps are caused by a lack of access to improved seeds. Differential access to agricultural inputs are a symptom of an inequality in power that keeps more women hungry than men, women poorer than men, with differential access to land (Agarwal 1994) and education (Klasen 2002), shouldering the triple burden (Moser 1989), and so forth (Behrman *et al.* 2012). Yet here it appears that by fixing a single symptom, one might address a cause. It's wishful thinking of course, but it's repeated often enough in the overview, with 'gender gaps' understood as differential access to fertilizer and inputs so frequently that one might almost begin to believe that patriarchy waits to be overcome with a bag of fertilizer and a few magic beans.

This is a point of continuity between original and New Green Revolutions. The household remains as black a box today as it was under the original Green Revolution. Smallholders, too, are poorly specified – one is led away from awkward class-filtered questions like asking whether the people displaced by 'land mobility' were not perhaps former and still aspiring smallholders. Indeed, as recent analysis of agricultural technology suggests (Witt *et al.* 2006; Richards *et al.* 2010) the category of 'the poor' itself seems to help the cause of agricultural technology, rather than the other way around (Glover 2010).

#### 4.5 Nutrition

The intertwining of state, philanthropy and academy continues just as it did under the original green revolutions (Ross 2005), with a variety of disciplines drawn to the flame of Foundation funding, especially in the twilight of public education resources in public universities in the Global North (Moyo *et al.* 2009). The financialization of agriculture deepens through the invention of technologies to turn agricultural production into fuel – an extension and deepening of trends within agricultural capitalism (Borras *et al.* 2010, White and Dasgupta 2010). But in concluding this essay, I want to focus on a subject that might initially seem a little removed from the central concerns of the Green Revolution: nutrition. The power to commodify has a corollary – the power to diagnose and treat problems arising from the exercise of commodification. There is nothing inherent within an era of financialized capital accumulation that necessitates a particular character of transformation. The transformation that has emerged in the neoliberal era has been conditioned by the politics that preceded it. Margaret Thatcher's 'there is no such thing as society' (Margaret Thatcher Foundation 1987) is the victory slogan of the neoliberal battle against socialism. It isn't unnecessarily Hegelian to notice that the neoliberal program is one that is markedly individual because of the collective politics it rejects. The Green Revolution that began as a tool for opposing socialism has been reconstituted with contemporary, and particularly individualized, political ideas and

concerns. It is in the domain of nutritional intervention that these individualizing politics are laid bare.

Central not to the Alliance for a Green Revolution in Africa, but to the Foundations behind the Green Revolution, has been a constant parallel track of investment in agriculture under the rubric of nutritional improvement. Nutrition strikes me as an exemplary case of biopolitics used in the service of capitalist agriculture. It is of course true that bodies have been damaged by poverty. Indeed, some of that damage can be traced to the Green Revolution itself. Yet common to the approach presented by foundations is a discourse that enables the treatment of the symptoms of poverty while postponing or even ignoring the deeper causes of that poor diet. The rise of nutritionism pulls the locus of policy action toward the individual body, rather than on the relations that humans have to one another, and the world around them (Scrinis 2008). In conceding this biopolitical shift, one loses the possibility of broader structural change. When *La Via Campesina*, for instance, demands change, it advocates for comprehensive agrarian reform, not 'vitamins for all'. Yet one of the consequences of the technics of the New Green Revolution has to normalize a policy approach based on deficits in blood chemistry, rather than inequalities in power. It is in this sense again that one can understand the Green Revolution's discourse and trajectory as an anti-politics machine, and one that matters for current events.

Again, it is possible and necessary to understand the bodily privations that have resulted from agrarian change. One need not throw out the baby of biochemical analysis with the biopolitical bathwater As Hardt (2011) notes, biopolitics can be a means of resistance. 'Biopolitics' is not a synonym for a kind of personalised totalitarianism. It is a terrain in which governance operates, one that is never total, and in which resistance is always possible. The food system has examples of resistance that takes bodily privation seriously, but that seeks to end that privation through systemic change (see e.g. Patel 2011b).

It is also important to understand that the domains of biopolitics are constitutive of, and constituted by geopolitics. So, for instance, it is reasonable to point to the changes in diet that resulted from the Green Revolution. While over 850 million people suffer from chronic hunger, two billion people suffer from malnutrition, with around six million of the 10 million deaths of children under five in developing countries related to micro-nutrient deficiency (Frison 2008). Around two-thirds of the world's undernourished live in Asia, the continent where the Green Revolution claims its greatest success in terms of yields (Rosset 2000). Furthermore, we are now also seeing an increasing incidence of 'diseases of affluence' in the developing world, with increasing rates of Type 2 diabetes, heart disease, cancers and obesity amongst poor people (Frison 2008).

One of the ways in which the Green Revolution has undermined human nutrition was through its displacing of nutritionally rich food crops with commodity crops. Traditional micro-nutrient rich crops such as pulses, vegetables and fruits have been substituted for cereal grains which have a much lower nutritional value. Whole cereal grains contain relatively high levels of anti-nutrients which reduce the body's absorptive capacity for micro-nutrients (Welch and Graham 2000). Yet the production of beans and pulses has declined significantly as land has been given over to the cultivation of cereals (Conway 1997). In south India, this decline in the production of pulses has been accompanied by an increase in iron-deficiency anemia in pre-menopausal women (Welch and Graham 2000).

Thus, it is possible to use nutrition data, such as the fact that 48% of stunted children live in India (Save the Children 2012), to agree with Jennifer Bryce and colleagues that vitamin deficiencies and poor sanitation are among the reasons for this malnutrition (Bryce et al. 2008), but to suggest very practically that even if one's goal is not to prevent the poverty that spawns this malnutrition, but merely to treat its symptoms effectively, the solution lies not in bags of vitamins and bars of soap, but massive investment in public healthcare systems. (Sonia Shah's (2010) analogous discussion of the failure of the Gates Foundations attempts to eradicate malaria for want of investment in public healthcare systems is instructive.)

Dixon observes that '[t]he social history of nutrition politics reveals that food regimes were in part based on the trade in human energy and health as much as a trade in commodities and capital' (Dixon 2009, 324). Yet it can surely be no accident that the Gates Foundation aims to tackle modern problems in Africa's food system not under the aegis of its New Green Revolution, but under concerns about public health. This implies a shift in Green Revolution institutional forms to a more specifically biopolitical mode of intervention than the first Green Revolution. This is not to say that public health is itself a bankrupt idea, but to be reminded that it is a distinctive mode of management and governmentality that allows concerns about poverty and injustice to be recast as bodily problems of nutritional inadequacy. Foucault's observations about the liberal state, and the terms in which it can conceive of problems and political solutions to those problems, match this picture well.

#### 4.6 *A new hope*

That 'things needn't be this way' is a standard response to the Green Revolution and its consequences (Daño 2007, Bereano and English 2010). Indeed, it is precisely the demonstration of another world being possible that disrupts the other Thatcherite neoliberal slogan 'there is no alternative' (Fisher and Ponniah 2003, Holt-Giménez 2008). The food crisis of 2008 has been analysed as the culmination of trends in agricultural development linked to financialization, neoliberalism and the failure of the Green Revolution (Holt-Giménez and Patel 2009). In response to such critiques, one commentator suggested,

romantics have portrayed the food crisis as demonstrating the failure of scientific commercial agriculture, which they have long found distasteful. In its place they advocate the return to organic small-scale farming – counting on abandoned technologies to feed a prospective world population of nine billion.

The 'romantic attachment' to peasant agriculture might well have come from Harvard's Magelsdorf in the 1940s. It comes instead from Oxford's Collier (2008). Calls for alternatives are, however, also to be heard from proponents of the New Green Revolution itself where 'sustainable intensification' (Reardon *et al.* 1999) or, more honestly, agricultural modernization (Kydd and Dorward 2001) is offered as a response to the unsustainable, backward way that farmers, particularly in Africa, farm.

It is, however, possible to reject the Manichean logic of 'disaster or capitalist sustainability' by looking at the evidence. Claims that, in the absence of the Green Revolution, starvation would have been rampant can be countered by observing both that starvation continues, and also that there are models for agriculture and

food distribution that address hunger, landlessness, poverty, ecological sustainability and gender inequality in ways that the Green Revolution never could.

Had the Green Revolution not happened, Evenson and Gollin tell us, crop yields in developing countries would have been 19.5–23.5% lower, requiring developing countries to increase the area under production (with attendant environmental consequences) and import between 27 and 30% more food. Food prices meanwhile would have been 35–66% higher. All this translates into a 13.3–14.4% lower calorie intake per capita and a 6.1–7.9% increase in the proportion of children malnourished. This would mean that the Green Revolution succeeded in raising the health status of 32–42 million preschool children. Interpreting these findings, Evenson and Gollin believe that ‘It is unclear what alternative scenario would have allowed developing countries to meet, with lower environmental impact, the human needs posed by the massive population expansion of the 20<sup>th</sup> century’ (Evenson and Gollin 2003, 761). This is the attenuated version of Borlaug’s hypothesis.

Yet deep counterfactuals exist. Badgley *et al.* conduct a modelling exercise demonstrating that ‘organic methods could produce enough food on a global per capita basis to sustain the current human population, and potentially an even larger population, without increasing the agricultural land base’ (Badgley *et al.* 2006, 86). Very recently, Seufert *et al.* (2012) have found that overall organic yields are 25% lower than conventional crops, though the yield difference varies: they find no statistically significant difference between organic and conventional fruit and oilseeds, and 26% and 33% less for organic cereals and vegetables respectively. They also find that the longer a farm has been organic, the better it performs. Seufert and colleagues compare large scale industrial with monocultural organic, and admit that their research leaves open issues of externalities associated with conventional and organic agriculture. They do not, however consider the agroecological farming featured in IAASTD (2008) and (De Schutter 2010). Examples from Cuba and Malawi, for instance, fell outside the parameters of the study, thus losing local evidence that agroecological systems might out-perform conventional agriculture (Msachi *et al.* 2009, Altieri and Toledo 2011, Rosset *et al.* 2011).

The absence of agroecological cases is significant because one of the most compelling features of high performing agroecological systems is not their yield, but their capacity to fight hunger through organizing and social change (Altieri and Nicholls 2008). It is important to appreciate that alternative farming systems will have alternative technics. Large-scale organic monoculture is the very slimmest of alternatives to large-scale industrial agricultural monoculture. Agroecological systems often have contrasting systems of governance, innovation and distribution. Rosset and colleagues, for instance, report a vibrant peasant movement striving for autonomy against a socialist state in Cuban agroecological practices (Rosset *et al.* 2011). Holt-Giménez similarly reports that agroecological best practices in Central America have been developed and shared in non-hierarchical, horizontal and collaborative ways (2002). Similar stories, involving hundreds of farmers researching and sharing results as peers, might be told of agroecological experiments and food distribution in Malawi (Msachi *et al.* 2009). The forms of government, and ultimate goals driving these researchers, couldn’t be more different from those behind the biotechnological revolution offered in the New Green Revolution (Kaimowitz 1996). There is a great deal more work to be done, though it’s clear that the politics that govern the distribution of food are likely to look different from markets as they

currently stand, whether domestically or internationally (Heynen 2009, De Schutter 2010, Alkon and Agyeman 2011, Holt-Gimenez 2011). A defining feature of alternatives to agricultural systems produced under the current phase of capitalist accumulation is likely to be the extent to which peasant groups are able to attain relative autonomy from the forces of state, private sector and civil society that have shaped the latter part of the Long Green Revolution (van der Ploeg 2008).

## 5. Conclusion

Unadvertised, this paper has been an attempt to outline a program of incorporated comparison (McMichael 1990, 2000b). To understand how the Green Revolution matters today, one needs to understand its place and transformation in a longer history of capitalist accumulation. Arrighi's project was one that followed McMichael in not presuming but constructing cycles of accumulation,

both factually and theoretically, with the explicit purpose of gaining some understanding of the logic and likely outcome of the present financial expansion. The comparison is incorporated into the very definition of the research problem: it constitutes the substance rather than the framework of the inquiry. The cycles that emerge from the inquiry are neither subordinated parts of a preconceived whole, nor independent instances of a condition; they are interconnected instances of a single historical process of capitalist expansion which they themselves constitute and modify. (Arrighi 2010, 24)

This paper, in pale imitation of Arrighi's project, has gestured at the possibility of a research project around agricultural change over the long twentieth century. Motivated by the threat of communism, the Green Revolution advanced through the concerted effort of large-scale philanthropy, the United States government, recipient governments, and the World Bank in ways that ensured accumulation for the dominant hegemonic bloc within countries in receipt of the package of technologies, subsidies and violence that constituted the programme.

Following the reconfiguration of the relation between states and the private sector under neoliberalism, agricultural development fell out of favour among international development agencies. It was, however, the source of increasing interest – a recurring and loaded word – for finance capital. Through the 1990s, instruments like the Goldman Sachs Commodity Index and firms like Glencore (Patel 2011a) were building positions beyond their core energy and minerals domains, within agriculture. The financialization of agriculture was well underway by the time the calls for a second Green Revolution were made by Conway. The timing of Conway's call follows the international liberalization of agriculture through the World Trade Organization, and slightly precedes an increase in investment from the World Bank in agriculture (World Bank 2012).

The character of the New Green Revolution is clearly different from its predecessor, insofar as it lacks an anti-communist tilt. Neoliberal suspicions over the role of the state have prevented the kinds of intervention that made the original Green Revolution successful in its own terms. No longer are subsidies thinkable. Violence, on the other hand, is very much within the purview of the neoliberal development state, as is the management of knowledge. Indeed, regimes of violence and truth are among the continuities of the Long Green Revolution. Development, and the intermittent need – in the name of developmental order – for the state to mete out violence on the bodies of the poor are constant refrains. For deeper

continuities, Braudel offers an understanding of the operation of capitalism that invites us to consider how the habits not only of peasants, but of philanthropists and academics, have changed in light of the original Green Revolution's transformation. From Marx, we nonetheless see in the processes of accumulation, and the conduits of circulation smoothed by a combination of state, private sector and philanthropic agencies, a distinctively new configuration of 'strategic philanthropy' (Barnes 2005, 243). Foucault helps to craft ideas about regimes of truth, and the biopolitical imperatives of the liberal state, to understand how problems of hunger, poverty, injustice and ecological destruction have been understood through the prism of capitalism, how certain ideas have been made true or false.

From food regime analysis, understood in a Gramscian light, we see the structures of legitimation that enabled the first Green Revolution, and its descendants. Central to this is a recognition that political ecology matters (Peet and Watts 1993). Climate change has already been deployed as an alibi for the spread of the New Green Revolution. The Gates Foundation sees adaptation – not mitigation or remediation – as the only response to climate change, in particular through the spread of drought-tolerant monoculture (Gates Foundation 2011). History suggests that ecology and climate have previously been conscripted to the cause of capitalist agriculture, whether in Mexico and India in the early days of the Green Revolution, or in Africa during the 1970s prelude to structural adjustment. Although historical knowledge isn't a sufficient inoculant against historical repetition, it's a necessary one.

The notion of a 'Long Green Revolution', and the suggestion that it is centrally a set of actions to control the process of accumulation, prompts further research questions. What, for instance, is the role of the recipient state in the New Green Revolution? In the first Green Revolution, the developmental state mattered (Cumings 1999). The state clearly matters in the New Green Revolution, and the emergence of sovereign wealth funds, particularly from China, India and Brazil, greatly complicates Arrighi's suggestion that we look to inter-state and inter-firm competition. Further, the character of international philanthropy capitalism, and its relation to US power, deserves a closer examination than I have been able to afford it here. The alignment of capital to state is certainly different in the New Green Revolution. The interests of Yara and Monsanto are more divorced from the governments of Norway and the United States than under the first Green Revolution.

For scholars interested in resistance, the attempt to wrestle with the Green Revolution's counterfactual can be fruitful, for the attempt prompts questions of how the state ought to be involved, if indeed it can be involved at all, together with questions of legitimation, distribution, and power beyond the call that agroecological farming rule the earth (Altieri and Toledo 2011). La Via Campesina's sloganeering – 'Small Farmers cool the Earth', for instance – may sound like an obfuscation along the lines of the New Green Revolution's attempt to help 'small farmers'. Absent an analysis of class and power, demands for food sovereignty can conceal no less than calls for 'pro-poor' agriculture. The difference, of course, is that food sovereignty is precisely an invitation to analyse the power that accompanies the food system's technologies (Patel 2009). Which returns us to Mumford's thoughts:

from late neolithic times in the Near East, right down to our own day, two technologies have recurrently existed side by side: one authoritarian, the other democratic, the first

system-centered, immensely powerful, but inherently unstable, the other man-centered, relatively weak, but resourceful and durable. If I am right, we are now rapidly approaching a point at which, unless we radically alter our present course, our surviving democratic technics will be completely suppressed or supplanted, so that every residual autonomy will be wiped out, or will be permitted only as a playful device of government, like national balloting for already chosen leaders in totalitarian countries. (Mumford 1964, 2)

An incorporated comparison suggests ways that the conscription of Green Revolution thinking into everyday practices might be more subtle and enduring than we suspect. But Mumford also points to ways in which, by appreciating the Revolution's technics, we might do things differently. The actuality of the resistance (Bosteels 2011) that has shaped the trajectory of the Green Revolution suggests this: the Green Revolution may be long, but it needn't be destiny.

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