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The global food economy: the battle for the future of farming

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The global food economy: contradictions and crises

Uneven bounty

> The shocking news is that hunger is increasing ... There are now 842 million people suffering from undernourishment in a world that already grows more than enough food to feed the global population ...
>
> It is an outrage that in the 21st century one child under the age of five will die every five seconds from hunger-related diseases ... Hunger will kill more people than all wars fought this year. Yet where is the fight against hunger? ...
>
> Hunger has increased, rather than decreased since 1996. This makes a mockery of the promises made by Governments at the World Food Summits held in 1996 and 2002, as well as the promises contained in the Millennium Development Goals. (*Jean Ziegler, Special Rapporteur of the UN Commission on Human Rights, 2004*)

Per capita agricultural productivity grew steadily over the second half of the twentieth century, and while this growth has slowed, there has never been more food available per person on a global scale than there is today (FAO 2002a). As the Special Rapporteur of the UN Commission on Human Rights put plainly, and as the Food and Agricultural Organization (FAO) of the UN has persistently emphasized, the volume of food produced cannot explain the persistence of hunger and undernourishment. In fact, the UN World Food Programme suggests that the volume of food produced is more than one and a half times what is needed to provide every person on earth with a nutritious diet. And yet while the percentage of the world's population living with severe food shortages has declined in recent decades, absolute numbers have grown. Roughly 800 million of the 842 million who suffer from chronic undernourishment live in developing countries. The FAO (2003: 4) calls this a 'continent of the hungry' that outnumbers Latin America or sub-Saharan Africa. Yet while severe episodic famines occasionally make the news in rich countries, the enduring famine of the 'continent of the hungry' is a near-silent one in rich countries. In addition, more than 2 billion people routinely suffer micro-nutrient deficiencies (ibid.; Pinstrup-Andersen 2000), and it is difficult to enumerate just how many people are in various other states of food insecurity that go unmeasured, such as the routine uncertainty of finding the next meal (Magdoff 2004). It is also difficult to derive statistics on the gendered asymmetries of hunger and food insecurity, though this should not obscure the fact that women and girls in many places are further marginalized within households and cultures. But whatever the challenges of measurement, plainly we live in a world where '"hunger amidst scarcity" has given way to "hunger amidst abundance"' (Araghi 2000: 155).

The widely cited UN and World Bank poverty estimates are that 2.8 billion people live on less than US$2 a day, well over two-fifths of the world's population, and that 1.2 billion people live in 'extreme poverty', defined as less than US$1 a day – and some argue that even these enormous figures are serious underestimates (Sanjay and Pogge 2005; Yates 2004). Virtually all of this population lives in the developing world. While universalizing poverty yardsticks have long been wrought with pejorative cultural assumptions, and used to justify dislocation and social upheaval in the name of Western-guided development and modernization, as subsistence needs are increasingly mediated by the money economy – in other words, non-market access to food, water, land and shelter shrinks – poverty lines defined in dollars have more generalized relevance to an understanding of material deprivation. They also help to give some measure to the scale of global inequality. The annual *Human Development Report* by the UN Development Programme (UNDP) has drawn consistent attention to the fact that the top fifth of humanity controls more than four-fifths of its wealth.

The crises of hunger and poverty are especially acute in rural areas, and regionally in South Asia and sub-Saharan Africa. There is a broadly inverse relationship between the scale of agriculture in an economy and the prevalence of hunger; of the population of the 'extreme poor' and hungry, roughly three-quarters live in rural areas and more than seven in ten depend on agriculture for their survival. Agriculture accounts for 9 per cent of GDP and more than half of all employment for the developing world as a whole, and these averages soar to 30 per cent of GDP and 70 per cent of employment in countries where more than one-third of the population is undernourished. South Asia has the largest total population of chronic undernourished at 303 million, nearly one in four, while sub-Saharan Africa has the largest relative population at 194 million, over one in three (FAO 2003). In sub-Saharan Africa, food insecurity

is also deeply entwined with HIV-AIDS, as most of the more than 20 million infected live in abject poverty. While the links are not adequately understood, mounting evidence suggests that poverty, food insecurity and land degradation fuel social instability and violent conflict (Pinstrup-Andersen 2000; Berry 1997).

Opposing the problem of hunger and food insecurity is that of obesity. Globally, the population of obese people now actually outnumbers the population of the undernourished. In 2000, the World Health Organization (WHO) identified obesity as a 'global epidemic' given this scale and the fact that it is the main cause of heart disease, the primary risk factor for diabetes, and is a major contributing factor in some cancers and other diseases. The contradictions of obesity and hunger in a world of aggregate surpluses are reflected clearly in the literal and proverbial belly of the global food economy's beast, the United States. Today, 12 per cent of Americans (roughly 35 million citizens) are considered to be food insecure, 4 per cent 'with hunger' (over 11 million) (Nord et al. 2005), while 65 per cent are considered 'overweight and obese' and 30 per cent 'obese', roughly *double* the levels from 1980, as diet-related diseases are pervasive (Hedley et al. 2004; for a more popularly oriented account, see Crister 2004). The US Surgeon General recently warned that obesity would soon be responsible for killing as many Americans each year as smoking (Economist 2003). These perverse poles of the global food economy, obesity and hunger, reflect the basic reality that while food is elemental to life and health it is conceived as a commodity and not a right – food aid and food banks, which reflect a minimalist conception of food rights, notwithstanding – and the motive force of profit prevails over concerns about equity and nutrition.

The place of agro-TNCs in the US food economy, and a fast globalizing model, is likened by Heffernan (2000: 66) to an 'hourglass which controls the flow of sand from the top to the bottom', reflecting how a small number of massive firms are situated between many producers and even more consumers, a position that gives them 'a disproportionate amount of influence on the quality, quantity, type, location of production, and price of the product at the production stage and throughout the entire food system'. On one side, fast-consolidating agro-input TNCs are increasingly controlling seeds, fertilizers, agrochemicals and livestock antibiotics and compelling the standardization and industrialization of farming techniques, while a handful of very large-scale manufacturers also dominate farm machinery. On the other side, agro-food TNCs are controlling, refining, combining, distributing and marketing what is being produced on farms in expansive new ways, and systematically detaching food consumption patterns from time, space and cultural traditions with long-distance sourcing and distribution networks, sophisticated processing and packaging systems that reduce perishability, and marketing tactics that forge strong consumer loyalty (Friedmann 2004: 1993), part of a more generalized phenomenon Klein (1999) dubs 'branding'. Globally, the rise and spread of processed and pre-prepared meals have implicitly served to undermine the cultural significance of food preparation and consumption, while the marketing efforts of agro-food TNCs in many parts of the world have explicitly aimed to 'downgrade not only local diets per se but also the symbolic value of traditional foods ... as culturally inferior' (George 1990: 148). Also related to branding strategies and the de-spatialization and de-culturation of food is the corporate manipulation of place and culture, with many packaged items given an exotic façade that often bears little or no connection to where the food was actually produced and processed: 'Mexican' corn chips, 'Moroccan' soup, 'Mediterranean' pizza, 'Caribbean' fruit punch, 'Cantonese' spring rolls – the list is long. Where food is not so easily decoupled from culture, agro-food TNCs have employed nuanced strategies to conceal global sourcing patterns, such as using various localized brand names in different places (Fagan 1997). As Western entertainment and media exports expand throughout the world they are another nebulous but significant influence on cultural change, lifestyle aspirations and, at some level, diet. Dietary change also relates to increasing urbanization and the desire or need for convenience and pre-prepared foods in fast-paced, fragmented lifestyles (Sexton 1996).

In short, 'consumers' maps of meaning' are being reshaped (Cook 1994: 236) and diets are converging – taking on a '"food from nowhere" character' (McMichael 2004a: 11) as they bear less relation to seasonal rhythms and local productive bases. As Friedmann (1994, 1993) has emphasized, the global food economy is characterized by *distance* and *durability*, something which is highlighted by the useful concept of 'food miles'. Food mile calculations account for the distance that food has travelled from land to mouth, which has steadily increased in industrialized nations (Lang and Heasman 2004; Halweil 2002) to the point where estimates of food miles for the average food item in the USA and Canada typically range between 2,000 and 2,500 kilometres. And further, these estimates do not generally include the distance that the inputs which went into producing the food have travelled, which are especially significant for bulky fertilizers, or the petroleum involved in fertilizer and agro-chemical production.

The FAO (2002a) notes how dietary convergence is especially marked in the rich countries of the Organization for Economic Co-operation and Development (OECD), commenting that change in diets has closely followed income growth and has occurred 'almost irrespectively of geography, history, culture, or religion'. But the increasing detachment of diets from space is occurring almost everywhere to some degree, with the populous and booming economies of China and East Asia, South-East Asia and India seen by agro-food TNCs as having the biggest capacity for market growth. This process has clear class dimensions, and is most extreme at both ends of the world's economic spectrum: for the world's poorest, who depend on food durables like flour, cornmeal and rice shipped from temperate breadbasket regions, and in affluent supermarkets, North and South, which possess a dizzying selection of fresh and packaged items sourced from around the world – Reardon et al. (2003) discusses the growth of supermarkets in the developing world. And as the health implications of industrial foods become better understood and organic production commands premium prices, given the cost-accounting system in which food produced by machinery, fossil fuels and chemicals appears so much more cheaply than food produced by labour-intensive organic methods, the world's wealthy consumers are those poised to better access the most fresh, nutritious and chemical-free food baskets (Friedmann 2003).

As the globalization of food brings wealthy consumers greater access to more diverse and healthy foods and the poor more refined food durables, there is one especially conspicuous space of dietary convergence between these classes: the proliferation of junk food – soft drinks, packaged snacks and so-called convenience foods that are full of fats, sweeteners, artificial flavours and colouring. Many of the same small farmers in the developing world who cannot earn a decent livelihood on the land can now find a can of Coke, a tin of Nestlé Milo or a bag of Doritos in their rural shops. Fast-food restaurants, so ubiquitous in the American cityscape (Schlosser 2002), are another clear embodiment of this corporate-led dietary convergence and the uneven bounty of the global food economy. Fast-food restaurants are spreading rapidly on a global scale, especially in wealthy urban areas of Asia and Latin America and the Caribbean. The exuberant forecast of one of the world's fast-food giants, Yum! Brands, gives a broader suggestion about the corporate strategizing involved in dietary change:

> From Hong Kong to Malaysia, a Customer Mania revolution is

> taking hold – driving customer loyalty and differentiating the brands ... And there's one thing for certain – this maniacal focus on the customer is driving global growth – growth in sales, growth in profits and growth in new units ... We also had big wins with new product launches last year ... New promotions, such as the 'Hot & On Time or It's Free,' guarantees in Australia and Korea, and the introduction of the Colonel's famous KFC bucket in China have added to our revenue growth ... in China, our fastest growing and most profitable country outside the US ... [our] business volumes and margins continue to be off the charts, and KFC has been rated the number one brand in the entire country![1]

In short, as food production and consumption become bound increasingly tightly within an integrating and uneven global system, small-farm livelihoods are becoming less viable, traditions surrounding harvest, preparation and mealtimes are severed and agriculture is rapidly losing its place as 'an anchor of societies, states and cultures' as it is transformed into 'a tenuous component of corporate global sourcing strategies' (McMichael 2000a: 23).

The industrial grain-livestock complex

The 12,000-item supermarket noted in the Preface presents a compelling impression of diversity, but apart from the globally sourced fresh produce, the majority of the shelves are packed by what George (1990: 44) aptly calls 'commercial pseudo-variety'. The global food economy is increasingly dominated by a small range of crops and farm animal products, with the basic same core of 'raw materials' reconstituted in myriad ways with a range of standardized additives and fabricated flavours. Schlosser's (2002) description of the secretive corporate laboratories cooking up flavours in test tubes helps illuminate one dimension of this very vividly.

As many as seven thousand plant species have been cultivated or collected for food in human history, but this diversity is shrinking precipitously. There was a drastic decline in both the diversity of crop species planted in agricultural systems and the genetic diversity within species (called 'genetic erosion') during the twentieth century, with these declines as great as 75 to 90 per cent according to FAO estimates. Thirty crops now essentially feed the world, providing 95 per cent of humanity's plant-based calorific and protein intake. The world's top ten crops (rice, wheat, maize, soybeans, sorghum, millet, potatoes, sweet potatoes, sugar cane/beet and bananas) supply over three-quarters of humanity's plant-based calories and dominate the world's cultivated lands, and the 'big three' cereals alone (rice, wheat and maize) account for more than half of all plant-based calories and 85 per cent of the total volume of world grains produced (FAOSTAT; FAO 1997). Though the growth of soybeans (an oilseed) has been spatially concentrated in the USA, Brazil, Argentina and China, its scale and central role in the industrial fusion of grain and livestock sectors is such that it is now part of a 'big four' of global crop production. Soybean cake, the hardened mass after the oil has been pressed, provides a protein-intensive feedstock, and this now comprises almost two-thirds of the world's protein feed given to livestock (Ridgeway 2004). Since the 1970s, soybeans have had the fastest growth in land space of any crop, and it is expected that their per capita production will continue to advance over cereals given their key role as livestock feed (FAO 2002a). Between 1990 and 2005 alone, global soybean production roughly *doubled*.

Crop research in the dominant cereals coupled with rising inputs brought a near-tripling of the world's annual grain harvest between 1950 and 1990, and while some of this growth related to new lands brought under cultivation it was primarily rooted in the rising productivity of cereal monocultures, especially the 'big three'. Other staple crops which have particular importance in poor areas or less favourable climates (e.g. cassava, plantain, beans and yam) have received little scientific attention (FAO 1997). On a global scale, grain yield per hectare expanded by roughly 2.4 times during this period, the amount of global cropland under irrigation expanded by more than 2.6 times, and fertilizer use rose more than tenfold (Brown 1996). The model of industrialized, high-input cereal production has revolutionized farming in the world's temperate regions, namely the United States, Europe, Canada, Australia, New Zealand, the southern cone of South America (Argentina, Uruguay and southern Brazil) and the former Soviet Union, as well as in some pockets of the developing world.

Industrialized agrarian landscapes dominated by a small number of grains and soybeans are inseparable from rising livestock production, and this *'meatification' of diets* – that is, the radical shift of animal products from the periphery to the centre of human food consumption patterns – is another fundamental aspect of dietary convergence and the uneven bounty. While the human population has more than doubled since 1950, meat production grew nearly fivefold by volume (Nierenberg 2005; WorldWatch 2004) – implying a near-doubling of meat consumption in the average diet of every single person on earth amid a soaring human population. On a global level, per capita egg production also doubled in this time, as did per capita fish production, with the volume of the latter roughly half that of the total volume of animal flesh produced. Brown (1996: 53) calls rising total and per capita meat production in the second half of the twentieth century 'one of the world's most predictable trends', and as a result of this 'livestock revolution' animal products now comprise 37 per cent of gross agricultural production according to the FAO (Delgado and Narrod 2002; Delgado et al. 1999). Though these aggregate statistics conceal great disparities within and between nations they clearly underline the magnitude of global dietary change.

Meat consumption and production remain uneven, most intensive in the world's temperate regions, but levels are rising quickly across the developing world. The 20 per cent of the world's population living in the world's richest countries consume about 40 per cent of all meat, or 80 kilograms per person, and this is projected to grow still further to 90 kilograms per person (FAO 2002a). Since the 1960s, however, the relative increase in per capita meat consumption has been much greater in the developing countries of the South than in the North, especially in parts of industrializing Asia and Latin America (Nierenberg 2005, 2003; WorldWatch 2004; Economist 2003; FAO 2002a, b). For the developing world as a whole, over the last three decades of the twentieth century the per capita consumption of meat increased by 150 per cent, from 10 kilograms to 26 kilograms, while the per capita consumption of milk and dairy products rose 60 per cent, from 28 kilograms to 45 kilograms (FAO 2002a).[2] Per capita meat consumption in the developing world is now approaching 30 kilograms per person, and is expected to reach 36 kilograms per person by 2020. Even in the world's poorest region, sub-Saharan Africa, per capita meat consumption is projected to double by 2020. At the clear forefront of these trends is East Asia and the emerging economic colossus of the twenty-first century, China. Per capita meat and dairy consumption in China has more than doubled over the past two decades and is expected to reach the levels of industrialized countries by 2020. In 2005, China consumed more meat than did the world's entire human population in 1961 (Nierenberg 2005). On a global level, the FAO (2002a) projects the per capita consumption of meat to continue rising by another 44 per cent by 2030, while consumption of most other food items levels off (see also Delgado and Narrod 2002; Delgado et al. 1999).

As with crops, livestock production is concentrated on a handful of species, with 88 per cent of all animal flesh by volume in 2005 (265 million tons) coming from livestock's 'big three': pigs (39 per cent), chickens (26 per cent) and cattle (23 per cent), with the production

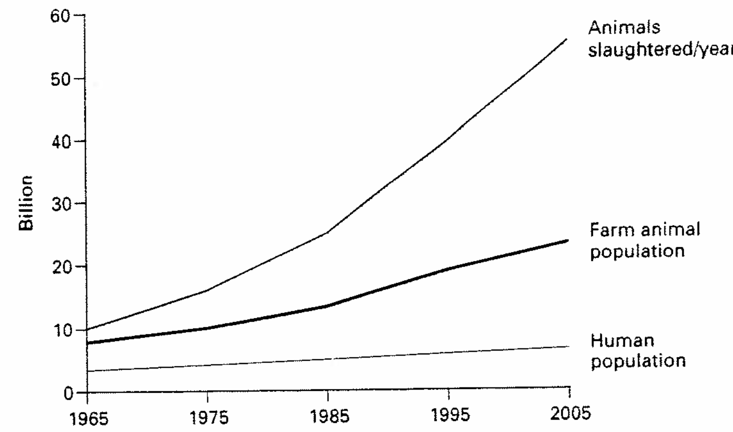

FIGURE 1.1 The meatification of diets worldwide

of pigs and poultry (primarily chickens, but also ducks, geese and turkeys) growing at an incredible rate. Since 1990 alone the global volume of chicken production in the world has roughly doubled, and the FAO (2002a) expects poultry to lead the continuing growth of meat production in the coming decades. Livestock populations understate the growth in production. From 1965 to 2005, the population of pigs on earth at a given time in a year has nearly doubled, reaching 961 million, and the population of poultry more than quadrupled, from 4.2 to 17.8 billion, but because the 'turnover time' of animals has been so shortened by industrial techniques the annual number of animals slaughtered has actually grown at a higher pace. Under industrial techniques, broiler chickens can be brought to slaughter weight in a few months, pigs in as little as six. In 1965, roughly 10 billion farm animals were slaughtered; by 2005 this had risen to more than 55 billion, led by a more than a sevenfold increase in the annual number of chickens slaughtered, from 6.6 to 48.1 billion (see Figure 1.1).[3]

The industrialization of farm animal rearing is the productive basis for the rapid meatification of global diets, with maize and soy the two primary feed crops, often combined. Pioneered in the USA with broiler (meat) and layer (eggs) chickens, Concentrated/Confined Animal Feeding Operations (CAFOs), or factory farms as they are widely known, involve the warehousing of large populations of animals in crowded, industrial conditions, where their growth and biorhythms can be managed and accelerated. Though the export of this model has been relatively recent, on a global scale factory farms are already responsible for 40 per cent of all meat production by volume, a dramatic increase from 30 per cent only a decade earlier. Factory farms are also responsible for a much higher percentage of the global farm animal population than this large and growing volume suggests, since 74 per cent of the world's poultry and 68 per cent of the world's egg production comes from factory farms, there are many more individual chickens than any other farm animal species, and their 'turnover time' is the shortest. The factory farming of pigs is growing at a similar pace, and now accounts for 50 per cent of the world's pig meat (Nierenberg 2005, 2003). Factory farming is even moving offshore, with strong links to industrial farm systems on land. In aquaculture, or fish farming, fish are densely stocked in large pens, fed not only other fish but also grain and farm animal by-products, and given chemical additives and antibiotics to control disease. Roughly a third of the global fish harvest is, in turn, ground up into fish meal and fed to livestock (Nierenberg 2005). With open-water fisheries effectively exhausted and fish farming growing so quickly, the FAO (2002c) projects that the volume of fish produced from aquaculture will overtake the volume caught at sea as early as 2020. A number of fast-industrializing Asian nations are at the helm of the rise in industrial fish farm production. While small-scale, artisanal fish farming (e.g. shrimp, fish, crabs) has a long history in integrated Asian rice paddy systems, the growth in fish exports is not from these methods but from coastal and oceanic pens (Nierenberg 2005).

Having already come to dominate livestock production in much of the industrial North, factory farming has also begun growing quickly in significant parts of Asia (namely China, India, Indonesia, Malaysia, Pakistan, the Philippines, South Korea, Taiwan, Thailand and Vietnam) and Latin America (especially Argentina, Brazil, Chile and Mexico), with China now the world's leading volume producer of animals and home to half the world's pigs. With most of this production oriented towards affluent classes in growing domestic markets, factory farms are typically situated close to urban centres where they compete for water with the sprawling slums discussed in the following section. There is a significant export emphasis to the rise of factory farming in some countries, particularly Brazil, Argentina, and Thailand (Nierenberg 2005, 2003). The FAO (2002a) notes that in recent years industrial livestock production in the developing world 'has grown twice as fast as that from more traditional mixed farming systems and more than six times faster than from grazing systems', and projects this trend to continue into the foreseeable future.

A snapshot of global agro-food trade

Roughly 10 per cent of the world's total agricultural production is now traded across national borders, and as market [illegible] speeds up and thrusts different farm systems into competition with one another, the structural surpluses from the large-scale, [illegible] mechanized (and in the USA and the EU, heavily subsidized) farm sectors of the temperate world have come to dominate global agricultural trade patterns and prices. In 2004, both the USA and the EU produced roughly 17 per cent of the world's agro-exports by value, Canada, Australia and New Zealand together accounted for 15 per cent, and the major South American exporters (Brazil, Argentina, Chile and Uruguay) 13 per cent. This means that 62 per cent of the world's agro-exports in 2004 came from countries that together comprise only 15 per cent of the world's population and only about 4 per cent of the world's agricultural population. This same group of countries accounted for 40 per cent of the world's agro-imports, predominantly the EU and the USA.[4] These industrial surpluses – sourced at prices that bear little relation to the actual economic or environmental costs of production and dominated by a small number of giant agro-food TNCs – effectively establish the global market price for the world's food staples (Rosset 2006). The real prices of the 'big three' cereals, rice, wheat and maize, fell by 60 per cent from 1960 to 2000 (FAO 2002a). The prices of livestock products have also fallen sharply on a global scale, with beef a good example: between 1971 and 1997, the real price of beef declined by two-thirds (Economist 2003). As the FAO (2003: 21) notes, 'depressed world prices create serious problems for poor farmers in developing countries who must compete in global and domestic markets with these low-priced commodities and lack safeguards against import surges'.

By far the largest segment of global agricultural trade is the grain-livestock complex, and these exports are dominated by a small number of countries. The major components of this are cereals, meat, soybeans and dairy products, which collectively comprised 45 per cent of the value of global agricultural trade in 2005, which understates the scale given how these are contained in various processed foods and how cheap and bulky grains comprise a much greater relative volume of agricultural trade than their value represents. The export of cereals relative to total world production has been relatively constant, but this could increase as the FAO (2002a) projects that cereal production in the developing world as a whole will not keep pace with its growing demand, forecasting a 157 per cent rise in the volume of the cereal deficit and a 56 per cent rise in its food deficit as a ratio of consumption by 2030.

The major cereal exports are wheat and maize, with the USA, the EU, Canada, Australia and Argentina combining for almost 70 per cent of all cereal exports in 2004, including virtually all wheat and derivatives (the most traded cereal by value). US grain exports grew fivefold in the second half of the twentieth century and, as will be discussed in Chapter 3, this played a major part in shaping import dependences and consumption patterns in many of the world's poorest countries. The USA is the chief exporter of maize, accounting for about two-thirds of the world's total, followed by Argentina. More than 60 per cent of traded maize is used for animal feed, and maize exporting for feedstock goes hand in hand with soaring soybean exports, which are almost entirely used for feed. Soybean exporting has more than doubled since 1990, dominated almost exclusively by the USA and Brazil. Over 90 per cent of global rice production occurs in Asia, where it is the keystone of food security, and only a small percentage of rice production is traded. Two of the world's largest grain producers are China and India, which together produced almost 30 per cent of the world's cereal output in 2004, but both are minor players in global agricultural trade as they have long sought to manage external trade as part of their food security policies (while pursuing very different agrarian transformations). China has fairly consistently accounted for 5 per cent of the world's total agro-imports and exports, and India only 1 per cent of global agro-imports and exports, though this could soon change rapidly (see Chapter 3). The dramatic growth in per capita global meat consumption has been relatively higher in developing countries, and while this has been met primarily by rising local production it has also led to the rising importation of feed crops as well as meat and dairy products. Pig and poultry are the world's most traded meats, and as with cereals and soybeans global meat exports are highly concentrated: roughly three-quarters of the world total derives from the USA, Brazil, the EU, Canada and Australia, with Brazil's export capacity having grown spectacularly in recent years.

The flipside of the highly mechanized temperate grain-livestock production at the heart of global agricultural trade is the fact that the overwhelming majority of the world's farming population is located in Asia, with three-quarters of the world's farming population, and Africa, with almost one-fifth (see Figure 1.2), where food import dependence is greatest. Most of the world's population growth is expected to be concentrated in Africa and Asia in the coming decades;

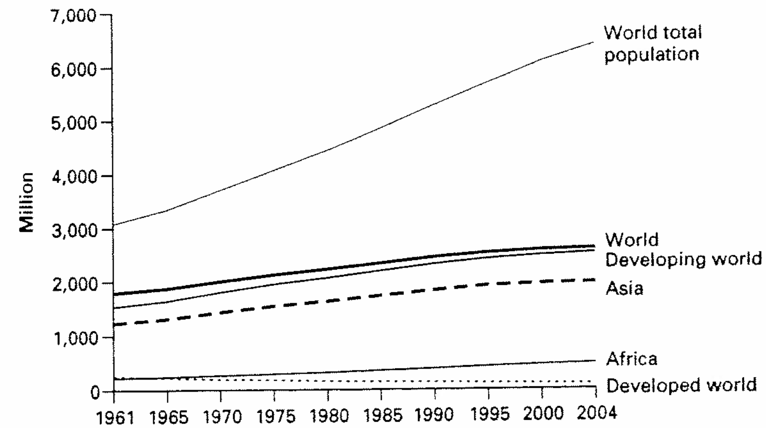

FIGURE 1.2 Agricultural populations

despite the HIV-AIDS pandemic, sub-Saharan Africa will be home to one in three people added to the world population in 2030 and one in two in 2050 (FAO 2002a). Food import dependence is expected to continue growing in most of the world's Least Developed Countries (LDCs), which, as noted, tend to have the greatest relative agrarian populations.

An agricultural trade deficit implies, on a basic level, that a nation's demand for food – not confined to nutrition-based needs, and obviously affected by changing dietary patterns – cannot be fully met by its own domestic production and the agro-export equivalent to its agro-imports. While a deficit may reflect a measure of national food insecurity this is not necessarily so. In fact, neoliberal advocates of global market integration such as the International Monetary Fund (IMF) and the World Bank insist that trade liberalization, the 'discipline' of the market and export competitiveness are the best assurance of national food security, irrespective of the overall agricultural trade balance, and this logic has been repeatedly implanted in their structural adjustment programmes (SAPs). The essential argument of the free market approach to food security is that a nation should concentrate its productive resources on those sectors, agricultural or otherwise, where it has a comparative advantage to maximize the generation of foreign exchange, and open its markets in order to import goods that are produced more cheaply elsewhere (SAPs and the free market approach to food security are discussed in more detail in Chapter 3). But for most developing countries which have narrow, commodity-focused export bases and have endured protracted declines in terms of trade – the 'tropical commodities disaster' (Robbins 2003) – this logic does not hold up well. For countries like Burkina Faso, Bangladesh or Haiti, and the many low-income food deficit countries identified by the FAO which collectively spend roughly half of their foreign exchange on food imports, such prescriptions have widely translated into 'food dependence on world "breadbasket" regions' (McMichael 2000a: 23).

The FAO (2002a) projects that the broad patterns of agricultural trade described here will deepen considerably in the coming decades, with grain and livestock exports from temperate regions entwined with rising food import dependence in much of the developing world. Compared with annual levels in the late 1990s, the grain imports in the LDCs are expected to double by 2020, while meat imports for the developing world as a whole are expected to grow nearly fivefold by 2030, from 1.2 to 5.9 million tonnes (MT), and the annual volume of milk and dairy imports is expected to nearly double, from 20 to 39 MT (ibid.). The competitive pressures and dietary shifts associated with market integration in the highly uneven global food economy ultimately make small farming less viable by reducing earnings per volume output, especially when faced with debts and rising input costs. These patterns and projections are an integral part of an unfolding social revolution in the developing world known as 'de-peasantization', where attention now turns.

The great agrarian question of the twenty-first century

Eric Hobsbawm (1994: 289, 415) argues that 'the death of the peasantry' was 'the most dramatic and far reaching social change' of the twentieth century, cutting 'us off forever from the world of the past', as 'the peasantry, which had formed the majority of the human race throughout recorded history, had been made redundant by agricultural revolution'. Between 1950 and 1990, for the developing world as a whole, agricultural employment declined from 80 to 60 per cent of the workforce (UNHSP 2003), and the world's agricultural population, though still rising slightly in absolute terms, continued a steady decline relative to the world's total population, falling more than 5 per cent from 1990 to 2004. Meanwhile, in the 1990s alone the urban population of the developing world increased by an astonishing 36 per cent (ibid.). Some time in 2007 the world human population of roughly 6.6 billion people will hit a historic milepost: it will become more urban than rural. The UN Human Settlements Programme (ibid.) submits that the world's rural population has likely peaked, and that all future population growth will occur in cities as the

world heads towards a population of between 9 and 10 billion by mid-century, where it is generally expected to level out.

While Hobsbawm does effectively draw attention to the scale and speed of social change and urbanization, caution is needed in using terms like 'the death of the peasantry' and 'redundancy'. Small-farm households, after all, still constitute nearly *two-fifths of humanity* (Araghi 2000; Bernstein 2000), and redundancy concedes a measure of inevitability to the current course. Rather than an endpoint, de-peasantization is better understood as a social revolution impelled by unequal distributions of land, the lopsided industrialization and control of agriculture, market integration and the environmental irrationality of increasing food miles. The contention here is that neither this course nor its social fallout is inevitable or stable.

As discussed in the preceding section, global agricultural trade is extremely imbalanced, with a few per cent of the world's farm population responsible for more than three-fifths of the world's agro-exports by value, at the same time as there are many low-income, increasingly food-import-dependent nations with large small-farming populations. Amin (2003) provides a conceptual framework to assess global disparities in per-farmer productivity, identifying three broad classes of farmers in the world. The first are the massive-scale, highly mechanized grain-livestock producers in the temperate world whose total population is in the tens of millions. The second is a more populous but still relatively small group of large-scale farmers who are well positioned within inequitable developing-world landscapes in countries like India, Thailand, Chile and South Africa, and have benefited from industrial methods and inputs. The third group, which makes up the overwhelming proportion of the global agricultural population, are the small-scale farmers who lack access to most new technologies, but might be trapped by rising costs for some inputs like seeds, depend upon human labour, have little or no government support, and often do not have sufficient or good-quality land. Amin (ibid.) estimates that the per-farmer output of the first class is roughly two thousand times that of the third.

Disparities in technology and scale are exacerbated by the agricultural subsidy regimes in the world's richest countries, which together spend over US$200 billion subsidizing their own agricultural sectors, concentrated on the largest farmers (the actual dollar figure attached to rich-country agro-subsidies varies significantly, with the World Bank's oft-cited estimate being US$1 billion *a day*). In contrast, these same countries devote less than US$1 billion *a year* in official development assistance to agricultural development in the developing world (FAO

2003), and between 1988 and 1996 foreign aid for agricultural development to poor countries fell by 57 per cent (Paarlberg 2000) (this is a point of reference, not to suggest that development assistance has always been necessarily beneficial, as it has often doubled as an export promotion exercise and entailed contentious assumptions about the path to modernizing development). As will be seen in Chapter 4, rich-country agro-subsidy regimes have become a flashpoint for protest over how global agricultural trade is regulated, though this has been a partial and potentially distracting target.

With so many small farmers incorporated into market relations and global market integration deepening in the context of long-term global price declines and distorted competition, the magnitude of threatened dislocation is truly staggering. Amin frames this in blunt terms (2003: 3):

> ... agreeing to the general principle of competition for agricultural products and foodstuffs, as imposed by the WTO, means accepting the elimination of billions of non-competitive producers within the short historic time of a few decades. What will become of these billions of human beings, the majority of whom are already poor among the poor, who feed themselves with great difficulty?

Even a widely dispersed, decades-long industrial boom would not come close to absorbing so many people into productive employment, and this is highly unlikely given the patterns of industrial growth across the developing world (ibid.), to say nothing of the environmental impacts or biophysical constraints of such a prospect. According to the International Labour Organization (ILO), the informal sector has dominated recent job creation in Latin America and Africa (Bangasser 2000), and as much as two-fifths of the economically active population of the developing world are informal workers concentrated in urban and peri-urban areas, comprising 'the fastest growing, and most unprecedented, social class on earth' (Davis 2004: 24, 2006). Castells (1993: 37) describes this as a shift of a significant part of the world's underclass 'from a structural position of exploitation to a structural position of irrelevance'. Compounding this is the fact that most developing countries lack significant outlets for external migration, such as European countries seized through colonialism when capitalism and industrialization revolutionized their countrysides and enabled the continent to effectively export its agrarian question (Magdoff 2004; Amin 2003). Rather, in a great historical twist, immigration policies in rich countries today are skewed to primarily admit the wealthiest and most highly educated professionals from developing countries.

So while some ex-peasants might find formal-sector employment in manufacturing or services, the flight to escape rural poverty is pushing many into a new vulnerability in insecure or informal work arrangements in cities; what Araghi (2000: 145) describes as the 'huge urban masses of superfluous people'. Though these 'superfluous' masses might appear to be irrelevant to formal labour markets and systems of accumulation, the scale of global un- and underemployment – coupled with the mobility of capital – acts as a strong global brake on the power of labour and the cost of wages, connecting the process of de-peasantization to broader labour market inequalities. A recent report by the UN's Economic Commission for Latin America (2005) also pointed out the fact that waves of urban migration are often heaviest among the youth, depriving rural areas of their talents and energies and leaving behind an ageing population, an important and underemphasized dimension of this urban migration.

With breakneck urban migration so 'radically decoupled from industrialization, even from development *per se*' in large parts of the developing world (Davis 2004: 9), and racing ahead of growth in adequate employment, housing, infrastructure and service provisioning, the answer to the agrarian question of the twenty-first century appears to be pointing towards what Mike Davis (2006, 2004) evocatively calls a 'planet of slums'. In a detailed survey on the character of the contemporary urban explosion in the South, the UNHSP (2003) estimates that roughly one billion people currently live in slum conditions, which it defines in terms of lacking access to durable housing, safe water, adequate sanitation, secure tenure and sufficient living space. This constitutes almost one in every three urban residents on earth, nearly all of whom are in the developing world. At present, slums comprise 78 per cent of the collective urban population of the LDCs. Regionally, Asia has the greatest absolute slum-dwelling population (60 per cent of the world's total), while sub-Saharan Africa has the greatest relative share of its population in slums (72 per cent) (ibid.). The UNHSP (ibid.) projects that on the current course the global slum population will be 1.4 billion by 2020 and that it will approach 2 billion by 2030, at which point it would represent nearly one in every four people on a planet of more than 8 billion.

The threat of 'slum sprawl' is complex and daunting in the world's two most populous nations, China and India, which are together home to just under two-fifths of the world's population and more than half of the world's agricultural population. Though both have sought to limit agricultural trade, their population and rapid (if uneven) industrialization, economic growth and urbanization have agro-food TNCs eyeing major market expansion potential, and both countries have come under increasing multilateral pressure for liberalization. China's race up the protein ladder towards more meat-intensive diets has turned it into a net grain importer, with increased feedstock import dependence likely in the future. And despite their high rates of industrial growth, tremors of seismic social change abound in both rural China and India, discussed in Chapter 3, which agricultural trade liberalization would undoubtedly magnify.

Finally, it is important to note how this urbanization could lead to a dangerous expediency in food policy. Challenging new food security questions are posed by the rapid expansion of urban poverty and the concurrent decline in people's abilities to access food outside of markets. Thus, while cities have long been seen as poles of development and modernity, in a planet of slums problems of food insecurity and undernourishment are bound to increasingly shift 'from rural to urban areas, even though the prevalence of each of these conditions will continue to be higher in rural areas' (Pinstrup-Andersen 2000: 131). The urbanization of food security problems in slums could, in turn, reinforce short-range national food policies such as trade liberalization designed to ensure access to the cheapest supplies on global markets, since underfed, frustrated and concentrated urban masses tend to be viewed as a more volatile and hence more politically influential constituency than the rural poor (Weis 2004a) by governments fearing that, as Bob Marley once put it, 'a hungry mob is an angry mob'.[5]

Assessing the ecological footprint of industrial agriculture

The destructive and unstable trajectory of the global food economy must be understood not only in human terms but in terms of its impacts on the environment and on other species. Agriculture is a major part of humanity's 'ecological footprint', a conceptual framework that quantifies the land-space needed to meet the resource consumption (source) and waste absorption (sink) demands levied by individuals and societies, and helps to envisage the scale and nature of human economic activity relative to the precarious future of biodiverse life on earth (Rees and Westra 2003; Wackernagel and Rees 1996). To understand agriculture's escalating ecological footprint the discussion starts by reviewing how industrial methods transformed the nature of farming and exact a mounting toxic burden. Agriculture's expanding footprint is then framed within the epochal contexts of climate change and biodiversity loss, which must in turn be understood relative to the political and economic inertia of the present order and the limitations of conventional cost accounting.

Simplification and toxicity Throughout history the long-term viability of farm landscapes has depended upon the maintenance of functional diversity in soils, crop species (and seed germ plasm within species), trees, animals and insects to maintain ecological balance and nutrient cycles. To this end, agro-ecosystems were managed with a variety of different techniques, such as multi-cropping, rotational patterns, green manures (turning undecomposed plant tissue into soils, typically from nitrogen-rich legumes), fallowing land, agro-forestry, careful seed selection and the integration of small animal populations. This conception of farming was transformed by capitalism and industrialization, a transformation which, 'despite many variations in time and place ... shows one clear tendency over the span of modern history: a movement toward the radical simplification of the natural ecological order in the number of species found in an area and the intricacy of their interconnections' (Worster 1993, quoted in Foster 1999: 121). This was made possible by the development and rising use of synthetic fertilizers, agro-chemicals, enhanced seed varieties, farm machinery, concentrated feedstuffs, animal antibiotics and hormones, and the expansion of irrigation systems, which allowed industrial techniques to override previous ecological constraints. Embedded in this has been the extraordinary new dependence upon fossil fuel consumption in the twentieth century, not only in the steadily rising food miles noted earlier and the substitution of combustion engine machinery for animal traction, but with the petroleum demands of proliferating synthetic fertilizers and agro-chemicals. The minimization of on-farm diversity has occurred downwards in scale to the level of soil micro-organisms, detritivores and invertebrates, and in the genetic constitution of plants and animals, and upwards in scale to monocultured landscapes and animal factories where technology can more easily replace human labour.

The simplification of on-farm biodiversity accelerated with rising corporate concentration and control over both farm inputs and outputs. At the input end, packages of seeds, chemicals and fertilizers have been progressively woven together and traditional plant selection and breeding by farmers has moved into laboratories, while pressures on the purchasing end increased demands on the size, appearance and timing of output. Corporate-driven agricultural research treats farmers as recipients (i.e. customers) rather than participants in the process of innovation. Put another way, as farmers become increasingly dependent on manufactured inputs they are losing control over knowledge and with it their experimental impulses and confidence in their own analytical and on-farm problem-solving capacities. Thus, as industrial agriculture expands in scope, knowledge transfer occurs less and less from farmer to farmer or between generations, with older farmers less venerated as a source of applied knowledge, and more from agronomist (sometimes directly employed by agrochemical companies) to farmer. When the culture of farming, to which this generational knowledge transfer is central, breaks down, it is not an easy thing to rebuild. And as the locus of innovation moves off farms and into corporate research laboratories it is destroying the importance of local ecology and knowledge in the process of crop development, one of the most potentially destabilizing aspects of the industrial simplification of agro-ecosystems. Given how global food security hinges on such a small number of crops, the FAO (1997) highlights the importance of conserving the genetic diversity within these crop species and points to the centrality of the world's small farmers in this conservation, at the same time as large monocultures dominate the production volume of all of the world's major crops and the world's seed base is increasingly coming under the control of a handful of very large agro-input TNCs.

The basic promise associated with this transformation has been that 'modern, uniform varieties, under stable, high-input conditions, are both high-yielding and yield-stable' (Wood 1996: 110), a sort of cornucopian narrative – more broadly embodied in the so-called 'technological optimism' of Simon (1981) – in which landscape productivity was seen to be bounded more by human ingenuity than by biological limits and given force by the rising per capita food productivity described earlier. The development of the industrial, high-input model in the temperate breadbaskets and its spread to developing countries in the Green Revolution is credited by some with having accelerated the growth of food production ahead of dramatically expanding human populations in the twentieth century, though condemned by others for its socially polarizing effects, and the belief that technological progress can increase yields still further is used as a justification for research in genetic modification (GM) by its advocates, sometimes spuriously coupled in their arguments with the persistence of hunger and undernourishment (McMichael 2004a).

The most obvious price of an agricultural model built on ecological simplification is chronic toxicity. High-yielding crops grown in industrial monocultures typically require more fertilizer, agro-chemicals and water than do crops grown in rotation or in multi-cropped farms,

and the heavy use of inputs serves to both mask problems while creating difficult new ones, setting in motion a treadmill of technological fixes (Altieri 1998, 1995; Gleissmann 1997). Excessive mechanized tillage and the bare ground between planted rows in monoculture fields have led to serious rates of soil erosion, which the FAO identifies as a factor in 40 per cent of all land degradation worldwide, with problems particularly acute in the developing world (FAO 1998).[6] The magnitude of soil erosion is difficult to comprehend given the challenge of thinking on the sort of timescales on which soils are formed (Friedmann 2003), and has long been obscured in industrial systems by synthetic fertilizer. The efficiency with which crops turn nitrogen and phosphorus from fertilizers (along with water from irrigation) into yield gains has, however, been in long-term decline (Buttel 2003; Tilman et al. 2002), and the petroleum that synthetic fertilizer manufacturing depends upon is not an infinite resource.

Monocultures are also more vulnerable to pest infestations, a threat that is typically suppressed by greater chemical usage and which can lead to pest resistance and mutations over time, which in turn tends to be met with more and new chemicals – a cycle that ultimately also affects non-pest species and poses serious risks to human health. In the early 1990s the WHO reported that 3 million people suffer acute pesticide poisoning every year, causing 220,000 deaths (including those caused by pesticide-induced suicides), a figure that does not even account for the impacts of chronic exposure (WHO 1992; WHO and UNEP 1990); more recent WHO estimates now top 250,000 annual deaths. Pimentel (2005) calculates that in the USA alone the annual environmental and societal costs of agricultural pesticides are roughly US$10 billion, with costs measured in terms of their impact on human health, pesticide resistance in pests, crop losses induced by pesticides, bird losses from pesticides and groundwater contamination – see also Pimental and Lehman (1993) for a ranging analysis of the impacts of massive pesticide usage in industrial agriculture. Because plants cannot absorb all the nutrients from fertilizers or agro-chemicals, the excessive nutrient loads and toxic effluence end up running off, leaching and accumulating in groundwater, streams, rivers, lakes and even coastal oceanic waters. The cumulative impact of high-input farming in water is most evident in the hypoxia or 'dead' zone of the Gulf of Mexico, where unnatural levels of nitrogen and phosphorus, stemming mostly from agricultural run-off in the Mississippi river basin, foster the growth of large algal blooms which choke the oxygen from (or *eutrophy*) thousands of square miles of coastal waters and make it uninhabitable for aquatic life (WorldWatch 2004; Buttel 2003).

The industrialization of agriculture and the tremendous productivity gains of the twentieth century have also rested on the transformation of innumerable river and riparian ecosystems through diversionary water schemes, from the micro-scale to colossal canal systems and dams (also prized as a source of hydroelectricity). Large dams have often exacted great environmental and social costs, as they have been a leading cause in the extinction or endangerment of one-fifth of the world's freshwater fish and flooding has pushed somewhere between 30 and 60 million people from their lands (McCully 1996). Irrigation demands have sometimes led to groundwater overuse, typically on a localized scale though in places more extensively. The greatest example of groundwater depletion is in the dry US Midwest, where the industrial grain-livestock complex has been steadily running down the massive Ogallala aquifer, which threatens to raise the possibility of stupendous environmental change as replacement sources are sought (see Chapter 2).

Agriculture is easily the world's largest consumer of water, responsible for 72 per cent of all global freshwater withdrawals, and Pinstrup-Andersen (2000: 133) suggests that 'unless properly managed, fresh water may well emerge as the most important constraint to global food production', an issue that also has great geostrategic importance given the plausibility that access to fresh water may emerge as a key source of conflict in the coming decades. In addition to irrigation supply, the salinization, alkalization and subsidence of heavily irrigated and poorly drained soils can also be a major problem that is often very difficult and, where possible, costly to reverse. The FAO (2006) estimates that as much as 10 per cent of the world's irrigated lands have been severely damaged through waterlogging and salinization as a result of poor drainage and irrigation practices, and also notes that this can contribute to a series of human health impacts through the spread of waterborne diseases, such as diarrhoea, cholera, typhoid and malaria.

The risks associated with ecological simplification threaten to be magnified by GM crops, which differ from millennia of plant selection and the first wave of modern seed enhancement by transferring germ plasm *across* species. This raises the potential for unintended and unforeseeable outcomes such as further pest and weed resistances, viruses and genetic transfers through cross-pollination to non-GM crops and wild plant relatives, as genetically modified organisms (GMOs) can reproduce and recombine once released (Cummings 2005; Kloppenburg 2004; Altieri 1998), and the inevitable drift of seeds makes it near impossible for farmers who reject GM crops in principle to resist the contamination of their fields in practice when such crops are planted in neighbouring fields, an issue that is discussed in Chapter 2. There have been steep adoption curves after 1996 for GM soy and maize in the USA, Argentina and Canada, with some production also growing overtly in China and clandestinely in Brazil (Buttel and Hirata 2003). Though this is a small number of countries it nevertheless means that a large percentage of the world's predominant feed crops are already now grown from GM seed, a transformation that has outpaced both the scientific understanding of long-term risks to ecosystems, other species and human health (e.g. new allergies, impacts on immune systems, threats to antibiotics) and meaningful public discussion and debate in these countries. There have been only a very small number of studies on GMOs and human health, and though troubling concerns have been identified in the countries with widespread GMO diffusion the agro-chemical industry has nevertheless been 'given a blank check by government allowing it to commercialize the technology prematurely, before science could validate the techniques being used or evaluate the safety of the products being developed' (Cummings 2005: 30). Beyond the few major adopters, however, agro-input TNCs have been less successful in keeping the matter from public discussion and democratic control, limiting further GM dispersal and becoming a major fault line in multilateral agricultural trade regulation.

Another major and fast-expanding source of pollution caused by industrial farming practices stems from factory farms and feedlots (Nierenberg 2005; Midkiff 2004; WorldWatch 2004; Ladd and Edward 2002; Marks 2001; Mallin 2000; Silverstein 1999; Tolchin 1998). Incredibly dense livestock populations are major consumers and polluters of water, and these environmental impacts are seen most plainly in the USA, the leader in this fast-globalizing model. In excess of 3,000 litres of water go into producing a single kilogram of US beef, as much as an average American household will use for all of its activities in a month (Durning and Brough 1991), while a factory-farmed pig demands roughly 132 litres of water a day for drinking and the flushing of wastes. A typical US slaughterhouse consumes roughly the daily equivalent of the water demand of 25,000 people, with nearly 1,000 litres of water used per large animal in the slaughter, evisceration, deboning, washing of carcasses and sanitizing of equipment, all of which produces large volumes of waste water full of blood, intestinal contents, fat, grease and cleansing solvents (Midkiff 2004). In 1997, a report for the Senate Committee on Agriculture stated that the annual volume of animal manure produced in the USA (1.4 billion tons) was roughly 130 times more than the volume of human sewage, most of this in vast concentrations on factory farms and feedlots, and noted that animal agriculture is the largest contributor to pollution in 60 per cent of the rivers and streams classified as 'impaired' by the US Environmental Protection Agency (EPA) (ibid.; WorldWatch 2004; Silverstein 1999). As a result of all this, the US EPA describes industrial agriculture as the 'single largest threat to US waters' (quoted in Midkiff 2004: 2).

The waste cycling from factory farms does not come close to approaching how small animal populations on integrated farms were and are used to fertilize soils in rotations with grains, legumes and pastures. Because the volume of faecal matter from factory farms is far greater than what can be sprayed on nearby fields, much gets contained in massive cesspools or 'lagoons', some as great as 7 hectares in size. Up to three-quarters of the nutrient content from factory farm manure does not end up in the crop cycle but gets lost in its storage, treatment and handling (ibid.; Buttel 2003). Containing waste from cattle feedlots is also notoriously difficult. These large volumes of concentrated faecal matter inevitably end up contaminating both the water and air, as lagoons and feedlots and the sprayed manure that does not get absorbed by plants run off into waterways or seep into the ground, another major factor along with the synthetic fertilizer in the excessive nutrient loading which ends up impairing the health of aquatic ecosystems. Some unabsorbed nitrogen also gets released into the air as gaseous ammonia, creating infamous and unhealthy 'smell-scapes' around CAFOs (Nierenberg 2005; Midkiff 2004; Buttel 2003; Silverstein 1999). In addition to the dangers from seepage and airborne emissions, the huge volumes of waste from factory farms are also obviously vulnerable to negligence, accidents and severe weather, particularly the open-air lagoons. One particularly destructive event occurred when a hurricane hit the state of North Carolina, a national leader in factory-farmed pigs, causing 159 million litres of animal waste to enter the state's waterways (three times more volume than the oil spilled by the *Exxon Valdez*, one of the worst environmental disasters in the USA), killing an estimated 10 million fish (Mallin 2000; Silverstein 1999).

Industrial farm animal production poses serious risks to human health in a number of ways. Dangerous diseases are evolving as billions of animals are forced into extremely unnatural lives in cramped and often filthy quarters, and the nature of global poultry production is entwined with the great threat posed by avian influenza, or bird flu. While avian flu has been around for centuries, it has only

recently mutated into the exceptionally virulent strain of H5N1 that is now capable of jumping the species barrier into humans, with FAO reports drawing links between its development and the rapid industrialization, growth in scale and geographic clustering of poultry production in China and South-East Asia, as the chicken population doubled in China in fifteen years and trebled in Thailand, Vietnam and Indonesia from the 1980s (Nierenberg 2005). Public health officials worldwide are planning for the eventual mutation of H5N1 into a virus capable of spreading from humans to humans, which would set off a lethal global flu pandemic given the lack of human immunity. The WHO is warning that the occurrence of a large-scale outbreak is a matter of *when* not *if*, and is calling for massive preparation within and between national health systems (M. Davis 2005). Meanwhile, hundreds of millions of chickens have already been culled worldwide, and given that chickens are treated as cheap commodities throughout their life-cycle, with virtually no limit to the pain and suffering that can be inflicted, when they suddenly become an expense to be disposed of rapidly it is chilling but not unexpected to hear that many culls around the world have involved burning or burying alive whole flocks of birds as a means to cut losses (K. Davis 2005).

Another serious public health risk stemming from industrial farm animal production is bovine spongiform encephalopathy (BSE) and the human equivalent, Creutzfeldt-Jakob disease, popularly known as 'mad cow disease' because of the fatal brain wasting it induces. BSE can occur when cattle, a biologically herbivorous species, are given feed containing rendered neural tissue, bonemeal and blood from cattle carcasses, and humans who eat contaminated beef can then be infected. The United Kingdom prohibited 'cannibalistic' feeding practices after its mad cow outbreak, but mad cow scares continue recurring in some places, most notably North America. The spread of factory farming is also linked to a range of infectious food-borne pathogens, including *Escherichia coli* (E. coli), salmonella and listeria (Midkiff 2004; Mattera 2004; Schlosser 2002). As Nierenberg (2005: 49) suggests, however, 'instead of calling for changes in the way animals are raised and meat is processed, many producers and government officials have proposed simply irradiating meat to kill food-borne pathogens and bacteria', which is essentially a means to 'mask filth ... from factory style methods'. The localized air pollution from factory farms, particularly the toxic hydrogen sulphide emissions that give pig farms their indelible stench, produces a variety of health problems for workers and nearby residents, including persistent headaches, respiratory ailments, depression, anxiety and fatigue.

Concentrated factory farm effluence has been found to produce the toxic microbe *Pfiesteria pescicida*, which is deadly for fish and can cause a variety of skin ailments for humans (ibid.; Midkiff 2004; Buttel 2003; Silverstein 1999).

The industrialization of farm animal production is inseparable from the meatification of diets, which are typically high in saturated fats and cholesterol and have been identified in epidemiological research as a major contributing factor in chronic health problems such as obesity, cardiovascular disease, strokes, osteoporosis, diabetes and some cancers (IATP 2006; Campbell and Campbell 2005; Barnard 1993; Chen et al. 1990).[7] As well, the long-term health risks posed by the bioaccumulation of rising volumes of the pharmaceuticals used to stimulate growth and suppress disease in concentrated conditions, persistent organic pollutants and agro-chemicals (in feed derived from industrial monocultures, including often GM soy and maize) in factory-farmed animal flesh, egg and dairy products are not well understood and undoubtedly difficult to quantify. Another related human health concern is that antibiotics used to treat humans have been widely employed in factory farming, which can lead to antibiotic resistance in bacteria, fostering the emergence of more dangerous infectious diseases for humans and undermining the effectiveness of some medicines – the reason why the EU banned the sub-therapeutic, growth-enhancing use of such antibiotics (Nierenberg 2005; Buttel 2003).

In sum, there is a rather less savoury underside to the 'pseudo-variety' of the industrial grain-livestock complex:

> … routinely contained in nearly every bite or swallow of non-organic industrial food are antibiotics and other animal drug residues, pathogens, faeces, chemicals, toxic sludge, rendered animal protein, genetically modified organisms, chemical additives, irradiation-derived radiolytic chemical by-products, and a host of other hazardous allergens and toxins. (Lilliston and Cummins 1998, quoted in McMichael 2000a: 31)

Agriculture and epochal ecology While debates persist as to how changes in atmospheric chemistry will affect various climates and weather patterns, sea levels and oceanic currents, ecosystems and bio-feedbacks, the range and resilience of other animal species and agricultural production, there is global scientific consensus that anthropogenic climate change is occurring and a near-certainty that fossil fuel emissions have a fundamental role in destabilizing the earth's atmosphere (IPCC 2007, 2001). The Intergovernmental Panel on Climate Change (IPCC) – the forum established in 1988 by the World Meteorological Organization (WMO) and the United Nations Environment Programme (UNEP) for compiling and assessing the state of scientific research on climate change – has for some time emphasized that the negative fallout from climate change will be unevenly distributed, spatially and in class terms, set to 'fall disproportionately upon developing countries and the poor persons within all countries and thereby exacerbate inequities in health status and access to adequate food, clean water and other resources' (IPCC 2001).[8]

In essence, climate change modelling has projected the threats associated with sea level rises, increased severe weather and changing precipitation patterns to be the greatest in the poorest regions of the world, including many tropical countries, where the resources to respond are the least. Conversely, the per capita greenhouse gas emissions causing climate change are highest in the wealthiest, temperate countries of the world, led by the USA (five times the world average), which is the biggest obstacle to the modest multilateral greenhouse gas emission reduction commitments of the Kyoto Accord. The case for understanding the global inequalities associated with climate change and this inverse burden–responsibility relationship is summarized by Athanasiou and Baer (2002), and the unequal class vulnerability to severe weather hazards was seen unmistakably with Hurricane Katrina in the southern US in 2005, which even the world's richest country managed so poorly. Very recently, however, there has been a marked shift in how the economic fallout of climate change modelling is being understood, with profound economic ramifications for the entire global economy (IPCC 2007; Stern 2006).

The other epochal global context for assessing agriculture's footprint is the rapid loss of biodiversity, which can be understood only on the vast timescale of evolutionary history. While extinctions are a natural process in the course of evolution, for most of the history of life on earth they have occurred in small numbers over very long periods of time (the background rate), save for five 'spasms' in which extinctions occurred in large numbers over short periods of time. Today, as the eminent ecologist E. O. Wilson puts it, 'virtually all students of the extinction process agree that biological diversity is in the midst of its sixth great crisis, this time precipitated entirely by man', through the destruction and fragmentation of natural, self-organizing ecosystems (quoted in Leakey and Lewin 1995: 235; Wilson 2002; Novacek 2001). While there are only estimates about the precise number of species on earth and even larger voids in understanding interrelationships and responses to habitat reduction, modification and fragmentation, which has led to a range of estimates about current and looming extinction rates, this should not detract from the urgency of the matter. A mid-range estimate in the 1990s was that 30,000 species were pushed to extinction every year, or roughly three per hour (Leakey and Lewin 1995).

The range and long-term adaptive capacity of species within drastically simplified and human-dominated landscapes vary greatly, and the outcomes of disrupting ecosystems can often not be fully anticipated nor stability re-engineered. Climate change further magnifies the problem of habitat loss and fragmentation, as rates of change are expected to be much faster than most species could adapt to, and those capable of migrating will find movement difficult over long distances within a human-dominated environment. While plants and invertebrates comprise most of the thousands of species going extinct each year, the global biodiversity crisis has its most profound expression in the endangerment of animals, birds and amphibian species, of which there are much fewer. As natural ecosystems are reduced to smaller and often unconnected patches, other species – especially large animals – can find less refuge from human activity, leaving landscapes of 'ghosts' to borrow Grumbine's (1992) imagery. Macro-scale systems theorizing like Lovelock's (1987) Gaia hypothesis give additional cause for humility about the great unknown that the biodiversity crisis represents, along with both its ecological and moral weight.

But the captains of the global economy are impervious to these ecological and ethical imperatives associated with the extinction spasm and climate change, shielded by an insularity of frightening proportions that is braced by attacks on academic environmental science by corporate-funded think tanks like the Competitive Enterprise Institute (e.g. Bailey 2002) which are routinely echoed in the corporate media. Never has this insularity been put more bluntly than in George Bush Sr's famous remark to the Rio Earth Summit in 1992 that 'the American lifestyle is not up for negotiation', which was echoed a decade later by his son's attempt to explain the US refusal to sign the Kyoto Accord: 'We will not do anything that harms our economy, because first things first are the people who live in America. That's my priority.' In this context it is little wonder that the oil-fuelled productivity, chronic toxicity and increasing food miles discussed earlier, along with the ever expanding footprint of animal agriculture discussed below, have no bearing on the narrow measures of efficiency that are held up by the advocates of corporate-driven industrial agriculture, something that is discussed further in Chapter 5. And because conventional accounting systems fail to account for the atmospheric burden of emissions (the atmosphere being a free sink) or the damage to self-organizing ecosystems and the loss of other species (which go un- or undervalued), the externalization of these mammoth environmental costs must be seen as underwriting how the efficiency of industrial agriculture is reflected in markets.

Modern supermarkets around the world routinely feature food items that have been transported over great distances after having been produced on land that was tilled, seeded and harvested by large fossil-fuel-driven machinery and fertilized and sprayed with petrochemical-derived inputs shipped in from faraway factories, and yet which sell for a cheaper price than could comparable food items produced locally with less input-intensive methods. Whether this reveals something about efficiency and comparative advantage or rather a perverse cost accounting and incentive structure is surely debatable, recalling how the free market approach to food security rests on the assumption that market integration and the 'rationality' of comparative advantage will optimize the efficiency of supply and hence reduce cost per unit for the entire system. Instead, we see this universalizing claim to economic rationality, as held by mainstream market economics more broadly, to be a convenient guise for an ideological framework that allows foundational assumptions to be cast outside the realm of debate or moral concern. Normative economic measures have marginal, if any, capacity to assess the productive efficiency of farming in an ecologically rational way and different frameworks are urgently needed, an argument taken up in Chapter 5.

Additionally, to assume that the costs of industrial foods will continue to be subsidized by the relatively low price of oil is not only an environmental fallacy but could well prove untenable under conventional cost accounting. Most major oil-producing countries have already reached or are fast approaching the halfway point of their oil reserves and the reality of diminishing reserves coupled with the increasing energy needed to extract waning supplies is likely to drive rising costs, a phenomenon that has been called 'peak oil'. When these costs become embedded in transport, machinery use and agro-inputs it will have the most deleterious effect, at least in the short term, on low-income food-deficit countries, which are already spending large portions of their scarce foreign exchange on food imports. Given the extent to which industrial food production is dependent upon fossil energy and petrochemicals, this is a significant component of the great geostrategic tensions embedded in the struggle to control the world's oil supply (Heinberg 2005; Harvey 2003).

To appreciate the widening ecological footprint of animal agriculture requires more elaboration. Since the rise of agriculture humans have simplified and fragmented ecosystems and increasingly affected the lives of animals through farming both directly, in domestication, and indirectly, through habitat loss with the growth of human populations and technologies. Yet while agricultural production inevitably involves some deliberate manipulation and reduction of biodiversity, and though landscapes may have been transformed to the detriment of other species (and eventually often to the long-term detriment of those societies doing the transforming), agricultural systems have never before dominated the lives of individual animals on anything approaching the current scale or degree, nor have they so threatened the existence of other species. The flipside of the biodiversity crisis is that a relatively small number of animal species thrive in human-dominated landscapes at the same time as an even smaller range of animal species are exploited in ever larger numbers and intensity while largely disappearing from visible landscapes into factory farms.

The impoverishment of landscapes thus should be seen not only in extinctions and extirpations, which environmentalists tend to focus on, but in something they typically do not: the rapid growth and confinement of farm animal populations. The first and more obvious reason for this is that this growth has a strong relation to the growing physical scale of human economic activity and resource consumption, part of which has already been discussed and which will be further drawn out now. The second reason is that the ethical dimensions of humanity's footprint do not exist only at the abstract, species level which is commonly held up by environmentalists (i.e. that we should defend the natural areas in order to protect 'wild' species' place on earth), but relate to how sentient life has been commodified; in other words, how the lives of individual animals are dominated to serve human economies and how extreme violence has been systematized and pushed into the unconscious.

As noted earlier, livestock products now account for roughly 37 per cent of global food production, a large, growing and historically unprecedented percentage, if unevenly distributed. But this nevertheless greatly understates the place of livestock production in agricultural landscapes. More than two-thirds of all arable land is devoted to livestock production – roughly one-third of the earth's land surface – either as pasture or to grow feed crops (Nierenberg 2005; de Haan et al. 1997). While some cattle, pigs, sheep and goats graze on land that is not suitable for cultivation or which is left fallow between planting cycles, and poultry birds, pigs, sheep and goats commonly

scavenge around small-farm households in developing countries, the soaring global livestock population is increasingly reared in industrial systems, is consuming a rising share of the world's net cereal crop and grazes on extensive areas of agriculturally productive land.

The fact that not all land used for grazing and permanent pasture is suitable as permanent cropland is often used to justify extensive ranching on marginal arable lands, from arid regions to Amazonia, as though this were the only option in a binary equation of pasture or agriculture. In addition to assuming that other species have no claim to habitat on this land, such a case ignores the fact that extensive ranching is a major factor in most areas undergoing desertification (Rifkin 1992). Instead, in light of the global crisis of biodiversity and the scale of desertification, a basic conservation target would be the progressive removal of marginal lands from production and ecological rehabilitation for animal habitat. This is not to be insensitive to local peoples or traditional pastoralists; it is a generalized target and not a dogmatic objective, which must obviously be nuanced in various local settings with justice for local peoples a key goal. Justice often means movement away from marginal areas and redistributing better-quality areas, however, as poor farmers have been widely forced to work low-quality lands by the unequal distribution of the most productive arable land. Small farmers pressed into the frontiers of deserts or the front lines of tropical deforestation are good examples. This assumption in hand, the discussion of efficiency will focus on the efficiency of food production on agriculturally productive land, where the vast majority of animal production occurs.

As a basic rule, 'the resources required to provide a given diet depend chiefly on the amount of animal products it contains' (Gilland 2002: 48). This is because in the process of cycling grains through animals to produce meat, high percentages of plant protein, carbohydrates and fibre are lost. Gilland (ibid.) calculated the ratio of cereal feed to livestock protein product output to be 17; that is, roughly 17 units of cereal feed are used globally to provide 1 unit of livestock product protein output. He derives this calculation from 1999 figures, when 655 million tons of cereals were fed to livestock and 61 million tons of animal protein were consumed by humans, with marine products accounting for 10 million tons of this animal protein and grassland forage fortifying 12 million tons of animal protein, thus resulting in a ratio of 655:39. The US Department of Agriculture has furnished a similar estimate, suggesting that the production of 1 kilogram of beef requires the input of 16 kilograms of grain and soy feed. Precise ratios vary from species to species, with poultry a more efficient converter of feed to edible meat and cattle the least efficient, but in general these nutrient conversion losses in cycling feed through livestock mean the growth of animal agriculture and the meatification of diets require significantly more land to be cultivated per person than would be required for more plant-based diets. Roughly half of all cropland worldwide is used for animal feed, led by large percentages of maize and even larger percentages of soybeans (Nierenberg 2005; WorldWatch 2004; Goodland 1997; Brown 1996; Brown and Kane 1994; Durning and Brough 1991). While rising meat consumption is often treated as a normative part of an improved diet, this is a matter of much contention (Campbell and Campbell 2005; Barnard 1993; Chen et al. 1990).

As well, a sizeable share of the global fish harvest ends up as animal feed in an age when most waters have been harvested to or above their renewable limit. The fast-rising scale of fish farming is requiring additional grain production and levying its own very serious ecological disruptions (FAO 2002c; Ellis 2003). The FAO (2002c) classes 18 per cent of marine fish stocks or species groups as 'overexploited', 10 per cent as 'significantly depleted or recovering from depletion', 47 per cent as 'fully exploited' with 'no reasonable expectations for further expansion' and only 25 per cent as 'underexploited or moderately exploited'. The growth of industrial fish farming is increasingly restricting the access of small-scale fishermen to formerly communal areas and has become a major force in destroying mangroves and estuaries (ibid.).

The basic inefficiency of nutrient cycling means that increasing animal production expands not only agriculture's land-space but its demands on other resources such as water and energy. The additional demands on other resources such as water and energy. The additional grain demand and the cultivation of more cropland than would be required by more plant-based diets entail more fertilizer, chemical, water and energy usage on industrial farms. In the USA, for instance, livestock consume roughly 70 per cent of all domestic grains, including an even higher percentage of maize – a crop that alone consumes about one-third of US crop space, 40 per cent of nitrogen fertilizer and more total herbicides and insecticides than any other crop. Resource demands are further magnified by the intensity of water consumption and pollution from factory farms and slaughterhouses and the energy needed to control the temperature of factory farms and run the slaughter process. As a result of the additional grain and the resource budgets of these industrial systems it has been estimated that an edible unit of protein from factory-farmed meat requires 100 times more fresh water and more than eight times the fossil-fuel energy than does an edible unit of protein from grain. In addition,

what does not get accounted for in these calculations is the fact that meat and dairy have higher refrigeration demands than most foods, as can be seen clearly in any supermarket. The growth in farm animal populations has another notable impact on the atmospheric 'sink', as the flatulence and waste of farm animals contributes to 16 per cent of the world's emissions of methane, a potent greenhouse gas, and global methane emissions from livestock are projected to rise by another 60 per cent in the coming decades given the continued growth in farm animal populations (Nierenberg 2005; WorldWatch 2004; FAO 2002a; Durning and Brough 1991).

In short, the meatification of human diets and the industrialization of animal agriculture are exacting an ever-growing 'ecological hoofprint' in different ways, and this is increasingly being recognized by environmental organizations and researchers (e.g. Nierenberg 2005; WorldWatch 2004; Silverstein 1999; Lutzenberger and Halloway 1999; Goodland 1997; Brown 1996; Brown and Kane 1994; Durning and Brough 1991). Historically, Western environmentalists have placed great emphasis on containing human population growth, and together with this some are also now stressing the importance of both resource consumption disparities and the important role livestock products play in these. In recent years the WorldWatch Institute has been paying special attention to how rising affluence and meat consumption in Asia are placing increasing pressure on global grain stocks.

But an additionally crucial environmental issue, though it is not often understood as such within mainstream environmental organizations, relates to violence embedded in industrial farming practices and the ethical questions associated with humanity's treatment of, and moral obligations to, non-human animals, as increasing numbers of farm animals are being subjected to lives of immeasurable suffering. Midkiff (2004: x), an author who comes from a pig-farming family in the US Midwest, describes the proliferation of factory farming as an 'ever expanding boundary of suffering and filth'. In factory farms, animals are kept in small individual enclosures on metal grated or concrete floors, allowing excrement to be collected in cesspools and the spaces washed more easily, or in very crowded but shared larger spaces deprived of sunlight and fresh air, and are fed concentrated diets of specialized feed, pharmaceuticals and in some cases hormones. Females are repeatedly inseminated and separated quickly from their young, separation which is a violent act in itself regardless of whether it is recognized that an emotional or biophysical nurturing impulse is being denied. Among mammals this separation is especially swift for dairy cattle and their male calves, which are raised as veal. Routine mutilations such as castration, branding, horn and tail docking and debeaking are done to mask various behavioural problems that emerge from these confined conditions, and are generally performed without anaesthetic. Regan (2004) and Masson (2003) make compelling cases for people to recognize not only the physical pain but also the intellectual and emotional capacities of farm animals, and hence the stress, confusion, fear and sadness they endure in these conditions, arguing that farm animals are the subjects of individual lives that are worthy of moral consideration.

The life of factory-farmed animals culminates in callous transport to slaughter during which they are commonly deprived of food, water and temperature control on long journeys, and face a terrifying final ordeal on the killing floor. At fast-moving slaughterhouses animals are kicked, dragged, thrown or prodded down narrow chutes, watch their fellow beings slaughtered ahead of them amid screams, wailing and the smell of blood, and with the quickening pace of 'disassembly lines' it is not uncommon for animals to be mis-stunned and slaughtered while fully conscious. Factory 'layer' hens arguably face the worst conditions of all farm animals as they are packed in wire-mesh battery cages, in many cases so small they cannot turn around or spread their wings, and their feet commonly grow painfully around the wire as they are immobilized in constant light and cacophony, conditions that have been likened to a 'high-tech torture chamber' (Watts 2005: 531). Male layer chicks, whose genetic make-up makes them uneconomical to raise, are variously suffocated, gassed, drowned, crushed or ground up alive in egg-producing factories upon hatching. Given these conditions and the fact that there are many more individual chickens than any other farm animal species, and that chickens are so heavily factory farmed, Karen Davis (2005) describes this as 'the biggest universe of pain and suffering' humanity has inflicted on another species.[9] Yet while these 'torture chambers' are fast spreading globally they remain shrouded in the social unconscious, hidden from the vast majority of people.

Conclusions

This chapter has sought to bring into focus some of the key issues in what is at stake in the battle for the future of farming. It has done this by exploring the power exerted by agro-food and agro-input TNCs throughout the global food economy, the imbalances in production and trade, the social dislocation that is occurring and projected, and the unstable environmental foundations of modern industrial agriculture at different scales. Agro-input and agro-food TNCs are at the heart of a series of transformative pressures decreasing the

viability of small-farm livelihoods: standardizing inputs, production conditions and techniques; replacing labour with technology; shifting control and surplus steadily off the farm; ensnaring farmers in a rising cost–falling price squeeze, reducing their margins; replacing biological diversity on farms with 'pseudo-variety' on supermarket shelves; increasing food miles; propelling dietary convergence (especially for global elites but also, in very different ways, for the world's poor) that is divorcing food from time, space and culture; rearing animals in much greater numbers and confinement; and externalizing untold costs upon the environment, including the expanding 'ecological hoofprint' as more grains are cycled through livestock in absolute and relative terms.

And yet any critical review of the global food economy must also recognize its great bounty. As has been emphasized, never before has so much food been produced on the per capita level, and for most people in industrialized countries and increasing numbers in developing countries, supermarkets appear as a veritable Julian Simon-esque cornucopia, teeming with a far greater range of cheap items than even a few decades ago. This bounty is also coupled with the expansive and intensifying commodification of food and the fact that the social relations, resources, technologies and animal lives behind the commodities are becoming ever less visible and comprehensible to consumers. People in many parts of the world are sitting down to meals with less idea than ever before about where the food in front of them was grown, the conditions under which it was cultivated, reared and processed, what chemicals it contains, who is making the decisions or how it was distributed, much less anything about the broader social and environmental implications of the system through which they get their food. A brand name instead substitutes for most of this knowledge.

Thus, the system is upheld not only by the vested interests such as the corporate executives, shareholders, politicians and large farmers it enriches and empowers, and its ability to provide a surfeit of cheap food, but also by the degree to which its logic becomes either invisible or is accepted as the normative way of doing things, so decreed by the almighty law of competitiveness. And as the logic of food as a commodity produced on large, industrial farms, dominated by huge agglomerations of capital, and purchased in markets becomes more accepted, conceded or invisible, there is no doubt that it acquires an aura of inevitability, akin to Margaret Thatcher's famous claim that 'there is no alternative' to capitalist market integration and the dominance of large corporations within the global economy.

The following chapters attempt to trace the pivotal modern dynamics in how the global food economy evolved and has been institutionally fortified, emphasizing throughout that there was nothing inevitable about this process and that there were and are alternatives.

Notes

1 From a 2002 annual report, accessed in 2003 at <www.yum.com/about/international.htm>. ©2002 Yum! Brands, Inc.

2 Measured between the base years 1964–66 and 1997–99 (FAO 2002a).

3 The statistics given in this chapter are derived from the excellent FAOSTAT database.

4 All world trade totals discussed in this section have been adjusted to exclude intra-EU trade as exports which, when included, greatly exaggerates Europe's place in the global food economy.

5 From the song 'Them Belly Full but We Hungry' (*Natty Dread*, Island Records, 1974).

6 A computer image of the magnitude of the soil degradation problem is produced by the United Nations Environmental Programme, entitled the Global Assessment of Human Induced Soil Degradation (GLASOD). It is available at <www.grid.unep.ch/data/data.php?category=lithosphere>.

7 The Physicians Committee for Responsible Medicine provides valuable sources of public health and nutritional education. See <www.pcrm.org/>.

8 The IPCC's useful website can be found at <www.ipcc.ch/>.

9 For more on Davis's work on behalf of poultry birds, see United Poultry Concerns at <www.upc.org>.

TWO
The temperate grain-livestock complex

Speeding agrarian revolutions

Revolutionary changes in agricultural production once unfolded over the course of millennia (e.g. the domestication of crops and livestock), then over centuries (e.g. the English enclosures and the rise of capitalist agriculture; the ecological impacts of imperialism) and in the twentieth century were compressed into the space of mere decades (e.g. the Green Revolution, factory farming, genetic engineering) (Friedmann 2000). Though the focus in this chapter is on the speeding agrarian revolutions of the twentieth century, the dynamics initiated by the enclosures and the ecological transformations wrought by imperialism are a necessary foundation for understanding the radical simplification, industrialization and integration of the temperate grain-livestock complexes. As Bernstein (2000: 28) suggests, two elemental ways in which capitalism conditions agriculture help to make sense of the structure and ongoing mutations of the global food economy:

> The first is the drive of technical innovation to *simplify* and *standardize* the conditions of agricultural production: to reduce the variations, obstacles and uncertainties presented by natural environments to approximate the ideal of control in industrial production ... The second, and related feature, is the increasing *integration* of farming by capital concentrated upstream and downstream of production on the land.

The rise of agrarian capitalism The changing conception of agrarian property and the enclosure movement in England were at the heart of the historic rupture of feudalism and the origins of capitalist social relations. Feudalism was a deeply stagnant social order, as land was held by title or custom and tribute extracted from the weak by the powerful through obligation and threat of force, stifling social and technological change. For various historically specific reasons, including an especially strong monarchy, a fragmented nobility, weaker customary land rights for peasants and more developed domestic