

## CHAPTER ONE

### Introduction: Why environment and food?

“Eating, more than any other single experience, brings us into a full relationship with the natural world. The act itself calls forth the full embodiment of our senses – taste, smell, touch, hearing, and sight. We know nature largely by the various ways we consume it. Eating establishes the most primordial of all human bonds with the environment...(it) is the bridge that connects culture with nature...” (Rifkin 1992: 234).

“No area of concern demonstrates the difficulty of managing the contradictions of the food system as clearly as the environment” (Goodman & Redclift 1991: 202)

If, according to Wendell Berry, “eating is an agricultural act” then by extension it is also an ecological act. What we eat and how we eat has more impact on the earth than almost anything else. Yet we have shown little interest in this connection until recently, when terms such as ‘food miles’, ‘carbon footprints’ and ‘fair trade’ have come into wider public discourse.

The basic biological necessity for all human life – the essential physiological requirement that we all share – is the need to eat. Historically, the kinds of food that we ate and the style in which it was consumed reflected a host of social, cultural and geographical factors. The past one hundred years, however, has probably witnessed a greater transformation in the foods that we eat than at any time since the Neolithic Revolution twelve thousand years ago when hunting and gathering gradually gave way to farming. During the twentieth century significant changes gathered pace, initially in North America and Europe but spreading quickly to other societies around the world, that has seen a greater convergence in dietary practices with marked consequences for food production methods and for human health.

With respect to the former the application of scientific methods and industrial technologies dramatically altered the scale and productivity of farming and food processing. Established practices in the rearing of animals and cultivation of crops;

the sourcing, processing and distribution of agricultural produce; and in the purchase, preparation and consumption of food were all fundamentally transformed. This was to have a significant impact on the environment: on landscapes, soil and water resources, biological diversity and the global climate system. As regards human health, food is now cheaper in real terms and more readily available (for those with the means to purchase it) than ever before. But the ubiquity of highly processed, cheap and convenient foods is driving rising levels of diet-related diseases and associated risk factors (cardio-vascular, diabetes, obesity) on a global scale (Hawkes 2008).

We have arrived at a point where food has become a highly contested arena of competing paradigms (Lang and Heasman 2004). In the realm of production some commentators insist that the “application of agricultural and food system science has been one of the great success stories of mankind”. Fresco reminds us that since the 1960s,

“(W)orld population has doubled while the available calories per head increased by 25 percent. Worldwide, households now spend less income on their daily food than ever before, in the order of 10-15 percent in the OECD countries, as compared to over 40 percent in the middle of the last century. Even if many developing countries still spend much higher but declining percentages, the diversity, quality and safety of food have improved nearly universally and stand at a historic high” (Fresco 2009: 379).

These have been remarkable achievements to date, of this there is no doubt, particularly for those of us in the high-income countries of the world as well as for increasing numbers of urban residents in middle-income countries who, on the whole, enjoy a privileged position within the global agri-food system. Clearly science has played a major role in helping to feed the world, as the green revolution demonstrated (Godfray et al 2010). However, if agricultural and food system science is such a success story, as Fresco argues, “because of the collective capacity of humankind to adjust to the lessons learnt”, then this would appear to be a vital moment to take stock of the shortcomings and weaknesses of the current global agri-food system and remind ourselves that:

- The reliance upon the market as the sole effective mechanism for the supply and demand of food requires every individual to possess the capacity to buy. Such a mechanism cannot ensure equitable access to food, nor can it guarantee the provision of even basic nutrition for all. An estimated one billion people in the world are experiencing hunger and malnutrition because of their lack of **entitlements** through which to express a demand for food.
- In a context where international food policy appears no longer ‘fit for purpose’, the profit-seeking behaviour of food companies encourages them to promote those snack, convenience and confectionary products that are high in salt, sugar and fat. It has been suggested that over one billion people in the world are overweight or obese and susceptible to a range of diet-related diseases (Lang et al 2009).
- The declining share of food in the household budgets of consumers does not reflect the true economic, social or environmental cost of its production, distribution and consumption. What we pay for food at the supermarket checkout does not take into account the loss of ecological services, the depletion of resources, the impairment of earth system processes, and the rising medical costs of poorer human health.
- Calls for a ‘doubling of food production’ to meet rising demand from a growing, more urbanised and possibly more affluent global population must not result in more of the same kinds of productivity-driven science and technology ‘solutions’. Rather, questions of delivering global food security with sustainability will require new approaches that can ensure appropriate developmental, environmental and social justice outcomes (Pretty et al 2010).

So in a context where the world produces enough food for all at historically low prices, the global food system has created unprecedented numbers of underfed and overfed people. And at a time when it has recently been shaken by growing volatility of food prices, with severe impacts for the world’s poor, it is confronted by a number

of serious challenges, including the prospect of growing freshwater scarcity, a tightening of energy markets and greater climatic perturbation.

### **Food and the environment**

There is now sufficient evidence and scientific consensus around the phenomenon of human-induced climate change, with warming of the climate system now regarded as unequivocal (IPCC 2007). According to a report produced for the European Commission, what we eat has more impact on climate change than any other aspect of daily life, accounting for 31 percent of the **global warming potential** of products consumed (Tukker et al 2006). One category of foods that records the greatest environmental impacts across a range of categories is 'meat and meat products', with livestock production accounting for 18 percent of global greenhouse gas emissions. Yet projections that talk of doubling demand for food by 2050 assume that consumption of meat will continue to rise sharply in rapidly developing economies as an inevitable aspect of the nutrition transition (Popkin 2006). With around 40 percent of global meat production supplied by factory farms, increasing volumes of cereals and oil seed crops are being grown for livestock feeds, and account for at least one-third of total global grain output.

Agriculture accounts for around 86 percent of global freshwater consumption and it has been estimated that one person alone might eat up to 5,000 litres of 'virtual water' per day, depending upon their diet, represented by the evaporation and transpiration associated with growing crops (Hoekstra and Chapagain 2007). Yet freshwater resources in some regions are seriously depleted and raise questions about the appropriateness of water-intensive farming systems in dry countries producing export crops for distant markets.

Recent events have also revealed the degree to which the agri-food system has become entangled with global energy markets. In every aspect – from farming, through processing and manufacturing operations to retail and to the point of consumption – the modern food system rests upon an abundant, low cost supply of energy that is overwhelmingly provided by fossil fuels. Natural gas provides the

feedstock for fertilisers while oil is used to drive farm and other plant and machinery; is transformed by the petrochemicals industry into a wide range of packaging materials; and, critically, underpins the ever-lengthening supply chain that brings foods from all over the world to our local supermarkets. Concerns about rising energy prices and a belated realisation of the extent of our dependence on petroleum have resulted in a significant expansion of biofuel crops that compete with food crops for arable land.

### **Sustainability and food**

These brief observations should indicate that the perspective taken in this book is a good deal less celebratory of agricultural and food system science than conveyed by Louise Fresco's quotation. This is not to deny the evident achievements of scientists and farmers to increase food output, but to make clear that we need a more holistic framework through which to evaluate the performance of the agri-food system than the adoption of singular '**productivist**' criteria such as output volume or yield. It is in this regard that the notion of sustainability has emerged as a framework capable of conveying important underlying principles across the biological, economic and social realms. One of the essential requirements of sustainability is to maximise goal achievement across these three realms through an adaptive process of trade-offs, a process that must necessarily be place- and time-specific. Consequently, it is not possible to reconcile sustainability with the kinds of scientific and technological 'blueprints' created in the private or publicly funded research facilities of the North with the intention of rolling them out across the developing world. Striving to improve productivity is important, but so is achieving other system properties such as: stability (of output or prices); resilience (an ability to recover quickly to events such as drought or crop pests); social justice, durability, diversity amongst other things. At this stage a detailed understanding of the notion of sustainability is not required – we will return to it at the beginning of Chapter seven – but we can at least draw some simple rules.

First, a sustainable food system must be able to demonstrate that it can optimise agricultural output without compromising the stock of natural resources and

ecosystem services. However, it needs to move beyond that, extending through all subsequent stages of processing, manufacturing, distribution and retailing, to the point of consumption. Secondly, each stage of a sustainable food system must endeavour to minimise the use of non-renewable resources (such as fossil fuels), ensuring that the utilisation of renewable resources (eg wild capture fisheries) is within their capacity to regenerate stocks. Thirdly, a sustainable system must reduce waste streams to a minimum and aim to bring pollution levels to within the capacity of ecosystems (the atmosphere, streams, rivers and estuaries) to deal with and neutralise these wastes (a process known as remediation). Finally, a sustainable food system is also committed to the principle of equity, which means working to ensure the achievement of food - and, indeed, nutritional – security for all.

The notion of sustainability possesses markedly different meanings for different actors depending upon their position within the agri-food system. It is unlikely that a dairy farmer in Western Europe shares the same understanding as the CEO of a large food manufacturing company or that of a city-based office worker who buys their food from a supermarket, let alone an agricultural migrant worker toiling in the fields for below legal minimum wages: all will have quite different perspectives on what a sustainable food system looks like. Yet if sustainability is to have any real meaning at all, that is beyond the rhetoric of corporate ‘greenwash’, then finding ways for farmers and farm-workers, other food producers as well as consumers and civil society actors, to have a voice in shaping the rules and principles of the food system would seem vital.

It is apparent that since the rise of the modern agri-food system after 1945 (which is discussed in Chapter Two), there has been a relentless squeezing of the public into the category of ‘consumers’. Under the cover of a continuous and heavy barrage of advertising, consumers have had their attention refocused onto individualised concerns for convenience and low price. This has not only led to the exclusion from the mainstream of other food quality criteria (its sensual attributes, nutritional value, production methods, sourcing and traceability), but has allowed corporate interests to dominate the food system. This has left little room – at least until

recently – for the majority of people to make more profound judgements about their food beyond narrowly circumscribed choices between competing brands. It has also created the legacy of a ‘knowledge deficit’ in which scientists and policy makers assert a monopoly of wisdom over such things as genetically modified organisms and on which the ‘average citizen’ is regarded as uninformed.

With retailers especially anxious to resolve the contradictions of the food system on behalf of their customers (“How can meat be sold so cheaply if not produced under excessive stocking densities”? “Trust us: it’s farm fresh quality assured”) we have come to take for granted so much of what our food system does. As beneficiaries of the in-store cornucopia we have learnt not to ask questions, not to know too much, about the way in which our fillets of meat or green beans end up in polystyrene trays covered in a thin film of polymer. We are actively discouraged to peek behind the curtain that conceals the production methods of the modern food system, and our sensibilities are easily disturbed by unwelcome news of practices associated with intensive animal farming, children in distant countries picking coffee or cocoa beans, or gangs of migrant labourers closer to home collecting field vegetables, salad crops or shellfish. While the contemporary food system frees most of us from toiling for our food beyond the task of pushing a trolley around the supermarket, it has also removed a significant degree of personal responsibility. We have learnt to accept the retailers refrain that what we really want is cheap and convenient food.

Or have we?

There is increasing evidence that many people are choosing to take back some of their power from the corporate food system, to recover a degree of *food citizenship*. Developments, particularly throughout North America and Europe during the past two decades have seen a variety of initiatives aiming to achieve a more sustainable food system characterised by a greater degree of **re-localisation**. There are many different aspects of this phenomenon, some of which are described in Chapter Seven, but amongst the most successful has been the growth of farmers’ markets as sites for the retailing of ostensibly local products. Although there may be a number

of different, locally contingent factors that underlie specific initiatives, there appears to be some common denominator around a desire for food which embodies different quality attributes (fresher, healthier, tastier), which is associated with a producer or someone who can speak on behalf of its authenticity, and which promises to carry less environmental impact. Above all, there has been a desire to recover not only food that is traceable and trust-worthy but which is good to eat; food that is culturally, as well as physiologically, nourishing.

### **The focus and structure of the book**

Before describing the organisation and structure of the book, I should explain something of its geographical focus. The intention in writing this book was to be as global as possible in its approach, reflecting the fact that the world today is criss-crossed in supply chains carrying **agri-commodities** from distant sites of production in poor rural regions to the supermarket shelves of affluent cities. In telling this story there is potential for a great deal of 'thick description', a narrative that would illustrate much of the detail of labour practices, production methods, and consumption choices, but this is better done elsewhere (eg Cook 2004). Rather, the intention here is to outline some of the wider implications of this global system and so specific examples here are, on the whole, briefer and more concerned with environmental and, potentially, systemic consequences.

Given that fish provide less than one percent of the overall caloric intake of the world's human population, and less than five percent of total food protein (Pimentel et al 2008), it was decided to focus in this book on terrestrial – that is land-based – primary food production. Although aquacultural (fish farming) systems are growing rapidly in number and capacity, until recently fish consumption was largely met by harvesting wild populations (capture fisheries). The serious decline in wild fish stocks is now generally well known and represents a classic example of the unsustainable exploitation of a commons resource, where technological capacity (high endurance factory ships) has outstripped biological capability (the reproduction of stocks). Although there is a brief illustration of aquacultural systems in Chapter three, the

scale and systemic importance of agriculture and its food derivatives remains the primary focus of this text.

Throughout the book I generally use the terms 'North' and 'South' as shorthand to refer to the rich, powerful and generally liberal democratic states of what was once called the 'First World'; and to those parts of the world once labelled the 'Third World'. I share the view of Williams et al (2009) who note that the Global South still remains something of a residual category that is often represented as the site of *problems*, especially poverty and environmental degradation. It comprises an increasingly huge diversity of countries at very different levels of economic development and prosperity, with a range of governance structures and political cultures, and an even greater variety of social organisation. In relation to the global agri-food system, however, we seek to understand the way that countries of the South are connected to those of the North: through provisioning a widening range of food and feed commodities at low cost, and as sites where consumption is changing as a result of globalisation and the expansion of Northern-style dietary practices. The key throughout is a concern with relationality, the inter-connectedness, of North and South.

While the ambition may be global, in reality a book is written from a particular geographical perspective, a result of one's own location and frame of reference. In this regard and given its dominance here, the focus is inevitably concentrated on the global North, largely Western European though with examples and evidence from North America, principally the United States, where possible. There is greater reference to examples from the United Kingdom than anywhere else, and this is deliberate for several reasons. First, there is the quality of documentation and data that exists for the UK. Secondly, the UK is, in global terms, a mid-sized society and economy of 62m people with the capacity to exert a more influential global reach through the food supply chain than my own country of residence (with 4.2m people). While the USA (population 250m inhabitants) is more powerful still in shaping the global food system, it is more difficult to write authoritatively (and critically!) about consumption practices of which one has less first-hand experience. Finally, as the

first industrialised nation the British diet remains a source of interest as it is said to have gone “straight from medieval barbarity to industrial decadence” (Goody 1997: 338). Industrial processes were applied earlier and on a larger scale to food here than anywhere else in order to achieve a cheap, mass-produced diet for the urban working class, the ingredients for which were sourced from all over the world. The earliest agri-food commodity chains mostly led to England.

And so to the structure of the book. Chapter Two provides an overview of the global agri-food system. It begins by briefly tracing its recent development as a combination of global public policy and corporate interest. This has led to the formation of a liberalised market-driven structure in which countries are differentially integrated into a global food economy. Although countries of the global South have historically performed the role of producing a variety of tropical and sub-tropical agri-food commodities for consumers in the North, the chapter argues that their domestic markets have more recently become a focus for sales of processed food products. The global agri-food system is consequently a complex and dynamic system exerting a different combination of effects in different places around the world. In order to better understand the relative importance of different aspects of the system, however, Figure 2.1 provides a schematic representation identifying four key elements: primary food production; the agri-technology industries; food trading, processing and manufacturing; and food retail and the food service industry. These elements are discussed in turn through the remainder of the chapter.

Chapter Three is concerned with the resources and ecosystem services that support primary food production, principally agriculture. Drawing upon the findings of the Millennium Ecosystem Assessment, it highlights how our demand for food has impacted upon the world’s natural ecosystems, which perform vital regulating, provisioning and other services. Following a brief characterisation of the world’s principal agricultural systems, the chapter proceeds to evaluate the state of four key resources required for food production: soils, water, biodiversity and energy. In relation to the first three, it is argued that their management under intensive farming practices has been marked by a degree of utilitarian complacency that has

left these resources in a vulnerable state, though one which is still retrievable. As regards energy use, the rapid evolution of modern farming methods has been entirely underpinned by the availability of cheap fossil fuels. Signs pointing to a future of much higher energy prices suggest that urgent efforts will be needed to shift food production toward a more energy efficient and certainly less fossil fuel dependent path.

Chapter Four maintains a focus on resources and examines four key challenges, principally for primary food production. The first of these is climate change, which it was noted above in relation to the EU, is significantly affected by what we eat. Although the entire agri-food system is a source of greenhouse gases, the single most important element is agriculture, though this varies significantly between countries depending upon their mix of different farming, especially livestock, systems. The consequences of climate change will also impact upon primary production in complex and differentiated ways, offering the prospect of short-term opportunities for some regions but the likelihood of medium to long-term threats to global food security. For this reason farming systems must at the very least find ways to reduce their emissions of greenhouse gases. The second challenge confronting primary food production concerns the stock of global freshwater resources. The extraction of water for irrigation is discussed with boxed examples illustrating how serious can be the consequences when resources are used at unsustainable rates. Through the application of the concepts of 'virtual water' and 'water footprints', the need to rethink more fundamentally patterns of production in contexts of relative water scarcity is explained. The third challenge is that of 'peak oil', which argues that as we are at the midpoint of depletion in the total endowment of conventional oil and natural gas, it is likely that we face into a future of declining supply. Indeed, it is only the development of non-conventional sources of fossil fuels and the expansion of biofuels that has served to dampen even higher increases in energy prices. Such a predicament represents a major challenge for primary food production. The fourth, and final, challenge discussed in Chapter Four concerns the rising demand worldwide for meat and livestock products. Why is this a problem? Principally because of the

feed demands of intensive livestock production systems, that account for around one-third of global cereal production, and the waste streams that result.

Chapter Five moves beyond the farm gate and explores the elements downstream of agriculture: the processing and transformation of primary foods and the manufacture, distribution and consumption of final food products and their environmental consequences. It makes clear that the development of those food products that make up the modern urban diet are the outcome of complex and interacting forces stretching back into the nineteenth century. The food industry has successfully built upon social and economic changes, as well as advances in technology, in order to produce an enormous range of products, which are added to by thousands of new lines every year. The environmental dimensions of the many varied food processing and manufacturing operations around the world are schematically outlined, and again highlight the importance of water and energy to production. A section dealing with packaging reveals the wide range of materials that are needed to ensure the effective retailing of food and drink products, and once more the importance of oil via industrial petrochemical processes, is made clear. We are reminded again of the powerful role that corporate retailers exercise, both in the way they have reconfigured supply chain management in the sourcing of produce, and in its distribution to individual stores. Finally, the scandalous level of waste within the contemporary agri-food system is addressed. This is shown to comprise high levels of discard of perfectly acceptable product as well as the disposal of food regarded as surplus to requirements. With perhaps one-quarter of all purchased food thrown away and with most affluent societies guilty of over-consumption, this represents a huge amount of resources utilised simply to exacerbate the waste management problem and increase the risk of greater ill health.

Chapter Six is focussed upon the issue of global food security. It begins by tracing the evolution of the term and raises questions as to how effective an aspiration it is at a macro-level. The often-vexed issue of population growth is then addressed, noting how the clumsy Malthusian equation of numbers of mouths to volumes of food can

be utterly misleading at a global scale. Given considerable regional differentiation as regards economic performance together with a host of demographic variables, a much more spatially disaggregated analysis of food prospects is required. Such analysis would also need to take account of the changing global energy picture. Although the role of oil in food production has been previously discussed, its destabilisation of food security – as occurred during 2007-08 – is evaluated. The same must also be said for climate change: how this will affect different regions and countries around the world may also significantly impact their food security. Ultimately, however, this takes us back full circle to the issue of globalisation and the degree to which both production and consumption in distant countries is shaped by wider economic forces. The chapter closes with an evaluation of food sovereignty, a term that has come to recent prominence through the struggle of farmers and food activists in many countries around the world to assert their right to define their own form of farming and food consumption.

The last substantive chapter of the book, Chapter seven, considers what a sustainable agri-food system might look like. Following a discussion of the notion of sustainability, in which the emphasis is placed upon the need to appreciate the importance of complexity, dynamism and adaptation in socio-ecological systems, attention is turned to its application in the field of agriculture. Recognising that sustainable production methods would need to combine the particular social, ecological and technological resources and capabilities within an area, it is inevitable that this will result in a greater heterogeneity of agri-food systems. If production is therefore to become more diversified, this will have enormous repercussions for consumption; not least it will encourage reflection on the moral basis of existing behaviours and ask how these might become more sustainable. Two issues are used here to illustrate the possibilities for more sustainable consumption: fair trade and meat eating. Following this, the chapter examines the potential for the relocalisation of food supply chains and then concludes with a review of the possibilities for food planning. Combining mid-level government agencies with a revitalised notion of local citizenship, examples are used to demonstrate the capacities and potential for creating a more sustainable agri-food system.

## Further reading

Counihan, C. and van Esterik, P. (eds) 2008 *Food and culture: A reader*. Second edition. Abingdon: Routledge.

Conscious that this present text entirely ignores the cultural dimensions of food in order to focus on its relationship with environment, this title is offered as an antidote. The thirty-six chapters here demonstrate and justify the cultural turn in food studies.

Lawrence, F. (2008) *Eat your heart out: Why the food business is bad for the planet and your health*. London: Penguin.

Guardian investigative journalist Felicity Lawrence regularly delivers some hard-hitting exposés of practices within the agri-food system. This collection highlights some of the most troubling.

Patel, R. (2007) *Stuffed and Starved: Markets, power and the hidden battle for the world food system*. London: Portobello.

Roberts, P. (2008) *The End of Food: The coming crisis in the world food industry*. London: Bloomsbury.

These two titles are also good examples of the range of more popular and accessible texts that, like Lawrence's book, reveal some of the practices and resulting injustices of the global food system. Both bring together a huge array of stories and insights from the frontline with some insightful analysis.

Millstone, E. and Lang, T. (2008) *The Atlas of Food: Who Eats What, Where and Why*. London: Earthscan.

A valuable reference regarding the world of food through an excellent set of cartographic representations.