Nutrition and sustainability: an emerging food policy discourse

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It is well known that food has a considerable environmental impact. Less attention has been given to mapping and analysing the emergence of policy responses. This paper contributes to that process. It summarises emerging policy development on nutrition and sustainability, and explores difficulties in their integration. The paper describes some policy thinking at national, European and international levels of governance. It points to the existence of particular policy hotspots such as meat and dairy, sustainable diets and waste. Understanding the environmental impact of food systems challenges nutrition science to draw upon traditions of thinking which have recently been fragmented. These perspectives (life sciences, social and environmental) are all required if policy engagement and clarification is to occur. Sustainability issues offer opportunities for nutrition science and scientists to play a more central role in the policy analysis of future food systems. The task of revising current nutrition policy advice to become sustainable diet advice needs to begin at national and international levels.

Sustainable diet: Sustainability: Sustainable food: Food policy: Environmental impact: Food systems

The problem of sustainability and food

In this paper, we outline some developments in policy thinking on nutrition and sustainability. We suggest that difficulties in the integration of public health nutrition and sustainability which are the central challenge for twenty-first century food policy: how to feed huge populations equitably, healthily and in ways which maintain ecosystems on which humanity depends. While the modern food security debate stresses the case for raising food production to feed populations, the issue of sustainability re-injects the question of ‘how’ into public health nutrition: how to eat, modes of production and consumption, how much(1,2). This paper, firstly, summarises some of the strong evidence of food’s impact on current unsustainable consumption patterns; secondly, it outlines existing and emerging policy thinking at national and international levels; thirdly, it explores some future tensions and challenges for nutrition science when engaging with sustainability.

Over recent decades, a broad scientific agreement has emerged that the food system both illustrates and is a key element in the world’s environmental and wider sustainability challenge. There is less agreement, however, on how to address the issue through policy. Although processes have now begun, they are not yet receiving due political attention or support. This is partly because the environmental perspective on food systems raises some serious questions about notions of progress generally and for food in particular. Can we really eat what we like, have ever more, and more cheaply? Footprint analyses suggest that North America and Europe consume resources (energy, land, materials etc.) as though they inhabit multiple planets; USA consumes as though it inhabits five planets, Europe three(3). Food is a key factor in this picture. The implications for nutrition science of addressing environmental impacts when formulating population dietary advice are considerable. Should populations eat more fish? Almost all nutrition guidelines advise it(4); stock analysts are increasingly concerned(5,6). Indeed, the challenge of sustainability might well restructure not just societal definitions of progress, and consumer expectations and rights

Abbreviations: FAO, Food and Agriculture Organisation; GHG, greenhouse gas; SDC, Sustainable Development Commission.
*Corresponding author: Professor Tim Lang, fax +44 20 7040 8580, email t.lang@city.ac.uk
to food, but also the tasks demanded of nutrition science itself. This statement is not made lightly. Elsewhere we have proposed that, from a policy perspective, nutrition poses particular difficulties for policy-makers, whether in government, commerce or civil society (7,8).

Nutrition science, like many sciences, has different intellectual traditions, each of which proffers different emphases for public policy. We have identified three main traditions (7). The first is what we termed Life Sciences Nutrition, where nutrition seeks to explain phenomena by ever more refined biochemical understanding, ‘mining’ down into molecular and genetic detail. This perspective is currently dominant. The second is Social Nutrition which conceives nutrition science as explaining how nutrition is embedded within culture and ways of living, a function of socio-economic processes, ranging from culture to class and income. The third is Eco-Nutrition or Environmental Nutrition, which conceives nutrition as a function of the biophysical environment. This tradition has roots back to the Malthusian question of population and food supply, on the one hand, and to recognition of nutritional dependency on biophysical factors such as soil, biodiversity, water and climate. Each of these traditions had its own champions and founding thinkers yet today they show signs of being sealed off from each other. Although in theory, each offers policy-makers useful insights, currently one dominates, Life Sciences. Each poses questions in relation to sustainability and, vice versa, sustainability issues demand responses from each if a holistic picture is to be generated of value for policy-makers.

The word ‘sustainability’ itself needs clarification and some caution. Sometimes it is used as shorthand for environment issues but it contains a broader intellectual meaning too. In the 1987 report of the Commission on Environment and Development, chaired by Gro-Harlan Brundtland, former Norwegian Prime Minister and later WHO Director General, sustainability was defined within a multigenerational perspective and as giving equal emphasis to environment, society and economy (9). For Brundtland and the UN system which created her Commission, sustainability was championed to chart a route to environment, society and economy (9). For Brundtland, former Norwegian Prime Minister and later Environment and Development, chaired by Gro-Harlan Brundtland, former Norwegian Prime Minister and later WHO Director General, sustainability was defined within a multigenerational perspective and as giving equal emphasis to environment, society and economy (9). For Brundtland and the UN system which created her Commission, sustainability was championed to chart a route apart from that espoused by the Bretton Woods financial institutions. Whereas the latter stressed progress as stemming from the pursuit of efficiencies in free markets and liberal trade, Brundtland stressed development as injecting environmental and social justice perspectives into economics, a return to political economy sought by the 1980 Brandt Commission (10). As this ideological schism widened between the UN and Bretton Woods global institutions, there were, of course, attempts to bridge the gap. Green consumerism and a new wave of super-efficient technology were both proposed, for instance (11,12). In food, these arguments were more submerged but have now moved to the fore due to recent events summarised later. Policy-makers in state, commerce and civil society now are debating whether coming changes meant consumer culture altering and people eating differently. Key is how: can changes be implemented out of sight, before ‘western’ consumers see the food? If so, who has the power to do this?

Food’s impact on sustainability, whether defined in ‘hard’ or ‘soft’, ‘dark’ or ‘light’ green terms, is not disputed. In the last decade a sobering picture of the food system’s unsustainability in environmental, social and economic terms has emerged. The Stern report calculated that modern agriculture currently contributes about 14% of greenhouse gas (GHG) emissions (13). This is probably an underestimate. Of those agriculture-related GHG, animals are responsible for 31% and fertilizers (N₂O) for 38% (14). Much progress in raising crop yields and food availability is due to plentiful energy, particularly oil. A total of 75% of fossil energy use is by developed countries, with 17% of that unequal share expended on the production, processing and packaging of food products (15).

Social inequalities of consumption, meanwhile, are marked. Differences in quantity and quality determine foods’ environmental impact. A European Commission assessment of Europeans’ consumption patterns, a rich developed consumer profile, concluded that food accounts for one third of GHG emissions (16). Using life cycle analysis, it found that meat and dairy products contributed an average of 24% of consumers’ environmental while representing only 6% of consumers’ financial spending. The overall picture is of a complex web of interactions with deeper environmental footprints, as rising consumer affluence creates unforeseen consequences (3).

Meat and dairy are the most significant source of food-related GHG and other environmental impacts (17). There are direct and indirect reasons. One is land use; approximately half all cereals grown globally are fed to animals (17). One calculation suggests that, to feed the USA a healthy diet as officially defined, would require US farmers to increase fruit acreage by 117% and vegetable acreage by 137% (18). Food’s impact on biodiversity is also immense. The UN’s Millennium Ecosystem Assessment concluded fifteen out of twenty-four of the world’s ecosystem services are being degraded or used unsustainably, and that food is a major source of this degradation (19). In the twentieth century, about 75% of the genetic diversity of domestic agricultural crops was lost (20). With climate change access to water, already a key indicator of social progress, is set to become critical. Global agriculture accounts for 70% of all freshwater extracted for human use (21). Irrigation can raise crop yields but drain water sources, and create new competition for reserves. Rising demand for meat and/or dairy has immediate impacts on land and water use. Dutch studies for the UN show that in the Netherlands, 200 litres water are needed to produce a 200 ml glass of milk, and 2400 litres water to produce a 150 g hamburger (22). The UN’s World Economic & Social Survey 2011 concluded: ‘intensive livestock production is probably the largest sector-specific source of water pollution’ (13).

The nature of waste in the food system also changes; it is not declining as mid twentieth century food science anticipated. Whereas developing countries tend to have high wastage on or near the farm, once food gets to consumers, they waste little. Rich consumers, however, waste on a prodigious scale. According to the UN Environment Programme, Indian losses for cereals and oil seeds are 10–12%. In some African countries, 25% of cereals are lost post-harvest, and for more perishable crops such as fruits, vegetables and roots, post-harvest losses can be
50%. Dairy sector losses due to spoilage and waste in East Africa are also considerable; in Tanzania over 16% of dry season production and 25% of the wet season’s, while in Uganda milk losses are an estimated 27% of all milk produced(23). In the USA, 30% of all food, worth US$48.3 billion is thrown away each year(25). US food waste represents 4% of all US energy use and approximately one quarter of all water use(24). In 2007, UK consumers threw away 6.7 million tonnes of food, one third of the food they purchased, worth £10.2 billion. A fifth of this waste was judged unavoidable (peelings, cores, bones) but nearly one quarter of the 4.1 million tonnes was jettisoned whole, untouched or unopened(25). Of this, at least 340,000 tonnes was still in date when thrown away. UK consumers left 1.2 million tonnes uneaten on their plates, unimaginable to downstream still do. Indeed, while food putrefies, waste continues downstream still do. Indeed, while food putrefies, waste continues.

Policy engagement emerges across the food system
As data such as these emerged, it became clear to some policy-makers that consumer behaviour change would be central to any policy process, but this is politically delicate. Demanding or even subtly reframing consumer behaviour change is anathema to the neo-liberal ethos of consumer choice and sovereignty. Economists of diverse persuasions agree that consumers drive late twentieth century affluence(26–28). The right of consumers to choose has been dear to Western notions of democracy. It is one of eight rights espoused by the worldwide consumer movement(29). In the 2000s, some international advisory bodies and civil society organisations began overtly to champion the case for consumer change(30–33). The UK’s National Consumer Council, for instance, joined with the Government’s Sustainable Development Commission (SDC; since abolished) to produce an analysis of how to help consumers break out of the consumerist ‘lock-in’; the title was clear, I Will If You Will(34). Since 2009 the WWF, the conservation non-governmental organisation, has promoted and developed a ‘one planet diet’ strategy(35). Such moves signal awareness that dietary change at the population level may be required, and require more than just individual product differentiation or ethical appeal or ‘green’ options. It reflects a shift from ‘single-issue’ thinking by civil society campaigners and a resuscitation of more systemic thinking about food as cultural politics. In the late 1960s and 1970s, for example, early environmental arguments shaped the appeal to eat differently from researcher-activists (e.g. Moore Lappe and Collins’ best-selling Diet for a Small Planet), and by academics such as Gussow and Clancy’s proposal for 1986 guidelines for sustainable diets(36–38).

By the early 2000s, governments remained reluctant to enter this sensitive policy terrain, but food companies realised otherwise. Climate change alters business capacities and questions the view that ‘green’ issues are merely a niche market and opportunity for product differentiation. New corporate analyses and generating new practices and standards-setting processes independent of governments(41,42). EurepGAP, where GAP stands for good agricultural practice, began in the late 1990s but went global in the 2000s. The Sustainable Agriculture Initiative was created in 2002. These initiatives were by the world’s largest food transnational corporations. While critics were initially wary of ‘greenwash’ and ‘thin’ corporate responsibility, these initiatives made some remarkable commitments to reduce, for instance, water use and to lower C emissions(43). The world’s largest retailer, US-based Wal-Mart, had a sudden culture change following hurricane Katrina in 2005(44). In the UK, some retailers overtly adopted ‘choice-editing’ within overall strategy, in effect making choices for consumers before they could select between products(45,46).

National policy engagement: four hotspots
In this discourse, a number of key themes have emerged with sensitive policy implications for markets and societal aspirations: how to manage supply chains sustainably, how to internalise uncosted environmental damage, how to prevent market failures and distortions, how to address the coexistence of over- and under-consumption(47,48). These issues became high political priorities when world food commodity prices rocketed in 2007–08. Western complacency was shaken; its own food security was at stake, even as events destabilised food import dependent developing countries(49). A number of issues emerged as particular policy hotspots.

The first was waste. Reducing waste has been a persistent goal of food policy since the 1930s. Part of both the appeal of modern food production systems and its moral leverage in political debate was the folly of waste. Even before the 1845–50 Irish famine, but decidedly so afterwards, the juxtaposition of plenty and hunger was known and politicised. The extent of waste in modern developed societies, however, has re-energised debate. Waste is itself a plastic notion. Waste of what? Where? Why? A supermarket chain might espouse ‘zero waste’, but in practice that means them holding little waste while others up or downstream still do. Indeed, while food putrefies, waste might be intrinsic to food systems not just a regrettable aberration. Some waste might be inevitable. The issues are: what to do with it, who takes responsibility and how to complete the biological cycle. Since much food technology has intervened in that, can new mass composting or even feeding waste again to animals be considered, thus overturning or revising regulations brought in following food hygiene crises? Certainly, the 1940s and 1950s promise to reduce waste by agricultural efficiency and storage, and through supermarket-led supply chain management needs to be revisited(50,51). Should nutrition science ally with anti-waste advice?

The second policy hotspot is meat and dairy(52). Nutrition advice tends to support their consumption, but environmental concerns suggest more consideration be given to upper limits. As incomes rise and in line with the nutrition transition, even vegetarian food cultures such as India have experienced rapid rise in production and...
consumption\(^{53-55}\). Dairy animals have a high impact on land use, water and cereal use. The Food and Agriculture Organisation (FAO) estimates that feed production for animals accounts for about 33\% of all cropland use; about 50\% of cereals produced worldwide are consumed by animals\(^{17}\). Older, more cautious arguments are being resurrected. Even as recently as 1992, the FAO had reminded member states that animals are ‘poor converters of energy into foods for human consumption’, with an average of 29.288 kJ (7 kcal) input, if cereals are used, for every kcal generated\(^{56}\). Conversion ratios vary from 16:1 for beef production to 12.552 kJ (3 kcal) for broiler chickens. Where does nutrition science fit in the policy discussion about what policy mechanisms and instruments might reshape seemingly insatiable consumer demand. Can this be left to market signals? Will behaviour change if food prices more realistically reflect full costs? Could better consumer information work? Can change be left to more responsible marketing? Might rationing be needed, bearing in mind that markets already ration? Arguing that lowering average worldwide consumption is essential for climate change targets, McMichael and colleagues suggested an international contraction and convergence strategy for meat. With current global average meat consumption at 100 g per person per d (with a ten-fold variation between high-consuming and low-consuming populations), they proposed a 90 g per d working global target, with not more than 50 g per d coming from red meat from ruminants (i.e., cattle, sheep, goats, and other digastric grazers)\(^{52}\).

Not dissimilar considerations have emerged, too, about fish, the third policy hotspot for nutrition\(^{5}\). Most public health nutrition advice includes positive recommendations for regular fish consumption; the UK for example recommends two portions of fish of which one should be oily. Even concern about contamination in some stocks has not altered that advice\(^{57}\). Wild stock harvesting has globally plateaued, with aquaculture now the sole source of growth in supply\(^{58}\). By 2007, 52\% of global wild fish stocks were ‘fully exploited’ according to the FAO classification\(^{59}\). Should consumers eat fish: yes or no?

The fourth eco-nutrition hotspot is sustainable diets, on which some formal thinking emerged and grew in the 2000s, particularly in Europe, although the academic case had been made much earlier\(^{37,38}\). In 2009, two Swedish agencies combined to produce sixteen pages of advice for the ‘environmentally conscious consumer’, delivered for regular fish consumption; the UK for example recomended, for example, launched major Sustainable Living Plan commitments\(^{67}\). It remains to be seen whether this heralds a widening gulf between elected government and corporate action. Table 1 summarises some of the state level developments within the EU\(^{68}\).

Australia is another developed country which had begun to debate whether food and nutrition policies needed to address sustainability. In the late 2000s, when its national nutrition guidance was being revised\(^{69}\), arguments were made within the process by stakeholders and ‘insiders’ that environmental considerations should be factored into public health nutrition advice. This became highly contested, not least since this nutrition policy process coincided with a parallel national food policy review. Some sections of the food industry were alarmed at this prospect. Strong arguments that food production for animals accounts for about 33\% of all cropland use; about 50\% of cereals produced worldwide are consumed by animals\(^{17}\). Older, more cautious arguments are being resurrected. Even as recently as 1992, the FAO had reminded member states that animals are ‘poor converters of energy into foods for human consumption’, with an average of 29.288 kJ (7 kcal) input, if cereals are used, for every kcal generated\(^{56}\). Conversion ratios vary from 16:1 for beef production to 12.552 kJ (3 kcal) for broiler chickens. Where does nutrition science fit in the policy discussion about what policy mechanisms and instruments might reshape seemingly insatiable consumer demand. Can this be left to market signals? Will behaviour change if food prices more realistically reflect full costs? Could better consumer information work? Can change be left to more responsible marketing? Might rationing be needed, bearing in mind that markets already ration? Arguing that lowering average worldwide consumption is essential for climate change targets, McMichael and colleagues suggested an international contraction and convergence strategy for meat. With current global average meat consumption at 100 g per person per d (with a ten-fold variation between high-consuming and low-consuming populations), they proposed a 90 g per d working global target, with not more than 50 g per d coming from red meat from ruminants (i.e., cattle, sheep, goats, and other digastric grazers)\(^{52}\).

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lobbying associated with farming and traded outputs succeeded in curtailing the ecological public health revision sought by some on the revising committee. When environmental criteria were dropped from the nutrition revision process, the head of the national farming organisation welcomed it. Although he accepted that farmers need to take environmental issues seriously, he rejected that the environment should affect dietary advice. ‘We don’t believe it is the right criteria on which to base decisions about what we eat,’ he stated (70).

The transnational dimension and the role of Europe
As European member states began to engage with sustainable food and sustainable diet questions, the European Commission’s international role also came to the fore. In fact, the EC interest had deep roots. Following the 1992 UN (‘Rio’) Conference on Environment and Development, the EC offered moral and policy leadership to pursue the question of sustainable consumption and production. The present paper is not the place to explore these important and complex negotiations. Suffice it to say that by the 2002 World Summit on Sustainable Development in Johannesburg, there was embryonic agreement to create a 10-year process towards a sustainable consumption and production plan. Formally, the process was overseen by the UN Environment Programme and UN Department of Economic and Social Affairs. Within that the Swedish government took the lead (71,72). In 2003, a Marrakech Process was launched to build the international consensus for serious engagement. This had four goals: (a) to assist countries in their efforts towards sustainability; (b) to green their economies; (c) to help corporations develop sustainable business models; (d) to encourage consumers to adopt more sustainable lifestyles (73). This was ambitious but sets the context for more specific policy proposals and options.

To summarise the status now, while there is some acceptance of the need for change, the food issue has become mired in some difficulties. One argument is that developing countries cannot lead on or afford to shift food and nutrition policy towards sustainability. Their prime concern is poverty reduction. Economic growth is the priority. The counter argument is that developing countries already display the consequences of past models of development: rising obesity, the ‘westernisation’ of diet, environmental pressures from climate change, water stress, land degradation, the poverty from unplanned urbanisation and de-ruralisation. These were clear at the UN Conference on Sustainable Development, ‘Rio+20’, exactly as they were for its predecessor, the 1972 Stockholm Conference. The evidence exists; the challenge is for policy-makers to respond to that evidence. Thus far they have done so only inadequately.

### Table 1. Sustainable food consumption and production; emerging policy advice in European Countries (source: Barling (68))

<table>
<thead>
<tr>
<th>Country and date</th>
<th>Government agency or department</th>
<th>Policy document and scope</th>
</tr>
</thead>
<tbody>
<tr>
<td>UK 2006</td>
<td>Sustainable Development Commission (SDC) and National Consumer Council set up the Sustainable Consumption Roundtable</td>
<td>Sustainable Consumption Roundtable report 'I will if you will' – generic identification of challenges in moving to more sustainable consumption and identified the concept of ‘choice editing’</td>
</tr>
<tr>
<td>Netherlands 2009</td>
<td>Ministry of Agriculture, Nature and Food Quality</td>
<td>Sustainable Food: Public Summary of Policy Document Policy outline for achieving Sustainable Food; emphasised the role of sustainable food production and consumer education campaigns</td>
</tr>
<tr>
<td>Sweden 2009</td>
<td>National Food Administration (and Swedish EPA) – notification to EU Council for adoption as official standards</td>
<td>The National Food Administration’s Environmentally Effective Food Choices: Proposal Notified to the EU. Science-based assessment by range of product groups e.g. meat, fish and shellfish, fruits and berries etc.</td>
</tr>
<tr>
<td>UK 2009</td>
<td>SDC report to Department Environment Food Rural Affairs (Defra)</td>
<td>Setting the Table: Advice to Government on Priority Elements of Sustainable Diets Recommendations based on literature review, stakeholder and expert opinion on a low impact (sustainable) healthy diet</td>
</tr>
</tbody>
</table>

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There are reasons for this. While the food policy paradigm was statist and interventionist in the 1940s and 1950s, this changed from the 1970s with the rise of neo-liberal policy thinking. This tends to reject government involvement, to rely on market relations, and to restrict policy action to consumerist and ‘soft’ policy measures such as labelling or consumer advice. Attempts to introduce coherent, detailed sustainable dietary advice have partly been thwarted by such macro-economic thinking and lobbies. While some food companies would welcome a new ‘level playing field’, others want such framework thinking kept to the minimum.

Such tensions are neither new nor unexpected. Indeed a feature of the European project on food, from the 1957 founding of the Common Agricultural Policy to today’s battles over sustainable food systems, has been the EU dogged commitment and capacity to negotiate through such delicate and tortuous issues. The EU has balanced a seeming contradiction between formal support for liberal economics with strategic commitment to its own infrastructure and interests. On the one hand, the EU was a major player in farm trade liberalisation in the GATT Uruguay Round culminating at Marrakesh (1987–94) which brought agriculture and food into the world trade system, and in the creation of its own Single Market, which liberalised internal trade and which celebrated the advantages of rationalising food systems (see the 1988 Cecchini Report). Yet on the other hand, the EU has been quick to rein back neo-liberal tendencies when consumers have been alarmed by threats to public health and safety, as in the 1990s BSE and food safety crises. Only 8 years after the Single Market came into operation in 1992, the EU imposed strict requirements on food safety and international traceability. The net effect is that Europe now displays a complex policy position on food and health. Broadly, any foods can be sold as long as they are traceable, safe at source and labelled; health is an individual responsibility in the marketplace; healthcare is a member state responsibility; the role of the EU is to help provide some health education and consumer support.

Meanwhile consumer advice on sustainability has not fitted this pattern. There are EU-approved eco-labelling schemes for some processes such as organic food systems and energy efficiency labelling for white goods such as refrigerators and cookers, but until recently there has been reluctance to create an EU food sustainability labelling scheme.

This might, however, now change. The international process sketched earlier has already homed in on food as a key issue for sustainability. The data demand it. Formal policy thinking has emerged around resource efficiency in production and consumption as a sustainability driver for food systems. Table 2 summarises these developments, highlighting particular documents, and the commitment to sustainable consumption and production. A Commission Communication is in preparation for 2014. Already, the European Commission and researchers are being asked to grapple with how to measure environmental impact in and of food.

### The policy terrain ahead

Where does this leave public health nutrition on sustainability? We think it inevitable that nutrition science will be drawn into the sustainability debate. A combination of pressures is coming together with significant implications for nutrition. We highlight five.

#### Multi-level nature of food system requires multi-level policy

The first is that a significant feature of the challenge for better integration of nutrition and sustainability is the sheer complexity of modern policy making processes. If the growth of policy in the nineteenth century, in reaction to the effects of industrialisation, became an argument about which level to act on, local or national, by the twenty-first century, food governance had become not just five levels: local, sub-national, national, regional/continental global; but also multi-sectoral. Few can subscribe to the view...
Currently, the definition and measurement of (un)sustainability of food are dominated by climate change thinking and data, exemplified in CO₂ and CO₂ equivalent (CO₂e) measures. Initial footprint analyses of food and diet have concentrated on these measures\(^{(14)}\). But more recently, powerful cases to audit food in relation to embedded water, biodiversity and land use have been made\(^{(3,22,80–82)}\). These issues are not discrete but overlap and interact.

The UK SDC in its final report to government proposed a multi-dimensional or ‘omni-standards’ approach to sustainable food (see Table 3)\(^{(83)}\). This proposed six main issues for food sustainability: quality, health, social values, environment, economy and governance, and grouped factors under those main headings. Others are adapting footprint methodology to include factors beyond GHG, notably virtual or embedded water\(^{(35,84)}\). Useful though ‘hard’ measures such as these are, we are cautious about whether footprinting can be stretched to address the social and ethical values now needed. Here lies the potential reinvigorated contribution of the Social Nutrition tradition sketched at the start of this paper. One hopeful sign is the growing international interest in defining sustainable diets. UN Environment Programme, FAO and Bioversity (part of the Consultative Group on International Agricultural Research) all now recommend tighter operationalisation\(^{(82,83)}\). The latter two organisations have already proposed a working definition of sustainable diets as ‘…those diets with low environmental impacts which contribute to food and nutrition security and to healthy life for present and future generations. Sustainable diets are protective and respectful of biodiversity and ecosystems, culturally acceptable, accessible, economically fair and affordable; nutritionally adequate, safe and healthy; while optimizing natural and human resources’\(^{(86)}\). This now needs to be translated into population nutrition advice.

**Define sustainability in food terms**

Although this paper has pointed to difficulties in the policy translation of nutrition and sustainability, the pursuit of policy clarity is not helped by some looseness in the notion of sustainability itself. Therein lies another opportunity for nutrition science. It can help define food in sustainable terms and, vice versa, help clarify sustainability by operationalising what it means for food and diet. The tripartite Brundtland policy approach of environment, society and economy is too broad today. It may have been appropriate and imaginative in the 1980s but food companies may be correct in wanting more precision in the 2010s. The Brundtland tradition is too general, and lacks the detail required for policy translation, let alone data for contracts and specifications. A policy framework and perspective are required which provide, on the one hand, common goals and principles and, on the other hand, room to drill down sufficiently to provide depth, scale and range of action.

**Table 3. Sustainability as a set of ‘omni-standards’ or ‘poly-values’**

<table>
<thead>
<tr>
<th>Quality</th>
<th>Social values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Taste</td>
<td>Pleasure</td>
</tr>
<tr>
<td>Seasonality</td>
<td>Identity</td>
</tr>
<tr>
<td>Cosmetic</td>
<td>Animal welfare</td>
</tr>
<tr>
<td>Fresh (where appropriate)</td>
<td>Equality and justice</td>
</tr>
<tr>
<td>Authenticity</td>
<td>Trust</td>
</tr>
<tr>
<td></td>
<td>Choice</td>
</tr>
<tr>
<td></td>
<td>Skills (citizenship)</td>
</tr>
<tr>
<td>Environment</td>
<td>Health</td>
</tr>
<tr>
<td>Climate change</td>
<td>Safety</td>
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<tr>
<td>Energy use</td>
<td>Nutrition</td>
</tr>
<tr>
<td>Water</td>
<td>Equal access</td>
</tr>
<tr>
<td>Land use</td>
<td>Availability</td>
</tr>
<tr>
<td>Soil</td>
<td>Social status/affordability</td>
</tr>
<tr>
<td>Biodiversity</td>
<td>Information and education</td>
</tr>
<tr>
<td>Waste reduction</td>
<td></td>
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<table>
<thead>
<tr>
<th>Economy</th>
<th>Governance</th>
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</thead>
<tbody>
<tr>
<td>Food security and resilience</td>
<td>Science and technology evidence base</td>
</tr>
<tr>
<td>Affordability (price)</td>
<td>Transparency</td>
</tr>
<tr>
<td>Efficiency</td>
<td>Democratic accountability</td>
</tr>
<tr>
<td>True competition and fair returns</td>
<td>Ethical values (fairness)</td>
</tr>
<tr>
<td>Jobs and decent working conditions</td>
<td>International aid and development</td>
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<tr>
<td>Fully internalised costs</td>
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today that sustainable food and nutrition can be left to government, any more than they can be left to commerce or consumers. Modern food policy has to be multi-level, multi-sectoral and multi-disciplinary\(^{(7,8)}\). Nutrition science must engage with environmental science. And, if consumer behaviour (let alone policy maker involvement) is to follow, social scientific insights will be essential. We see this as nutrition science’s contribution towards an appropriate food policy for the twenty-first century.

**Single problems or a paradigm under stress?**

There is also the issue of food politics itself. Can sustainability be disaggregated into single issues or are the data such as cited at the start of this paper signs of emerging systems failure? Part of the resistance of some sections of commerce and certainly of governments is undoubtedly the sheer scale of change implied to be coming to the world of food. A number of major international-focused policy reports from chief scientific advisory bodies and major foundations are clear about impending difficulty. They have been tabled in the USA, UK, Australia, France, to name a few\(^{(2,87–89)}\). Collectively, they have perhaps added a neo-Malthusian tone of impending crisis from rising population, shortage of land and resources, environmental stress (climate, water, soil) and consumer expectations. In 2009, the UK’s Chief Scientific Adviser talked of a coming ‘perfect storm’\(^{(90)}\). Rockström *et al.*\(^{(91)}\) have proposed that human activity is now approaching its environmental limits on a number of indicators (see Fig. 1). Food production and consumption are implicated in half of these.

If such studies and figures are accurate and the food system is unsustainable, major adjustments to food policy are required. This is daunting but not the first time. In the
1930s, food-related scientists from nutrition, agriculture, biochemistry, began to coalesce around a vision, perhaps most famously articulated by John Boyd Orr and others (92,93). Although they debated how best to address the problems (94), they agreed on what the main problem was: unmet need and hunger. They generated a policy equation which reshaped twentieth century food systems. Application of investment capital (C), science and technology (S&T) and improved distribution (D) would generate increased output (O), which would in turn lower prices, which would make food more affordable and raise consumption (AC), which would result in improved public health (H) and amount to societal progress (P). This policy formula: C+S&T+D→O→Pr→AC→H=P was rational, evidence-based in its time, and socially progressive.

This twentieth century paradigm now needs to be rethought and recalibrated in the twenty-first century. In its own terms, the paradigm has perhaps been subject to two major moments of doubt, both associated with oil price rise (95). Although they debated how best to address the problems (94), they agreed on what the main problem was: unmet need and hunger. They generated a policy equation which reshaped twentieth century food systems. Application of investment capital (C), science and technology (S&T) and improved distribution (D) would generate increased output (O), which would in turn lower prices, which would make food more affordable and raise consumption (AC), which would result in improved public health (H) and amount to societal progress (P). This policy formula: C+S&T+D→O→Pr→AC→H=P was rational, evidence-based in its time, and socially progressive.

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Re-integrating nutrition science’s traditions

Sustainability poses exciting intellectual challenges for public health nutrition. It changes the intellectual framework for food and health general thinking from one which is abstracted from, and separate to, the biological environment to one which is linked to, interactive with and ultimately reliant on ecosystems. We have outlined some of the theoretical implications of this elsewhere (8). Above all, sustainability requires a pause in the fragmentation of nutrition across the three discourses outlined at the start of this paper: life sciences, social and environmental (7). These traditions have been disengaged and thus the voice of public health nutrition has been weakened. To see them as re-woven together as ecological public health helps bind the discourses together, and does not view one as triumphant over the others. Thus the moral compass for nutrition science is recalibrated, providing the reason to help resolve humanity’s need to eat within ecological space (the Malthusian problem). It focuses on how human food relies on but also alters the biological and material worlds on which we depend. It proposes nutrition as a central intellectual reason for (re)shaping the food system for all people not for rampant consumerism and its consequences. It revises the ‘farm to fork’ rhetoric of market economics, and poses the real post-Malthusian question: what would a farming and food supply chain look like if it was based around human physiological/nutrition needs, and if policymakers pursued a better match between global food systems, ecosystems and human pursuit of sustainable food security?

There are already some pioneering attempts to answer this question; sustainable intensification is one (2), ecological food systems is another (102), contraction and convergence is another (97). We need more. The answers look likely to centre on: more horticulture, less meat and dairy, more equal distribution, better skilled consumers, less consumption overall in the rich world. In short, the task of revising current nutrition policy advice needs to begin at national and international levels. The twenty-first century needs to reformulate population Nutrition Dietary Guidelines into Ecological Public Health shaped Sustainable Dietary Guidelines.

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References

Nutrition and sustainability


