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Citation: Lang, T. (2009). Reshaping the Food System for Ecological Public Health. Journal of Hunger & Environmental Nutrition, 4(3-4), pp. 315-335. doi: 10.1080/19320240903321227

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Link to published version: https://doi.org/10.1080/19320240903321227

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Journal of Hunger & Environmental Nutrition, 4:315–335, 2009
Copyright © Taylor & Francis Group, LLC
ISSN: 1932-0248 print/1932-0256 online
DOI: 10.1080/19320240903321227

Reshaping the Food System for Ecological Public Health

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Twenty-first-century food policy will have to address a new set of fundamentals. Some are relatively new such as climate change and peak oil, and some merely new versions of very old ones such as water, population, land pressures, labor, and urbanisation. Policy-makers now need radically to alter the policy mix inherited from the last major policy reconfiguration in the mid-20th century. Then the demon was supply, and poor health was mainly due to underconsumption and poverty. The policy solution was to raise output and reduce prices. Today the challenge is more complex, a coexistence of over-, under-, and malconsumption alongside continuing gross inequalities within and between nations. The article proposes that a new paradigm is emerging, termed here ecological public health, which sees human and planetary health as linked and food as a key connection point. The article outlines aspects of what this entails, stressing the need for food policy to address not just supply but governance and consumer cultural challenges too. Seven priorities are proposed for policy-makers.

KEYWORDS ecological public health, food policy, sustainable diets, consumer culture, governance

INTRODUCTION

The article assumes that health is and ought to be central to food and agricultural policy. The evidence for better integration is now almost irrefutable

Based on a paper for the conference Food Systems and Public Health: Linkages to Achieve Healthier Diets and Healthier Communities, held at the Airlie Center, Warrenton, Virginia, April 1–3, 2009.

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and has been summarized elsewhere.[1,2] More attention is needed, however, to clarify what priorities follow from that goal and where difficulties might lie. Though it appears logical that health and food should be better aligned, there are structural problems in trying to deliver this goal, not just with regard to the environment or supply chain but with consumer culture and aspirations. Consumers in developed countries often believe that they have unimpeachable rights to consume what they like and that choice is a private matter. Yet the evidence is that the health and environmental consequences of how rich developed country consumers eat today seriously impinge on the commons. What and how developed economies' consumers eat diminishes public goods and threatens planetary sustainability. The world cannot eat as the United States or UK eats; theirs is a diet too high in carbon, embedded water, and other environmental and public health goods for 6.7 billion people to eat, let alone the 9 billion anticipated for 2050.

Enormous challenges thus loom for 21st-century policy-makers. For decades they have basked in the legacy of the tough choices and changes made by their mid-20th-century predecessors, for whom food and health problems were primarily associated with underconsumption. Then the primary goal was to raise output. Today, reviewing the work of earlier generations of policy-makers—creating scientific, financial, and institutional reform—we can learn much from their brilliance and persistence. Then as now, they had to engage with a dominant ideological mix of individualism and economic liberalism. From the 19th century, and particularly in the first half of the 20th, they had to engage in an at times furious political struggle over whether and how to feed the mass population better and to improve its health through food. Across the developed world, the shape of these arguments, and the solutions and compromises achieved, took different forms. A core strand of debate was over whether people deserved better food, should pay less for a better diet, and if the natural world (its land and biology) could be reshaped to produce more food. This policy discourse was actually on the coattails of the challenges posed by Malthus and Darwin in the late 18th and mid 19th centuries, about population, natural limits, food supply, and evolution, in short about the nature of progress and social change.

The precise nature, ebbs, and flows of these debates need not detain us here. They are well covered, most recently by Vernon in his brilliant account of tackling hunger.[3] Suffice it to note that by the mid-20th century—not least due to the terrible leveling effect of World War II—food policy emerged as a political winner in the postwar reconstruction process. The US dust bowl, India's malnutrition, European wartime privation and rationing, all fed into and legitimated the emergence of a new science-led food policy paradigm.[4] This centered on raising production and enshrined a belief that a combination of scientific expertise, capital investment, and better distribution could grow, distribute, and deliver more food to more mouths and

push back the boundaries of unmet need, the Malthusian demon, without the bloody recipe of Marxist revolution.

Today, however, policy faces a more complex picture than the 20th-century policy focus on production rather than redistribution can address: a coincidence of under-, mal-, and overconsumption accompanied by a rise in noncommunicable disease (NCD). In addition, policy-makers now have to address enormous environmental and structural challenges, outlined by a Chatham House research team as new fundamentals for food policy: climate change, water stress, energy pressures, demographic change, the nutrition transition, and a host of societal and environmental considerations.[5] Whether the policy-making structures are fit for purpose or appropriate for confronting these fundamentals is fast becoming a critical issue, sorely in need of discussion. As in the 20th century, questions are raised about food rights and responsibilities, agency and capacities in the food system, and the role and relative power of various sectors. As in earlier times, siren calls to change slowly or not at all vie with more radical appeals.

The case and evidence for structural change—carefully managed and incremental maybe but fast and deep nonetheless—are strong. Bit by bit and despite their fragmented remit, United Nations bodies have collectively charted how food systems are unlikely to be able to continue developing on the path set out by the architects of productionism from the 1940s. The World Health Organisation (WHO) has summarized the case from a health perspective in two commissions: *Macroeconomics and Health* in 2002 and *Social Determinants of Health* in 2008.[6,7] The Food and Agriculture Organisation (FAO) in 2008 voiced deep concern about the decline in food output growth and the dangers of switching land from food to biofuel production.[8] In 2009, the UN Environment Programme summarized food's impact on the biosphere.[9] The Intergovernmental Panel on Climate Change (IPCC) in 2007 gave its latest summary of strengthening evidence of climate change, including the implications for food production in different parts of the world.[10] More policy coherence—globally to locally—is needed if we are to feed people, healthily and sustainably. Sustainability here means, as Brundtland stated in 1987, social justice and equitability, not just environmental protection.[11] Why then, faced by such wealth and range of evidence, is macro food policy not changing? Is it that the enormity has not yet sunk in?

The policy headache is not just how can this be done—by technical fix or softly and people centered, as recommended by the International Assessment of Agricultural Knowledge, Science and Technology for Development (IAASTD).[12] It also a question of who and which institutions might begin to unravel the current policy lock-in. At the heart of the contemporary debates about food and health, as in the past, is a strand of concern about agency. Who should act: the state, individuals, commercial interests, or social movements? In the name of which moral and political principles? With what effect on responsibilities? These are deeply political questions, as is the

"how" issue. Is it better for action to be state regulated or self-regulated, voluntary or legislated, left to the individual while providing all the information or, as the UK's Sustainable Development Commission has argued, through limiting some choices before the consumer even sees the food?[13]

Food and health questions inevitably raise the issue of power. Food systems are dominated by powerful interests, some of which can be deeply opposed to change; and too often, in battles for policy leverage, the public interest may get lost. Charting the policy boundaries between markets and public goods, needs and wants, sensible prevention and excessive protection, is a core thread of food politics for two centuries. Power, money, and mouths have depended on where the lines are drawn and how the public interest is defined. In mid-19th-century UK, for example, Edwin Chadwick, who is today often lionized as one father of modern public health with his 1842 Report on Sanitary Conditions,[14] met stiff opposition when trying to clean up the water supplies. Thomas Wakley, founder and editor of *The Lancet*, together with his food analyst Arthur Hassall, also faced stiff political opposition to their exposés of routine food adulteration in the British grocery trades.[15,16] They triumphed, but their stories should not lead us into thoughtless hero worship. It often requires social, not just medical, movements or legal change to improve food and public health.[17] And sometimes, the right thing may have been informed by wrong theories. Chadwick, for example, subscribed to the miasma theory of contagion: that disease was spread by foul air. Chadwick had his contradictions. On the one hand he believed in market discipline, but on the other hand he was convinced that the public interest had to take priority when making policy decisions about the shape of society and its public health infrastructure. His real legacy was to champion the notion that the public good cannot be delivered without effort and firm commitment.

WHAT'S THE PROBLEM?

When considering the sober tasks ahead, a long view of the nexus of food, supply, health, environment, and culture is required. Over the last 10 000 years, key transformations in supply have reshaped health and culture: how we eat and food's meaning (see Table 1). From this perspective, the changes of the 20th century are only the most recent in a series of revolutions. But as Table 1 indicates, the scale and pace of change has accelerated more recently and the increase in output has been unprecedented. Since World War II, more food per capita has been produced globally. More mouths have been fed. Supply chains and trade routes have grown. Nowhere has this picture of advance been clearer than in the United States. Total supplies, measured in calories, rose over the 20th century. The US food system has been characterized by oversupply rather than undersupply. When measured

TABLE 1 10,000 Years of Agricultural and Food Revolutions and Their Links with Farming, Culture, and Food-Related Health*

Era/revolution	Date	Impact on		Implications for food-related health
		Farming	Culture	
Settled agriculture	From 8500 BCE on	Decline of hunter-gathering; greater control over food supply but new skills needed	Fixed human habitats; division between "wild" and "cultivated"	Risks of crop failures dependent on local conditions and cultivation and storage skills; diet entirely local and subject to self-reliance; food safety subject to herbal skills
Iron age	5000–6000 BCE	Tougher implements (plows, saws)	Emergence of technology; spread of artistic expression	New techniques for preparing food for domestic consumption (pots and pans); food still overwhelmingly local, but trade in some preservable foods (e.g., oil, spices)
Feudal and peasant agriculture (not in some regions; eg, North America)	Variable, by region/ continent	Spread of enclosed land (parceling up of formerly common land by private landowners); use of animals as motive power; marginalization of nomadic practices	Division of labor; settlement around land-based production and village systems	Food insecurity subject to climate, wars, location; peasant uprisings against oppression and hunger
Industrial and agricultural revolution in Europe and United States	Mid-18th century	Land enclosure; rotation systems; rural labor leaves for towns; emergence of mechanization	Growth of towns; emergence of industrial working class with no access to land; rise of democratic demands	Transport and energy revolutions dramatically raise output and spread foods; improved range of foods available to more people; emergence of commodity trading on significant scale; emergence of industrial working-class diets

(*Continued*)

TABLE 1 (*Continued*)

Era/revolution	Date	Impact on		Implications for food-related health
		Farming	Culture	
Chemical revolution	Begins in 19th century in developed world, spreads thereafter	Fertilizers; later pesticides; emergence of fortified foods (e.g., Liebig's beef extract)	New applications such as packaging; emergence of large-scale food processing; population gradually increases with wealth	Significant increases in food production; beginning of modern nutrition; identification of importance of protein; beginnings of modern food legislation affecting trade; opportunities for systematic adulteration grow; scandals over food safety result
Mendelian genetics	1860s; applied in early 20th century	Plant breeding gives new varieties with "hybrid vigor"	Beginnings of biological science in everyday life; e.g., enzymes	Plant availability extends beyond original "Vavilov" area; increased potential for variety in the diet, in turn increases chances of diet providing all essential nutrients for a healthy life
The oil era	20th century	Animal traction replaced by the tractor; spread of modern, intensive agricultural techniques	Car use and supermarkets rise; emergence of large-scale food processors; modern mass consumerist food culture and brands take off	Less land used to grow feed for animals as motive power; rise of impact of excess calorie intake leading to diet-related chronic diseases; discovery of vitamins stresses importance of micronutrients; increase in food trade gives ever wider food choice

(*Continued*)

TABLE 1 (*Continued*)

Era/revolution	Date	Impact on		Implications for food-related health
		Farming	Culture	
Green Revolution in developing countries	1960s and after	Systematic plant breeding programs on key regional crops (rice, potatoes) to raise yields	Concentration of farming in larger holdings and more commercialized, intensive agriculture	Transition from underproduction to global surplus with continued maldistribution; overconsumption continues to rise
Modern livestock revolution	1980s and after	Growth of meat consumption creates "pull" in agriculture; increased use of cereals to produce meat	Rising incomes as more low-income countries achieve affluence; meat consumption rises (in meat-eating cultures); food suitable for humans (e.g., soya) is redirected to animals	Rise in meat consumption associated with nutrition transition; global evidence of simultaneous under-, over-, and malconsumption; beginning of the end of the 1940s production-focused policy consensus that increased output will, if guided by science and if distributed fairly, end most food-related health problems
Biotechnology	End of 20th century	New generation of industrial crops; emergence of "biological era": crop protection, genetic modification, genomics	Debate about drivers of progress, patent ownership; consumer information becomes central to management in "risk society"	Uncertain as yet; debates about safety and human health impacts and whether biotechnology will deliver food security gains to whole populations; investment in technical solutions to degenerative diseases (e.g., nutrigenomics)

*Source: Lang.[19]

against its already generous starting point, the 20th century yielded even more. By 2004 an extra 400 calories per person per day were being produced in the United States than in 1909, and this for a larger population.[18] Even when spoilage and waste are removed—to indicate what is actually consumed rather than just produced—the growth has been considerable.

Throughout the last century, US farms revolutionized what they did and how they grew what they grew. The range of crops dropped. Markets concentrated. Farm size grew. The rural population fell.[20] The capacity to produce more food was underpinned by agrichemicals and mechanization. In 1945, for instance, US farms had 12 million horses and mules and just over 2 million tractors. Just 15 years later, the animals were down to 2 million and tractor numbers had doubled.[20] By any standard this change was rapid. More importantly for the wider US economy, this combination of technical and economic changes, both on and off the farm, facilitated the fall in the proportion of disposable income that US consumers spent on food, even while the actual expenditure rose. In 1929, an average of 23.4% of household disposable income went on food. By 2008, this was down to 9.6%. In the same period, eating out went up from 3% of average income to 4%.[21]

This pattern shift in food production and costs is almost always interpreted as progress, particularly for people on low incomes. Its appeal to consumers was modernity, enabling them to trade up, to eat foods previously the preserve of the affluent, and buy other things. Meat and dairy products, for example, could become everyday foods rather than just special treats.[22] The amount of fats added both by the consumer in the home and by the processor at the factory doubled in the US in 1909–1998. This illustrates the mismatch of US production, consumption, and health which has translated so heavily into burdens on US healthcare.

The revolution on farms and in supply chains enabled (but also responded to) dramatic changes in consumer food culture, encapsulated by the term *nutrition transition*. As populations get wealthier and are subject to powerful marketing and changed availability of foods, their pattern of diet changes from traditional staples to processed foods, which are fattier, saltier, and sweeter. Feast day foods become everyday foods. Meat and dairy consumption rises. Sugary drinks replace water. Diets that are now known to be inappropriate for health become normalized.[23-27] This process, experienced by rich countries in the last two centuries, is now being experienced by developing ones. Huge marketing expenditure influences this process. A 2005 report by Consumers Union and the California Pan-Ethnic Health Network found that in 2004, for example, $11.26 billion was spent on advertising by the combined US food, beverage, and restaurant industries compared to a mere $9.55 million spent on communications for the federal as well as California's 5-a-day marketing programs.[28] Marketing health thus receives less than 0.0001% of industry's spend, a gap that proponents of health education and social marketing programs would do well to

debate. Just how can tiny health budgets possibly compete let alone compensate for such vast sums? No wonder industry prefers light food advertising regulatory régimes.

To add to the inequality of weight between health and the sheer avalanche of food products, today new viral, virtual, text, and other marketing methods have now joined traditional forms of 20th-century reach such as TV, radio, and print media, as well as sponsorship, educational materials, and funding. The net effect is that food culture has been reengineered, which is why it is folly for public health proponents to restrict their actions to narrow conceptions of education. By food culture is meant the sum of how humans relate to food, where and how we shop, our tastes, the experience, how we get to and from the food point of contact, our conceptions of quality and normality, and our aspirations. Table 2 gives an overview of this broader conception of food culture and how patterns of food purchasing, type, format, and meaning have changed in developed societies across two centuries of industrialization. In the developing world today, these transitions are often concertinaed.

CHARTING A NEW POLICY FRAMEWORK

The challenges that these processes raise for policy-makers are both daunting and exciting. One challenge has been to reengage public policy-makers with their responsibilities for the public good. With the ascendance of neoliberalism in economics in the 1970s and its triumph as the dominant force in national and international politics in the 1980s—the transition that generated the so-called Washington Consensus[29]—the role of government came under attack and was weakened. Food governance was articulated as a relationship between consumer, corporation, and markets. This happened differently in different countries but generally a narrow conception of market logic dominated, triumphing at the 1994 General Agreement on Tariffs and Trade, which achieved a global agreement to reduce tariffs, open up trade, and allow big companies to define food markets. Today, with the 2008 banking liquidity bailout still close, we are reminded of the limits of what markets mean and, to restate the core challenge, in food and health policy, we now have to engage with more than just insufficiency of nutrients, the 20th century's challenge. This century now has to address a more complex picture of under-, over-, and malconsumption simultaneously on a massive scale. Even a rich country like the United States has well-documented populations suffering food insecurity.[30,31] It is not kwashiokor but obesity and premature death. Food policy needs to change rapidly; hunger politics needs to be fused with the new politics of how food is grown; how the supply chain works; how as well as whether it gets to the consumer; how and

TABLE 2 Some Features of Affluent Society's Food Purchasing in the 19th, 20th, and 21st Centuries*

Factor shaping food purchasing	19th Century	20th Century	21st Century?
Format	Markets plus small diverse specialty shops	Supermarket	Mixture of giant hypermarket & specialty stores
Transport	Walk, bike, or animal-drawn	From mass transit to personalized car	Mixed
Energy source for logistics	Feedstuff (animals) + human	Oil	Hydrogen, electric, solar, or human?
Majority food labor	Farm	Factory	Service
Retail experience	Service at front of shop counter	Self-service	Self-service plus specialty
Location	Local	Distant	Distant (for the time rich) + home delivery (for the affluent but time poor)
Food sourcing	Seasonal	Aseasonal	Return of seasonal?
Food range	Limited within shops but variety of shops	Enormous	Shaped by climate change, energy and water costs
Where the consumer's money goes	Farmers	Processors	Retailers
Quality concerns	Crude adulteration	Scientific adulteration	Low carbon + high nutrient
Food market	Local	National/regional	Global, regional, local
Time taken	Daily local shopping	Weekly one-stop shop	Monthly + fresh weekly
Domestic expenditure	High percentage cost for majority	Falling costs	Cost internalization means price rises
Information sources	Print	Radio + TV	Text + Internet
Characteristic technology	Margarine	Barcode scanning	Internet shopping
Contentious technology	Bread adulteration	Agrichemicals + biotechnology	Nanotechnology
Food supply chain dominant player	Farming	Food manufacturers then retailers	Farming + retailers?
Overarching goal	Sufficiency	Value for money	Value for money

*Source: Lang et al.[2]

whether consumers burn off the calories; how sustainable the food supply chain from farm to consumer is; and so on.

In this new analysis, our conception of public health has to be carefully rethought.[32] The influences on health attributable to food are not just a matter of food supply but of culture and social values; not just an issue for individuals but societal choice; not just about availability of resources but their sustainable management. Delicate issues of politics run throughout the policy terrain of

food and health, from issues of accountability to questions of collective versus individual responsibility.

We can have confidence, however, that the case for redesigning food policy on ecological public health grounds is based on sound science. Summative reports like the 2008 IAASTD drew upon huge data sets and knowledge.[12] Like the scientists working on the reports of the Intergovernmental Panel on Climate Change (IPCC), the IAASTD team of 400 scientists recognized the need for robust data in framing advice to policy-makers. One might have expected a quick uptake. In fact, the reception of IAASTD was mixed. Some governments ignored or refused to consider it, whereas others notionally accepted but then marginalized it, a sober reality check for those who believe the language of evidence-based policy, a reminder that science is about values and policy levers not just evidence. The stakes for sound relations between policy and science are high in an era of climate change, energy, and water stress, and when knowledge about physiology is being transformed by genomics.[33,34]

What difference does this emerging big picture make? Certainly it makes food and health policy harder and the process of policy-making more politically delicate. The terrain requires a judicious mix of detail and panorama. Setting priorities can only be resolved by debate and good governance but contenders may be identified. The following section considers 7 of them.

View Food Policy Through an Ecological Public Health Lens

Getting the conceptual framework right for food policy has never been more important. It is the lens through which everything is viewed and delivered. Ecological thinking within public health is not per se new—the word *ecology* was invented by Haeckel in the mid-19th century[35]—but is essential for the 21st century. The word *ecological* conveys two linked but distinct ideas. One promotes the idea that food is the result of relationships, actions in a web, and sees public health as a sequence of actions to protect and enhance health through food. The other highlights how food connects people and planet; here ecological stresses our reliance on the thin membrane of biomass that surrounds the surface of Planet Earth.[36,37] Food policy has to invoke both senses of the word, but how to do this?

Trying to capture this notion of ecological public health, Geof Rayner and I have proposed that policies ought to aim always to address 4 dimensions or levels of existence.[32] The first is the physical or material world, by which is meant the world of nature and transformed nature—the built environment, the urban or rural space—and the extractive relationship with the environment; in this, nature is the reserve on which existence draws. The second is the physiological world, by which is meant the importance of biology and the bodily processes that transform food—not just calories but

micronutrients too—into bodily manifestation; food's biological impact is shaped by inherited genetic potential. The third is the social world, by which is meant the human relationships and all the societal institutions and interactions that frame how humans live, our domestic and working and everyday lives. The fourth is the cognitive world of interpretive structures within the human mind that are necessarily personally experienced and yet have meanings that others may share. This refers to how consciousness of existence shapes our actions.

To see food and health as shaped by the interplay of these 4 dimensions requires us to think in a cross-disciplinary way. By doing so, we can make sense of what and when public health works. To improve hygiene and contain infections, for instance, requires not just an understanding of microbiology but of social and cultural relationships, too, because the latter facilitate transmission. That is why changing human behavior is always part of public health campaigns. Tackling tuberculosis, for instance, involved changing cultural mores about spitting in public, washing hands, and so on. Similarly, stopping food-borne infections requires food handlers to behave differently, imposing barriers in what might be otherwise convivial relations with colleagues. Yet so much policy effort to tackle food-related noncommunicable diseases has been limited to health promotion via soft policy levers such as education. Is it any wonder that education programs have struggled when competing with the might of food industry marketing?

If we are serious about altering diet-related ill health, action needs to be coherent across all levels of existence. An example of current incoherence concerns the consumption of fish. Nutritionists encourage consumers to eat fish for their essential fatty acids, yet environmental analysis of the seas point to fish stocks being at danger levels.[38] Which evidence and advice should consumers follow? Both sources of evidence are true but their implications for policy are not joined up. The advice needs to be changed: eat only sustainably sourced fish; or get your essential fatty acids from seeds and seaweed, whatever is appropriate culturally and nutritionally. The point is that nutrition needs to be based on environmental principles.

Build Ecological Public Health Into the Business Model

In the 1940s, the public health champions of the new food policy approach won the day by showing how health could be injected into the business model and that some business could benefit. Just as environmentalists have been trying to reformulate what is meant by efficiency for an era molded by climate change and energy pressures,[39] so ecological public health needs to be injected into the food business model.[4,40] Business needs new legal and fiscal terms of reference if it is to address the new fundamentals. Carbon footprint audits are beginning to feature in company reports and accounts, measurement being a first step toward reducing greenhouse gases (GHGs).

But there is a long way to go before health and carbon/GHGs become linked issues for food businesses.[41]

Some voices in business dismiss the ecological public health perspective as too complex and challenging or as containable by offering niche products. Yet new ways of farming were seen as too difficult in the 1930s, only for the dustbowl, recession, and world wars to bring them to the fore. Winning business to health-focused change in the 1940s required opportunism, hard work, and perseverance by policy thinkers and researchers.[3] These qualities are needed again today, if 9 billion people are to be healthily and sustainably fed by 2050. Efficiency and markets need to be redefined. Productivity increases are needed but not at all costs. Twenty-first-century food production will have to be low carbon and water efficient. It will have to use land sustainably, protect soil structure, and rebuild, not just freeze biodiversity at current (collapsing) rates. Long supply routes, profligate energy use, and distorted price structures for nutrients—which have successfully delivered cheap calories while failing adequately to internalize the cost of environmental and health burdens—will have to be reworked.[42] Food businesses will have to be reengineered to be wholly sustainable not just treat sustainability as an opportunity to create new niche products or indulge in green hyperbole ("greenwash").

Tackle Inequalities of Power

Moving food policy to an ecological public health perspective will require cool political judgment. Food is subject to extremely powerful lobbies. Commercial interests dominate food messaging space. Junk food can too easily triumph. Although the language of consumerism accords primacy to the consumer, in fact power and markets are highly concentrated in most countries, and a global super elite has emerged. This inequality of power in the food system needs to be rebalanced. Competition policy is lagging far behind commercial reality; it ought to be a friend of public health. Controls on marketing are also sorely needed. How else can the informational imbalance between companies and health departments be righted? The annual marketing budgets of two giant food corporations dwarf the biannual budget of the WHO.[43]

Part of the rebalancing of power over the food system requires public health bodies to be more assertive. For decades, the prevailing ethos has been to rely on soft health policy measures such as labeling, health education, advice, and therapeutics that can be individualized rather than on population-wide or hard measures such as fiscal or championing regulatory interventions. Both soft and hard measures are required but whichever is used, emphasis is needed on tackling upstream causal drivers not just on downstream consumer behaviors. Power relations in the food system are not static, however; they have shifted in the 20th century from farmers to manufacturers

and now to retailers and traders, with the wholesalers also seeing an erosion of their position in many product supply chains.[2] Foodservice has changed, from being primarily a domestic service for the rich and the 19th-century middle classes to being a massive high street global presence; in many countries catering has by far the largest workforce within the food system. The consciousness industries (marketing and advertising) too have a huge presence, a feature of the shift from producer-driven to buyer-driven supply chains. Value has become increasingly captured near the consumer by retail buyers rather than the primary producer, the farmer/grower.

Help the Consumer by Rethinking and Deemphasising Choice

Western values are often said to center on constitutional as well as historical commitments to freedom and choice. Yet the imbalance of power in the food system, and the complexity of inequalities within and between societies in their access and availability of food, suggests that we need to debate what choice means in reality. Some argue that public health proponents can learn from the food industry—appealing to consumers to choose health—whereas others believe that we must do things differently. Advocates of social marketing argue that public health can harness the experience and techniques of the advertising industry. In truth, democracy is messy and takes time; control is neater but harsher and riskier. As Winston Churchill wryly noted in 1947, "democracy is the worst form of government, except for all those other forms that have been tried from time to time."[44] (p. 7566) The problem is that democratic access to health-enhancing diets is mediated by price structures, income, class, location, culture, which all warp the fabled level playing field in which consumer votes drive markets.

Ideologically, food and health policies have tended to be locked in to consumerism and choice. Yet choice can mean different things; even in prisons, where food selection is seriously restricted, there are choices. Choice is not an absolute driver of food and health. Indeed, choice is a dimension not a state of existence (see Figure 1). In Figure 1, the consumerist ideal of unrestricted choice is at the left end of the dimension, whereas poorer consumers remain closer to the limitations of choice experienced in total institutions such as prison.

As their wealth rises, consumers can move leftwards along the dimension of choice. Though developing countries need to give their consumers more choice, ecological public health for rich societies like the United States and UK probably means less of certain kinds of choices. All the yearround strawberries come at a cost as supply chain managers of Western supermarkets range the world for sources. There are not enough planets to feed the world with the volume or range enjoyed by Americans or Europeans.[42] But how can consumer aspirations be reframed to make food systems sustainable? Does this mean producing fewer cheap calories and consumers eating

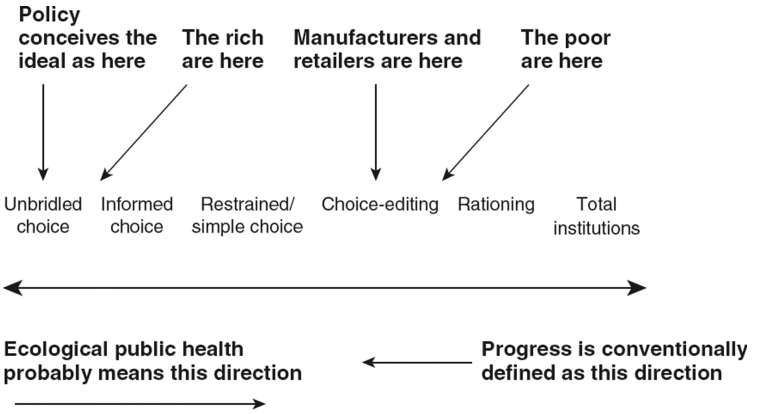

FIGURE 1 Rethinking choice for the era of ecological public health. Source: Lang et al.[2]

differently? The advantages of simplicity and consuming less might be greater if the benefits were clearer.[45] The UK Sustainable Development Commission has suggested that, ironically, while health proponents rely on labeling and information, the food industry *choice edits*. This is the term for the process used by retailers whereby they decide what to offer consumers and how to present it. Category buyers in retail chains filter what gets presented on shelves; their contracts and product specifications have more immediate impact on choice than consumers. Public health priorities need to be part of that choice-editing process.

Use or Create the Appropriate Policy Architecture

Food policy architecture straddles a 5-level food governance system: global, regional, federal, state, and community. This multilevel governance structure offers potential for better public health learning while adding further difficulties to already complex terrain. Globally, any move to reshape food for ecological public health policy encounters a long-standing tension between the United Nations (UN) bodies with its panoply of bodies—WHO, FAO, World Food Programme, Unicef, UNEP, and ancillary conferences and treaties—and the Bretton Woods institutions of the World Bank and International Monetary Fund (IMF). The World Trade Organisation (WTO), created in 1994, added to the tensions and complications. Public interest nongovernmental organizations (NGOs) have tended to pursue their interests through the UN, while business tends to see its allies in the Bretton Woods institutions.

One implication of multilevel food governance is the need to be clear about the appropriate level for ecological public health intervention. The right allies need to be in place; lines of communication should not be restricted to existing power brokers but across the food system. In the longer term,

we need to debate whether the institutional imbalances and divisions of responsibility are fit for purpose. Attempts to integrate nutrition across the UN, via the Standing Committee on Nutrition, for example, have been honorable but tortuous. They have not achieved requisite policy leverage. But what institutions would be needed to deliver coherent ecological public health? And how could agreement be achieved across ministries, at the national level, to integrate health, culture, and food supply? In private, many believe it will take crises—such as threatened in 2007–2008 with runaway food commodity prices—to bring fissiparous agencies together. But in such circumstances, already powerful voices can dominate input to decisions.

The main challenge for institutional reform is to inject ecological public health across existing departments and bodies. Climate change is already proving to be one such common rallying point, but the ecological public health perspective is more than climate change, important though that is. Seeing the breadth of what needs to be addressed sends signals to policymakers about the need to ensure that institutions are appropriate. A UK 2007–2008 Cabinet Office review of food policy which saw the nutrition–environment link led to the creation of a new cross-government food policy committee with parallel ministerial and civil service structures. (Following the *Food Matters* report in July 2008, a new Domestic Affairs [Food] Cabinet Subcommittee was created, chaired by the Secretary of State for Environment, Food & Rural Affairs.) The case for having a top-level integration point had become overwhelming. Time will tell as to its effectiveness but without such a structure, there is no chance. The smaller Nordic countries have also been experimenting with such structures.

Inject Health and Social Justice More Effectively Into the Sustainability Agenda

A theme for future food and health policy will be how to link the strong evidence on public health nutrition with equally strong evidence on the environmental attributes of eating. It is inconceivable that all humanity could eat a diet such as that consumed by many Americans or Western Europeans, high in calories and intensive in energy use. Rich, developed countries will have to lower their food system's ecological footprint. This is a matter of inter- as well and intranational justice. Within climate change negotiations, for example, the justice issue has come to the fore. It deserves to for food policy, too. There is more than a whiff of neocolonialism when Western advocates of sustainability target China or India for aping Western lifestyles. It is Western countries that developed food systems into oil dependency for mechanization, agrichemicals, and fertilizers.[46] A better argument is that even Western societies cannot afford the health burden of Western diets, let alone their environmental footprint. The Western diet is the planet's "canary," living proof of an unsustainable route for progress.

Humans inhabit an ecological niche on a crowded, delicately balanced planet where our actions threaten serious dislocation and perhaps even catastrophe. Defining what a sustainable food system is has become an urgent matter. The UK government took tentative steps in the right direction with its 2008 *Food Matters* report, which set priorities on nutrition and greenhouse gas reduction.[41,47] In 2009 Sweden gave explicit guidelines for consumers on how to combine health with environment in choice of food.[48] Its advice is now being debated at European Union level. Slowly, the competing demands long faced by consumers trying to eat sustainably are being acknowledged by policy-makers. What is a sustainable diet? How can it be delivered? Some argue that for developed countries, it is dietary simplicity: eating less, consuming fewer preprocessed foods, cooking more from raw, seasonal ingredients. Others counter that only highly centralized food production units (i.e., factories) can sufficiently control ingredients, portion size, and energy use to deliver those goals.

Research the Right Questions

Undoubtedly food policy for the ecological public health era will need cross-disciplinary research. As was noted above, the pursuit of evidence-based policy is more complicated than the term implies. Policy-makers do not receive consistent or coherent evidence. Often, the evidence that academics believe needs policy responses appears irrelevant to policy-makers. As well as evidence-based policy, we need to conduct research that is policy relevant, providing data on troublesome issues. An example of the latter is the cost of food. More sustainable food tends to imply rising costs, reversing the long decline in food process and the proportion of domestic expenditure on food. This has big implications for social equality; does making food more costly help or hinder the poor? This is fundamentally a political question. For decades, progress has been defined as cheaper food, yet now we know that prices also need to internalize the full cost of environmental and health externalities. There is already a vibrant debate about the potential of taxing fat, but consider how much more complex this policy debate needs to be if the food system is to reduce carbon, or if carbon and calories are not neatly aligned. In the EU, a carbon trading system began in 2005, giving carbon a price to incentivize CO_2 emission reduction, rather as the US created the 1990 Acid Rain Program to price sulfur and nitrous oxide to reduce acid rain. Such schemes are favored by economists and bankers, not least since they create new lines of business in themselves. It remains to be seen if they can actually cap, reduce, and contain bad practice more effectively than direct market interventions. Moreover, it is uncertain if they can or will reshape consumer culture which other analyses suggest might be a key factor.

The ecological public health research agenda on food needs to

- address both short- and long-term behavior change;
- help narrow the gap between evidence and policy but be policy relevant;
- locate health firmly within the sustainability agenda;
- address all the domains of existence: material, biophysiological, social, and cultural;
- be cross-disciplinary;
- take a whole chain approach from farm to consumption; and,
- point to appropriate levels of governance with which to formulate policy responses.

No single research project can be expected to tick all such boxes, but research programs must collectively do that. An immediate area for research is how to define a sustainable diet in locally appropriate ways. It is not likely that a sustainable diet would be the same in uplands of the United States as in Africa or China but the principles might be.

CONCLUSION

A new way of thinking about food and health is emerging, but there is much work to do before better integration of supply, society, and environment is achieved. The policy lock-in of recent decades is thankfully beginning to loosen, helped by internal contradictions as well as threats from new sources such as climate change and altered world political realities. The crises of food prices and financial markets in 2006–2008 cemented doubts about the intellectual rigidities of the Washington Consensus for the Global South and the assumptions of the infallibility of markets even in rich societies like the United States or EU. Food, health, and sustainability pose huge policy challenges but confidence can be gained by considering past successful health interventions, where boldness has been a hallmark. Think of water purification, controls on tobacco sales, reduction in air pollution, improved housing standards, and the regulation of food adulteration. The ecological public health approach proposed here could help provide vision for 21st-century policy on food systems. Rational and democratic debate is needed. Political and food sector leaders as well as ordinary consumers and players in the food system face enormous changes. Future generations will not thank us if we spurn the chance to engage or fail to be as ambitious as the evidence from diverse sources suggests policy now needs to be.

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