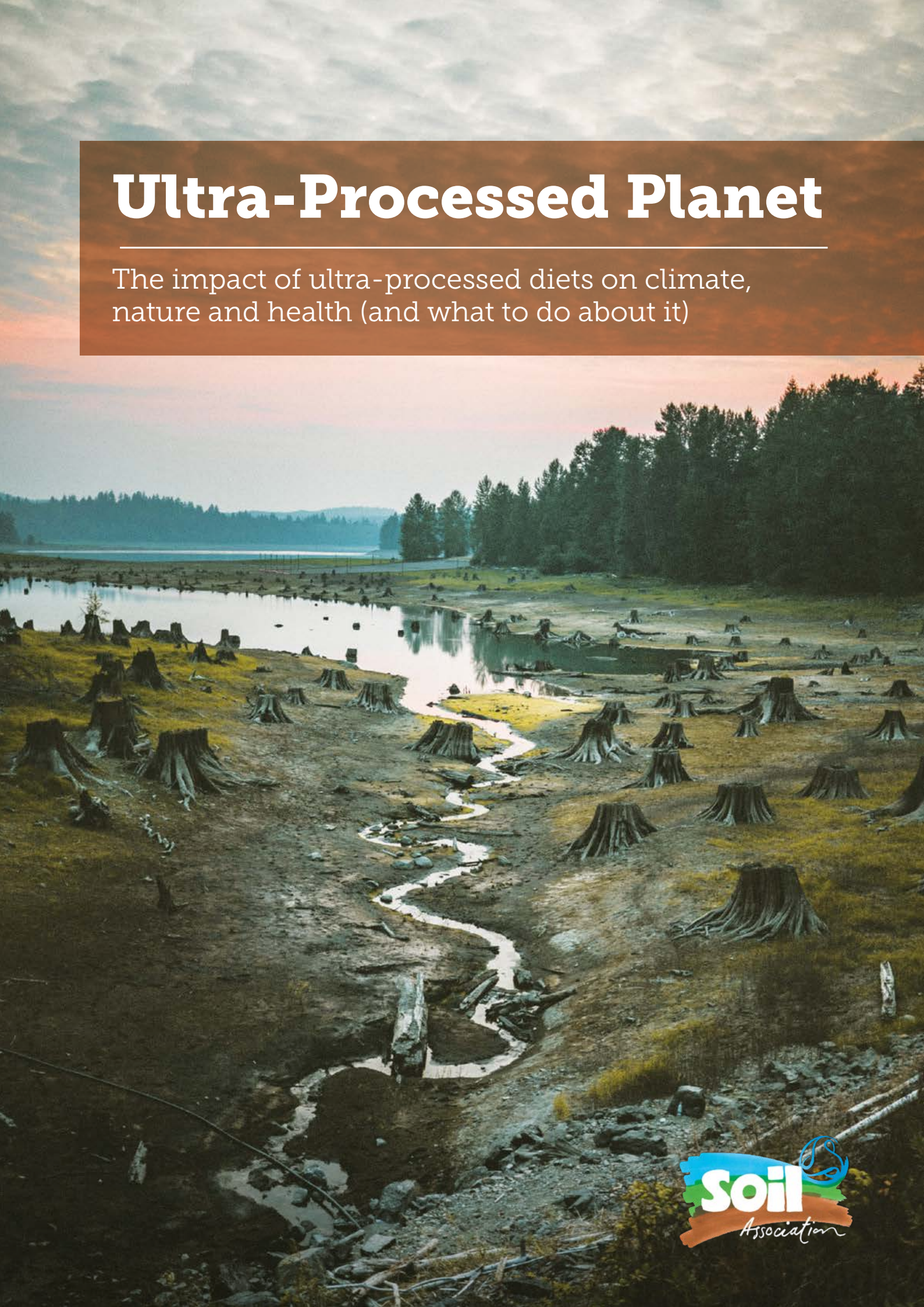
Ultra-Processed Planet

The impact of ultra-processed diets on climate, nature and health (and what to do about it)



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Introduction

UN Secretary-General António Guterres said it was "code red for humanity", speaking in response to the publication of a 2021 report from the Intergovernmental Panel on Climate Change (IPCC).

The IPCC warned that human activities are "unequivocally" fuelling the climate crisis, placing the planet's life support systems under severe strain, with extreme weather events such as floods and droughts set to intensify, unless radical and immediate action is taken to curb emissions.

The climate crisis is a present and escalating threat, but it is not the only challenge we face. In a 2019 paper in The Lancet, the authors described a 'global syndemic' of obesity, malnutrition, nature loss, and global heating. The word 'syndemic' is shorthand for a "synergy of epidemics", a set of global emergencies which "co-occur in time and place, interact with each other to produce complex sequelae, and share common underlying societal drivers." The paper says these emergencies are intrinsically inter-connected. It named ultra-processed foods as among the leading drivers.[1]

Ultra-processed foods are formulations of ingredients, assembled using sophisticated equipment and technology. The products that fall into this category typically contain little or no whole foods, are ready-to-consume or heat, and are made using industrial additives and processes that wouldn't be found in a household kitchen. They are often high in fat, salt and added sugar, and depleted in dietary fibre. They tend to be aggressively marketed. Such foods make up the bulk of the UK diet, comprising more than 50 per cent of the average shopping basket.[2]

We know that ultra-processed foods can be detrimental to our health. A robust body of science has found that diets rich in such products are associated with increased rates of obesity, metabolic disorders, depression, and all-cause mortality. As ultra-processed foods have become more prevalent globally, a wave of chronic disease has washed across the planet, and this health crisis has accelerated in parallel with the climate emergency and the destruction of the natural world.

> Ultra-processed diets are fuelling the ecological emergency. This report proposes a positive alternative, asserting that agroecology and organic offer a more equitable and sustainable approach to food and farming.

While the association between ultra-processed diets and ill health is well evidenced, and intuitively easy to understand, the association between ultra-processed foods and environmental degradation might seem less obvious. After all, 'ultra-processed' is a broad category, encompassing a wide range of products. Why would these foods be bad for the planet? Is it the processing, the use of additives, the ingredients, the packaging? What links ultra-processed products to the climate crisis?

This report addresses these questions. It presents evidence that ultra-processed diets are fuelling the planetary and human health emergencies, and it proposes a positive alternative, asserting that agroecology and organic offer a more equitable and sustainable approach to food and farming.

The report's publication has been timed to coincide with the 2021 UN Food Systems Summit, and in anticipation of the UK Government's response to the National Food Strategy, expected in January 2022. It makes recommendations aimed at fixing our food system, calling for changes in both global governance and national policy, both at a UK and devolved government level. Our political leaders must have the courage to stand up to vested corporate interests, responding to the evidence. We have created an ultra-processed planet, and the warning signs are flashing red, but there is still time to embrace the alternative.

Box i:

NOVA classification

(Monteiro et al., 2019)

NOVA (a name, not an acronym) was first developed by the Brazilian physician Carlos Monteiro and his team at the Centre for Epidemiological Research on Nutrition and Health (NUPENS) at the University of São Paulo. It now forms the framework for a growing body of scientific investigation.

Monteiro devised a categorisation system to divide commercially available foods into four groups:

Group 1	**Unprocessed or minimally processed 'whole foods'** This group includes anything from a tomato to a bunch of mint, a pork chop to a walnut. They are obtained directly from plants or animals and go through minimal processing (such as cleaning or freezing) before reaching our kitchens.
Group 2	**Processed culinary ingredients** This includes things like butter, sugar and honey. Imparted by nature they undergo simple processes such as pressing, grinding, crushing, pulverizing, and refining. They are often used sparingly to make other foods taste delicious.
Group 3	**Processed foods** These contain elements from groups one or two, processed by manufacturers – often salted, fermented, or pickled. They include bacon, cheeses, canned fruit and vegetables, smoked salmon, and traditionally made bread.
Group 4	**Ultra-processed foods** These are quite different from the other groups. They tend to contain the sugars, oils and starches from group 2, but instead of being used sparingly, these ingredients make up the bulk of these foods. Ultra-processed foods also contain ingredients unfamiliar to domestic kitchens, such as soy protein isolates. Colourings, emulsifiers, flavourings and other additives are added to make the products better-looking, tastier and longer lasting. They can also be extremely moreish – or "hyperpalatable". Foods in this group include most shop-bought snacks, biscuits and cakes, mass-produced bread and breakfast cereals, reconstituted meat products, mass produced desserts, infant formula and some baby foods, yogurts inclusive of sweeteners and artificial colourings, and many ready meals.[3]

Based on these definitions, more than 50 per cent of UK household food purchases are ultra-processed, the highest proportion in Europe.[4] Globally, the consumption of ultra-processed foods is escalating, especially in middle-income countries.[5]

In response to the evidence linking ultra-processed diets to ill health, several national governments have enacted a policy response:

- Brazil, Canada, Ecuador, Peru and Uruguay have introduced dietary guidance recommending citizens eat less ultra-processed food.
- Chile, Peru, Mexico, Uruguay, and Brazil have introduced labelling approaches to help consumers make healthier choices.
- France has introduced a percentage reduction target for ultra-processed foods in the national diet.

Box ii:

Why are ultra-processed foods so popular?

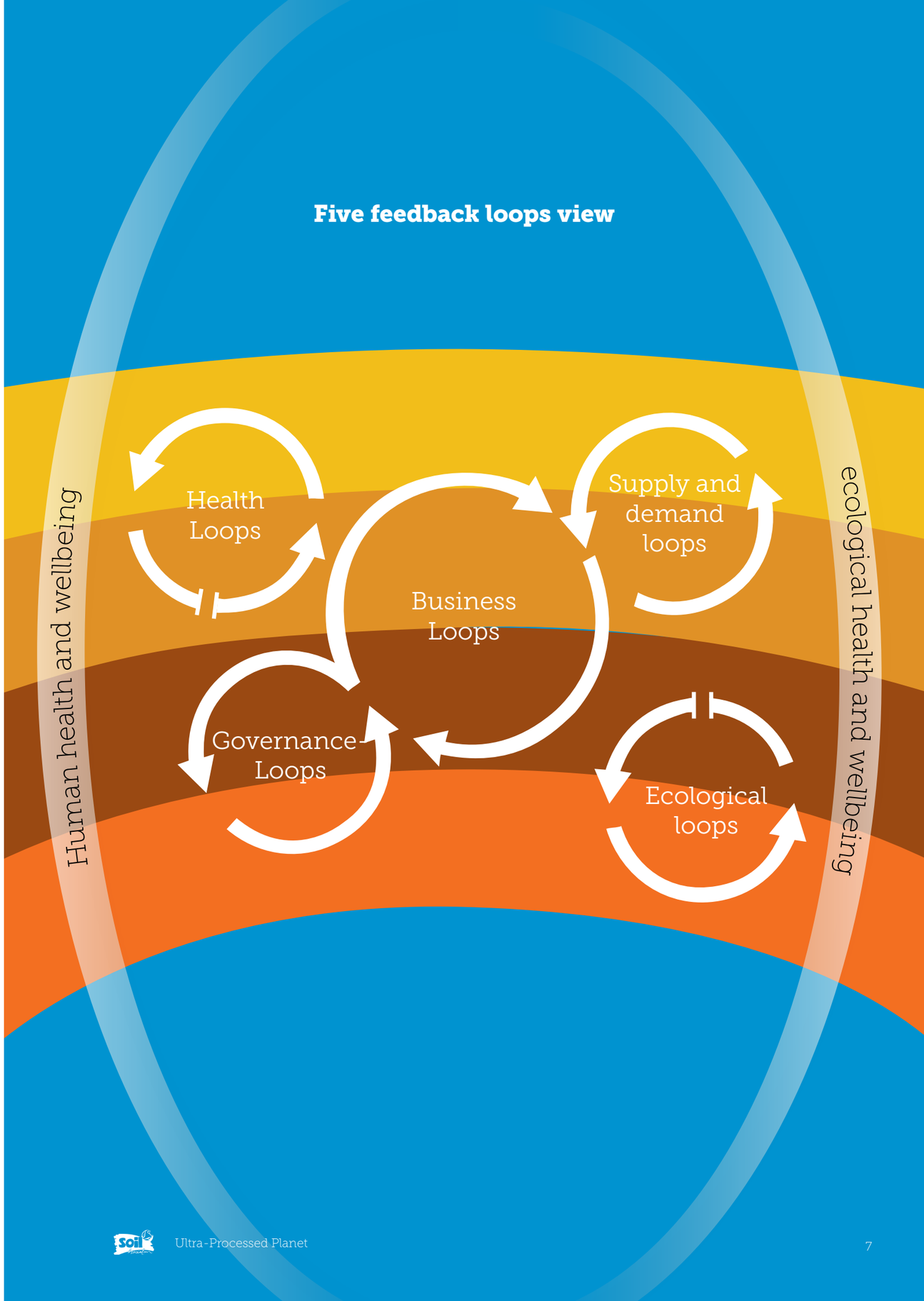
In the 'global syndemic' paper published in The Lancet the authors describe several self-reinforcing 'feedback loops' which help to create and perpetuate the conditions for ultra-processed products to dominate our diets.[6] These include –

Governance loops: The governance system is skewed in favour of ultra-processing. This is partly because food industry actors have sought to influence policy making by funding research favourable to their commercial interests, and by lobbying for deregulated operating environments characterised by weak accountability systems for human health and environmental externalities. This has led to governance frameworks which benefit the manufacture and sale of ultra-processed products, reinforcing the food industry's status and dominance .

Business loops: This interference in food system governance has been enacted to generate returns for shareholders. The logic of the market dictates that manufacturers pursue profitability, and this commonly means adding value along the supply chain. The current system functions in such a way that there is little money to be made in healthy whole foods, such as fruits and vegetables. Milk has less added value (in profit terms) than formulas, yoghurts, and ice creams. Through economies of scale, the use of cheap commodity ingredients, and additives that enhance palatability and shelf life, the manufacturing of ultra-processed products has become profitable and ubiquitous. These products, in turn, fulfil popular desires for taste, variety, choice, and convenience, and are frequently purchased.

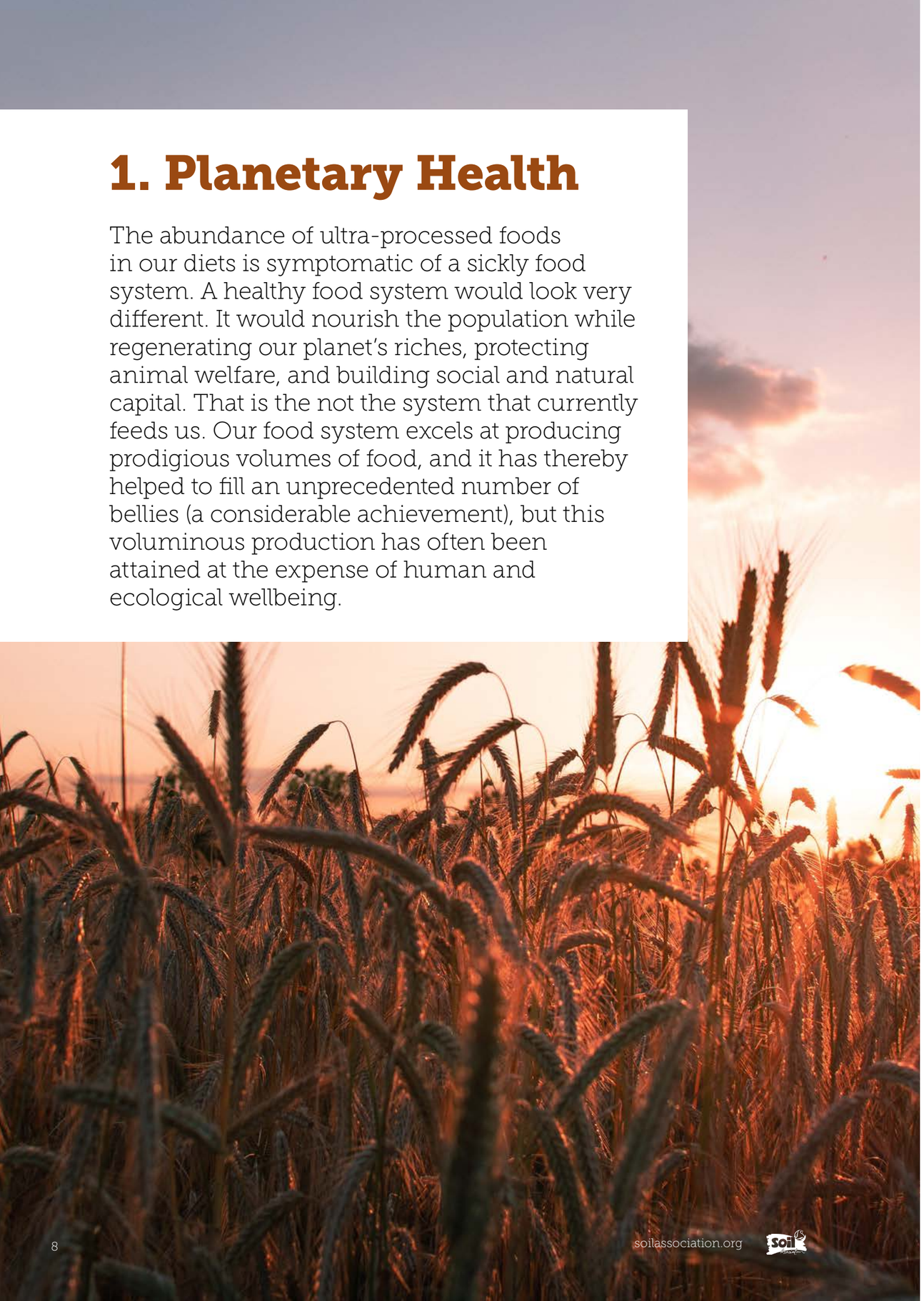
Supply and demand loops: Why do we purchase these foods? It's partly because we have biological, psychological, social, and economic vulnerabilities that the food industry exploits through marketing and advertisements. Ultra-processed products are manufactured to pique our preference for fatty or energy dense foods, weakening appetite control and creating novel eating patterns which translate into more frequent purchases. While some government measures, such as regulations restricting advertisements and promotions, front-of-pack warning labels, and fiscal policies, have partially constrained the supply and demand loop, our food environment remains saturated with ultra-processed products.

These feedback loops help to create and perpetuate the conditions for ultra-processed foods to dominate our food system and diets, to the detriment of human and planetary health.



1. Planetary Health

The abundance of ultra-processed foods in our diets is symptomatic of a sickly food system. A healthy food system would look very different. It would nourish the population while regenerating our planet's riches, protecting animal welfare, and building social and natural capital. That is the not the system that currently feeds us. Our food system excels at producing prodigious volumes of food, and it has thereby helped to fill an unprecedented number of bellies (a considerable achievement), but this voluminous production has often been attained at the expense of human and ecological wellbeing.



It is no coincidence that a system predicated on industrial production has generated a prevalence of industrially processed foods. Ultra-processing requires that whole foods are broken apart, with their components recombined to produce novel and profitable products. For maximal profitability, such processing must be performed upon cheap, standardised and readily available commodity ingredients, and largescale animal and plant monocultures, fed by industrial inputs, have emerged and have been sustained as a result. There is a symbiotic relationship between industrial food and industrial farming.

Among the commodity ingredients commonly used in the manufacture of ultra-processed foods are palm, soya, wheat, maize, milk, eggs, and meat. Some of these are known to contribute to the health impacts associated with ultra-processed diets, with processed meats displacing healthy proteins from the plate, and consumption of palm oil and soybean oil contributing to excess calorie consumption. Sugar often takes the blame, but our increased caloric intake in recent decades has primarily been due to the consumption of refined vegetable oils within ultra-processed products.[7] Beyond these health impacts, the production of these crops has also placed a growing burden on natural environments, positioning farming at the heart of the climate and nature crises.

The ecological impacts of soya and palm production are well documented. Wild habitats have been destroyed as land has been converted, putting iconic species such as the jaguar and orangutan at risk. The felling of forests and the loss of native foliage has exacerbated global heating, with more than 130,000 hectares of rainforest cleared for palm in Indonesia between 2015 and 2018, and the Brazilian Cerrado erased for soya at

130,000 hectares of rainforest cleared for palm in Indonesia between 2015 and 2018, and the Brazilian Cerrado erased for soya at a faster rate than the Amazon.

an even faster rate than the Amazon. The climate impacts of palm production have been exacerbated by the 'slash and burn' techniques used to clear the forest, which sometimes set the peat-rich soils beneath alight (like coal, dry peat is highly flammable). Indonesia's 2015 fire season emitted more than 1.5 billion metric tons of carbon. On a single day, these fires emitted more carbon into the atmosphere than did the entire United States economy.[8]

The natural environment in the UK has also suffered as agriculture has intensified and commodity crops have displaced wild habitats and more diverse modes of farming. Among the crops of concern are sugar, the production of which has contributed to soil degradation in East Anglia (the heart of the UK's sugar beet industry for the past few decades), with nearly 85 per cent of fertile peat soils in this region lost since 1850, and the remainder at risk of being lost over the next 30 years.[9] Also damaging soils across England is maize. While most maize is used as animal feed (often for dairy cattle) and as biofuel, both maize and modified maize starch (typically from imported sources) are found in many ultra-processed products, such as breakfast cereals and yoghurts.[10]

In the UK and globally, the ultra-processed food, animal feed and biofuel markets act in concert to support the production of intensively produced commodity crops. As many of the ultra-processed foods that result are

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'discretionary' – unnecessary to the human diet – such production represents a wasteful use of land and resources.[11] The costs of this entrenched waste are escalating. If global dietary trends continue, per capita greenhouse gas emissions resulting from the consumption of 'empty calories' within ultra-processed products are set to double by 2050.[12]

The transformation of wild habitats and biodiverse farmland into industrial monocrops has been facilitated by fossil fuel-based fertilisers, chemical inputs, and multi-national trade and marketing, which have radically changed the way we eat around the world. Urbanisation has exposed more people to ultra-processed foods, generating rising demand, while local food cultures and local varieties of food, have fallen out of favour. Of the tens of thousands of plants and breeds cultivated since the birth of agriculture, a mere twelve plants and five animals now account for 75 per cent of the world's food. Even as people have been presented with the façade of choice – a dazzling and expanding array of branded products – true choice and diversity have been eroded.[13]

When considering the environmental impacts of ultra-processed foods, it is prudent to look beyond the footprint of the individual product towards wider systemic impacts. On the product level, we might observe that processing requires energy, and the inputs required for ultra-processed foods can be higher.[14] In the manufacturing of soya isolates, for example, multiple processing steps are needed to fabricate the final product, and the use of solvents such as hexane, from petrochemical origin, entails additional energy and resource use.[15] Large scale manufacturing often requires the standardisation of ingredients, such as the dehydration of raw materials which are then rehydrated to a precise level, and both dehydration and rehydration are resource intensive.[16]

But there is a bigger picture, beyond these direct impacts. Processing is considered to have a relatively small environmental effect compared with other stages of the food supply chain, such as production or transportation. In the UK, for example, food manufacturing and packaging are responsible for 19 per cent of food chain greenhouse gas emissions, with production (at farm level) accounting for much of the remainder.[17] The important question is perhaps not 'what is the footprint of the product?' but 'which foods would we find in a food system that helped to resolve the climate and nature crises?' Such a food system, as argued below, is not one oriented around industrial commodity crops and fossil fuel inputs, but around agroecological farming, such as organic, and the consumption of a diverse range of fresh and minimally processed whole foods.

Our sickly food system is propelling us into a planetary emergency, but there is another way.

2. Human Health

Eating a diet rich in ultra-processed products can be bad for our health. Three recent meta-analyses of findings from epidemiological studies found unambiguous associations between consumption of ultra-processed foods at population level and the prevalence of overweight, obesity, type 2 diabetes, metabolic syndrome, depression, and all-cause mortality.[18] The first randomised controlled trial (considered the 'gold standard' in nutrition research), undertaken in 2019, found a causative relation between ultra-processed food consumption and excess calorie intake.[19]

The evidence is convincing, but it must be interpreted carefully, for the science does not suggest that all ultra-processed foods are equally unhealthy, or that they affect our health in the same way. It's more complicated than that. The evidence primarily pertains to diets high in ultra-processed foods, but health outcomes cannot be uniformly attributed to individual products within those diets. It's the overall pattern and quality of the diet which matters, with health outcomes shaped along multiple overlapping pathways.

These include:

1. The displacement pathway: As we eat more ultra-processed foods, fresh and healthy foods, such as whole foods, and more wholesome processed foods (such as tinned fish or tomatoes), are displaced from the diet. There is evidence that such displacement is especially prevalent among lower income groups, where fresh produce can be more difficult to access and afford.

2.The junk food pathway:
Many ultra-processed foods are energy-dense and high in added sugars, salt, unhealthy fats, and highly refined carbohydrates, while also typically being low in dietary fibre and essential nutrition. These are the classic 'junk' foods, sometimes described as 'high fat sugar salt' (HFSS) foods.

3. The depletion pathway:
Not all ultra-processed foods are easy to identify. Ultra-processing has contributed to the depletion in nutritional quality of everyday staples, such as bread and breakfast cereals, robbing them of a range of beneficial phytonutrients and antioxidants, edging them towards the 'junk' category. The milling process employed in producing ultra-processed supermarket breads, for example, can destroy various beneficial bioactive compounds and leave them depleted in dietary fibre.

4. The gut health pathway:
The lack of fibre and dietary diversity which characterises diets rich in ultra-processed foods can negatively alter the composition of the human gut microbiome. Additives, such as emulsifiers and sweeteners, can also diminish the diversity of gut microbiota, thereby affecting how our bodies digest and take up nutrients from our food.

5. The appetite and satiety pathway: The microbiome, digestive system, and hormone system, help to mediate satiety signalling, by which our body tells us it's full after eating. The capacity of ultra-processed foods to disrupt satiety signalling is the focus of a growing body of research, with a 2021 study exploring the ways in which these foods can "drive compulsive consumption."[20]

6. The eating pattern pathway:
The disruption of satiety signalling is just one contributing factor in the capacity of ultra-processed products to generate novel eating patterns. These products are often convenient, hyper-palatable, and marketed to be consumed absentmindedly, during distracting activities such as watching television. This can encourage more snacking, less chewing, faster eating, and increased consumption.

7. The early years pathway: Our eating patterns are influenced from a very early age. Aggressive marketing by formula companies has created a formula feeding culture in the UK, wherein most babies are given infant formula within days or weeks of being born, displacing breastmilk and prompting early cessation of breastfeeding, while also altering the gut microbiome.[21] Most infant food companies are marketing purée

products as convenient and healthy, even when they are high in free sugars, lacking in texture, and provide a predominance of sweet flavours that bear little resemblance to the natural flavours of fruits and vegetables. This can lead to overeating and a loss of recognition of the food being eaten, inhibiting the learning of chewing skills and the development of a grown-up palate. The introduction of snack foods in infancy can also generate eating patterns focussed on processed foods which track into childhood.[22]

Few ultra-processed products will act along each of these pathways simultaneously, but when diets are rich in such foods, the pathways overlap, multiply and interact, to the detriment of our health. It follows that some ultra-processed foods might be more harmful than others, and that it is the overall pattern and quality of the diet that matters.

Nutrient profiling is part of this picture. The association between ultra-processed foods and ill health is partly the result of the nutritional composition of these products, and the prevalence of 'high fat, sugar, salt' foods in ultra-processed diets. Efforts to address the excessive consumption of such junk foods, including via reformulation, are likely to be necessary, but ultimately insufficient in improving dietary health across the population. The removal of nutrients of concern, such as excessive salt or added sugar, from ultra-processed products is likely to confer health benefits, but these products might still undermine health along one of the other pathways. Epidemiological and experimental studies indicate that an ultra-processed diet may increase risks for obesity and related diseases in ways that extend beyond the nutritional composition of the foods consumed.[23]

This 'multiple pathways' view suggests that improving dietary health will require action on multiple fronts, with an emphasis on shifting the overall balance of the diet towards fresh and minimally processed whole foods, beginning in infancy. Fortunately, such efforts align with the trajectory needed to resolve the climate and nature crises. Instead of growing commodity crops for processing, we should be growing a more diverse range of fresh foods in agroecological systems. Instead of allowing food manufacturers to inappropriately market and sell unneeded ultra-processed products, we should be enacting policies that support the consumption of the whole foods, of both plant and animal origin, that are known to benefit our health.

Box iii:

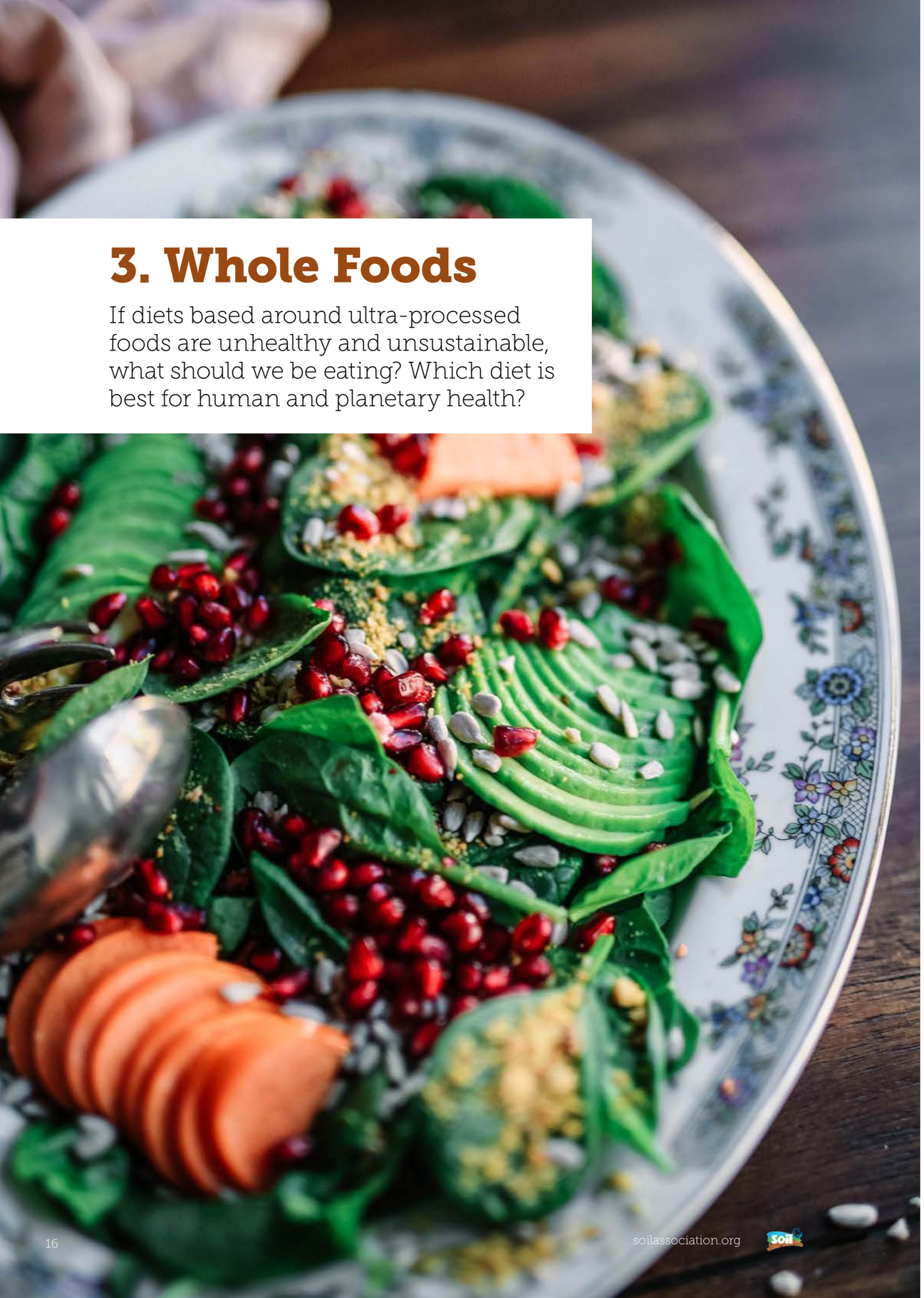
Nutritionism

The term 'nutritionism' was coined by Professor Gyorgy Scrinis to describe "a reductive scientific methodology that favours the fragmented and isolated analysis of single foods and single nutrients out of the context of the foods and dietary patterns in which they're consumed."[24]

This methodology has been championed by food industry actors keen to divert attention from the study of the ingredients, additives, and processing techniques used in the manufacture of ultra-processed products, and from the study of such products as a whole, the dietary patterns they encourage, and the broader social, commercial, and ecological determinants of dietary health.

Within this nutrient centric model, any health harms associated with ultra-processed diets are attributed to their typically high concentration of specific nutrients (salt, added sugars, saturated and trans fats, and so on) or their energy density. In framing the harms of ultra-processed foods in this way, the solution is accordingly framed as the reformulation of these products to reduce the levels of the offending nutrient. The overall pattern of the diet needn't change, the argument goes, only the composition of the products consumed.

While nutrition scientists and public health nutritionists have progressively shifted their focus over recent decades to the bigger picture – from nutrients to foods, dietary patterns, food environments, and the ecological contexts in which foods are produced and consumed – food corporations have stepped up to become the primary promoters and defenders of a nutrient centric model. A paper published in the British Medical Journal in 2021 found that ultra-processed food industry actors have sought to influence global health policy at the highest levels of the United Nations and World Health Organization, including by "funding and disseminating research favourable to commercial interests", and "lobbying of Member States to support industry positions", with the aim of perpetuating a policy environment characterised by nutritionism.[25]



3. Whole Foods

If diets based around ultra-processed foods are unhealthy and unsustainable, what should we be eating? Which diet is best for human and planetary health?

Claims abound for the competing nutritional merits of various diets – low carb, plant-based, keto, Mediterranean, and so on – but virtually all eating patterns associated with meaningful evidence of health benefit overlap substantially, sharing common features. As the authors of a recent analysis published in the Annual Review of Public Health concluded, "a diet of minimally processed foods close to nature, predominantly plants, is decisively associated with health promotion and disease prevention and is consistent with the salient components of seemingly distinct dietary approaches."[26]

Accordingly, the healthiest diets are typically those based around 'whole foods' – foods consumed largely as they are found in nature. Foods in this category include the edible parts of plants, such as fruits, seeds, leaves, stems, roots, and tubers; and those of animals, such as muscle, offal, eggs, and milk; as well as fungi and algae. These foods may be lightly processed to remove inedible or undesirable parts, and by drying, crushing, grinding, roasting, boiling, refrigeration, freezing, chopping, and other methods that do not rely on industrial additives or techniques, and still be considered whole foods.

Why are diets based around such foods associated with good health? It is partly because these foods are typically 'nutrient dense' – packed with the good stuff. Analysis from the Global Burden of Disease study suggests that the absence of such foods from the diet – especially wholegrains, vegetables, fruits, nuts, and seeds – can be a greater marker of disease risk than the excessive presence of unhealthy nutrients such as fat, sugar, salt.[27] These foods also deliver their nourishment in a beneficial biochemical 'package'. Evidence suggests this package – known as the 'food matrix' – can contribute to good health.

Whole foods are brilliantly complicated, comprised of thousands of biochemical components. When we eat these foods, we're not only eating macronutrients such as fat and protein, but a dense matrix of polyphenols, minerals, oligo-elements, vitamins, and phytonutrients, which can act in synergy when consumed. Studies have shown that the food matrix (this biochemical package) can enhance the nourishment provided by a food or a meal, including by increasing the bioavailability of nutrients, influencing chewing speeds and digestive kinetics, triggering hormonal secretions, and promoting feelings of satiety.[28]

Some scientists have accordingly called for the 'health potential' of foods to be re-defined according to both the food matrix and its nutrient composition.[29] While ultra-processed products can be reformulated to improve their nutrient composition, their 'health potential' might still be lower than that of whole foods, for nutrients extracted from their initial matrix and incorporated into artificial structures do not interact with the body in the same way. It follows that dietary guidelines should look beyond micronutrients of concern to emphasise the benefits of consuming a diverse range of fresh and minimally processed whole foods.

Diversity is important. Our industrialised food system has led to a radical decline in the diversity of animal and plant life both on farms and in the wild, while ultra-processing has diminished the diversity of the foods we consume and the biochemical complexity of those foods. Such losses are undermining human and planetary health, but there is another way, an approach to production and consumption predicated on increasing diversity, embodied in agroecological and organic farming.

Box iv:

Ultra-processed plant protein products

The popularity of plant-based meat and dairy alternatives has grown exponentially in recent years, with the UK at the forefront of product innovation. Many of these plant-based products are ultra-processed, and while they typically perform functionally similar roles to meat and dairy in the diet (plant-based milks can be used in similar ways to dairy milk, for example), their nutritional profile and biochemical composition are often different, sometimes significantly so.

A 2021 study interrogated these differences, concluding that milk alternatives "may be useful as practical replacements of dairy products but cannot be considered nutritional replacements." The study found that dairy milk contained more energy, saturated fat, carbohydrates, protein, vitamin B2, vitamin B12 and iodine, and less fibre and free sugars, than plant-based alternatives. Notable differences were also found between yogurt and cheese and their corresponding alternatives.[30]

These differences might have consequences for dietary health in some contexts and among some population groups. A 2020 study found that one in three vegans in Germany displayed iodine levels below the World Health Organization threshold for "severe iodine deficiency",[31] with dairy providing a primary source for the rest of the population. A second study found that exclusive consumers of plant-based milks in the UK were classified on average as "iodine deficient", whereas those consuming dairy milks were not.[32] These deficiencies can be addressed through dietary change or supplementation, but these studies illustrate that meaningful nutritional consequences can arise when consumption of meat and dairy are swapped for their respective alternatives.

Beyond these nutritional differences, plant-based alternatives are also typically ultra-processed, and do not replicate the full complexity of the food matrix found in animal foods. A 2021 comparison of the food matrices of a plant-based meat alternative compared to grass-fed beef, for example, found notable differences, with numerous metabolites found either exclusively or in greater quantities in beef (along with some essential nutrients such as long chain omega 3 fatty acids). These differences arose despite similarities in the products' 'nutrition facts' panels (the products were similar in fat content and serving size), and the study authors caution they might be significant for our health.[33]

It is not the case that all plant-based meat and dairy alternatives are intrinsically unhealthy, or less healthy than equivalent meat products, or that all swaps pose a health challenge, and indeed there is evidence that plant-based alternatives can be healthier in some contexts.[34] But when a product is composed of plant protein isolates, industrially manufactured with additives, flavourings, colourings, and binding agents, it is unlikely to offer the same nutritional benefits as the whole plant foods from which it is derived. Soy protein isolates lack many of the beneficial nutritional components found in whole soybeans, for example.[35] The most notable health concern posed by plant-based alternatives might be their capacity to displace healthy whole plant proteins from the diet.

The same can be said of processed meat, which makes up 7 per cent of the UK diet, and is arguably already displacing healthy plant proteins from our plates. These meat products also often derive from intensive production systems associated with environmental degradation, zoonotic disease risk, the threat of antimicrobial resistance, and poor animal welfare. In light of these issues, there may be good pragmatic reasons to swap ultra-processed meat to ultra-processed plant proteins. But this swap should only be seen as a steppingstone towards a truly healthy and sustainable diet – one characterised by agroecological production, and the consumption of diverse whole foods, including 'less and better meat' and 'more and better' plants.

4. Agroecology

Our food system is fuelling the climate and nature crises. The production of commodity crops for animal feed and ultra-processing is degrading soils and damaging the natural environment.

The prevalence of ultra-processed products in our diet is also eroding our health. As the authors of the 'global syndemic' report explain, a complex array of political, cultural and biological forces are acting to create the conditions wherein ultra-processing dominates our diets. But there is another way, a healthier, more equitable and more sustainable way of producing and consuming food.

This is agroecology, defined by the UN as "the science of applying ecological concepts and principles to manage interactions between plants, animals, humans and the environment". Agroecological farming involves practices which are good for both people and planet. These include reducing fossil fuel and chemical inputs; rotating and integrating crops and livestock; using green and animal manures, recycling nutrients on farm; harnessing ecosystem services; farming with trees; promoting living, carbon-rich and biodiverse soils; and deliberately cultivating diversity both within the farm system and the encompassing ecosystem. Organic farming is the best known and the only accredited example of agroecological farming.

Agroecology stands opposed to many features of our industrialised food system, including the intensive production of commodity crops for ultra-processing. It champions diversity, and prioritises fresh foods supplied through local supply chains. It also offers an alternative political model for the food system, emphasising 'food citizenship' and a more democratic balance of power, promoting policies that ensure a 'fair deal' for producers and citizens. Agroecology is ultimately concerned with putting the damaging feedback loops of our ultra-processed planet into reverse, generating positive feedback loops that promote both human and planetary wellbeing.

One such positive feedback process might be observed in the capacity of agroecological systems to produce foods that are nutritionally different. A 2014 meta-analysis found that concentrations of a range of desirable antioxidants such as polyphenols are substantially higher in organic crops, such as fruit and vegetables, compared to those which are intensively grown. These include phenolic acids, flavanones, stilbenes, flavones, flavonols and anthocyanins. Various of these have been linked to a reduced risk of chronic diseases in dietary intervention and epidemiological studies. Pesticide residues are also known to be far lower in organic fruits and vegetables.[36]

The altered 'food matrix' in organic crops derives from the way in which these crops are grown. Intensive cropping typically entails the use of synthetic nitrogen fertilisers, which flush the soil with an excess of nitrogen, prompting the plant to channel its energy into rapid growth. The result might be a bumper crop, but less energy is allocated to the production of secondary metabolites used in defence against pests. Polyphenols are one such group of metabolites secreted by plants in response to stress stimuli, such as attacks by pests. As organic foods are produced in a more 'stressful' environment, with less excess nitrogen, they typically have higher concentrations of these compounds. Polyphenols have been positively associated with a healthy gut microbiome, with the higher polyphenol content of organic foods understood to confer potential health benefits.[37]

The use of synthetic nitrogen also typically prompts the farmer to apply pesticides, as nitrogen fuels weed growth and thins the plant's cell walls, allowing pests and diseases to take hold more easily. These pesticides are increasingly understood to be contributing to the loss of insects and pollinators globally, including by disrupting the animals' gut microbiome. Pesticides are understood to damage the intestinal microbiota of bees and bumblebees, increasing sensitivity to pathogenic microflora, which leads to a higher death rate. They also affect insect and pollinator vitality, mating success and characteristics of their offspring.[38]

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While industrial farming tends to denature the soil, deplete insects, and is associated with the manufacture of ultra-processed products which denature the human microbiome and deplete human health, agroecological farming nurtures healthy soils, benefits wildlife, and aims to produce foods which support good human health. What we eat and how we farm are intrinsically connected. If we are to address the over-prevalence of ultra-processed foods in our diet, we must change the way we produce food and relate to the land.

Box v:

Organic principles and processing

The organic movement adheres to a set of principles which shape its vision for food and farming in a global context.

The Principle of Health: 'Organic agriculture should sustain and enhance the health of soil, plant, animal, human and planet as one and indivisible.'

The Principle of Fairness: 'Organic agriculture should build on relationships that ensure fairness with regard to the common environment and life opportunities.'

The Principle of Ecology: 'Organic agriculture should be based on living ecological systems and cycles, work with them, emulate them and help sustain them.'

The Principle of Care: 'Organic agriculture should be managed in a responsible manner to protect the health and wellbeing of current and future generations and the environment.'

These principles inform the development of organic standards (which are defined in law) and the practices typical of organic farming (the best known and only accredited example of agroecological farming). Organic processing standards – which govern how raw ingredients are transformed into branded products – have also developed in line with these principles.

These standards stipulate that processing must be undertaken with care, learning from biological processes rather than industrial techniques, where possible. They include restrictions on additives and ingredients used for technological or sensory functions, and require micronutrient fortification and processing aids to be used minimally, only if there is an essential technical need or if required by law. Of the 100 most common additives found in ultra-processed products, only 42 are permitted in organic. These 42 are mostly of plant, animal, or mineral origin.

Restrictions in the standards mean many ultra-processed foods could never be certified as organic. Examples of ingredients and additives banned in organic (but commonly found in ultra-processed foods) include nanoparticles and nanomaterials, GM ingredients, hydrogenated fats, artificial food colourings, monosodium glutamate, sodium benzoate, potassium sorbate, aspartame, acesulfame K, and sorbitol. Only organic or natural flavours can be used, with Soil Association organic standards enforcing additional restrictions on the extraction solvents using in the manufacture of flavourings.

Organic foods strive to be transparent, ensuring "the exclusion of substances and processing methods that might be misleading regarding the true nature of the product." The fake colourings and flavourings ubiquitous in ultra-processed products fall into this category, while organic also prohibits techniques that modify or restore attributes that are lost during processing or storing (reconstituted meat, for example, is not permitted). To be certified organic, all processed products must contain minimum 95 per cent organic ingredients, with the remaining 5 per cent coming from a carefully controlled list of exemptions. Organic licensees are subject to rigorous inspection every year to maintain their licence.

Some organic products do fall into the ultra-processed category, including some infant formulas, plant-based meat alternatives and protein powders. Some organic products might also be more highly processed than they could be, due to consumer and retailer demands for long shelf life and palatability. But in such cases, the additives and processing aids within them are limited to those that have been approved for organic products and, the organic ingredients of which these products are composed still derive from nature-friendly farming systems which help to resolve the climate and nature crises.

> If you buy organic, you can be sure of the provenance and quality of the ingredients.

5. Recommendations

It is known that under current consumption levels, ultra-processed foods are causing damage to our health and planet. It's essential that the Government support a transition to agroecology and organic by implementing each of the following recommendations.

1) Harness the Food Systems Summit to enhance food system regulation and governance

The UN Food Systems Summit should urge international and national food and health authorities to review their dietary guidelines to encourage consumption of minimally processed whole foods and reduced consumption of ultra-processed products, following the example of countries such as France, Brazil, and Canada. These guidelines should emphasise the importance of healthy diets for infants and young children, recognising the importance of breastfeeding and healthy eating in the early years.

National governments should also be urged to use a variety of approaches, such as fiscal measures, marketing regulations, front-of-pack labelling, food education and food procurement policies, to promote uptake of minimally processed whole foods, and to discourage the consumption of ultra-processed foods, resisting lobbying from food industry actors to prioritise voluntary reformulation programmes.

These policies should be introduced in tandem with policies supporting a transition to organic and agroecological farming, plus shorter and more flexible supply chains, supportive of SME and local producers and processors, and a more democratic balance of power across the food system.

2) National governments in the UK should adopt a percentage reduction target for ultra-processed foods

National governments across the UK should follow France's example by setting a percentage reduction target for ultra-processed foods in the national diet, including for infants and young children. In their public health strategy, the French government set the target of reducing ultra-processed foods in the national diet by 20 per cent.

The aim should be to move England, Scotland, Wales and Northern Ireland from 'worst in class' to among the 'best in class' within ten years. As a rough ambition, this would mean flipping the 51 per cent of ultra-processed foods in the UK diet to a scenario wherein these foods make up only 15 per cent of the diet.

3) Introduce dietary guidelines addressing ultra-processed foods

The National Food Strategy recommended that the role of the Food Standards Agency (FSA) should be expanded to cover healthy and sustainable food as well as food safety, with new duties to report annually to Parliament on our national progress towards a healthier and more sustainable food system. It said the FSA should also develop an updated "reference diet" for the nation, in line with health and sustainability goals, working closely with the Office of Health Protection and Defra.

These recommendations should be implemented by UK Government, and this reference diet should be developed to promote the consumption of a diverse range of fresh and minimally processed whole foods, and discourage the consumption of ultra-processed foods, following the example of the Brazilian dietary guidelines, which say:

1. Make natural or minimally processed foods the basis of your diet.
2. Use oils, fats, salt, and sugar in small amounts when seasoning

and cooking natural or minimally processed foods and to create culinary preparations.

3. Limit consumption of processed foods.
4. Avoid consumption of ultra-processed foods.
5. Eat regularly and carefully in appropriate environments and, whenever possible, in company.
6. Shop in places that offer a variety of natural or minimally processed foods.
7. Develop, exercise and share cooking skills.
8. Plan your time to make food and eating important in your life.
9. Out of home, prefer places that serve freshly made meals.
10. Be wary of food advertising and marketing.

Other countries which have introduced dietary guidelines addressing ultra-processed foods include Canada, Ecuador, Peru, and Uruguay.

While the National Food Strategy recommendations do not directly apply to Scotland, the Scottish Government should similarly update national dietary guidance to address the over-consumption of ultra-processed foods and do more to promote minimally processed whole foods, in line with the Brazilian example.

4) Introduce labelling to indicate when products are ultra-processed

The UK Government – along with the Scottish and Welsh governments – should introduce front-of-pack labelling to discourage consumption of ultra-processed foods and encourage consumption of whole foods and less processed foods. A precedent for such an approach is found in Israel, where the government introduced a labelling system which incorporates mandatory red warning labels on products that do not meet nutritional criteria ('HFSS' foods) with a green label on whole foods and minimally processed foods.

Further precedent is found in Chile (introduced 2016), Peru (2019), Mexico (2020), Uruguay (2021), and Brazil (2022), where a range of labelling approaches have been introduced to help consumers to identify unhealthy foods and drinks and to make healthier choices.

5) Reconnect children with where their food comes from, and implement practical food education

We know that food education can be transformative. The 'whole school approach' embodied in the Soil Association's Food for Life School Award has had a marked impact on diets and inequalities. Independent evaluation shows that pupils in Food for Life-engaged schools – where pupils are engaged with food, cooking and growing and visiting farms – are twice as likely to eat their five-a-day compared to children in matched comparison schools, and they eat a third more fruit and vegetables overall. If every primary school in the country was a Food for Life school, a million more children would be eating their five-a-day.

> We know that food education can be transformative. The 'whole school approach' embodied in the Soil Association's Food for Life School Award has had a marked impact on diets and inequalities.

The National Food Strategy recognised the potential of these approaches, saying: "Schools should be encouraged to adopt a 'whole school approach' to food. This means integrating food into the life of the school: the dining hall should be treated as the hub of the school, where children and teachers eat together; lunch treated as part of the school day; the cooks as important staff members; and food as part of a rounded education. The Government should require all schools to work with accreditation schemes – such as Food for Life – to improve school food and education using this whole school approach."

Governments across the UK should work with Food for Life to implement this recommendation.

6) Support a transition to agroecology and organic farming

The National Food Strategy has called for agroecology to become the norm in England. Outlining its vision for English land use, the strategy says: "A small amount of our farming land will be given over to native woodland, peatland, heath and species-rich grassland maintained by conservation grazing. On the remaining farmland, lower intensity, agroecological farms will sit alongside higher-yielding farms that use the latest technology to maintain yields without polluting." A map alongside the recommendation makes clear that 'low-intensity agroecological farming' is envisaged as having the largest 'compartment' in this model.

In support of this agroecological transition, the National Food Strategy also calls for –

- **A guaranteed budget for agricultural payments until at least 2029** to help farmers transition to more sustainable land use.
- **A Rural Land Use Framework** based on the 'three compartment' model, with agroecology and organic as the largest compartment.
- **Investment in farmer-led innovation**, saying it "is important that this funding should be used to … get more support to the agroecological methods that have been starved of investment up to now."
- **Dynamic Food Procurement to support agroecological and organic producers** and SMEs to gain access to public sector markets.
- **Mandatory local food strategies**, following the example of the Sustainable Food Places network.

It's essential that the Government supports this proposed transition to agroecology and organic by implementing each of these recommendations.

In Scotland, a long-term plan for agricultural payments should similarly be agreed up to at least 2029, and the 'three compartment' model for land use should be embedded through relevant policy mechanisms such as the Land Use Strategy, National Planning Framework and Rural Land Use Partnerships.

The Scottish Government should also invest in farmer-led innovation as well as public procurement to support agroecological and organic producers and SMEs. The Scottish Government's approach to local food strategies (currently under consultation) should build upon the Sustainable Food Places model. The governments in Wales and Northern Ireland should take similar measures.

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