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Round Table on Global Food Security

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Food is at the heart of our future



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Foreword

We must all eat, every day, in order to survive and thrive. That adds up to more than 8 trillion meals a year. Present projections of demand by the Food and Agriculture Organization of the United Nations (FAO) indicate a need for 60 per cent more food by the mid-century. However, failure to address the current shortcomings of the global food system could potentially result in a global food shortfall of up to 40 per cent. Our Second Round Table finds that the future of food cannot be taken for granted.

In its first Round Table report, the Commission for the Human Future called on all people and nations to prepare a plan for humanity to survive and thrive, far into the future in the face of ten intersecting threats. Food, and how we produce and share it, lies at the very heart of such a plan.

For a growing range of reasons, the world food supply is not sustainable. Currently humanity consumes 1.7 times the resources that the Earth can sustainably provide. We have already seen clear evidence that our food system is starting to fracture – and we need to act now, before it falls apart. The reasons are many and deeply intertwined. They have to do not only with soil, water and climate but also with nutrition and its lack, with systems of governance and economics, with population growth and the progressive destruction done to the natural world, with fairness and inequity. Food has been termed a ‘wicked problem’ because it is so complex – but that does not mean it is insoluble. Rather, it is a worthy challenge.

Our purpose in this report is to identify, clearly, some of the extreme vulnerabilities and weaknesses of our present food system – and also to highlight some possible solutions. We make no firm prescriptions, nor do we detract from the great work by many bodies worldwide who are trying to build a better food future. We support and add to it. Our chief aim is to place food within the context of the ten catastrophic risks now facing humanity, explain the urgency of a united global effort to transform it and so build a more secure nutritional future for everyone.

Our greatest enemy is complacency – the lazy belief that because there is food in the shops today, it will always be there tomorrow. This view has coloured the attitudes of governments, corporations and consumers alike. It has bred inaction, lack of interest, lack of vision, lack of will for change, lack of research. It has allowed dangerous, corrupt and unhealthy elements to assert control over this most precious life-giving substance.

This second report is a call for action by everyone – farmers, consumers, industry, governments, communities, indigenous people, scientists, cooks and investors – to join in building a healthy, renewable food industry for the future. Its aim is to stir discussion, debate, ideas and a worldwide will for transformation in food.

John Hewson

Chairman

Commission for the Human Future

Part 1: Risks

1.1 A system bound to fail

The global food system is headed for failure in the mid C21st, with catastrophic consequences for all people, nations and for civilisation as a whole. The Round Table agreed that, for this reason the current system must be transformed to one that is safe, sustainable, healthy and fair to all.

Fracturing of industrial food chains is already evident in the Covid19 pandemic, diet-related disease is the greatest killer of our age and, in the medium to longer term, the food supply is imperilled by scarcities of soil, water and nutrients, genetic narrowing and climatic instability. Global action to remedy these risks is far from what is required.

Industrial food production, as practised today, cannot be sustained in the longer run. It causes massive land degradation, wastes water and overuses toxic chemistry; it generates 30 per cent of the world's greenhouse emissions; it is the chief contributor to the loss of two thirds of the world's wildlife; it demands crops suited to industrial rather than nutritional needs; it wastes enough food every year to feed 3 billion people; it is exceptionally vulnerable to a changing climate. The excessive dominance of the corporatized global food system, where control is concentrated among a handful of transnational companies, is bad news for farmers, for consumer health and nutrition and for the environment that grows our food.

These factors already cause widespread starvation and even in high-income countries will result in episodic food shortages and even famines towards the mid-century, as the Earth's population continues to grow and demand more food, key resources fail and the climate becomes more hostile to agriculture. These factors, in combination, can trigger regional famines, governance failures, mass migration and wars.

There is currently a worldwide focus on renewable energy to power the human future: the focus on renewable food is negligible. This has to change. The two go hand-in-hand.

1.2 Resource risks

Our current food system is having serious adverse impacts on planetary health. Among the greatest risks to global food security in the face of expanding human demand is the destruction of the natural resource base – soils, water, biodiversity and healthy ecosystems – on which humanity's future ability to feed itself depends.

The focus of the current 'agribusiness' philosophy is on productivity/yield, rather than sustainability. This is leading to the mining of natural resources like soil, water, forests and

fish stocks rather than preserving and regenerating them for future food and ecological needs.

Worldwide loss of soil, due mainly to agriculture, is estimated at between 36 billion and 75 billion tonnes a year. Around one third of the world's topsoil has been lost since 1970 and half of what remains will be lost by 2060, potentially putting traditional soil-based agriculture on a path of no-return. The loss of soil pollutes rivers, lakes, dams and the ocean, destroying fisheries, fish farms and coral reefs. There are now more than 760 'dead zones' worldwide, eutrophic regions rendered stagnant or sterile by soil and fertiliser washed or blown off the land. Further loss of productive soils will severely compromise food production and food security, increase the prospect of price volatility and potentially plunging hundreds of millions more people into poverty, hunger and civil unrest.

Furthermore, the availability of prime land to grow food is diminishing worldwide as agriculture is obliged to compete with other uses, including the sprawl of vast cities, biofuels, recreation, conservation and re-wilding. There is also growing global pressure from land lost to salinization, acidification and desertification due to poor management.

Agriculture is responsible for three quarters of deforestation worldwide, which destroys around 30 million hectares of trees every year and is the principal driver of the Sixth Extinction of life on Earth.

Food production currently uses 70-75% of the world's available fresh water to grow 40% of the world's food – in most cases, unsustainably. Groundwater is widely over-extracted without thought for the future and is running out at an alarming rate in key foodbowls worldwide. Farm water is now being bought up by megacities, miners and speculators who can afford to pay more for it, preventing its future use for food production. Privatisation and market-based 'solutions' for managing of water have largely failed, delivering it into the hands of the richest and most powerful. Much of the world's fresh water is now too polluted to safely use in food production.

Four billion people now face acute water shortages at least one month a year. By 2025 1.8 billion people will be living in countries or regions with absolute water scarcity and by 2030, given present climate trends, water scarcity in some arid and semi-arid areas could drive up to 700 million people to flee their homelands.

Compounded by climate, a foreseeable global water crisis is now approaching and poses the next overwhelming threat to global food security. Most countries and governments appear as unprepared for this as they were for Covid-19 and as they are for climate change.

In addition, any food system that relies on fossil fuels for production, transport, processing and distribution of food is not sustainable in the longer term, because of their impact on contamination of the food chain and biosphere and on adverse climate change.

1.3 Climate risks

Global warming is the defining issue of our Age and one of its most ominous effects is on our ability to produce sufficient nourishment for ten billion people living on a hot, resource-stressed planet in the mid-century. Harsh and unpredictable impacts of changing climatic systems affect farm and fishery production, food safety, storage and delivery systems. These are already in evidence. Under present circumstance, it is impossible to de-link food security from catastrophic climate risk: if we fail to curb the climate threat, global food security will worsen profoundly.

The mild climate epoch in which farming arose has ended. Warming will increase the stress, unreliability and failure of existing food systems throughout much of the world within the lifetimes of our children, due to heatwaves, droughts, floods, shifting rainfall patterns, extreme weather events, fishery collapses, water wars, pest and disease outbreaks, more frequent and severe pandemics arising from land clearing, intensive animal husbandry and government failures due chiefly to complacency about the scale of the threat. As the planet warms these events are expected to increase in frequency as well as scale.

Global warming is on track for +2 degrees by 2060, posing a growing catastrophic risk to traditional farming systems. As temperatures rise to +3 and +4 degrees, in line with recent trends, agriculture in many regions will either fail or be forced to relocate. It is not only the damage inflicted by individual weather events, but also the increasing volatility of the climate, swinging sharply from drought to flood, heat to storm and back, that will undermine food security.

No country, region, community or person on Earth will be immune from the effects of climate-driven food price instability, mass migration and the conflicts this may cause.

Food production is both a victim and a cause of global climate change, through the emissions released by land clearing, cropping, intensive livestock production, use of nitrogen and the operations of the food chain. Overall, food production is responsible for around 30% of climate emissions. However, there are many opportunities to break this link.

Generally, the best food producing lands (climate + soils) have already been cleared in the temperate regions and are still being taken in the tropics. Land clearing releases large volumes of carbon as forests, woodlands and grasslands are lost and soils degraded. Avoiding ecosystem conversion is an important key to curbing humanity's carbon emissions, especially in still-forested lands such as Brazil, Indonesia, DR Congo, SE Asia and Australasia.

Around two thirds of the food consumed worldwide is produced by a billion smallholder and subsistence farmers across Asia, Africa and Latin America – the majority of these are

women, who are especially vulnerable to climate change adversities as well as economic discrimination and disadvantage.

Climate action, though generally agreed to, is progressing far too slowly worldwide to avoid the worst impacts of climate change on global food production. Indeed, the evidence suggests that hostile climatic conditions are developing at rates which will make future food crises unavoidable in many regions and possibly worldwide.

1.4 Agroecosystem failure

Without mature, worldwide discussion and preventive action on the issue of the 'human carrying capacity of the Planet' there is a high risk of irreversible damage to global ecosystems, biodiversity and so, to future food supply itself.

Industrial food production is the main driver of global environmental degradation and extinction. The loss of biodiversity across the planet (including oceans, rainforests, woodlands, farmland and urban areas) is reaching a critical "point of no return".

Access to clean water around the planet is diminishing. Water for drinking, domestic use, agriculture, irrigation and the environment is an essential resource and should be treated as such. Market-based solutions for the management of water have largely failed. Erosion, salinisation, acidification and desertification are spreading, reducing the availability of well-watered arable soils for food production and making the global food supply more reliant on marginal lands subject to crop failure.

Around 5 million tonnes of pesticides are released by agriculture into the global environment each year. Among many impacts, this is leading to a collapse in insect-provided pollination services worldwide (valued at half a trillion dollars), widespread loss of soil microbiota responsible for fertility, and the poisoning of rivers, lakes and aquifers. There is mounting scientific evidence that, while pesticides protect crops in some ways, they also cause substantial harms in others, to both the agro-ecosystem and to human health. The question of balance, and the tradeoffs, have not been addressed.

The failure of both natural and agro-ecosystems and food chains is leading to increased biosecurity issues – and to the risk of fresh pandemics. Viruses alien to humanity are emerging from landscapes newly cleared for agriculture and being distributed, *inter alia*, by the food chain (in the US alone, 25,000 meat workers have contracted corona virus.) Climate change and crop monocultures are exacerbating the threat to food production from the international spread of farm pests and diseases such as locusts, armyworms and swine fever.

Any discussion of global food security necessitates deep consideration of the economic systems that underly it. There is growing concern that power over food is being concentrated in fewer and fewer hands. These, while they offer large benefits on the form of assured supply and microbiological safety also place profit ahead of human and

ecological health. The influence of these food chain participants directly affects the quality and security of the global food supply, as it does the climate – in many cases negatively. Some consider there may be an equivalent case for public divestment from food corporates as there is from fossil fuel corporates or for reviewing the social licence that allows food corporations to act contrary to public good.

Increasing ‘financialisation’ and corporate ownership of food resources ranging from land, water and farming inputs (seed, fertilizers, pesticides, machinery) to transport, processing, marketing and distribution mean that the future food production environment is not valued – but is viewed increasingly as an opportunity for short-term rent extraction and capital gain rather than a fundamental source of human nutrition.

There is a global deficiency of independent (‘public good’) research, development and innovation for sustainable, regenerative and climate-resilient systems of food production. At present the global agricultural research agenda is substantially skewed towards corporate needs, not farming or human nutritional needs. There are signs that the peak production is being reached in some western agricultural systems.

Losses in agricultural biodiversity – the range of crops and animals raised by humans – driven by a corporate focus on monocultures of a handful of industrial crops and animals, are resulting in declining resilience and increasing risk of crop failure.

Modern industrial agriculture and its annual use of 5 million tonnes of biocides has led to wholesale clearing of forests and grasslands, the elimination of two thirds of the world’s large wild animals, diminishing species of plants, animals, insects and fungi. This places ecological systems and the services they provide to humanity in peril. An example is the worldwide loss of pollinating insects, including honeybees, which are responsible for producing half a trillion dollars’ worth of food each year.

Fisheries globally are in collapse as humans eat their way down the food chain, due to overfishing, over-development in coastal areas, pollution of rivers, estuaries, coastal and deep seas, and the impact of coastal aquaculture. The degradation of the oceans from global warming, over-fishing and pollution (particularly plastic and eroded soil) is having a devastating effect on the ability of many countries who rely on the sea to feed their people.

1.5 Hunger amid plenty

The modern industrial food system, while providing large volumes of generally safe and uniform food to most people, is failing in dietary terms. Poor diet is now the leading cause of preventable disease, disability and premature death globally. A sound diet is the number one determinant of preventable disease and life expectancy

The food system is currently implicated in four pandemics – diabetes, obesity, other noncommunicable diseases (cancer, heart, liver etc) and antibiotic resistance –

responsible for the majority of human deaths in both developed and developing countries and for the lion's share of exploding healthcare costs in every country.

In the 21st Century humanity needs to consider not only the many people still suffering hunger, but also the over-consumption of foods that are nutrient poor. Malnutrition – including over-nutrition (2 billion people), under-nutrition (1 billion) and micronutrient deficiencies (2 billion) – now affects more than half of the human population. It is the 'new normal' in nearly all countries and societies. Populations in 53 countries have recently experienced acute hunger, resulting from conflict and food insecurity, climate shock and economic turbulence – while in others, one person in three is overweight/obese. Most countries are now experiencing the triple burden of undernutrition, obesity and diet-related disease. In Australia, for example, 35% of nutritional calories come from junk food and people spend up to 58% of their food budget on such industrially processed foods.

Malnutrition in the developed world stems from overprocessing of produce into less nutrient-dense foods, from a decline in the nutrient content of the soil due to over-farming, and partly from distributional problems ('food deserts'). This in turn leads cyclically to greater use of artificial inputs to force yields, which increases nutrient stripping and hence, results in an ever-less nutritious food supply. Research indicates that global warming may also make important foods, such as rice, less nutritious.

The modern diet may contain up to 14,500 man-made chemicals, presenting a grave risk to human health, safety and child development in the medium term. There is no global screening process to exclude these substances or limit their interactions, although some countries test food for pesticides. There are no policies to prevent toxic mixtures arising. These food-chain toxins are part of a pandemic of 'environmental' poisoning which claims 9 million lives a year.

A growing concern is the nutritional safety of mothers and children, especially, in low- and middle-income countries, which may be adversely affected by anti-livestock campaigns run by vegetarian activists in high-income countries. However, a consensus is growing that reduced meat consumption and greater emphasis on whole-food plant-based nutrition is desirable in wealthier, high meat-consuming societies.

Inequity is a potent factor at the heart of 21st Century malnutrition. This is driven by socio-political-economic determinants of health, such as access to education, employment, adequate housing, clean water and sanitation, welfare support and healthcare. Oxfam estimates that the world's richest 26 people command more wealth than the poorest half of humanity. As inequity grows, worldwide, the pressure for cheap, unsustainable and unhealthy foods also burgeons. 17,000 children die daily from preventable causes, linked principally to poverty and malnutrition; at the same time, the corporations at the centre of the global food oligopoly accrue record profits. We cannot address the converging crises of food insecurity, public health and ecological collapse without addressing the grotesque and extreme levels of inequality that occur within countries and between countries.

Many governments in the developed world tend to regard food and nutritional security as an issue for the developing world, of little immediate concern to them. Consequently, it occupies a low place among their priorities and their interest in reforming the food system is negligible. Political attention is lavished on food corporates rather than on consumer health, the cost of the healthcare system, the deteriorating state of the resources upon which it all depends, or on the needs of farmers. Overall, the prevailing attitude of governments, corporates and consumers alike to global and local food security is one of complacency and unawareness.

The practice of modelling future population food requirements on kilojoules and tonnes of output instead of nutritional value inflates future demand and generates ultra-processed foods, leading to overconsumption, obesity and diet-related disease.

Food, diet, agriculture and fisheries are generally treated by governments as if they were separate issues. They are not. They are intimately connected. What happens on the farm and ocean, in the factory and the supermarket affects what happens in the hospice: cheap, poor quality food increases the danger of lifestyle disease and adds to the cost of healthcare to society. Preventive healthcare through healthy diet remains a low national priority in most countries.

There is a global disconnect between agricultural research and nutritional research, in both public and private sectors. Ideally the research agenda should focus on humanity's nutritional needs and how to meet them, rather than on the forced overproduction of 'empty calories'.

The Sustainable Development Goals, to which all nations have agreed, are at risk - yet they are central to food security, food sovereignty and human health, as well as people's rights to natural landscapes providing clean water, fresh air and mental wellbeing. In particular, SDG 2, "End hunger, achieve food security and improved nutrition and promote sustainable agriculture," appears further from fulfilment than it was at the start of the 21st Century.

Above all, the Universal Human Right to Adequate Food is a well-recognised pillar of international human rights law, adopted by 170 countries from every culture and region around the world and should be a cornerstone of all food and nutrition policy.

1.6 Overproduction and waste

Our civilisation currently produces around 5 billion tonnes of food a year, up to 2 billion tonnes of which is wasted – enough to feed 3 billion people, in a world where nearly 1 billion go hungry. A third of the world's cropland is harvested to feed livestock rather than people. This has resulted from an overwhelming emphasis on yield and volume of production to meet commodity demands – at the expense of nutritious food, healthy consumers and viable farmers. This model has to change.

Food waste offers one of the greatest opportunities to redesign the food system on 'circular economy' principles. So far, efforts to salvage wasted food worldwide have been small. However, the principle of "renewable" food depends on designing a system that recycles all the nutrients presently lost or trashed by the current system and using them, over and over again, as is the case in nature. Solving the issue of nutrient waste offers ways to overcome malnutrition.

The principle of renewable food also depends upon renewable energy. The two go together. Renewable energy is a perfect diversification for rural enterprises, creating a new source of income for struggling farmers. Unlike fossil fuel extraction, it does not compete with food production for water. It can help to minimise or offset agriculture's climate footprint. It offers synergies with both crop and livestock production.

The genetic base of the human food supply is now narrower than it has ever been in history. Owing to the dominance of food corporates, humans presently consume fewer than 1 per cent of the world's edible plants: the modern menu consists of less than 300 out of 30,000 known edible plant species. Over-reliance on an extremely narrow range of 'high yielding' livestock and crops and their gene pools has made food production riskier, less nutritious and less sustainable. This has produced a system that favours the profits of industrial food processors, handlers and retailers over the survival of farmers, the health of consumers and the health of the Planet.

There is serious undervaluing of the role of smallholders, peri-urban farmers, urban food producers, agroforesters, fish farmers and indigenous cultures in helping to secure a fresh, healthy and diverse supply of food for an increasingly urbanised humanity. Often these 'small actors' are crushed by regulation or corporate dominance of marketing chains. Concentration in the food chain, and the elimination of small farmers that accompanies it, also constitutes a powerful barrier to young people entering food production, depriving the food sector of their energy, dedication and skills.

1.7 Adverse economics

The global food system is slave to a productionist paradigm that focuses on producing more food, for monetary profit rather than nutritional purposes. This outmoded system rewards the volume of food produced rather than its dietary virtues or quality.

It is dominated internationally by a small number of extremely large agribusiness, food processing and retail corporations and their relentless drive to increase both production and consumption. These punish farmers by paying them less and less for producing more and more. This has devastating impacts on rural communities, on people, animals and on the farming environment. Effectively, the current agribusiness system drives farmer to become miners of their soils, water, landscapes and biodiversity, degrading the very ecological system and climate that sustain healthy food production.

Increasing concentration of corporate ownership has corrupted the goal of sustainable food production and captured control of regulation intended to protect the agro-ecosystem and consumer health. It gives preference to high-fat, high-sugar, high-salt, high-chemical and heavily processed foods that defy sound nutritional advice. It invests in large-scale land clearing and the slaughter of wildlife, such as the orangutan. Furthermore, corporate funding of scientific research has sullied science, causing it to lose consumer and government confidence.

Food producers worldwide are now locked into a competitive spiral to produce food at the lowest possible prices to meet the needs of supermarkets promoting cheap food while creating profits for a handful of transnational corporates, using systems that take no account of our ability to sustain the human food supply in the longer term. The industrial farming model unfairly advantages large corporate and company farms over smaller family farms. Consequently, millions of smallholders and farmers who can no longer compete are being forced off their land. The corporate model aggregates land and water holdings then, when it has extracted its rent, re-sells them to realise capital gain. This transforms the farming landscape and society forever as it sheds skills, degrades natural capital and bars young farmers from entering the industry.

Consumers everywhere now eat food that does not reflect the real cost of producing it. They are disconnected, almost completely, from the people who originally produced the food, and how it was produced, leading to wide-scale public ignorance about which foods are healthy, safe and sustainable and which are the opposite. Food consumption patterns are now extensively determined by advertising agencies rather than by nutritionists or sustainable farmers, leading to growing health problems and rising death rates. Consumers have been trained by corporates to expect 'cheap' food, with disastrous consequences for the environment that produces their food and their own health. The reality is that today's food is too cheap to last.

A new way to value food is imperative. There is room for far more involvement by consumers, farmers, dieticians and nutritionists in the human diet than the industrial system permits today.

Food chains, typically extending for thousands of kilometres, undermine the capacity of local food producers to supply their own markets, and the contact between producers and consumers so necessary to a healthy, sustainable diet. They cause massive waste and muffle market signals to producers. They are responsible for a large part of the food sector's climate emissions and high costs. For all these reasons the world urgently needs solutions that *shorten* supply chains, notably a return to locally produced foods.

A complex web of political economy factors drives today's food systems. Dominant market-based approaches to food governance prioritise economic over social and environmental interests and have led to hyper-concentration in the market and political power of transnational corporations across the entire food chain. Concentration of ownership of food processing, marketing, transport and supply is dominated by around 20 global mega-corporates. Four companies now control more than 60 percent of global

proprietary seed sales; this is causing large-scale agricultural biodiversity loss and threatens future food security.

Of equal concern is corporate dominance of the supply chain that provides farmers with chemicals, fertiliser, machinery and other inputs, and its effect on rural communities. Corporate agribusiness argues we need to intensify agricultural production to meet future food demands, using disruptive digital, chemical and genetic technologies; however, these will further entrench their control of the food chain. In the words of one farmer, “These corporate players don’t recognise the importance of social and community values in their balance sheets or their reporting to their shareholders.”

Oceans should not be forgotten. Corporatisation and increased scale of fishing has intensified the emptying of the world’s oceans as fishery after fishery disappears, through over-allocation and ineffective quota enforcement. While aquaculture is presented as a solution, often it depends on unsustainable use of both agricultural and marine feed sources.

Individualism, a cornerstone of Western identity, is a major obstacle to a global shift to mindsets that value collective goals, such as food security, health, safety and sustainability, over private ambitions. Changing this may be a critical step in achieving true global transformation towards food security.

Consequently, the global, industrialised and commodified food system is deeply unsustainable and grossly unfair. Its failures and fragilities have been apparent for decades and have been brought into sharp relief in the current pandemic. The case for transformative change is urgent and overwhelming. Addressing power asymmetries between corporations, governments, farmers and consumers within and surrounding food systems represents a core challenge for any transformation agenda.

Among others, the Eat-Lancet Commission, Lancet Obesity Commission, the High-Level Panel of Experts on Food Security and Nutrition, IPCC, IPES-Food, FAO and IFPRI have all highlighted the parlous state of the world food system and the need to reinvent it.

1.8 Food chain failures

The coronavirus pandemic has highlighted the systemic fragility of just-in-time chains that are a feature of the world commodity food system – and the risk this poses to reliable food supplies in future. Covid-19 clusters in meatworks, food processing plants, produce markets and other concentration points caused breakdowns in demand and supply and extensive food waste when farmers in many countries were forced to plough their crops under.

Food security has four key components: production, storage, distribution and food safety. In many parts of the world, none of these are fit for purpose, as revealed by the Covid-19 chaos.

A widely neglected issue is that no major city, anywhere on Earth, can feed itself. All rely for their food from transport, processing, storage and supply chains extending for thousands of kilometres. This makes them highly susceptible to fragmentation, oil shocks, transport failures, supply shortages, climate and weather impacts, conflicts, trade disputes, industrial strikes, health lockdowns and other forms of disruption.

Countries reliant on food imports are especially at risk. Unfair trade and investment terms, combined with a broken system of aid, has entrenched food import dependency in low-income countries.

The chief goal of global food chains is profit for the corporations and shareholders that control them, not assured supply, good nutrition or health. Being privately held, increasingly outside of national jurisdiction, they lack both transparency and accountability to the public. They limit the choice of foods to those which are most profitable to transport and process, or which meet narrow marketing aims such as eye-appeal. They foster the incorporation of toxic chemistry, mostly derived from petroleum and coal, as preservatives, colourings and additives and the leaching of packaging materials, into the food supply.

Corporate dominance means there is a lack of independent 'public good' research into food production, food systems, logistics, novel foods, nutrition and health, serving the needs of humanity, rather than agribusiness. Instead research tends to be focussed on corporate food chain needs.

1.9 Population

The issue of a sustainable food supply for humanity through the 21st Century is inseparable from the question of the human population, at what level it may peak and how it can be brought down to a number capable of living within the Earth's resources. Nor can these two be separated from the issue of climate change.

At present, humans and their livestock account for 97 per cent of the biomass of all vertebrate land animals on Earth – an almost complete reversal of the situation barely a century ago. Population growth is the great driver of unsustainable use of water, food and other vital resources.

Underpinning all 10 catastrophic threats to the human future is our failure to contain human numbers, to address how they are to be constrained and brought back into balance with the Earth's capacity to support us. Indeed, many governments are still bribing their citizens with subsidies and tax breaks to produce more babies on the misguided assumption that this leads to economic growth. These short-sighted policies increase the scale of catastrophic risk faced by all.

While population growth tends to be strongest in developing regions, reckless overconsumption of resources is strongest in the wealthy world. Both issues need to be

controlled if human civilisation is to survive. The Commission will discuss this issue in more detail in future reports.

1.10 Links to global risks

Food insecurity is intimately linked with the 10 catastrophic risks with which the Commission for the Human Future is concerned (scarcity of key natural resources, collapse of ecosystems, overpopulation, global warming, nuclear conflict, global poisoning, uncontrolled technologies, food insecurity, failure to act, etc)

Food insecurity is a prime impeller of societal upheaval, civil conflict and international wars. The protection of national borders enclosing food production resources constitutes the chief justification for defence spending. The world presently spends \$1.8 trillion a year on new weapons – but only \$70 billion a year on improving food and its production, an imbalance ratio of 25 to 1.

Competition and disputes over increasingly scarce food, land and water resources in a shifting climate have the potential to ignite local, regional and global conflicts, including nuclear.

Food failures, whether combined with conflict or not, have the potential to unleash mass refugee tsunamis out of afflicted regions, with domino-like destabilization of neighbouring lands, their governments and even whole continents. This was foreshadowed in the Syrian refugee crisis and its impact on Europe and West Asia.

The combination of industrialised agriculture and an increasingly unstable climate is leading to rapid hyper-urbanization as hundreds of millions of rural people are driven off their farms and into cities. This in turn can destabilise urban societies, cause governments to fall, with global economic repercussions.

Food production today is a key contributor to an avalanche of human chemical emissions which are polluting the entire planet and affecting all life. It is a primary driver of climate change, loss of biodiversity and extinction. It is a major factor in the rise of pandemic disease, both infectious and noncommunicable. It is an underlying factor in about two thirds of human conflicts. It is a major user of disruptive new technologies, including biotechnology and nanotechnology, with unknown and unregulated consequences for humanity.

The appearance of well-stocked supermarkets in wealthy societies feeds the illusion that the food problem is 'solved', leading to overwhelming complacency on the part of government, industry and society and a lack of preparedness for future global food crises.

From these, it can be seen that food insecurity is intimately interwoven with all ten of the catastrophic risks facing humanity, and must be solved in conjunction with them, and through a systems approach, with solutions that make none of the threats worse.

Food security, ahead of most other issues, is central to the future of our civilisation and the human species. It concerns every person, every single day.

This account of the risks facing current and future food production does not claim to be exhaustive, as it is simply the product of round-table discussion by well-informed participants. Its purpose is to highlight the urgent necessity for clarifying the problems and developing approaches to avoid future food and nutritional consequences here described. Some of these are presented in the following part of this report.

Part 2: Solutions and pathways

2.1. Seeking sustainable goals

The solutions we choose to overcome food insecurity and establish economically, socially and ecologically sustainable food systems, must be compatible with, and must not worsen, the other nine problems which the Commission for The Human Future is considering under the heading of Catastrophic and Existential Risks.

Globally, the single most important framework for positive change is the [Sustainable Development Goals](#) (SDGs). These are part of an agreed global framework signed off by all UN member countries. It is imperative that all nations and communities give greater priority and focus to this shared vision for the human future.

The second goal of the SDGs is '[Zero Hunger](#): end hunger, achieve food security and improved nutrition and promote sustainable agriculture'. It is a priority focus of the sustainable development goals. When we look across the other 16 SDG's, food links into all of them in one way or another, sometimes, to a small extent and sometimes to a large extent. Increased resilience in food will impact positively on all the other SDGs.

2.2. Act now on climate change

The agricultural and fisheries sectors must strive to achieve carbon neutrality by 2040. This essential target must be accompanied by every part of world society playing their role in achieving a zero-carbon society while ensuring justice for the resource-poor and underprivileged around the world. This requires a binding global greenhouse gas emissions treaty to limit climate change to 2 °C of warming, with a commitment to retreat to 1.5 °C or below.

In relation to the food and agriculture sector, positive contributions include:

- Employ regenerative farming practices that promote carbon sequestration, repair environments and decrease and reverse deforestation universally;
- Research, develop and enforce globally truly sustainable fishing practices that restore oceans and fisheries;

- Integrate solar and wind energy with regenerative agriculture and fisheries on suitable farmland and marine environments (as solar and wind are much more efficient at producing usable energy per hectare than biological processes such as biofuels production and do not compete for water);
- Cease all use of fossil fuels, petrochemicals and their plastics in the food industry and universally;
- Create a harmonious policy environment that supports reduced greenhouse gas emissions through resilient and efficient food systems operating within the carrying capacity of the planet by linking public health, environmental health and regenerative food production; and
- Inform consumers how to choose low-carbon and carbon neutral foods.

2.3. Towards renewable food

Resilience is built on diversity, both ecological and social. Nature wastes nothing and recycles everything – and for a truly renewable food supply, humans must do likewise. This means adopting regenerative food production, which applies ecological principles to agriculture and fisheries and ensures sustainable use of natural resources and ecosystem services. This will enhance productivity and natural capital, soil and ocean health and fertility, water holding capacity, ground and canopy cover while also facilitating biological, food system and marketplace diversity. It will also greatly improve consumer health.

Food operates through complex adaptive systems, which must function sustainably for the sake of both human and planetary health. This means ending ecologically dysfunctional material and nutrient flows in our cities and urban food systems, food waste to landfill and sewage discharge to the oceans, while simultaneously turning all organic ‘waste’ into feedstock for renewable industries, products and services to support urban greening, food security, landscape agrobiodiversity, silviculture and aquaculture.

An equitable transition to regenerative production must be carefully managed as the process is knowledge- and often capital-intensive. This hurdle will decrease with scale as the field matures and will benefit from indigenous knowledge of land and water ecosystems and foods. Key goals are: support for the adoption of better agroecological land and water management practices to enhance biodiversity, land and ocean health and food and water quality; and ensuring urban food, water and nutrient ‘waste’ are no longer lost to the food system but used renewably.

The systems that support sustainable food and nutrition security will employ a mix of locally appropriate, safe, sustainable and ethical:

- Terrestrial farmed and free-living plant and animal production and harvesting systems;
- Aquatic farmed (e.g. larger-scale deep ocean and small-scale) and free-living plant and animal production and harvesting systems;
- Urban food production systems that use renewable resources, especially nutrients and water; and
- Bioculture food production systems, both small and large scale.

2.4. Urban food security

The world's urban population is on track to reach 7 billion in the 2060s. To address the extreme vulnerability of the world's great cities to climatic and other forms of food disruption (e.g. pandemics, wars, floods, trade disputes, strikes etc), it is essential that they be redesigned for renewable food production. This involves recycling nutrients and water, which are presently largely wasted, back into existing and novel urban food systems.

These include skyfarms, rooftop farms, agritectural designs, peri-urban horticulture, hydroponics, aquaponics, algae culture, entomoculture and biocultures of edible plant, animal, fungal and microbial tissues.

Such systems are being trialled in cities around the world now, and locally produced urban food is already a growing component of the urban food chain. Based on nutrients presently wasted, it is possible for a city to generate half or more of its food needs through a combination of these techniques. Besides enhancing urban food security, such measures can add hundreds of millions to dollars and tens of thousands of jobs to the local economy by replacing food imports.

For urban food to succeed the following issues are important:

- Outdated food and health regulations must be revised or replaced with ones that favour local food production and sale, at all scales from micro to corporate;
- Building ordinances must be designed to include the safe recycling of water and organic waste into the food system;
- Cities must replan their water, sewage and waste disposal networks to take account of future food needs;
- The dumping of organic waste should be banned. Instead it should be recycled through algae and insect farms, organic fertilisers and composts and other food-chain inputs;
- Urban food systems must be developed with a strong focus on climate-proofing;
- New investment and job opportunities should be encouraged by urban governments in the field of renewable food at all scales;

- A strong focus on nutritional quality of novel foods such as meat from animal stem cells, plant meat substitutes, etc; and
- A strong focus on safe, nutritious, affordable food from intensive systems for the urban poor in both developing and developed worlds
- A strong focus on food ethics.

2.5. Farming the oceans

Aquaculture is the world's fastest growing food industry, providing around 40 per cent of all the fish sold globally, as wild harvests dwindle, as well as all of the sea plants and algae. It is on track to double or even triple by the mid-century. However, the sustainability of the present system is questionable, owing to its food sources (land and sea), disease and chemical issues, and impact on coastal ecosystems. Most of these are potentially soluble.

Besides aquaponics – the growing of plants and fish in intensive urban food systems – new opportunities include large-scale farming of microalgae and sea plants, biocultures of marine protein and the rapidly emerging technology of deep ocean aquaculture. This enables large-scale production of fish and sea plants to take place offshore, in ocean currents, where there are none of the pollution problems associated with coastal fish farms.

The great advantage of ocean aquaculture is the fish are raised in three dimensions instead of the usual two. This means that a hectare of ocean can produce many times more protein and nourishment than a hectare of crop or cattle on land. The emerging global industry of algae culture can provide feed for extensive fish and livestock farms for zero loss of soil and without wasting fresh water. This means that vast areas of the world now used for inefficient farming and grazing can potentially be replaced by a far smaller area of ocean food production, enabling the land to be returned to nature, so helping to end the human-caused Sixth Extinction.

Developing deep ocean aquaculture may be an option for any nation that enjoys a large sovereign marine area. Consideration at global level must now be given to rules for farming the high seas, beyond any country's jurisdiction. If it is to succeed, deep ocean aquaculture must not repeat the previous mistakes of industrial food production but rather, set new world standards for food safety, animal welfare, environmental and corporate governance standards.

A significant opportunity exists in the farming of halophytes – salt-tolerant plants – in coastal and desert areas, using saline or brackish water. These plants can produce human foods rich in micronutrients, animal fodder, biofuels and other useful industrial products. They can draw down carbon from the atmosphere and release water and land now used in cropping for other

uses, so helping to ease both climate and resource problems. There are some 10,000 species of halophytic plants that are candidates for human or animal use.

2.6. Transforming food

Transforming food systems to deliver healthier and more sustainable outcomes represents a huge, largely untapped, opportunity for technical creativity, new investment, new jobs and fresh business opportunities. Developing healthy, sustainable and ethical food systems is one of the world's most promising growth opportunities for livelihoods, ideas, advanced technology and business, greater even than renewable energy.

Transformational interventions need to be integrated across the main food system activities (production, processing, distribution, consumption). They must include sound enabling policies and regulatory settings. A stronger policy focus on the nutritional quality of food will help reduce the production and consumption of junk foods (sugar-sweetened beverages, cakes, candy and alcohol). This will enable people to live longer, healthier lives, reduce healthcare costs, improve food chain economics of the food chain, combat global warming, extinction and lower the risk of conflict.

Renewable food systems must be socially equitable, enabling people to make healthier, more sustainable choices about what they eat and how and where it is produced. To achieve this, we must start by shining a light on the drivers and governance of food systems, including corporate interests, building public knowledge and awareness and insisting on policy environments that reward those who use healthy, safe and renewable practices.

2.7. Circular food economies

A [circular economy](#) keeps resources and materials continually in use by recycling them, regenerates natural systems and eliminates all waste and pollution. The real cost of today's food production and 'waste' can be estimated through Kate Raworth's [Doughnut](#) model of social and planetary boundaries. This will enable the development of internationally based frameworks for transparent natural capital accounting to show food producers and consumers, for example, whether the landscapes which produce our food are getting better or worse and, indeed, whether the food itself is becoming more or less nutritious. The key is to balance healthy and equitable food environments (where food remains affordable to

vulnerable households and natural food nutrient density scores are maintained) with just and sustainable remuneration of family farmers, fisher and producers (enabling them to care for both their households and their land and aquatic environments).

Where possible, we need to encourage closer contact between producers and consumers through the encouragement of fair and local distribution networks (e.g. farmers markets and direct sales) and by re-embedding food systems into local economies (e.g. community-supported agriculture). Local food networks are also essential to maintaining security of supply in cases where global food chains fragment or break down, as they did in the Covid-19 pandemic.

2.8. Empowering change

To change the world food system to one that is renewable and healthy, we need to engage everyone, for we are all consumers of food. That means creating a flow of trusted information about food, how it is produced and how healthy it is, that can reach every level of society in every country. It is a large ask, but with the internet and social media, not an impossible one. Indeed, much sound food information is already moving at lightspeed round the Planet by these means.

With a paradigm shift to circular economies, our traditional education and training systems must be refocussed on approaches to regenerative food production, processing, distribution, marketing and consumption, in ways that facilitate easier access by all regardless of gender, age, geographical location, etc.

Strategic investment in knowledge generation and sharing between farmers, agribusiness, regional communities, policymakers and consumers is essential. With digital technology, the evidence generated by science and the experience of thought leaders who have already made the transition to regenerative or renewable food, the initial costs involved can be recouped relatively quickly. Rapid, widespread sharing of information across society about nutritious, sustainable food will lead to reductions in the 'lifestyle diseases', healthcare burden and rates of early death in the community. They will also involve the regeneration of food-producing land and aquatic resources and the rewilding of marginal lands for conservation and species protection.

It is essential that young generations grow up knowing how to eat healthily, safely and sustainably, as they are the consumers of the future and will set the market trends. Nature studies and holistic food production (e.g. permaculture) should be included in school curricula with both theoretical and hands-on components. Participants noted the great success of food gardens in hundreds of schools which are ensuring healthier diets for children, an interest in

how food is produced as well as emotional wellbeing and self-esteem amongst those involved. These school gardens also enable children to educate their parents about what is good and healthy to eat.

Removal of food additives of concern from our food supply will have major effects on health, education and learning for children and adults. Consumer education and enlightened government are both central to achieving this.

Circular economies for food will also inform consumers so they can develop diets that meet their and their families' nutritional needs affordably, using locally available, in-season food while reducing waste. Successful interventions at scale will require more effective public-private partnerships, with circular economies providing a policy framework that promotes and rewards ethical practice in food production, distribution, marketing and preparation.

2.9 Flattening the population curve

On a Planet with finite resources, we must try to ensure that the human population growth curve is flattened – and then start to bring it down as quickly as is consonant with fairness and free will. The good news is that human population growth can be quite quickly flattened and even reduced by two measures: economic growth and access for women to education, jobs, credit, health services and adequate food. Gender equity is thus at the heart of global food security. There must also be an end to all government subsidies aimed at increasing birthrates.

The huge expansion in the numbers of intensively raised livestock for human consumption has resulted in one third of the world's scarce crop land being devoted to animal feed instead of human food. It has also raised the frequency and severity of pandemics in both animals and humans. With the transition to renewable food systems, urban food, deep ocean aquaculture and biocultures, heritage plant varieties and animal breeds with higher quality nutrient profiles will increasingly contribute to agrobiodiversity.

This means we can reduce total meat consumption at the global level and still feed people better.

Increasing urbanisation and economic growth has been accompanied by a growth in the number and legal status of companion animals who must also be nourished. In countries such as Japan and the US, where companion animals are now considered family members that must be rescued during disasters, planning to deal with food security shocks going forward must also take these additional family members into account.

2.10 Recasting food policy

In most countries food and nutrition is the poor cousin in national policy formation, often an afterthought rather than the central pillar on which the entire society depends. Food is central to the survival of individuals, communities and nations. It is more important than defence policy. It is central to health policy. It is at the core of economic policy. It is key to environmental policy. Yet it is often pushed aside or taken for granted.

The future of civilisation demands effective national and global food policies which integrate with other national and international policies such as climate, energy, water, healthcare, nutrition, regional and industry development, biodiversity conservation, defence and security. In this goal a [Planetary Health](#) lens is helpful. Inclusive policy- and decision-making must be part of this integration process.

Because everyone eats and benefits from food it is vital that everyone has a chance to participate in the process of food and nutrition policy formation, to discuss, learn, contribute and adopt in their own lives: we need to 'own' the food we eat and the policies that give rise to it. If consumers work with politicians and industry to achieve healthy, renewable food it will reward the corporations, small enterprises, farmers, fishers and foresters who produce it – and will discourage those who produce poor quality food using unsustainable systems. Inclusive policy implementation and monitoring will contribute to timely policy review and refinement.

Strong public discourse and consumer action are often required to motivate governments to govern better. The aim of future food policy is (i) to facilitate the efficient growth of agroecology and transition away from subsidies and policies that enable extractive, industrial agriculture and other corporate technocratic options, (ii) to foster renewable food based on a circular economy model, and (iii) to encourage major climate-proof food systems such as urban food and deep ocean aquaculture.

It will be important for society to pay farmers to restore landscapes based on bioregional natural resource groups (e.g. [Landcare](#) in Australia) in order to empower small, medium and large-scale producers to improve their land, water and biodiversity management. The present cheap food system does not do this. The repair of the Earth's life support systems can be encouraged by changing urban planning rules, banning the clearing of forests, encouraging regenerative agriculture, re-wilding of marginal lands, penalising extractive agriculture, nurturing woodlands and regulating wild capture fishing, especially on the high seas.

Examples of positive change already delivering improved outcomes for farmers, food security and landscapes include those from [Australia](#), [Ethiopia](#), [New Zealand](#), [South Africa](#) and [Vermont, USA](#), to urban agriculture in [Singapore](#). Globally, encouraging examples include: The [United Nations Programme on Reducing Emissions from Deforestation and Forest](#)

[Degradation](#) which aims to reduce forest emissions and enhance carbon stocks in forests while contributing to national sustainable development; and [The Great Green Wall of Africa](#) is already bringing life back to Africa's degraded landscapes at an unprecedented scale, providing food security, jobs and a reason to stay for the millions who live along its path as well as helping to reduce the impact of climate change.

The rights of farm and food workers must be guaranteed. The UN Declaration on the Rights of Peasants and Other People Working in Rural Areas (UNDROP) asserts the rights of peasants to use their local natural resources (land, water, genetic resources) in a sustainable manner, and to be protected from adverse exploitation of those resources by others (amongst other rights). relevant policy- making activities. National governments must work harder to promote and protect the rights enshrined in the UNDROP in all related policies and regulations.

The emergence of diet-related disease as the world's leading cause of death underscores the need to formulate and implement policy frameworks across sectors, from production to consumption, to support healthy and sustainable diets for all. It emphasises the need for sound nutrition to drive the food system – not for the food system to drive nutrition. Good nutrition begins on the farm, with the soil and agroecosystem.

The future of renewable food should be driven by evidence-based nutrition policy which supports healthy, sustainable and equitable diets. Sustainable and equitable diet frameworks can be built on existing food safety policy frameworks by expanding them to ensure that food is good for you in the short- (i.e. free of biological, chemical and physical contaminants without placing overly onerous requirements on smaller enterprises supplying local markets) and the long-term (i.e. has a nutrient composition that supports healthy life for individuals and whole populations).

Sound policy should recognise and support the vast diversity of food systems, formal and informal, economies and food movements, so they can operate in parallel. It must reduce market barriers and obsolete regulations at local, regional, national and global levels. Increasing the engagement of farmers, nutritionists, food system participants and consumers in the discussion of planetary health, food ecosystem protection and global biodiversity is crucial. It is important to include a wider range of stakeholders in the discussion around the [Convention on Biological Diversity](#).

2.11 Food and national security

Without food and water security, there can be no national security. Disputes over food, land and water underlie two thirds of the 40 conflicts which have taken place worldwide since that start of the 21st Century. Conversely, if access to food, land and water are secure, the risk of

conflict between competing groups is greatly de-escalated: in future, food must be seen as a 'weapon of peace', an essential pillar of national security, as important as armies or navies.

Water is essential to all life. It is also essential to a secure global food supply and must be therefore be held in public ownership and not sold off to the highest bidder. It is essential that clean water be available to ALL the people on the planet, with no preference given to those who can afford to pay more than others. If people are cut off from water and food the risk of conflict rises sharply. To secure the future of civilisation involving 10 billion people on a hot, stressed planet, there must be a return to thinking in terms of 'the commons', giving everyone fair access to clean water and air, land, food knowledge and the means to produce their own food. Restricting these things to a handful of corporate giants is asking for trouble.

The time is ripe to overhaul the food chain vulnerabilities which COVID-19 has exposed, including the heavy reliance on illegal migrant workers, intensive livestock production, fragile supply chains, ecosystem degradation, lack of market access for small- and medium farmers and smallholders, lack of adequate storage and preservation facilities and inequitable food access. Fragile food chains represent a defect in both national and global security and need to be addressed with urgency equal to that accorded to any military weakness.

2.12 Re-investing in food

To develop a renewable global food system to protect and nourish human civilisation into the future demands a vast co-operative research effort, on a par or even greater than that invested in renewable energy. It requires a second Green Revolution, though a more sophisticated one, focussed on nutrition, equity and sustainability.

This is essential to delivering sustainable diets for all and to achieving the Sustainable Development Goals by 2030. The COVID-19 pandemic has highlighted how quickly governance and food system frameworks can fracture and change. With this renewed impetus, we must link what the pandemic has taught us about the fragility of global food systems with the issues raised by nutritionists and food experts for decades, to design and implement renewable, life-affirming, diverse food systems.

There must be stronger emphasis on developing food environments that yield good health for people, animals and the environment. This can be achieved through evidence-based R&D that employs problem-solving structures which enable us to assess and respond to interdependent risks simultaneously. Public and private R&D investment must be directed away from intensified chemical farming and ultra-processed foods, towards safe, wholesome and healthy diets and diverse food supply chains for fruits, vegetables, breads and cereals, dairy products, eggs and meat and meat alternatives. We must encourage farmer-led

research, and support farmer-to-farmer and farmer-to-consumer processes to stimulate innovation and sharing of knowledge.

An important field for future diet and food production research is the 30,000 edible plants which human society does not presently eat, described by [Food Plant Solutions](#). These represent a boundless diversity of farming, food, health and livelihood opportunities which have been entirely overlooked by the present narrow industrial food system.

Agriculture and food production and distribution are the linchpin of our society and our civilisation. Those who produce and distribute surplus food enable the whole human population to engage in the vast array of activities that define us. To ensure a bountiful human future, we must rethink food because “We care - and together we can achieve healthy, renewable food.”

This overview of sustainable food production on Earth does not claim to be exhaustive nor does it offer a single, neat solution. Rather it sets out creative ideas from a round-table discussion by well-informed participants who are anxious to see positive change. As in any such discussion, sometimes ideas conflict and people disagree – but the important thing is to keep the discussion and debate going. Above all, we must acknowledge that the weaknesses of our present global food system pose a real threat to human civilisation in the short, medium and longer term, and that enlightened, courteous and informed discussion of how to overcome them is the best way forward, and vital to our future.

Conclusion

The future of humanity is defined by the future of food. It is one thing we cannot survive without. How we produce our food has a profound impact on that future – often beneficial, but sometimes wasteful, toxic and destructive.

The Commission for the Human Future sees solving the food problem as integral to solving all 10 catastrophic and existential risks that together constitute the greatest emergency humanity has ever faced in its time on Earth. If we can solve food, we can also make real progress in solving other threats, such as climate change, global poisoning, pandemic disease, wars, resource scarcity, overpopulation and species extinction.

Food is the fulcrum on which a systems approach by humanity to overcoming our greatest threats turns. It is also an issue that involves everyone personally, not just governments or corporations. Reshaping our food supply offers an unparalleled opportunity to reshape our world, to one that can sustain, heal and feed us far into the future. It buys us time to manage our population back to a level the Earth can support. It offers a chance to restore the vanishing world. It promises more peace, fewer wars and migration crises. It is a worthy challenge for each of us, not just for countries or enterprises.

It is also an opportunity for humanity to unite around something we can all agree on: our need to eat, safely, healthily and renewably, every single day. It is a model for how we must conduct ourselves in future if our civilisation and species are to last.

But food is many other things. Besides nourishment, it is about family and friendship, it is about pleasure, it is about a long life of good health, it is about joy. Food is one of the greatest expressions of human creativity and care ever devised by our kind. It is worthy of a special, universal and collaborative effort to rethink food – one which can lead us to a safer, saner future on a healthy, blue and green Planet.

Appendix: Participants and contributors

Professor Robyn Alders AO

Robyn is an Australian veterinarian whose research & development activities focus on sustainable food & nutrition security in Australia & globally. Affiliations: Senior Consulting Fellow, Chatham House, UK; Honorary Professor, ANU Development Policy Centre & Tufts University; & Chair, Kyeema Foundation

Dr Phillip Baker

Phil is a research fellow in public health nutrition at the Institute for Physical Activity and Nutrition, Deakin University. He is a member of the Global Nutrition Report expert group, and regularly consults to the UN food and nutrition agencies on policy and food governance topics.

Em Prof Snow Barlow FTSE, FAIAS

Snow is an Emeritus Professor at the University of Melbourne who currently chairs the Australian Academy of Technological Sciences' Agricultural and Food Forum. He is a Commissioner of the NSW Independent Planning Commission. Snow is an Agricultural Scientist, who has written extensively on the impacts of climate change on food production systems. He has had extensive involvement in Australia's agricultural R&D system as a researcher and a director of Rural Industry R&D Corporations and several CRCs

Paul Barratt AO

Paul is a former Secretary of the Australian Department of Primary Industries and Energy and of Defence. As secretary DPIE he was Director of Quarantine, covering plant, animal and human health, and co—responsible (with health) for Office of Food Safety. He is co Deputy Chair of The Commission for The Human Future

Professor Bill Bellotti

Bill is Professor in Food Systems, University of Queensland Academic background in agronomy, sustainable agricultural systems, and rural development. Leader of agricultural research for development projects in China and India. Currently developing proposals on food security in Indonesia and Pacific Island countries.

Professor Justin Borewitz

Concerned global citizen, father of young children and Professor of Plant Energy Biology at the Australian National University. He grew up on an experimental vegetable farm outside San Diego California, trialling new agronomic and breeding methods. His PhD in qualitative genetics was in 2002. Since moving ANU his research has been on identifying the genetic basis of adaptation in model organisms and new approaches to climate ready crops including rapid domestication of new species.

Dr Sinead Boylan

Sinead has studied the dietary patterns of populations across Western and Eastern Europe, Southeast Asia, Australia and East Africa. Her research aims to identify strategies to promote a healthy and sustainable diet. She strives for equitable, healthy food access for all.

Tracy Brown

Former agricultural economist now dairy farmer and Nuffield Scholar from New Zealand. Tracy has been leading environmental change for dairy for the last decade. She has several environmental awards and holds a range of leadership and governance roles. She is passionate about sustainable agriculture and growing vibrant, prosperous communities.

Dennis Bushnell

Dennis is the Chief scientist, NASA Langley Research Center, Hampton, VA USA. He has undertaken extensive research and lectures on the futures and issues/solutions/ applications of Technology, Energetics, Propulsion, SensorsSpace Access, Space Exploration, Aeronautics, Warfare Threats/Vulnerabilities, Robotics/Smart Materials, Education, Climate/Ecosystem and Societal Existential Issues for the U.S. Intelligence Community, US, Canadian and NATO national security organizations, government agencies and organizations, corporate planning boards and universities.

Professor Andrew Campbell FTSE FAICD

Andrew is the CEO of The Australian Centre for International Agricultural Research (ACIAR). He was instrumental in the development of Landcare as Australia's first National Landcare Facilitator from 1989-92, and he managed the philanthropic Potter Farmland Plan initiative in western Victoria in the 1980s. He was Executive Director of Land & Water Australia from 2000-2006 and Managing Director of Triple Helix Consulting from 2007-10.

Gabrielle Chan

Gabrielle is a rural-based journalist and author who lives on a sheep and wheat farm. She has covered politics for The Australian and Guardian Australia and has a personal interest in helping rural communities thrive.

Lucinda Corrigan

Is an agricultural leader who has spent her career working across Australian agriculture in local, state and national levels, focussing on innovation. She is the Chair of Farmers for Climate Action, The Animal Genetics and Breeding Unit at UNE, the Animal Welfare Science Centre at Melb. Uni, and a member of the board of the UWS Centre for the Environment.

Julian Cribb FRSA, FTSE

Julian is an Australian science author who writes about catastrophic risk. His career includes roles as newspaper editor and senior correspondent in the media, director of National Awareness at CSIRO and as a science communication consultant. He is a foundation member of the Commission for the Human Future.

Dr Howard Dengate

Howard is a food scientist and consumer activist. He has been a researcher, an agricultural research institute director, a senior government executive for agricultural development and trade and chaired an agribusiness finance board. Now he helps run the 15,000 member Food Intolerance Network.

Em Prof Dickson Despommier

Dickson is an emeritus professor of microbiology and Public Health at Columbia University. From 1971-2009, he conducted research on intracellular parasitism and taught courses on parasitic diseases, medical ecology and ecology. Prof Despommier has received world media coverage for his ideas on vertical farming.

Em Prof Bob Douglas AO

Bob retired from his post as the first Director of The National Centre for Epidemiology and Population Health at ANU in 2001 and was the Founding Chair, and is still a Director of Australia21, an NGO for The Public Good, which worked with ANU to establish The Commission for The Human Future, of which he is now Secretary.

Mark Dorman

Mark is experienced in increasing public awareness and understanding of complex ideas and leveraging this for capacity building and positive social change. He holds a Bachelor of Forensic Science and Psychology and a Master Degree in Environment, specialising in Education and Social Change. Mark has hosted a podcast series titled 'Survival Matters' – a series centered on engaging Australian youth in the Existential Threats and potential solutions. Mark is a member of the Board of The Commission for The Human Future.

Em Prof Lindsay Falvey FTSE

Formerly Dean and Chair of Agriculture, University of Melbourne; current Board Chair International Livestock Research Institute; international agricultural career across 45 years in private and government sectors.

Anthea Fawcett

Anthea is a sustainability researcher, program developer and communicator and is CEO of Foodswell Ltd that works to promote food security, food sovereignty and action for healthy landscapes for all Australians. She is an Industry Associate, Institute for Sustainable Futures, UTS.

Hannah Ford

Hannah is the ACT State Campaigner for the Australian Youth Climate Coalition. In her current role, she is responsible for facilitating national campaigns within the ACT. In 2018, Hannah was awarded the ACT Moira and John Rowland Young Environmentalist of the Year Award in recognition of her efforts in the climate movement. She is completing a Bachelor of Development Studies at the Australian National University and is a Founding Board Member of The Commission for The Human Future.

Professor Sharon Friel

Sharon is Professor of Health Equity and Director of the Menzies Centre for Health Governance at the School of Regulation and Global Governance (RegNet), ANU. Her interests are in the political economy of health; governance, policy and regulatory processes related to the social determinants of health inequities, including trade and investment, food systems, urbanisation, climate change. Her 2019 book "Climate Change and the People's Health" highlights the importance of addressing the global consumption system, and her 2019 edited book with Mark Lawrence describes the risks and pathways forward for 'Healthy and sustainable food systems'.

Professor Russell Gruen

Russell is the Dean, College of Health and Medicine, Australian National University. The College includes the John Curtin School of Medical Research, ANU Medical School, Research School of Population Health, and Research School of Psychology. He leads ANU in its efforts to be the academic home for advancing the health of nations – that is, the health and wellbeing of our great Australian nation, our First Nations, and our neighbouring nations. He seeks to make ANU a leading source of expertise for the health systems for the 21st Century.

Rachel Hay

Rachel is on the Board for the Commission of the Human Future. She is in her fifth year of a Bachelor of Arts and Law at the University of Tasmania. Her interest is in how policy and law can be used to address social and environmental concerns.

Maj Gen John Hartley (Retd)

John is the CEO of Future Directions International (FDI), an independent, not-for-profit Research Institute. It was established in 2000, by Major General (Retd) the Honourable Michael Jeffery (former Governor General of Australia and Governor of Western Australia) together with a small group of leading facing Australia

Professor John Hewson AM

John has had several careers in academia, bureaucracy, business, politics, and the media. He is currently a Professor in the Crawford School of Public Policy at ANU, and an Adjunct Professor at Curtin, UTS, Canberra and Griffith Universities, having been Professor and Head of the School of Economics at UNSW, and Professor of Management and Dean Macquarie Graduate School of Management at Macquarie University. He is the Founding Chair of The Commission for The Human Future.

Professor Mark Howden

Mark is Director of the ANU Climate Change Institute. He has worked on climate impacts, adaptation and mitigation for agriculture and food security, the natural resource base, ecosystems and biodiversity, energy, water and urban systems. He helped develop the national and international greenhouse gas inventories that are a fundamental part of the Paris Agreement and pioneered sustainable ways to reduce emissions. Mark has partnered with many industry, community and policy groups via both research and science-policy roles and is a high profile public communicator. He has been a major contributor to the IPCC since 1991, currently being a Vice Chair.

Dr Arnagretta Hunter

Arnagretta is a cardiology specialist at the ANU, who is deeply committed to environmental sustainability. She is The ANU Human Future Fellow and a founding member of the Board of The Commission for The Human Future.

Tammi Jonas

Tammi is co-custodian of Jonai Farms & Meatsmiths, a community-supported agriculture (CSA) farm raising pastured heritage-breed pigs and cattle, with an on-farm butcher's shop. She is president of the Australian Food Sovereignty Alliance

(AFSA), promoting everyone's right to access nutritious and culturally-appropriate food grown in ethical and ecologically-sound ways, and our right to democratically determine our own food systems. She works globally with peasant farmers and indigenous peoples in the fight for food sovereignty and is a regional leader for the International Planning Committee for Food Sovereignty (IPC), which articulates to the FAO and other UN governing bodies.

Dr Sue Kleve

Sue is Senior Lecturer - Public Health Nutrition, Dept of Nutrition, Dietetics and Food, Monash University. Dr Kleve is a senior member of Dietitians Association of Australia (DAA) and Accredited Practicing Dietitian. Dr Kleve is also a member of the Public Health Association. She is the convener of the Australian Food Security Amongst Households Research Collaboration (AFSHRC), a group of researchers from Universities across Australia. She represented DAA in the discussion.

Professor Mark Lawrence

Mark is Professor of Public Health Nutrition at Deakin University. Conducts research and teaching (co-edited international reference book) into healthy and sustainable food systems, and advisor to FAO, WHO and member of IUNS Taskforce on Sustainable healthy diets.

Professor Amanda Lee

Amanda is Professor of Public Health Policy in the School of Public Health, at The University of Queensland where she leads the Division of Health Promotion and Equity. She has expertise in public health nutrition, food and nutrition security, and Indigenous health. Her work takes a strong systems focus, underscored by the pillars of health and wellbeing, equity, prosperity, and environmental sustainability.

Alison Leigh

Alison is a science communicator who has spent the last three decades bringing complex science and scientific issues to a broad audience around the world. Her career includes 15 years as a TV and radio reporter/presenter(UK), 10 years as a TV producer and executive producer. She is a founding member of the Board of the Commission for the Human Future.

Anika Molesworth

Anika is a young Australian farmer, agroecologist and science communicator who is passionate about sustainable farming, environmental conservation and climate change action. She is a Founding Director of Farmers for Climate Action and established the knowledge sharing platform Climate Wise Agriculture.

Rob Napier

Rob is a former Principal of Orange Agricultural College - 15 years as an international farm management and strategic planning consultant - travelled with an agricultural focus in over 60 countries – 35 years of on-farm Landcare projects - lifelong passion the future of family farming - Patron of The International Farm Management Association.

Professor Manny Noakes

Manny is a former CSIRO research scientist in nutrition and health. She has published and communicated extensively in many fields of nutrition including dietary patterns and sustainability

Charlie Prell

Charlie is a sheep farmer from Crookwell, NSW and the Deputy Chair of Farmers for Climate Action. He is passionate about revitalising the prosperity and integrity of small family owned farms and their regional communities. The roll out of renewables into these communities in an equitable manner can assist with this resurrection.

Christina Pollard

Public Health Priorities, School of Public Health Curtin University. Representing and Vice President (Policy) Public Health Association of Australia (PHAA). Member DAA. Over 35 years' experience working as a public servant for the Department of Health in Western Australia.

Oscar Rodriguez

Architect and Building Integrated Agriculture Specialist at Architecture & food Policy. He is Director at the UKUAT (UK Urban Agri-tech).

Dr Nick Rose

Nick is a specialist in sustainable food systems design, research, policy and practice. A Churchill Fellow (investigating innovative models of urban agriculture), he is the Executive Director of Sustain: The Australian Food Network and teaches food systems, food movements and food politics at William Angliss Institute.

Assoc Prof Louise Sales

Louise is Friends of the Earth Australia's food and technology spokesperson, a member of Friends of the Earth International's food sovereignty steering group and an educator with the 24 Carrot Gardens Project. She has campaigned on food issues for over a decade.

Rumtin Sepasspour

Rumtin is a Policy Officer at the Department of the Prime Minister and Cabinet, where he works on foreign policy and national security issues. He has been a Visiting Researcher at the Centre for the Study of Existential Risk, at the University of Cambridge, looking at the ways that national governments can help to manage global catastrophic risks.

Dr Ashley Schram

Ashley is a Braithwaite Fellow at the Australian National University. Her work studies regulation, governance, policy, and politics in areas such as food systems, trade and investment liberalisation, social determinants of health inequities, and sustainable development

Pennie Scott

Pennie is an independent scholar, regenerative farmer, editor, researcher, writer, entrepreneur and creator of local food systems and economies. In 2010, wrote paper for RIRDC on Australian food security showing cultural, not technical innovations are essential for human survival (amongst other things!)

Mahalia White-McCall

Mahalia is a student at the University of Tasmania, studying a Bachelor of Natural Environment and Wilderness Studies. She is working for the university's Sustainability Office, as an intern.