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Food Research Collaboration

Putting climate on everyone's table

Summary of what the IPCC WG3 report says about food and diet

Series editor:
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About this Policy Brief

In April, the International Panel on Climate Change (IPCC), the authoritative global collaboration of experts in natural and social sciences, published its latest report. The IPCC reports represent a gigantic sifting and reviewing of state-of-the art knowledge on climate change, and provide the best information we have about what lies in store for ourselves, our descendants and our planet. The latest report is by Working Group 3 of the IPCC (IPCC WG3), and it focuses on 'mitigation' – the practical steps we need to take to adapt to climate change and avert its most serious future impacts.

Mitigation has a lot to do with food systems. According to the report, food systems are associated with roughly 42% of global greenhouse gas (GHG) emissions, so changing how we consume and produce food has great potential for cutting emissions.

Abbreviations

ASI	Avoid-Shift-Improve
Bn	Billion
CDR	Carbon Dioxide Removal
CH_4	Methane
CO_2	Carbon Dioxide
CO_2e	Carbon Dioxide equivalent
GHG	Greenhouse Gases
$GtCO_2e$	Gigatons of Carbon Dioxide Equivalent
IPCC	International Panel on Climate Change
$kgCO_2e$	Kilograms of Carbon Dioxide Equivalent
WG3	Working Group 3

The reports themselves are dense and complicated. **This FRC Brief summarises the sections of the latest report that are relevant to food systems, food advocacy and food policy.** The Brief is based on a document published online by the UK-based website Carbon Brief, which specialises in the science and policy of climate change. The text in the shaded areas is an edited version of the Carbon Brief document. All other sections are authored by the FRC. References to 'the report' mean the IPCC WG3 report.

Previous IPCC reports have shown that humanity's goal should be to limit global warming to no more than 1.5° or 2° Celsius above the temperatures that prevailed before the developed world's industrial revolution, which are seen to be relatively stable and favourable to human and other life. The latest report tracks current efforts to tackle climate change – and looks at what would be needed to meet these targets. Alongside steps across all economic sectors to reduce emissions rapidly, the report says that carbon dioxide removal (CDR) will also be necessary to reach 'net zero' – a situation when the amount of greenhouse gases entering the atmosphere is cancelled out by a similar amount being removed. CDR uses various natural and technological methods to remove carbon dioxide from the atmosphere, such as afforestation or carbon capture and storage.

The report has two sections that are strongly relevant to food systems and food policy: a chapter on the impact the food system and dietary choices can have on emissions (Chapter 6) and a chapter on the 'demand-side', looking more broadly at a range of types of demand for goods and services, including food and diet, and assessing how change could reduce climate impacts (Chapter 5). These are the chapters summarised here.

We hope the Brief will help anyone whose work involves food to access the IPCC's essential messages about food systems, diets, food advocacy and food policies.

We know that many people in the FRC network of food system researchers, activists and policy advocates are aware of climate change as a concern but may not have capacity to investigate its relevance to their day-to-day work. This summary brings you a digest of the IPCC's most recent conclusions, based on its analysis of the evidence.

Key messages

- Food-related decisions, from individual up to policy level, are very relevant to climate change;
- These decisions could make significant, 'gigaton-scale' differences to GHG emission levels;
- Action is called for on the 'demand' side (i.e., how we use high-emitting goods and services, including in the food system) as well as on the supply side (how we produce them);
- Demand-side measures come with 'multiple interacting benefits' – for example, improvements to nutrition and health;
- Individual behavioural change is insufficient for climate change mitigation unless embedded in structural and cultural change;
- 'Choice architecture' – interventions or 'nudges' based on how choices are presented to people – can shape their demand decisions;
- Sustainable food systems that provide healthy diets for all are within reach but require actions from all sectors, including better agricultural practices, consumers changing their diets, and food producers, distributors, retailers and consumers reducing food waste.

How *likely* are these impacts and how *confident* are the scientists that they will happen?

The IPCC WG3 report uses what the IPCC calls 'calibrated language' to communicate levels of certainty behind the statements it includes. This is to show the authors have weighed up every statement in the report, and want to convey different levels of probability accurately and consistently. The terms fall into two categories. The first is 'confidence', which reflects the authors' qualitative judgements on the soundness of a particular finding or statement. The second is 'likelihood', which is used when the uncertainties around a statement can be quantified. These sorts of probabilistic judgments can be based on methods such as statistical analysis or expert judgments. These statements of confidence and likelihood are presented in italics in the original report and in this Brief.

What impact can the food system and dietary choices have on emissions?

Food systems are associated with roughly 42% of global greenhouse gas (GHG) emissions, states the report, even as 'there is still widespread food insecurity and malnutrition'. Between 1990 and 2018, greenhouse gas emissions from food systems grew from 14 to 17 gigatons of carbon dioxide equivalent (14-17 $GtCO_2e$) per year. This is the standard measure for GHG emissions, and refers to their weight, translated into the equivalent weight of the commonest greenhouse gas, carbon dioxide, of which the chemical formula is CO_2 – hence CO_2e. The weight is expressed in grams (g), kilos (kg), tons (t) or gigatons (Gt), as in 17 $GtCO_2e$).

Looking at households' carbon footprints, the food sector 'dominates in all income groups', even more than energy use. Globally, it accounts for 28% of these footprints on average, with rice and cattle being the 'major contributors'.

Food also accounts for 48% of household impacts on land and 70% of household impacts on water resources, and these impacts rise with incomes driven by higher consumption of meat, dairy and processed food, says the report.

There is *high agreement* that mitigating food sector emissions to their full potential **'requires change at all stages, from producer to consumer and waste management'** via integrated packages of policy including supply- and demand-side measures.

Sustainable food systems that provide healthy diets for all are within reach, state the report's authors after assessing literature on health, diets and emissions. However, they require 'significant cross-sectoral action', including **better agricultural practices, consumers changing their diets, and food producers, distributors, retailers and consumers reducing food waste.**

Shifting consumption towards plant-based diets has 'high mitigation potential', says the report. There is *robust evidence* that 'diets high in plant protein and low in meat and dairy' make for lower GHG emissions.

The report estimates with *high confidence* that **shifts to sustainable healthy diets have a 'technical potential' to reduce emissions by 3.6 $GtCO_2e$**, with a range of 0.5 to 8 $GtCO_2e$. This is the amount of emissions that could be saved if financial and other constraints are ignored.

Meats from ruminants such as sheep and cows have the highest GHG intensity. However, the report observes that **beef from dairy systems is less emissions-intensive than beef reared in herds purely for meat**, with emissions of 8-23 $kgCO_2e$ per 100g protein and 17-94 $kgCO_2e$ per 100g protein, respectively. The report acknowledges the widely varying estimates, attributing this to the **difference in production systems**: intensive livestock rearing where cattle are largely fed grain versus pastoral practices, where herders move livestock from summer to winter pastures, or rear them on rangelands.

This is illustrated in Chart 1, which shows the emissions intensity of different protein-rich foods, in $kgCO_2e$ per 100g protein, from the highest (beef from beef cattle) to the lowest (nuts).

In addition to 'substantial[ly]' lowering emissions from the food system, **diets with a higher share of plant-based protein and reduced intake of 'added sugars, salt and saturated fats' would cut land use and nutrient losses to the environment, as well as offering health benefits**, the report says.

Beyond dietary changes, the report says there is *limited evidence*– but *high agreement* – that a suite of **'emerging technologies' could bring**

'substantial reduction in direct GHG emissions from food production'. These include plant-based alternatives to animal products, cultured meat and 'controlled environment agriculture', which it describes as 'hydroponic or aquaponic cultivation systems that do not require soil'. These technologies typically have lower water, land and nutrient footprints, but as some of them are energy-intensive, they **need to have access to low-carbon energy**.

Food waste is another aspect the report draws attention to. According to studies assessed by the report's authors, **roughly 20-40% of food produced worldwide is wasted** before it reaches the market, or goes to waste in households. It estimates that global food loss and waste accounted for 8-10% of total GHG emissions between 2010 to 2016. **Reducing food loss and waste globally has the technical potential to cut emissions globally by 2.1 $GtCO_2e$**, with a range of 0.1-5.8 $GtCO_2e$, the report estimates with *medium confidence*.

Global food supply chains have a strong influence on per-capita food consumption emissions, particularly for red meat and dairy, the report notes, such that **the highest per-capita food-related emissions 'do not correlate perfectly with the income status of countries'**. In other words, even relatively poorer countries may have a high per-capita food footprint. As a result, the report says **'it is crucial to focus on high-emitting individuals and groups within countries, rather than only those who live in high-emitting countries, since the top 10% of emitters live on all continents and one third of them are from the developing world'**.

Changes in the food sector would have broad implications. **Reducing food waste, coupled with dietary shifts, can 'further reduce energy, land and resource demand' and result in 'substantial' benefits in places where food is grown, putting food security there under less strain.** Both measures 'have highly relevant repercussions' for land-use emissions, the report says, because they **can free up land for other uses, such as afforestation or bioenergy**. Moreover, shifts in diets and lowered pressure on land are also 'reflected in **reductions of land degradation**' and reduced deforestation, says the report.

Key enablers for these shifts could include **creating 'novel narratives'** in the media and entertainment industry to 'help to break away from the established values, discourses and the status quo'. These might portray plant-based diets as healthy and natural, for example. The report explores other measures that could be used to influence choices in the food sector, including taxes or carbon pricing on food, both of which it says would be 'regressive', meaning they disproportionately burden poorer members of society. Instead, it points to options including **marketing regulations, procurement policies, dietary guidelines, labelling and 'nudges'**.

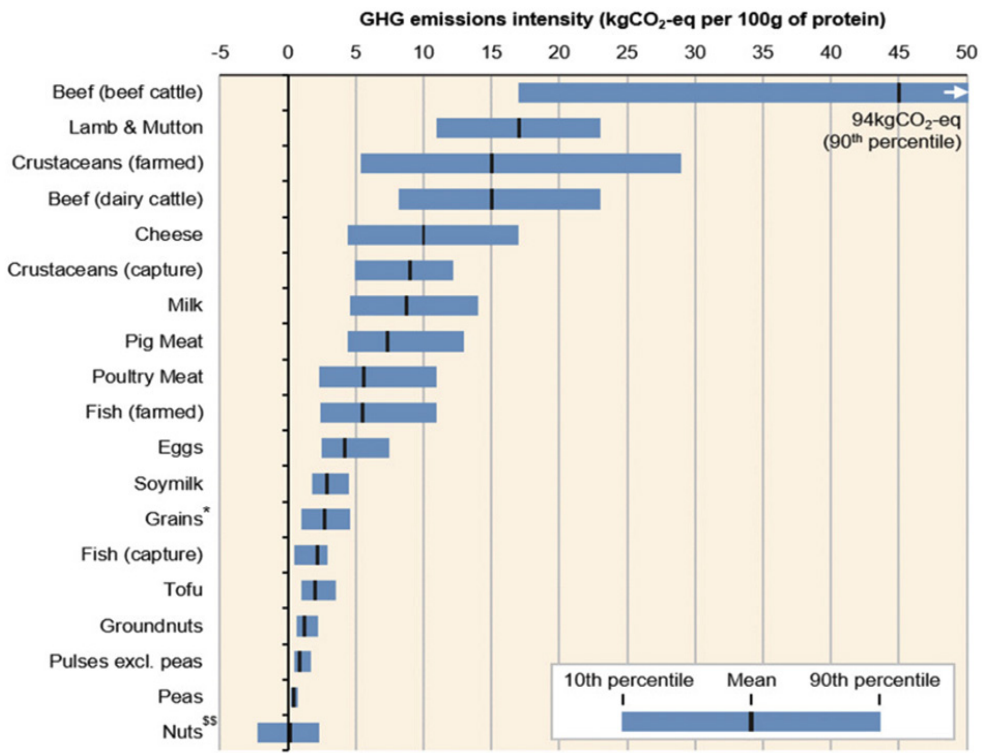

Chart 1. Range of greenhouse gas intensities, kgCO2e per 100g protein, for various protein-rich foods. (Visit Carbon Brief's interactive piece on the climate impact of meat and dairy that explores this data in more detail.)

How can shifting peoples' demand for products and services cut emissions?

For the first time, this IPCC WG3 report includes a chapter dedicated to the 'demand, services and social aspects of mitigation', which explores the social science literature to assess **how people's behaviour – and the choices they are offered – can cut emissions**.

'Demand-side' climate measures are those that reduce the use of high-emitting goods and services by targeting uptake of technologies and people's consumption patterns. Examples include making it easier for people to use cleaner forms of transport, or to eat more plant-based foods.

Behavioural and cultural changes represent a **'substantial overlooked strategy'** that have been left out of many transition pathways and scenarios, the report says.

While this means there is only *medium evidence* on the role they could play, it notes that there is *high agreement* among researchers that **such changes 'hold up to gigaton-scale CO_2 emissions reduction** potentials'.

Crucially, the summary of the report prepared by WG3 for policy-makers adds with *high confidence* that such efforts to reduce demand would 'significantly reduce' the challenge of mitigation overall, dependence on CDR, pressure on land, and carbon prices needed to meet climate goals. The report states that low-demand pathways 'eliminate the need for technologies with high uncertainty' – in other words, if less GHG is *put into the atmosphere* as a result of changing demand, there will be less need for other technologies, some still untested, to *remove* GHG from the atmosphere.

Overall, the report concludes with *high confidence* that, by 2050, **demand-side strategies could cut global greenhouse gas emissions by 40-70%** 'compared to baseline scenarios'. It also notes with *high confidence* that Covid-19 lockdowns 'demonstrated that behavioural change at a massive scale and in a short time is possible'.

Among the types of demand-side 'service' that were assessed (food, industry, aviation, shipping, land transport, buildings and electricity), **the greatest potential – 8 bn tonnes of CO_2 equivalent avoided in 2050 – comes from changes in food demand**.

The report uses the 'avoid-shift-improve' (ASI) framework to explore options for demand-side measures, through a combination of socio-cultural, infrastructural and technological changes. Overall, the report notes **that choosing low-carbon options could reduce an individual's carbon footprint by up to 9 tCO_2**. Effective 'avoid' options include not using a car and cutting back on flights, effective 'shifting' includes switching to plant-based diets and using public transport, and effective 'improving' includes purchasing an electric car or a heat pump.

As demand-side solutions require both motivation and capacity for change – and motivation by people worldwide to change their energy consumption is 'generally low' – the report states that **'individual behavioural change is insufficient for climate** change mitigation unless embedded in structural and cultural change.'

The report says there is *high evidence* and *high agreement* that **'choice architecture' – referring to interventions or 'nudges' based on how choices are presented to people – can shape their energy-related decisions.**

Behavioural nudges can be used to encourage uptake of everything from food waste reduction to using geothermal energy for district heating, the report concludes. It highlights effective measures including 'green defaults', such as automatic enrolment in clean energy provision, and clear labelling of products with climate-relevant information.

In its section on demand-side measures, the report also considers proposed 'transformative megatrends', namely the 'sharing economy', the 'circular economy' and 'digitalisation'. While all of these ideas have received 'much attention from the research, advocacy, business models and policy communities', the report concludes that to date they have 'made a limited contribution to climate change mitigation'. There is only *medium evidence* for such systems having a marked impact on emissions.

Crucially, the summary for policy-makers notes with *high confidence* that **demand-side measures are 'consistent with improving basic wellbeing for all'**. A key concern about policies focused on cutting emissions is that they may reduce people's quality of life, but the report finds, with *medium confidence*, that '**decent living standards' – a benchmark of minimum material conditions for human wellbeing – for everyone are 'achievable through the implementation of high-efficiency low-demand mitigation pathways'.**

The report states that **addressing inequality supports climate change mitigation efforts** and notes with *high confidence* that **demand-side measures come with 'multiple interacting benefits' – for example, improvements to nutrition and health**.

In conclusion: sustainable diets are within reach but require effort by all actors

The IPCC WG3 report summarised here makes the fundamental point that food-related decisions, whether by governments, industry, civil society or individuals, have huge potential to influence climate change and avert its worst impacts. It shows that alterations in how food is produced, offered to consumers, chosen by consumers, used and disposed of, as well as in how foods are discussed, promoted and advertised, can make significant cuts in damaging greenhouse gas emissions. These findings are relevant to everyone whose work involves food. As the report states: sustainable food systems that provide healthy diets for all are within reach. However, they will require actions from all sectors, including better agricultural practices, consumers changing their diets, and food producers, distributors, retailers and consumers reducing food waste. These observations are not new, but they come with the IPCC's seal of authority, and are more urgent with every month that passes.

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This report is based on Carbon Brief's 'In-depth Q&A: The IPCC's sixth assessment on how to tackle climate change', available at https://www.carbonbrief.org/in-depth-qa-the-ipccs-sixth-assessment-on-how-to-tackle-climate-change, accessed 12.4.22. It summarises IPCC Working Group 3 2022 report, Chapter 5 ('How can shifting peoples' demand for products and services cut emissions?') and Chapter 6 ('What impact can the food system and dietary choices have on emissions?').

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About Us

The Food Research Collaboration is an initiative of the Centre for Food Policy. It facilitates joint working between academics, civil society organisations and others to improve the sustainability of the UK food system, and to make academic knowledge available wherever it may be useful.

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