Journal club

40 minutes to read

5-10 minutes to present

- What does the paper speak about and why does it matter ?
- Methodology
- Main results
- Conclusion

Affordability of the EAT–*Lancet* reference diet: a global analysis

Kalle Hirvonen, Yan Bai, Derek Headey, William A Masters

Article https://doi.org/10.1038/s43016-023-00749-2

Low-carbon diets can reduce global ecological and health costs

Received: 17 March 2022

Elysia Lucas[1,2], Miao Guo[3] & Gonzalo Guillén-Gosálbez[2]

ARTICLE

https://doi.org/10.1038/s41586-018-0594-0

Options for keeping the food system within environmental limits

Marco Springmann[1,2]*, Michael Clark[3], Daniel Mason-D'Croz[4,5], Keith Wiebe[4], Benjamin Leon Bodirsky[6], Luis Lassaletta[7], Wim de Vries[8], Sonja J. Vermeulen[9,10], Mario Herrero[5], Kimberly M. Carlson[11], Malin Jonell[12], Max Troell[12,13], Fabrice DeClerck[14,15], Line J. Gordon[12], Rami Zurayk[16], Peter Scarborough[2], Mike Rayner[2], Brent Loken[12,14], Jess Fanzo[17,18], H. Charles J. Godfray[1,19], David Tilman[20,21], Johan Rockström[6,12] & Walter Willett[22]

Fig. 1-2-3 & discussion/conclusion

Affordability of the EAT–*Lancet* reference diet: a global analysis

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Fig. 4 (or Extended data Fig.3), Fig. 5 and Fig. 6

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Fig.2, Fig.3, Fig. 4 + 'Policy implications' paragraph + IPCC Sixth assessment Fig.6 of the Summary for Policy makers of the IPCC Sixth assessment report (Working group III)

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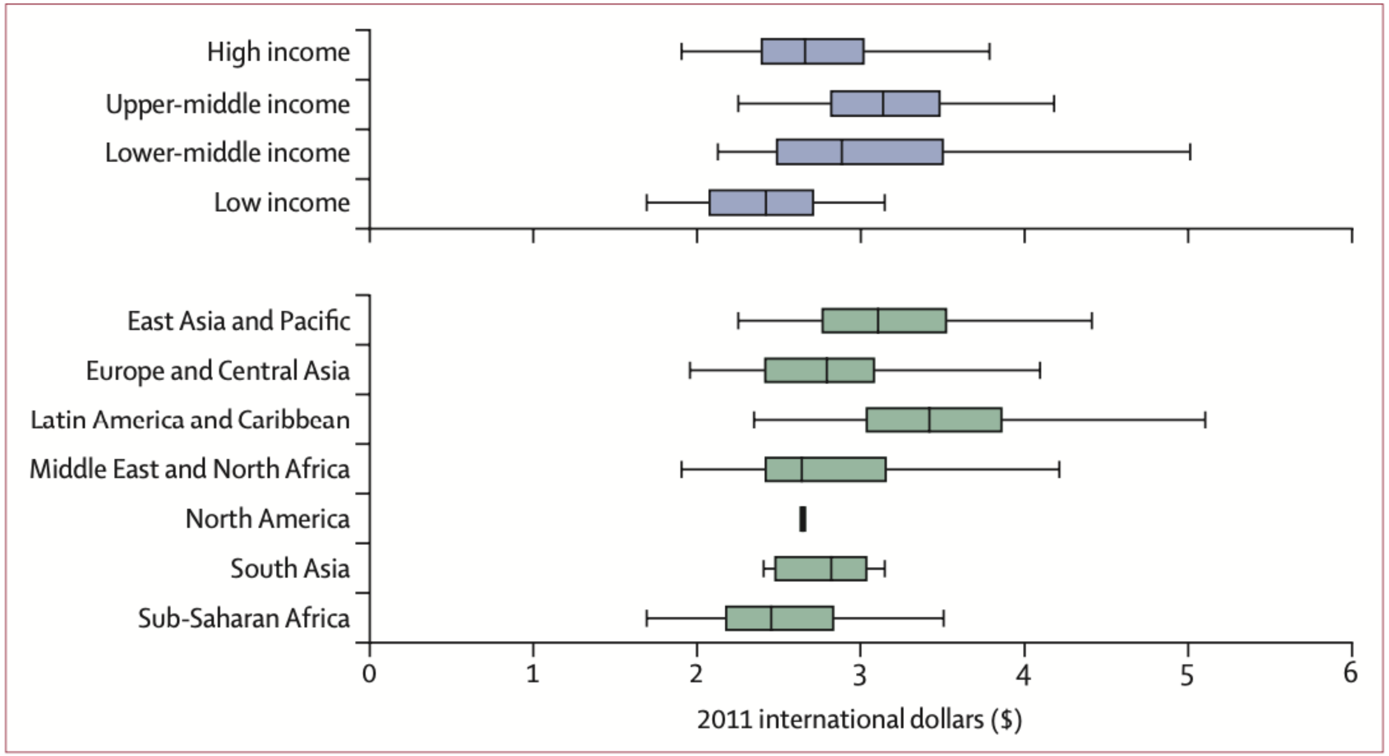

Figure 1: **Cost of the EAT–*Lancet* reference diet in 2011 international dollars, by country income levels and major regions**

We used price data from the International Comparison Program to estimate the cost of the EAT–*Lancet* reference diet in 159 countries. Cost estimates are reported in 2011 international dollars, adjusting for inflation using purchasing power parity price levels for household consumption. The size of the box indicates the IQR. The bottom and top rule marks the bottom 5th and top 5th percentiles, respectively. The vertical bar rule inside the box shows the median value for the income group or geographical region.

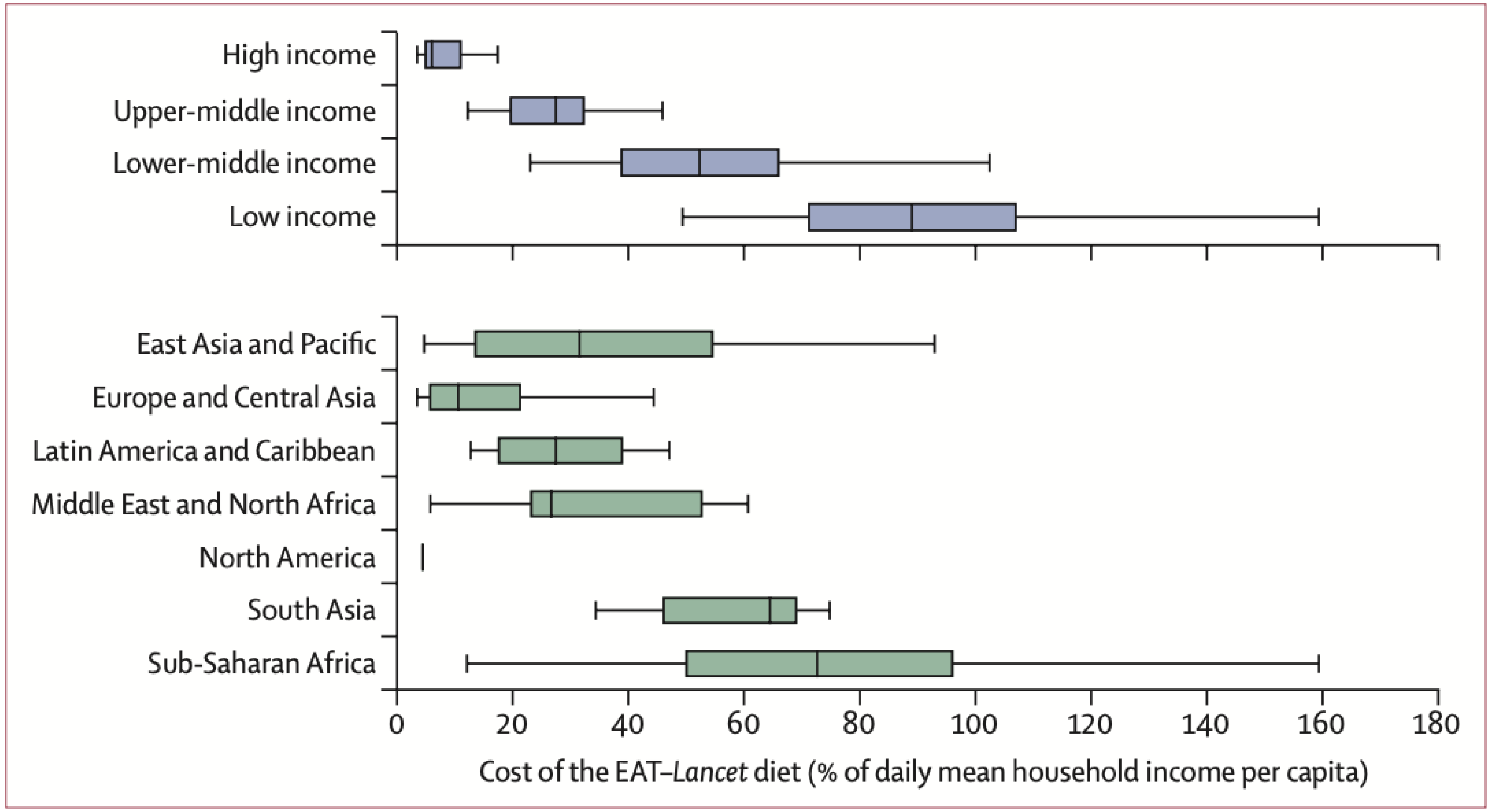

***Figure 2:* Cost of the EAT–*Lancet* reference diet relative to mean daily per capita household income by country income levels and major regions**

We used price data from the International Comparison Program to estimate the cost of the EAT–*Lancet* diet and compared these estimates to mean daily per capita household income. The size of the box indicates the IQR. The bottom and top rule marks the bottom fifth and top fifth percentiles, respectively. The vertical bar rule inside the box shows the median value for the income group or geographical region. N=141 countries.

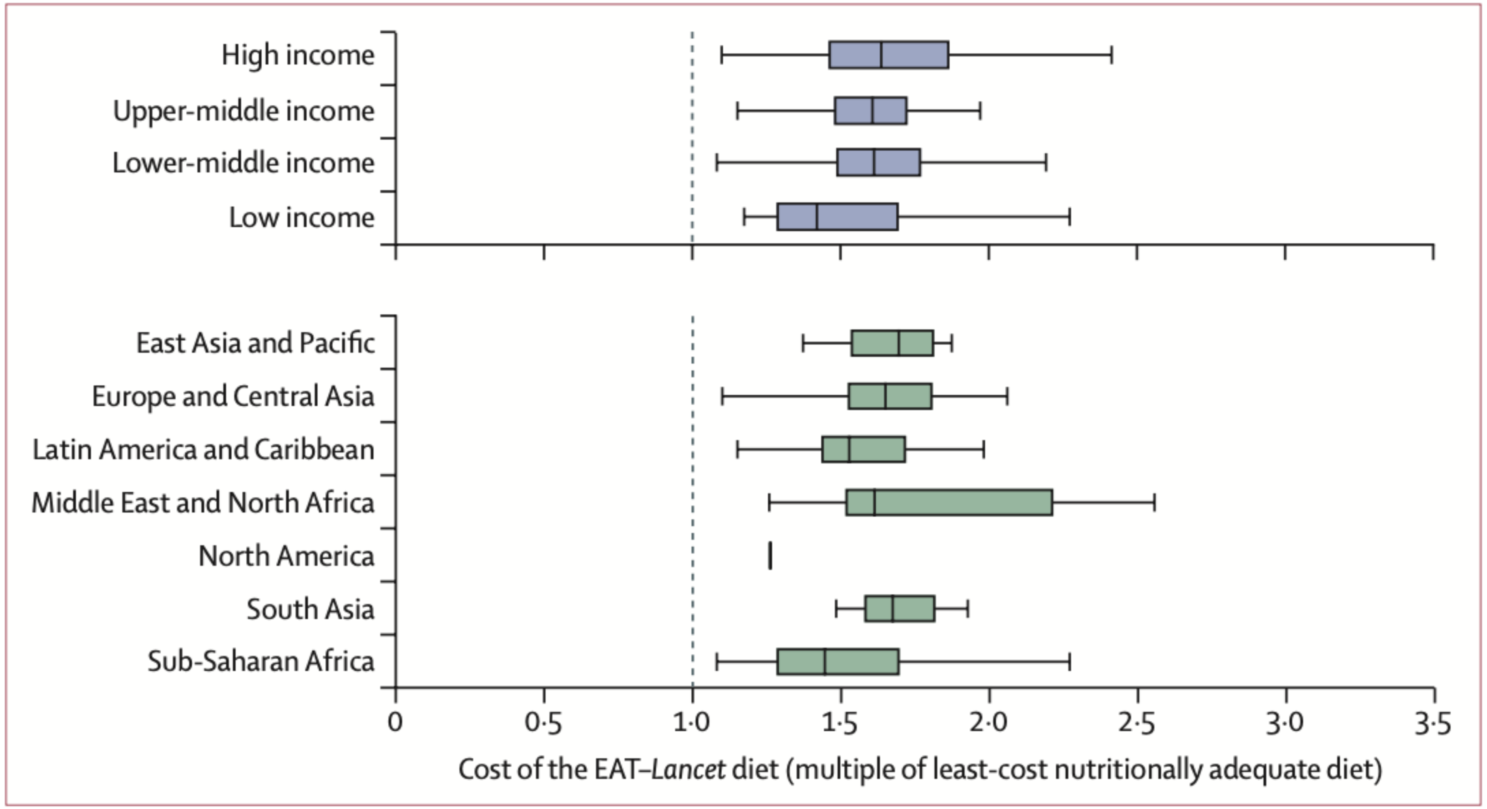

***Figure 3:* Comparing the cost of EAT–*Lancet* reference diets to the minimum cost of nutrient adequacy, by level of national income or geographical region**

We used price data from the International Comparison Program to estimate the cost of the EAT–*Lancet* diet in 159 countries, and computed the cost of meeting only estimated average requirements, upper limits and average macronutrient distribution ranges for essential nutrients. At the dashed vertical line, the two diets would have identical cost. Data shown are the cost of an EAT–*Lancet* diet as a multiple of the nutrients-only diet—for example, a value of 1·5 represents a 50% higher cost. The size of the box indicates the IQR. The bottom and top rule marks the bottom fifth and top fifth percentiles, respectively. The vertical bar rule inside the box shows the median value for the income group or geographical region. N=159 countries.

Conclusion/discussion

Article

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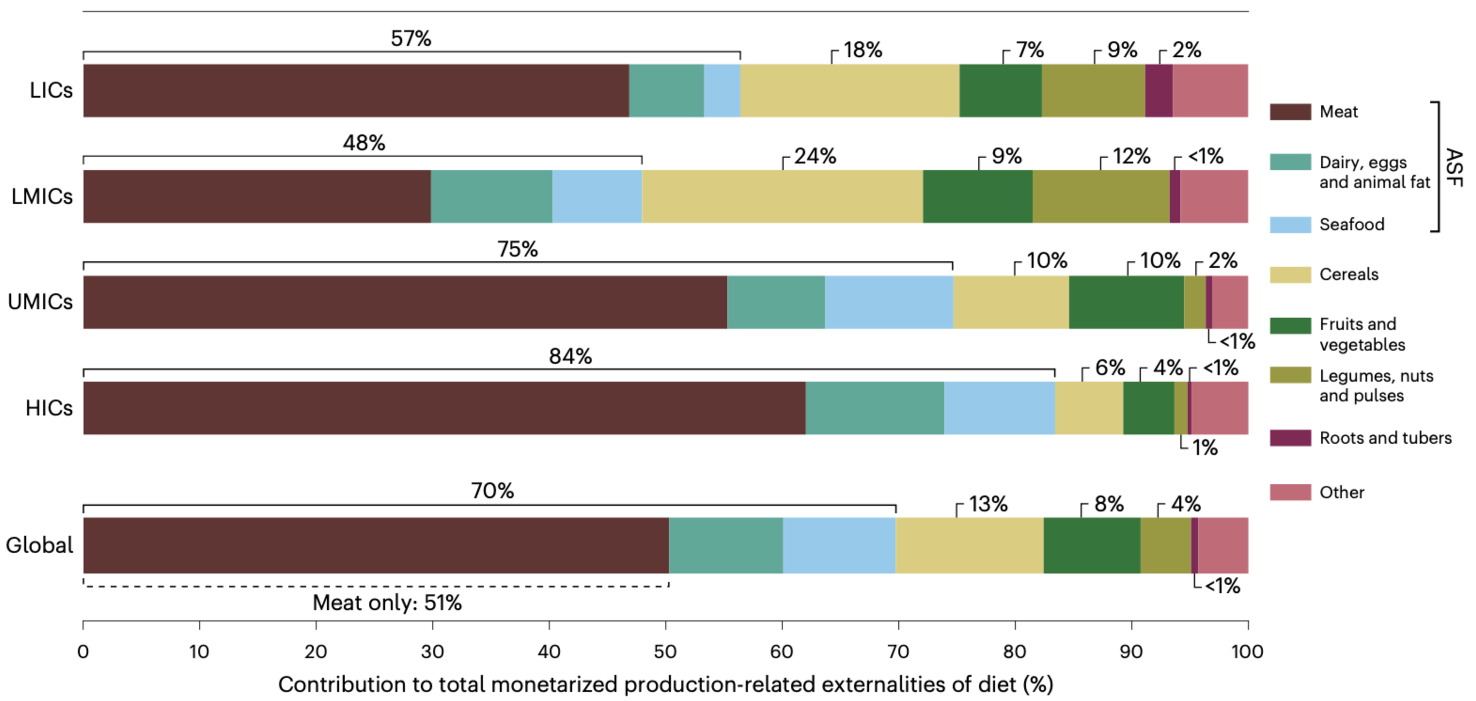

Fig. 4 | Food group contributions, expressed as a percentage of total monetarized externalities caused by the production of food consumed globally and in LICs, LMICs, UMICs and HICs. Bars represent the total combined external costs on health and ecosystems. Total externalities for the average per capita diet of each income group (that is, total externalities of all food group contributions in absolute monetary terms) are provided in Fig. 2. 'Other' includes contributions from oil crops, oils, stimulants, spices and sweeteners.

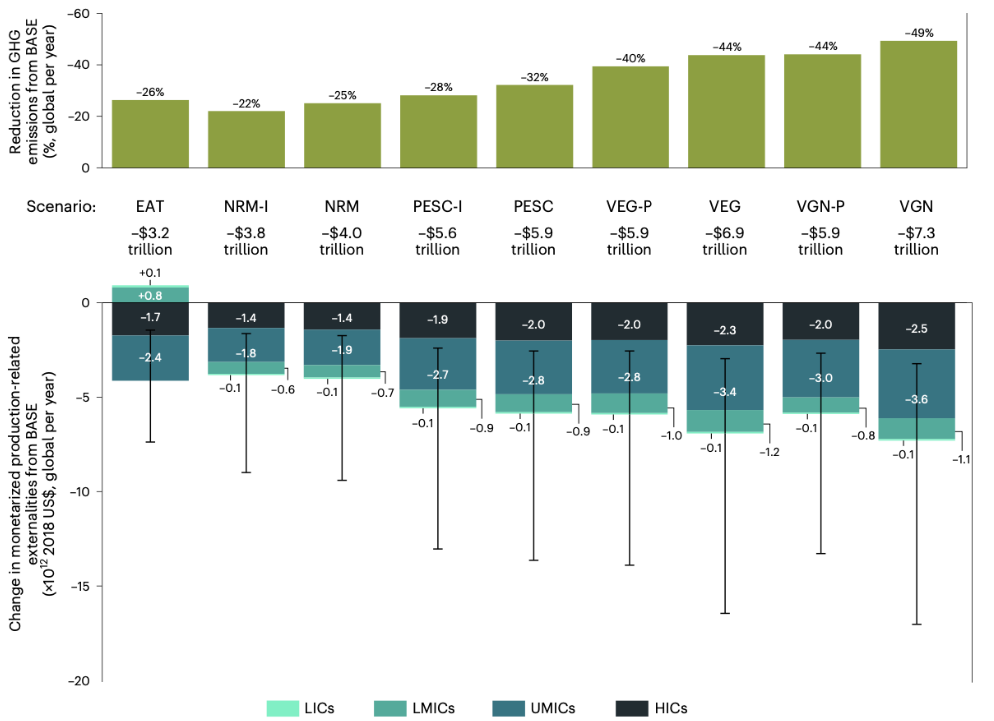

Fig. 5 | Modelled dietary change scenarios show potential to reduce GHG emissions and deliver savings in production-related externalities. Top: reductions in GHG emissions are expressed as total global percentage reductions from the BASE scenario (2018 food supply patterns, 101 countries). Bottom: change in external costs from BASE scenario are in terms of monetarized damage of food production to health and ecosystems. Bar segments of externalities reduction for dietary change scenarios correspond to the total external cost savings contributions of each income group classification of countries—LICs, LMICs, UMICs and HICs. Error bars indicate lower and upper bounds of the uncertainty range on the total global reduction of external costs based on the 95% confidence interval values of life cycle impacts of food items (n = 1,000 Monte Carlo simulation runs) and the lower and upper bounds of the monetarization factors of DALYs and species loss.

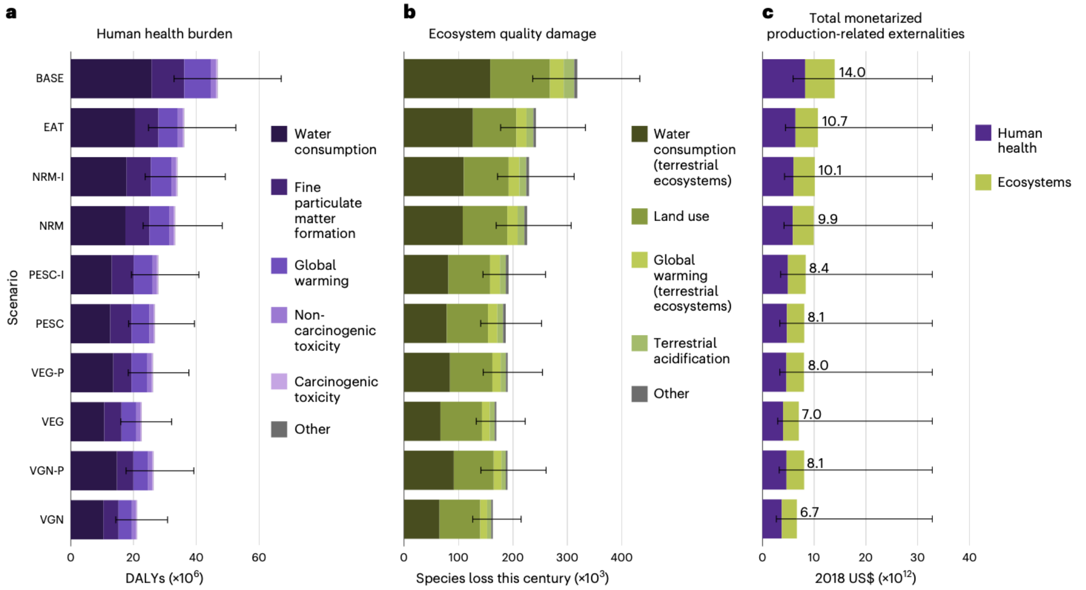

Fig. 6 | Externalities associated with the production of total food supply in 101 analysed countries for BASE (2018) and modelled dietary change scenarios. **a**,**b**, Further details on the underlying environmental mechanisms or resource use types driving the externalities caused by food production in 2018 and in each dietary scenario. **a**, Estimated damage to human health, expressed in million DALYs, linked to the environmental impacts caused by annual food production for BASE and dietary change scenarios in 101 countries. Stacked bars show the contributions of individual environmental impact category to human health burden. The top five contributing environmental impacts are explicitly shown, and contributions from 'Other' include impacts of ozone formation, ionizing radiation and stratospheric ozone depletion. **b**, Estimated damage to ecosystems, expressed in thousands of species loss over the next 100 years, linked to the environmental impacts caused by annual food production for BASE and dietary change scenarios in 101 countries. Stacked bars present the contributions of individual environmental impact category to ecosystem quality decline. The top four contributing environmental impacts are explicitly shown, and contributions from 'Other' include impacts of global warming on freshwater ecosystems, ozone formation on terrestrial ecosystems, freshwater eutrophication, marine eutrophication, terrestrial ecotoxicity, freshwater ecotoxicity, marine ecotoxicity and water consumption on aquatic ecosystems. **c**, Total estimated monetarized damage to health and ecosystems, expressed in trillion US$, caused by annual food production for BASE and dietary change scenarios in 101 countries. Error bars indicate lower and upper bounds of uncertainty ranges on total global externalities of each scenario based on the 95% confidence interval values of life cycle impacts of food items (n = 1,000 Monte Carlo simulation runs) in **a** and **b**, and on the lower and upper bounds of the monetarization factors of DALYs and species loss in **c**.

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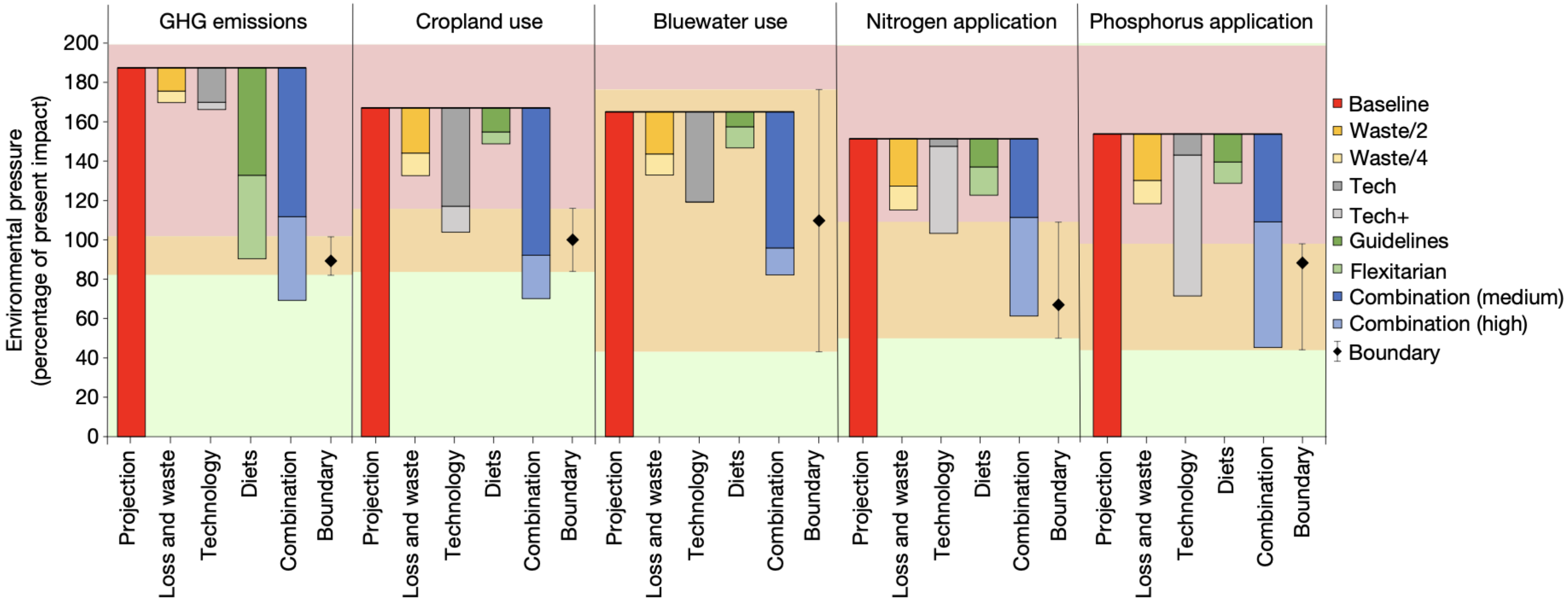


Fig. 2 | Impacts of reductions in food loss and waste, technological change, and dietary changes on global environmental pressures in 2050. These projections of environmental pressures in 2050 are baseline projections without dedicated mitigation measures for a middle-of-the-road development pathway, and are expressed as percentages of present impacts (see Fig. 1). The different measures of change and their combination are depicted as reductions from the baseline projections for the different environmental domains (for example, the 'diets' bar that ends at 90% of present impacts of GHG emissions indicates that ambitious dietary changes (flexitarian) can reduce the projected increase of GHG emissions from 187% of present impacts to 90%, which represents a reduction of 52% or 97 percentage points; and dietary changes of medium ambition (guidelines), which in the figure end at the split line of the 'diets' bar, can reduce GHG emissions from 187% of present impacts to 133%, which represents a reduction of 29% or 54 percentage points). The loss and waste scenarios include reducing food loss and waste by half (waste/2) and by 75% (waste/4). The technology scenarios include medium-ambition technological changes up to 2050 (tech) and more ambitious technological changes (tech+). The diet scenarios include diets aligned with global dietary guidelines (guidelines), and more plant-based flexitarian diets (flexitarian) that are reflective of present evidence on healthy eating. The scenario combinations include all measures of medium ambition (comb(med): waste/2, tech, guidelines) and all measures of high ambition (comb(high): waste/4, tech+, flexitarian), the latter including an optimistic socioeconomic development pathway with higher income and lower population growth. The diamonds indicate mean planetary-boundary values (boundary), each associated with uncertainty intervals highlighted by colour (light green, below the mean value; light orange, between minimum and maximum values; light red, above maximum values).

Diet scenario	Tech scenario	Loss and waste scenario	GHG emissions			Cropland use			Bluewater use			Nitrogen application			Phosphorus application		
			SSP2	SSP1	SSP3	SSP2	SSP1	SSP3	SSP2	SSP1	SSP3	SSP2	SSP1	SSP3	SSP2	SSP1	SSP3
Baseline	Baseline	Baseline	4	4	4	4	4	4	3	3	3	4	4	4	4	4	4
		Waste/2	4	4	4	4	4	4	3	3	3	4	4	4	4	4	4
		Waste/4	4	4	4	4	4	4	3	3	3	4	4	4	4	4	4
	Tech	Baseline	4	4	4	4	4	4	3	3	3	4	4	4	4	4	4
		Waste/2	4	4	4	3	3	3	2	2	2	4	4	4	4	4	4
		Waste/4	4	4	4	2	2	2	2	2	2	4	4	4	4	4	4
	Tech+	Baseline	4	4	4	3	3	3	3	3	3	3	3	3	2	2	2
		Waste/2	4	4	4	2	2	2	2	2	2	3	3	3	2	2	2
		Waste/4	4	4	4	1	1	1	2	2	2	3	3	3	2	2	2
Guidelines	Baseline	Baseline	4	4	4	4	4	4	3	3	3	4	4	4	4	4	4
		Waste/2	4	4	4	4	4	4	3	3	3	4	4	4	4	4	4
		Waste/4	4	4	4	4	3	4	3	3	3	3	3	3	4	4	4
	Tech	Baseline	4	4	4	3	3	3	3	2	3	4	4	4	4	4	4
		Waste/2	4	4	4	2	2	2	2	2	2	4	3	4	4	4	4
		Waste/4	4	4	4	2	1	2	2	2	2	3	3	3	4	3	4
	Tech+	Baseline	4	4	4	2	2	2	3	2	3	3	3	3	2	2	2
		Waste/2	4	4	4	1	1	1	2	2	2	3	3	3	2	2	2
		Waste/4	4	3	4	1	1	1	2	2	2	3	3	3	2	2	2
Flexitarian	Baseline	Baseline	3	2	3	4	4	4	3	3	3	4	4	4	4	4	4
		Waste/2	1	1	2	4	4	4	3	3	3	3	3	3	4	4	4
		Waste/4	1	1	1	4	3	4	3	2	3	3	3	3	3	3	3
	Tech	Baseline	2	1	2	3	3	3	2	2	3	4	4	4	4	4	4
		Waste/2	1	1	1	2	2	2	2	2	2	3	3	3	4	4	4
		Waste/4	1	1	1	1	1	2	2	2	2	3	3	3	3	2	3
	Tech+	Baseline	1	1	2	2	2	2	2	2	3	3	3	3	2	2	2
		Waste/2	1	1	1	1	1	1	2	2	2	3	2	3	2	2	2
		Waste/4	1	1	1	1	1	1	2	2	2	2	2	2	2	1	2

Fig. 3 | Planetary option space. The figure shows combinations of dietary change, technological change (tech or tech+), changes in food loss and waste (waste/2 or waste/4), and socioeconomic development pathways (SSP1, SSP2 or SSP3). These changes are applied to baseline conditions in 2050 (baseline). The diet scenarios include diets aligned with global dietary guidelines (guidelines), and more plant-based flexitarian diets (flexitarian) that are reflective of the current evidence on healthy eating. The loss and waste scenarios include reducing food loss and waste by half (waste/2) and by 75% (waste/4). The technology scenarios include medium-ambition technological changes up to 2050 (tech) and more ambitious technological changes (tech+). The socioeconomic development pathways include a middle-of-the-road development pathway (SSP2), a more optimistic one with higher income and lower population growth (SSP1), and a more pessimistic one with lower income and higher population growth (SSP3). Colours and numbers indicate combinations that are below the lower bound of the planetary-boundary range (dark green, 1), below the mean value but above the minimum value (light green, 2), above the mean value but below the maximum (orange, 3), and above the maximum value (red, 4).

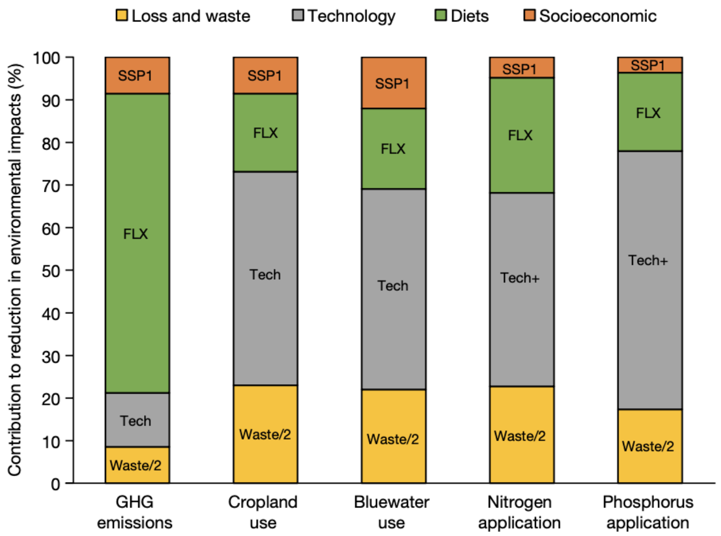
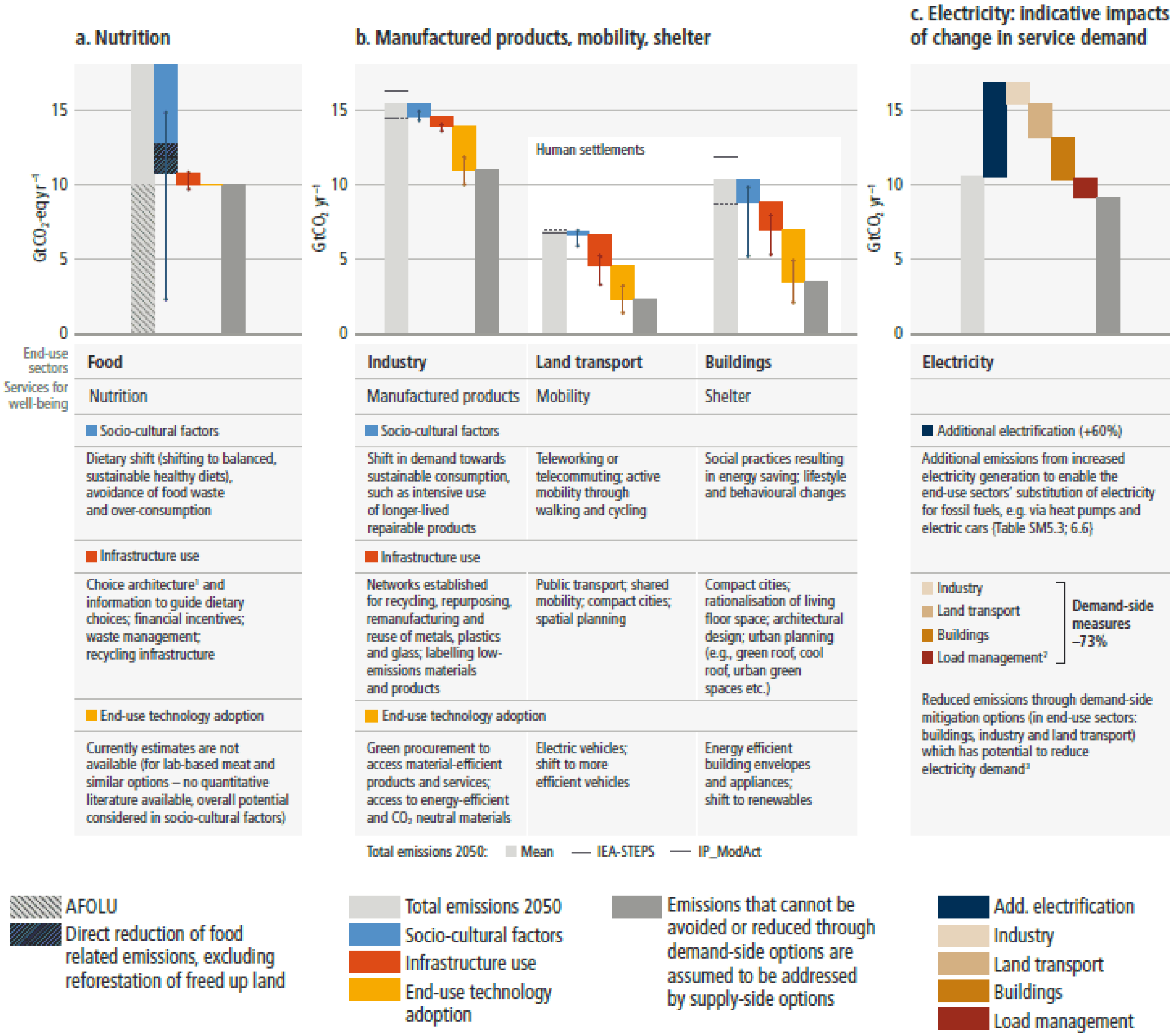


Fig. 4 | Combination and relative contributions of mitigation measures that simultaneously reduce environmental impacts below the mean values of the planetary-boundary range. The mitigation measures include different levels of technological improvements for each environmental domain (measures of high ambition (tech+) for nitrogen and phosphorus application, and measures of medium ambition (tech) for GHG emissions and for cropland and bluewater use). The other measures are not differentiated by environmental domain, and include a halving of food loss and waste (waste/2), changes towards more plant-based flexitarian diets (FLX), and optimistic socioeconomic development with higher income and lower population growth (SSP1) than expected at present. A middle-of-the-road development pathway is also feasible when combined with more ambitious reductions in food loss and waste (see Fig. 3).

Policy implications



[1] The presentation of choices to consumers, and the impact of that presentation on consumer decision-making.

[2] Load management refers to demand-side flexibility that cuts across all sectors and can be achieved through incentive design like time of use pricing/monitoring by artificial intelligence, diversification of storage facilities, etc.

[3] The impact of demand-side mitigation on electricity sector emissions depends on the baseline carbon intensity of electricity supply, which is scenario dependent.