Healthy diets from systainable food systems

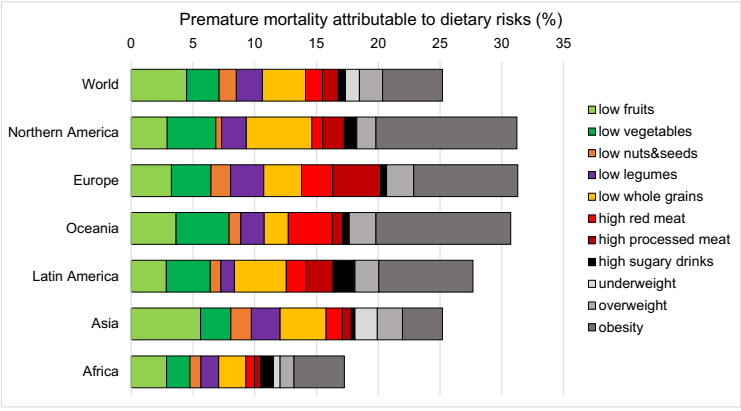
Dr Marco Springmann
Professor in Climate Change, Food Systems and Health

London School of Hygiene and Tropical Medicine
marco.springmann@lshtm.ac.uk

Climate Change
& Planetary
Health

Many diets are unhealthy

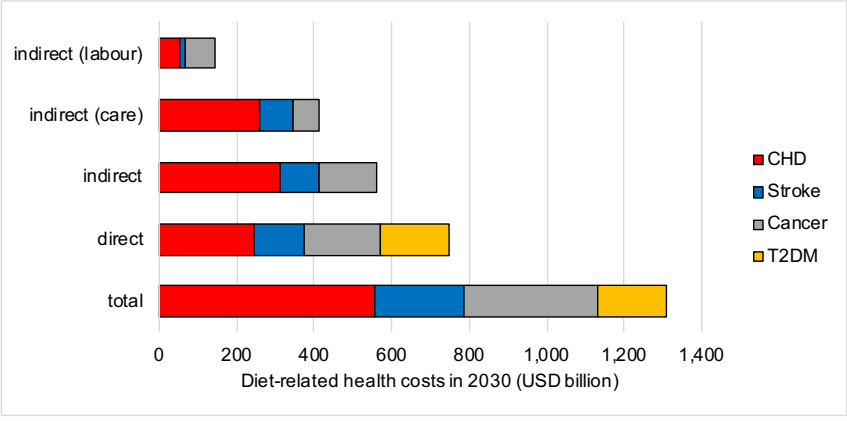
Dietary risks are leading risk factors for NCDs and premature mortality:



Global Nutrition Report (2021), GBD Diet Collaborators (2019)

Health and economic consequences

Imbalanced diets require **costly** treatment:



Springmann et al (SOFI 2020, PNAS 2016)

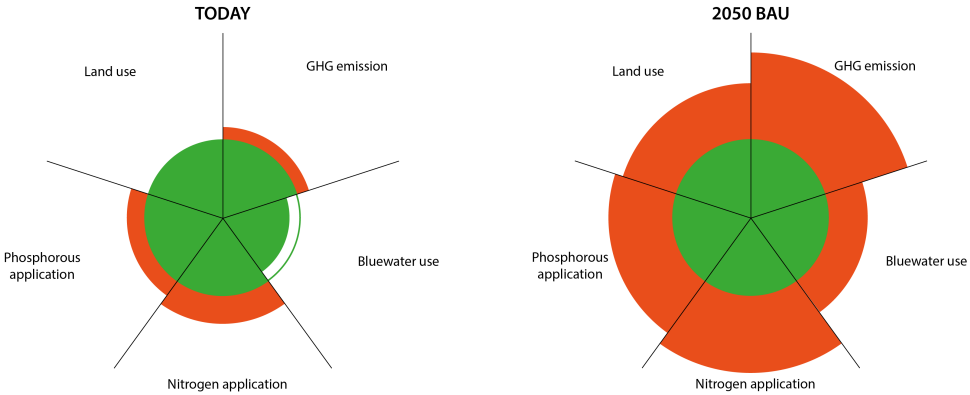
Most diets are unsustainable

The current food system is environmentally unsustainable:

- major driver of climate change
  (33% of GHG emissions, IPCC, 2019);
- major driver of land-use change and biodiversity loss
  (40% of the Earth's surface, Ramankutty et al, 2008; Houghton et al, 2012);
- major user of freshwater resources
  (70% of global freshwater withdrawals (WWAP, 2012);
- major polluter of terrestrial and aquatic systems through fertilizer runoff
  (>400 dead zones in coastal oceans, Diaz and Rosenberg, 2008)

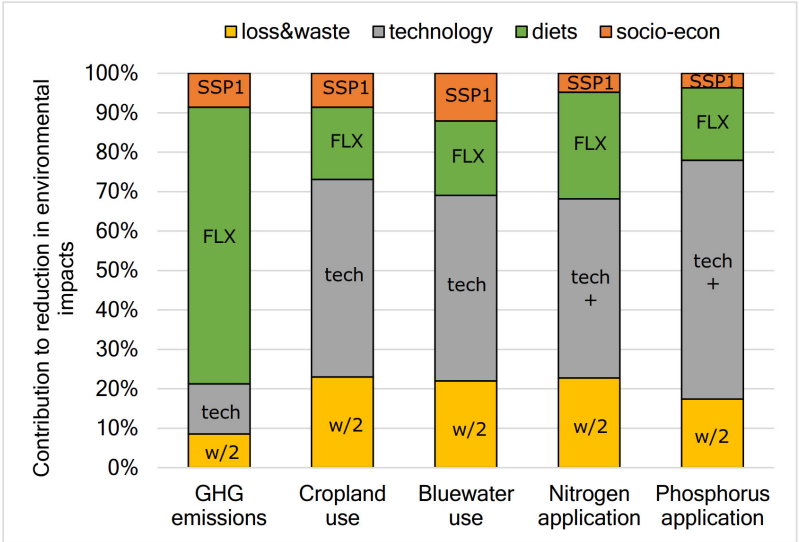
Environmental and planetary consequences

Without dietary changes, there is an increasing risk of exceeding **planetary boundaries**:



Springmann et al, *Nature* 2018

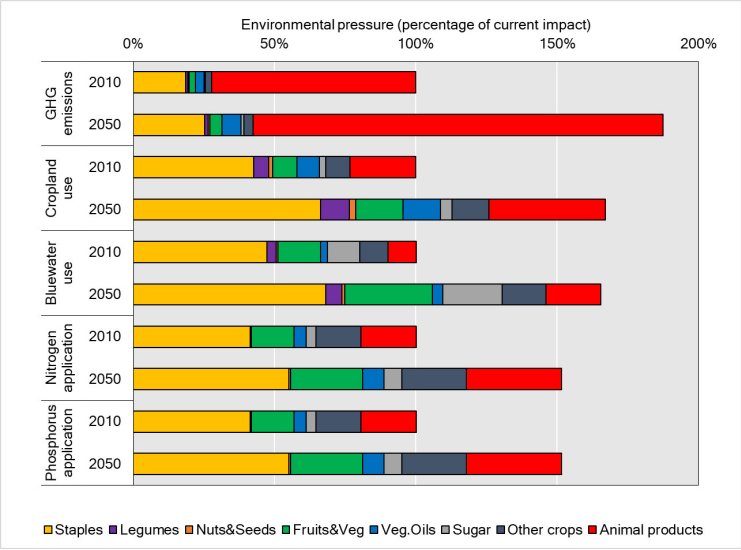
Need for dietary changes to healthy and sustainable diets



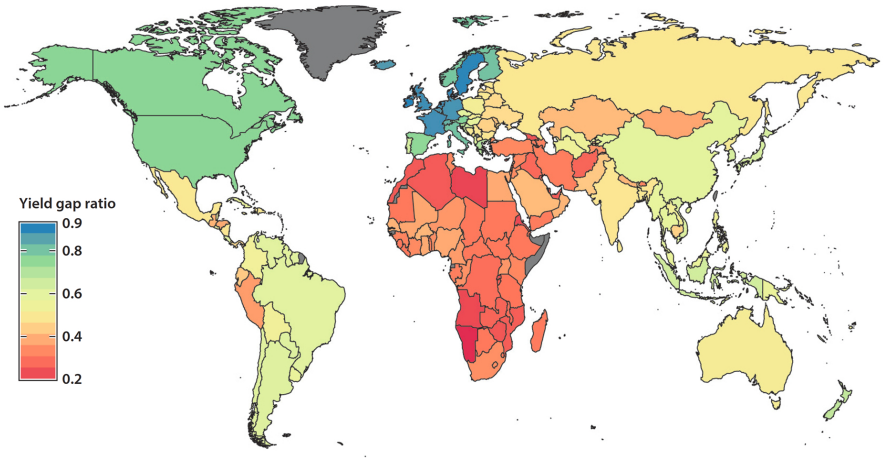
Environmental footprints per serving of food

Food item	GHG emissions ($10kgCO_2$/serving)	Cropland use ($10m^2$/serving)	Freshwater use ($10m^3$/serving)	Nitrogen use (10gN/serving)	Phosphorus use (10gP/serving)
wheat	0.10	1.51	0.22	12.93	1.98
rice	0.53	1.58	0.48	16.49	2.34
maize	0.08	0.89	0.07	10.25	1.60
other grains	0.13	2.76	0.07	7.36	1.22
roots	0.08	0.76	0.05	3.99	0.78
legumes	0.08	3.86	0.33	0.00	0.00
soybeans	0.04	1.38	0.05	0.96	2.06
nuts & seeds	0.21	1.92	0.13	4.28	0.63
vegetables	0.05	0.41	0.07	8.12	1.42
fruits (temperate)	0.11	1.65	0.47	17.82	2.67
fruits (tropical)	0.13	1.32	0.45	14.38	2.21
fruits (starchy)	0.15	1.18	0.16	8.76	1.50
sugar	0.01	0.07	0.05	0.89	0.15
palm oil	0.26	0.43	0.00	3.13	0.50
vegetable oil	0.09	1.44	0.07	5.98	1.61
beef	35.74	4.64	0.24	30.01	5.89
lamb	36.33	6.86	0.54	30.27	5.43
pork	3.21	6.69	0.38	56.68	9.75
poultry	1.55	7.25	0.44	55.22	9.92
eggs	0.79	3.43	0.22	25.61	4.40
milk	2.93	3.21	0.19	15.18	3.79
shellfish	0.08	0.40	0.04	3.69	0.89
fish (freshwater)	0.33	1.66	0.11	18.46	3.98
fish (demersal)	0.02	0.14	0.01	1.32	0.32
fish (pelagic)	0.00	0.00	0.00	0.00	0.00

Domains: livestock-dominated and staple-crop-dominated



Unequal distribution of technology and capital



Global dietary recommendations

EAT-Lancet Commission on Healthy Diets from Sustainable Food Systems (Willet et al, *Lancet*, 2019):

	Macronutrient intake grams per day (possible range)	Caloric intake kcal per day
Whole grains		
Rice, wheat, corn and other	232	811
Tubers or starchy vegetables		
Potatoes and cassava	50 (0–100)	39
Vegetables		
All vegetables	300 (200–600)	78
Fruits		
All fruits	200 (100–300)	126
Dairy foods		
Whole milk or equivalents	250 (0–500)	153
Protein sources		
Beef, lamb and pork	14 (0–28)	30
Chicken and other poultry	29 (0–58)	62
Eggs	13 (0–25)	19
Fish	28 (0–100)	40
Legumes	75 (0–100)	284
Nuts	50 (0–75)	291
Added fats		
Unsaturated oils	40 (20–80)	354
Saturated oils	11.8 (0-11.8)	96
Added sugars		
All sugars	31 (0–31)	120

Consumption changes (%) to reach balanced flexitarian diets

Food groups	World	HIC	UMC	LMC	LIC
red meat	-82	-90	-83	-78	-57
sugar	-48	-56	-68	-39	-15
white meat	-38	-59	-52	-6	-7
milk&eggs	-32	-55	-31	-17	-8
staples	-28	8	-16	-36	-33
fish	50	20	98	46	106
vegetables	55	50	92	35	247
fruits	59	24	24	72	117
legumes	249	485	198	240	187
nuts	280	336	294	248	335

National food-based dietary guidelines (FBDGs)

Food-based dietary guidelines

Background | Regions | Resources | Capacity development

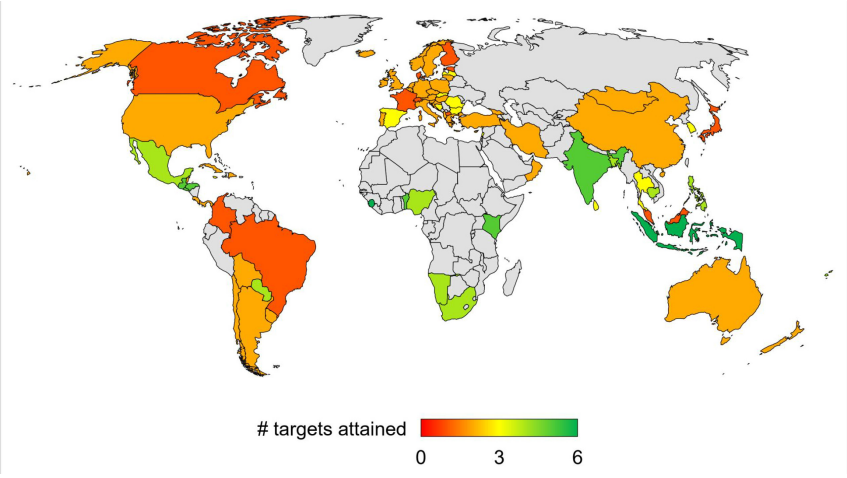
Food-based dietary guidelines (also known as dietary guidelines) are intended to establish a basis for public food and nutrition, health and agricultural policies and nutrition education programmes to foster healthy eating habits and lifestyles. They provide advice on foods, food groups and dietary patterns to provide the required nutrients to the general public to promote overall health and prevent chronic diseases.

FAO assists Member Countries to develop, revise and implement food-based dietary guidelines and food guides in line with current scientific evidence. FAO also carries out periodic reviews on progress made in the development and use of dietary guidelines, tracking changes in their overall focus and orientation.

More than 100 countries worldwide have developed food-based dietary guidelines that are adapted to their nutrition situation, food availability, culinary cultures and eating habits. In addition countries publish food guides, often in the form of food pyramids and food plates, which are used for consumer education *Read more*

Please note that individual country pages are only available in English.

Current FBDGs are not in line with sustainability targets

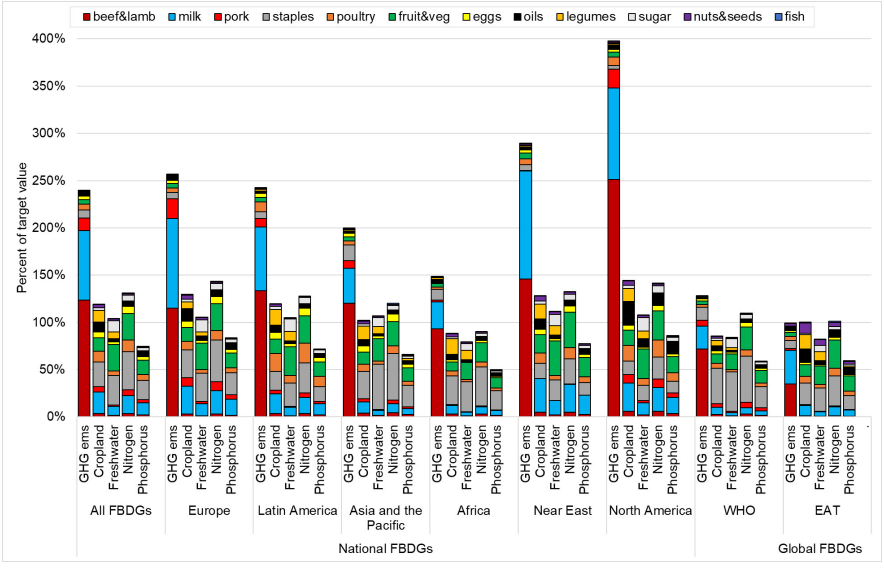


Springmann et al, *BMJ* 2020

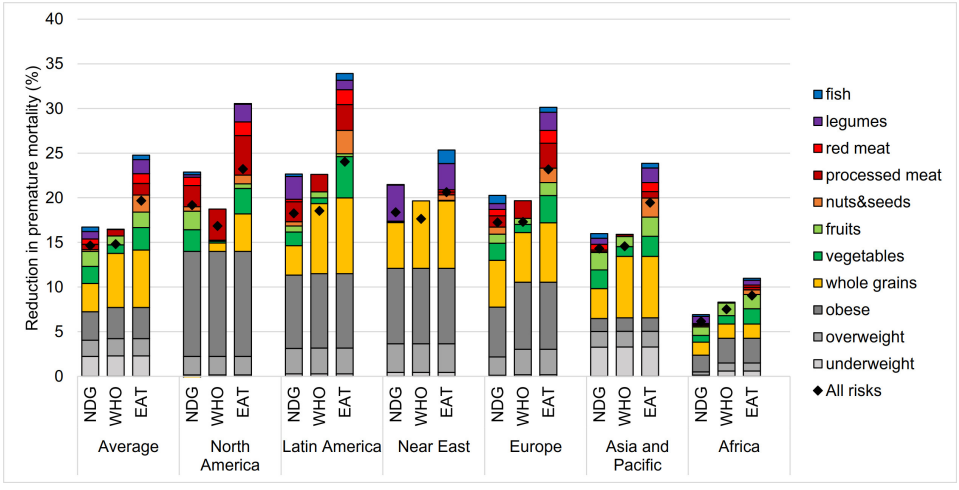
Health and environmental targets

Planetary boundary	Motivation	Method	Global targets	Comment
Climate change	Further increasing GHG emissions increase climate-related risks to ecosystems and cultures, e.g. from sea-level rise and increased occurrence of extreme weather events, such as heat waves, extreme precipitation, and coastal flooding [82].	Food-related GHG emissions in line with limiting global warming to below 2 degrees Celsius [63] with uncertainty derived from a model comparison of integrated assessment models [58].	**Paris Climate Agreement**	The Paris Agreement's long-term goal is to keep the increase in global average temperature to well below 2 °C above pre-industrial levels; and to limit the increase to 1.5 °C, since this would substantially reduce the risks and effects of climate change. Reflected in **SDG 13** and in the plenatary boundary for climate change.
Land-system change	Further increasing the amount of agricultural land through deforestation could impact the functioning of ecosystems [3], release large amounts of carbon dioxide [1], and diminish habitat for wild species and thereby pose major threats to biodiversity [4].	Analysis of conservation levels for each forest biome in line with preserving ecosystem integrity, scaled up to a global value [12] and related to cropland use [33,39].	**Aichi Biodiversity Targets**	Target 5: By 2020, the rate of loss of all natural habitats, including forests, is at least halved and where feasible brought close to zero, and degradation and fragmentation is significantly reduced. Related to **SDG 15** and planetary boundary for land-system change.
Freshwater use	Further depletion and overexploitation of groundwater resources impairs natural streamflow, wetlands and related ecosystems, and can lead to land subsidence and salt-water intrusion in deltaic areas [6] and, eventually, to cascading impacts on the global hydrological cycle [77].	Basin-level assessments of the environmental flow requirements of river systems [12,20] scaled to agricultural bluewater use [5,33].	**SDG target on water withdrawals**	**SDG 6.4**: By 2030, substantially increase water-use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity and substantially reduce the number of people suffering from water scarcity. In line with planetary boundary for freshwater use.
Bio-geochemical flows	Agricultural runoff from overapplication of fertilizers leads to eutrophication, an increase in chemical nutrients in the water [7,9], which in turn can lead to excessive blooms of algae that deplete underwater oxygen levels resulting in so-called dead zones in coastal oceans [8].	Analysis of eutrophication risk based on nitrogen and phosphorus pollution estimates of agricultural runoff and ecological thresholds [19], with an upper value in line with re-balancing of application between over and under-applying regions [32].	**SDG target on nutrient pollution**	**SDG 14.1**: By 2025, prevent and significantly reduce marine pollution of all kinds, in particular from land-based activities, including marine debris and nutrient pollution
Healthy diets	Levels of malnutrition are increasing, in particular overweight, obesity, and dietary risks. All people should have access to healthy and nutritious diets.	Review of literature on healthy eating and construction of general food-based dietary guidelines in line with healthy diets.	**NCD Agenda**	**SDG 3.4**: the target is to "reduce by one third premature mortality from NCDs through prevention and treatment, and promote mental health and wellbeing", which builds on the World Health Organization (WHO) "25x25" NCD target.

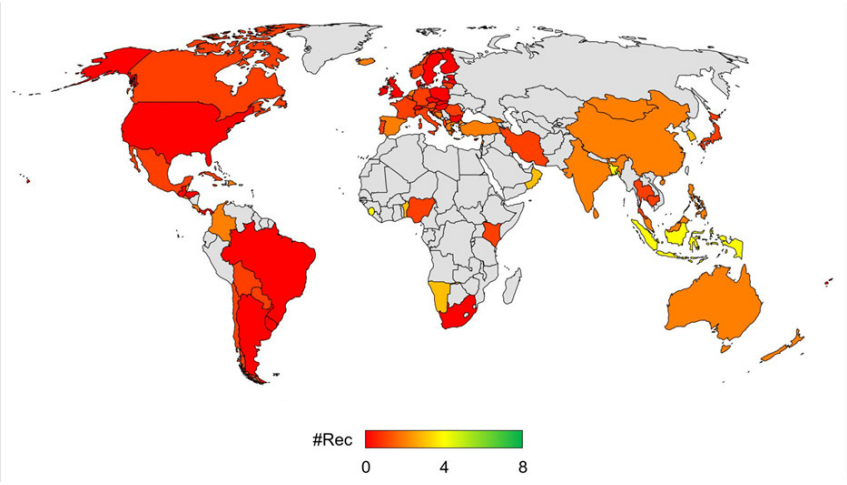
Too lax recommendations for reducing ASF are problematic



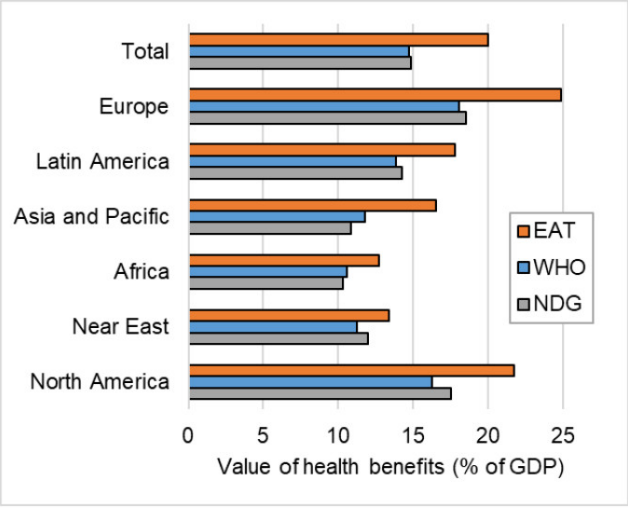
FBDGs could also be healthier



Number of recommendations achieved



Need for policy support, coherence, and investment



Dietary change

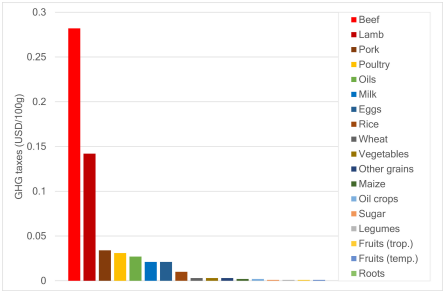
How to incentivise healthy and sustainable diets?

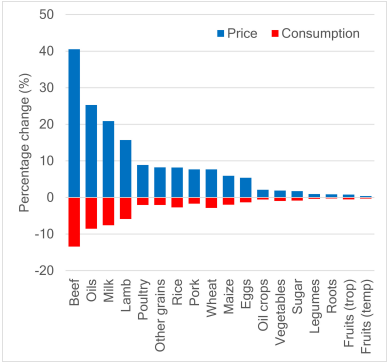
- Providing information without additional economic or environmental changes has limited influence on behaviour;
- Integrated, multicomponent approaches that include clear policy measures are best suited for changing diets (Mozaffarian et al, 2012, 2016):

1. Media and education campaigns; labelling and consumer information; update national dietary guidelines
2. Fiscal measures, such as taxation, subsidies, and other economic incentives, including for producers
3. School and workplace approaches; local environmental changes;
4. Direct restriction and mandates

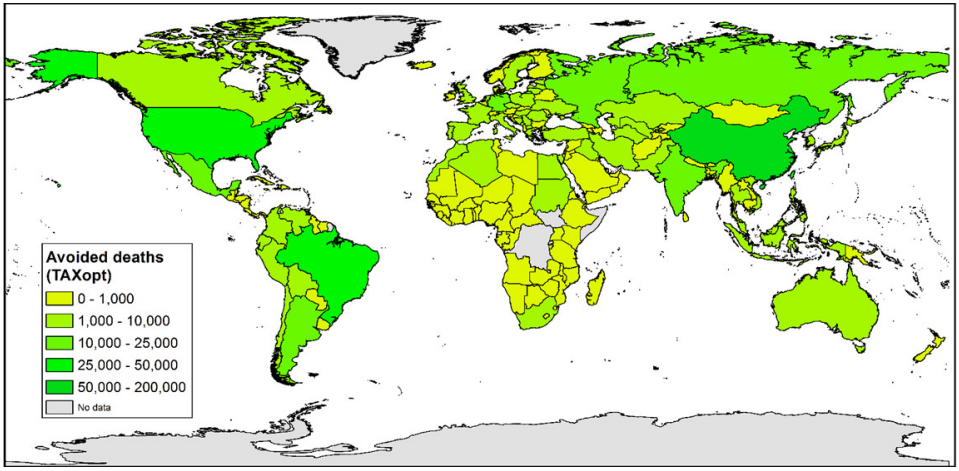
Fiscal incentives

Adjust food prices for climate damages
(Springmann et al, 2017, *Nature Climate Change*):





Health-sensitive taxing scheme linked to use of tax revenues



Fiscal incentives

Adjust food prices for health costs
(Springmann et al, 2018, *PLOS One*):

International Agency for Research on Cancer

World Health Organization

PRESS RELEASE
N° 240

26 October 2015

IARC Monographs evaluate consumption of red meat and processed meat

Lyon, France, 26 October 2015 – The International Agency for Research on Cancer (IARC), the cancer agency of the World Health Organization, has evaluated the carcinogenicity of the consumption of red meat and processed meat.

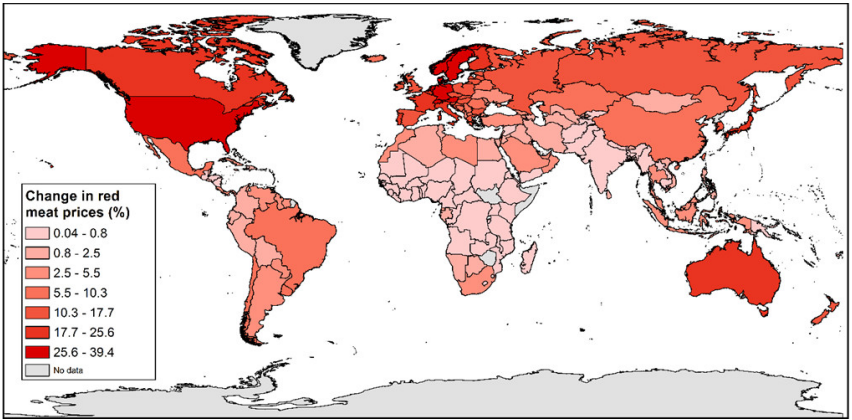
Red meat

After thoroughly reviewing the accumulated scientific literature, a Working Group of 22 experts from 10 countries convened by the IARC Monographs Programme classified the consumption of red meat as *probably carcinogenic to humans* (Group 2A), based on *limited evidence* that the consumption of red meat causes cancer in humans and *strong* mechanistic evidence supporting a carcinogenic effect.

This association was observed mainly for colorectal cancer, but associations were also seen for pancreatic cancer and prostate cancer.

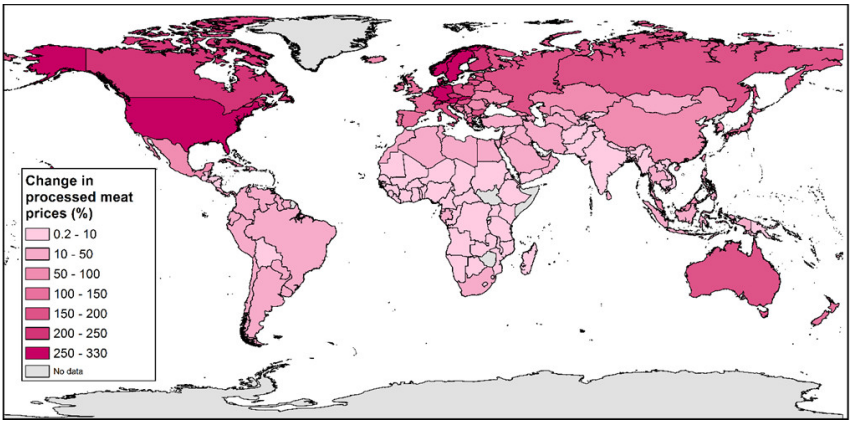
Health taxes on red meat

Prices changes needed to pay for health care-related costs in equilibrium (**red meat**):



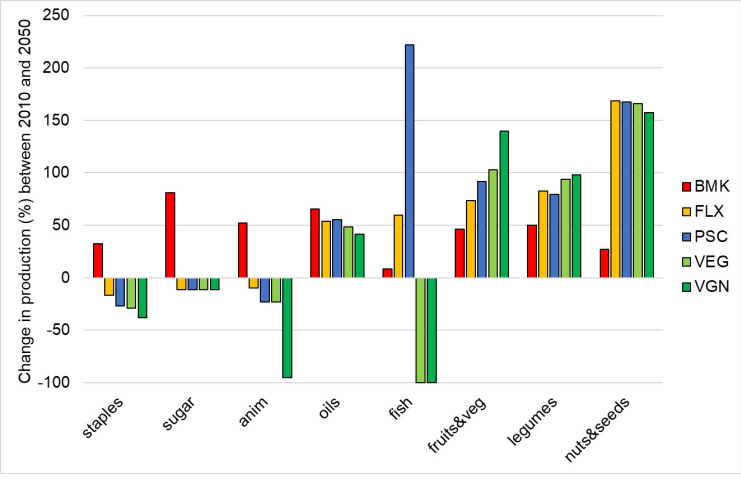
Health taxes on processed meat

Prices changes needed to pay for health care-related costs in equilibrium (**processed meat**):



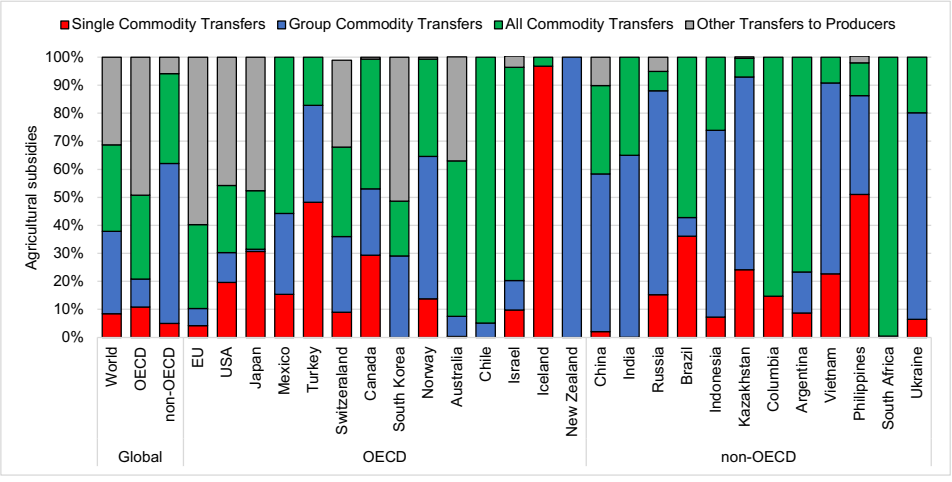
Agricultural subsidies

Align agricultural subsidies with public health objectives
(Springmann and Freund, 2022, *Nature Communications*):



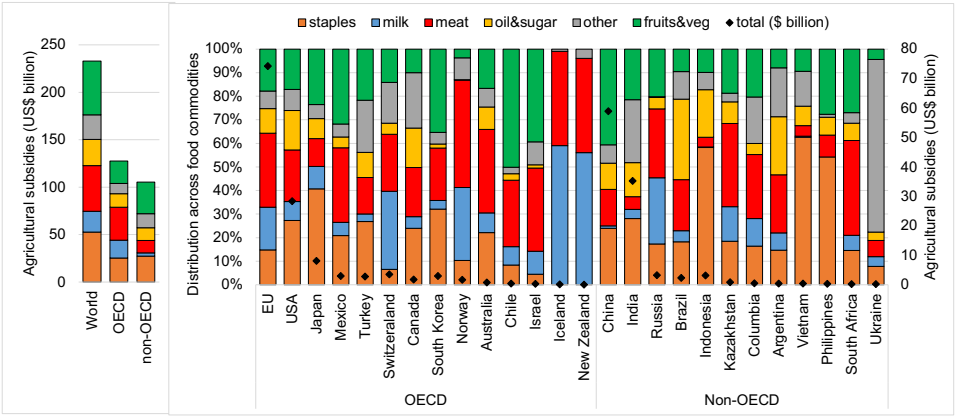
Agricultural subsidies

Agricultural support measures by **type**:



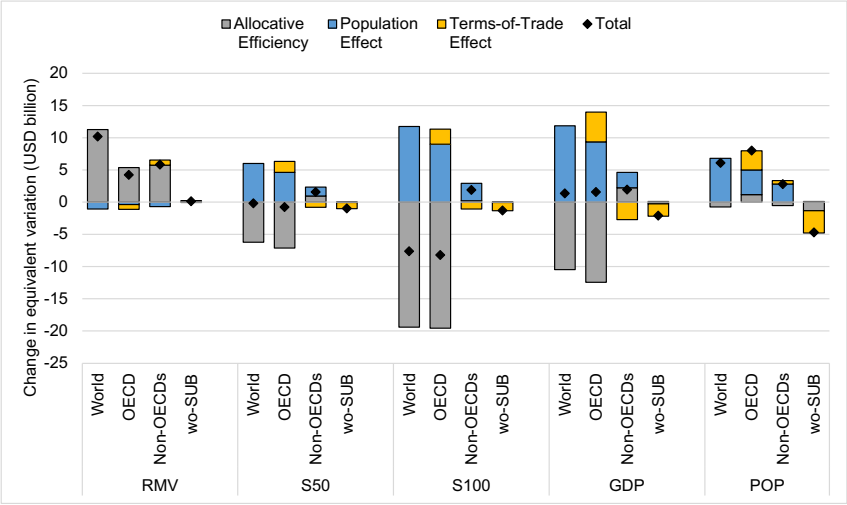
Agricultural subsidies

Agricultural support measures by **final use**:



Agricultural subsidies

Change in **economic welfare**:



Where to find more details

References:

- Springmann et al, 2018, Options for keeping the food system within environmental limits, *Nature* 562, 519-525.
- Springmann et al, 2018, Health and nutritional aspects of sustainable diet strategies and their association with environmental impacts: a global modelling analysis with country-level detail, *Lancet Planetary Health* 2, e451-e461.
- Springmann et al, 2020, The healthiness and sustainability of national and global food based dietary guidelines: modelling study, *BMJ*, 370:m2322
- Springmann and Freund, 2022, Options for reforming agricultural subsidies from health, climate, and economic perspectives *Nature Communications*, 13, 82.

DIA model:

- WHO Europe, The Diet Impact Assessment model: an interactive tool for analysing the health, environmental and affordability implications of dietary change, WHO/EURO:2023-8349-48121-71370

Thank you

Contact, comments and suggestions:

- at LSHTM: marco.springmann@lshtm.ac.uk
- at Oxford: marco.springmann@ouce.ox.ac.uk