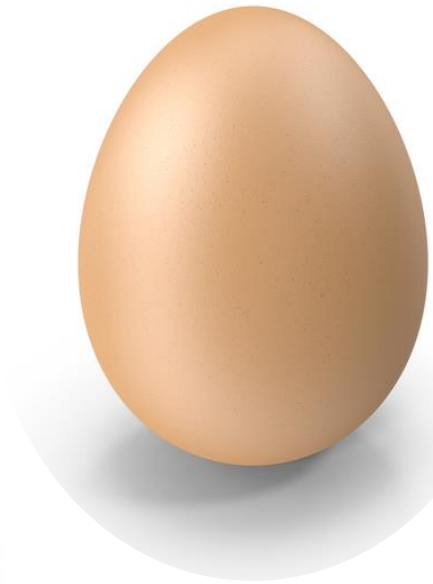


The environmental footprint of animal foods: beware of simplifications

Belgian Association of Meat Science and Technology

BAMST

VUB VRIJE UNIVERSITEIT BRUSSEL

November 6, University Foundation, Brussels, Belgium

Prof. dr. ir. Frédéric LEROY

What's on the table? According to some: *elimination* of the need for animal foods

UN Environment
@UNEnvironment
Follow

Warning: no meat was used in the following video.

Cutting back on meat is an essential part of preventing the degradation of our environment.

Mainstreaming meatless burgers benefit businesses, consumers & our planet.

RethinkX

The drop in cost of #PrecisionFermentation plus the rise in cost of beef will bring about the collapse of the dairy and cattle industry by 2030.

- Agendas go way beyond "cutting back"

Beyond Meat CEO wants to make traditional protein from animals 'obsolete' MarketWatch

Published: May 6, 2019 7:13 a.m. ET

- This is not just food folklore!

BusinessWire
A Berkshire Hathaway Company
HOME SERVICES NEWS EDUCATION ABOUT US

Since its founding, Impossible Foods intentionally designed a robust supply chain that is highly scalable, with from abundant plant crops. Impossible Foods has a clear, long-term roadmap to exponentially expand capacity, and the funding will accelerate the scaleup.

IMPOSSIBLE FOODS
"The company's goal is to eliminate the need for animals in the food chain by 2035"

Based in California's Silicon Valley, Impossible Foods makes delicious much smaller environmental footprint than meat from animals. The pr Brown, M.D., Ph.D., Professor Emeritus of Biochemistry at Stanford U nvestigator. Investors include Khosla Ventures, Bill Gates, Google Ve Temasek, Sailing Capital, and Open Philanthropy Project.

Google ventures

khosla ventures

BILL & MELINDA GATES foundation

Surreal times: how did this end up being part of a 'big plan for a small planet'?

UN Climate Change @UNFCCC · Oct 10

Barcelona ✅
Copenhagen ✅
Guadalajara ✅
Lima ✅
London ✅
Los Angeles ✅
Milan ✅
Oslo ✅
Paris ✅
Quezon City ✅
Seoul ✅
Stockholm ✅
Tokyo ✅
Toronto ✅

CONSUMPTION INTERVENTION	PROGRESSIVE TARGET IN 2030	AMBITIOUS TARGET IN 2030
Dietary change (this intervention is characterised by three major changes which are described in more detail)	16 kg of meat per person per year[31]	0 kg meat consumption
	90 kg dairy consumption (milk or derivative equivalent) per person per year[32]	0 kg dairy consumption (milk or derivative equivalent) per person per year
C40 CITIES HEADLINE REPORT	2,500 kcal per person per day	2,500 kcal per person per day

These cities have just committed to achieve a planetary health diet for all by 2030. 🍅🍆🥕🍗

European cities urged to reduce both beef and dairy with 80-100% by 2030

The EAT-Lancet Commission's controversial campaign

A global powerful action against meat?

5.4k Shares | Share | Tweet | in

The kick-off meeting will held on January 17th in Oslo

EAT is a global, non-profit startup dedicated to transforming our global food system through sound science, impatient disruption and novel partnerships. According to the website, "the EAT-Lancet Commission on Food, Planet, Health brings together more than 30 world-leading scientists from across the globe to reach a scientific consensus that defines a healthy and sustainable diet".

NATURAL CAPITAL COALITION

WWF IUCN

Stockholm Resilience Centre

International Institute for Applied Systems Analysis

WORLD ECONOMIC FORUM

WORLD RESOURCES INSTITUTE

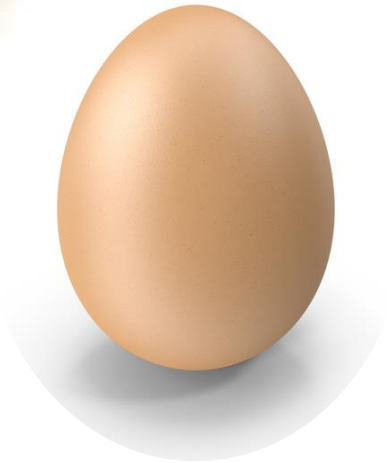
UNEP

World Business Council for Sustainable Development

ABOUT US | EARTH COMMISSION | SCIENCE-BASED TARGETS | EARTH HQ | SYSTEMS CHANGE | PARTNERS | NEWS

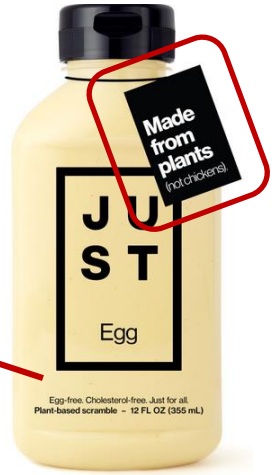
What is being proposed as alternatives? Reductionist approaches to food

Food.



Future of food?

Water, coconut oil (non-hydrogenated), modified starch (E1404, E1450), starch, sea salt, vegan flavours, acidity regulator, citric acid (E330), preservative: sorbic acid (E200) (0.2%). Colour B-Carotene.



"Egg-free"

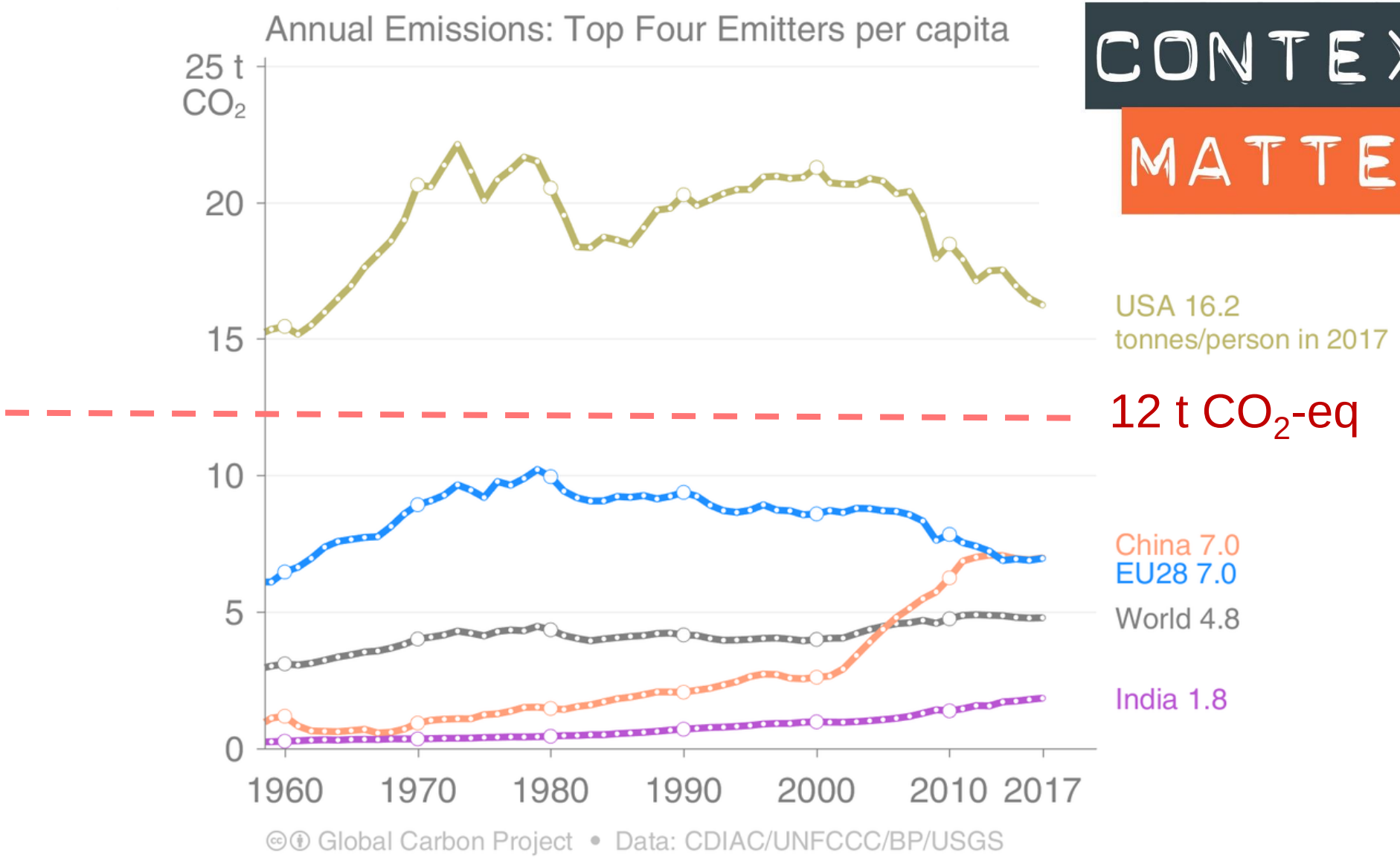
Water, Mung Bean Protein Isolate, Expeller-Pressed Canola Oil, Contains less than 2% of Dehydrated Onion, Gellan Gum, Natural Carrot Extractives (color), Natural Flavors, Natural Turmeric Extractives (color), Potassium Citrate, Salt, Soy Lecithin, Sugar, Tapioca Syrup, Tetrasodium Pyrophosphate, Transglutaminase, Nisin (preservative). (Contains soy.)

According to most people.

According to a load minority.

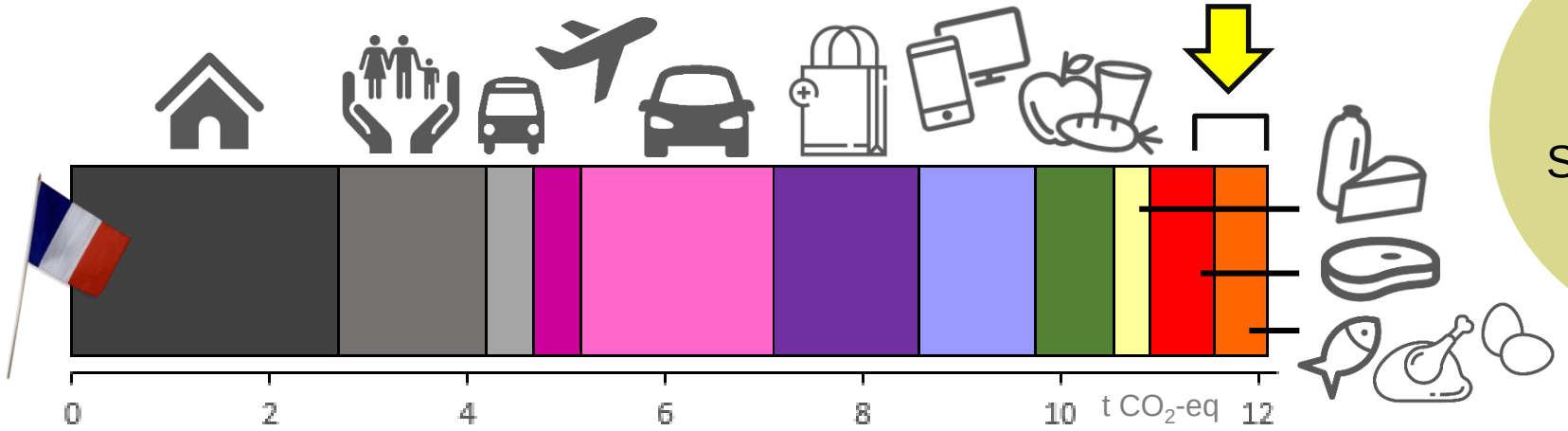
Nothings sells as well as slogans urging people to *eat right*

Individual GHG emissions of a Western individual



CONTEXT MATTERS

Breakdown in categories and effect of dietary shifts

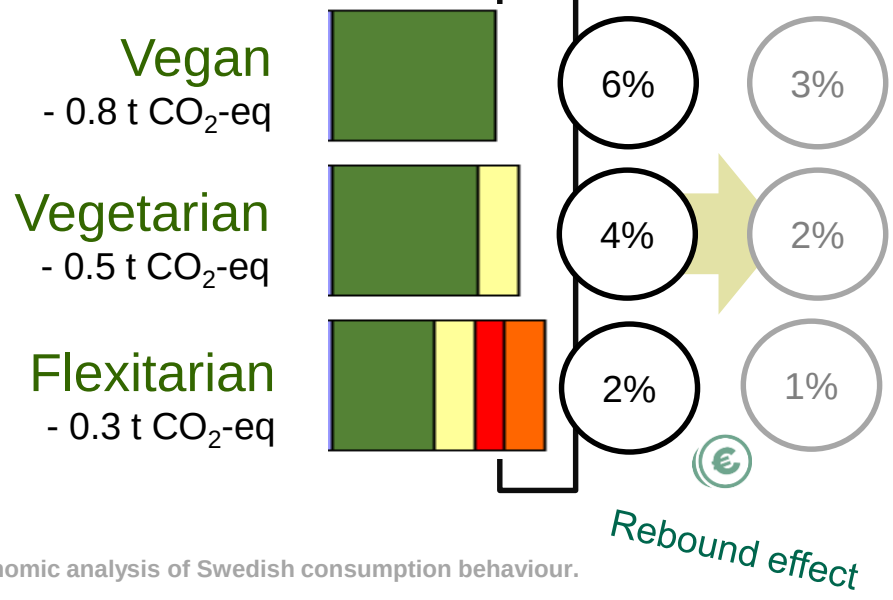


12 t CO_2-eq

Switch to plants
1-6% effect

Avoid flights
London-LA
- 1.6 t CO_2-eq
London-Rome
- 0.2 t CO_2-eq

Live car-free
- 1.0-5.3 t CO_2-eq



https://ravijen.fr/?p=440; Carbone 4; Agreste; INSEE; 2015-2016

Environmental impact of dietary change: a systematic review.
Hallström et al. (2015) Journal of Cleaner Production

The rebound effect of switching to vegetarianism. A microeconomic analysis of Swedish consumption behaviour.
Grabs (2015) Ecological Economics

The climate mitigation gap: education and government recommendations miss the most effective individual actions
Wynes & Nicholas, (2017). Environmental Research Letters

Breakdown in categories and effect of dietary shifts

One vegan meal a day is equivalent of driving from Los Angeles to New York … Starting with one meal is graspable … it's a doable thing

- Oprah Winfrey's air travels *alone* are equal to 40x the *total* yearly emission of an average American
- Her meal interventions correct for <0.001% of that output

12 t CO_2-eq

Switch to plants
1-6% effect

OPRAH URGES 42 MILLION FANS TO DITCH ANIMAL PRODUCTS AT LEAST ONCE PER DAY

Winfrey recently interviewed Amis Cameron […] "Changing one of your meals a day saves 200,000 gallons of water, and the carbon equivalent of driving from Los Angeles to New York. That's one person. So think about multiplying that out," Amis Cameron said. Winfrey was receptive to the idea and responded, "And you're not even trying to convert the whole world. You're just saying start with the one meal … that is graspable. My mind can hold that, I can receive that, it's a doable thing. I can turn that into a fun exercise. One meal a day." After the show aired, Winfrey took to social media to promote the concept of eating fewer animal products daily.

Celebrity	Hours	t CO_2
Bill Gates	356	1629
Emma Watson	71	15
Mark Zuckerberg	110	485
Oprah Winfrey	139	616
Paris Hilton	286	1261

Air travel emissions of celebrities, 2017

Celebrities, air travel, and social norms

Stefan Gössling

Annals of Tourism Research

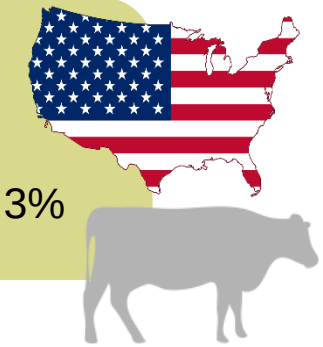
Volume 79, November 2019, 102775

https://vegnews.com/2019/10/oprah-urges-42-million-fans-to-ditch-animal-products-at-least-once-per-day

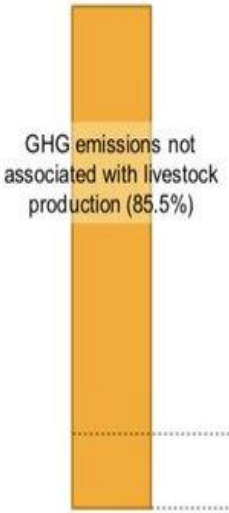
Individuals of course make up a multitude - what's on the macro level?

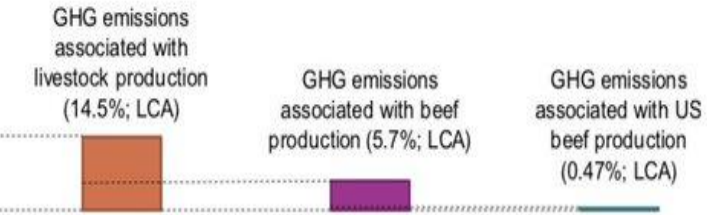
Dietary change US

- Vegan = - 2.6%
- Meatless Monday = - 0.3%



US livestock 4%





UN FAO's estimates the impact of **beef production** at **6%** of global GHG emissions (LCA) with a 95% CI of 50% due to high variability in herd parameters and land-use change emissions, meaning a contribution situated **between 3 and 9%**

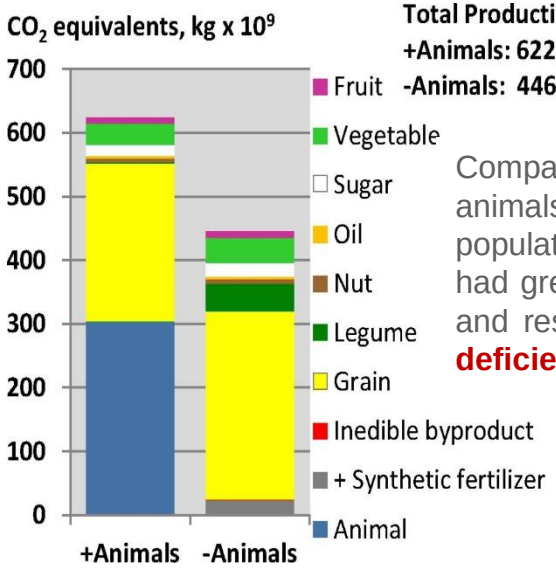
Source: Dr. S. Place

Data sources: UN FAO, 2013 Tackling Climate Change through Livestock
Rotz et al., 2019. Ag. Sys. 169: 1-13.

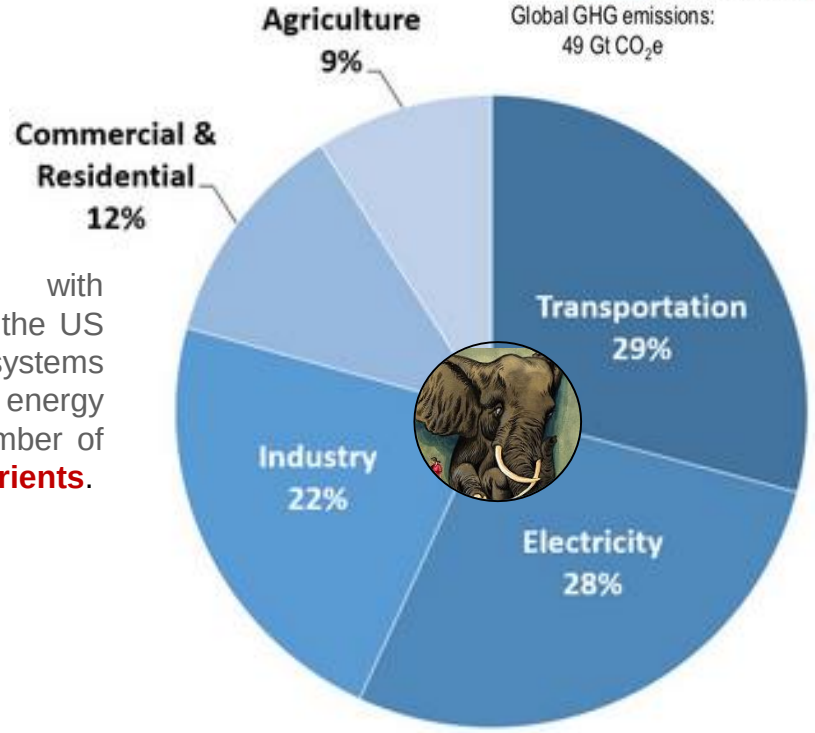
Nutritional and greenhouse gas impacts of removing animals from US agriculture

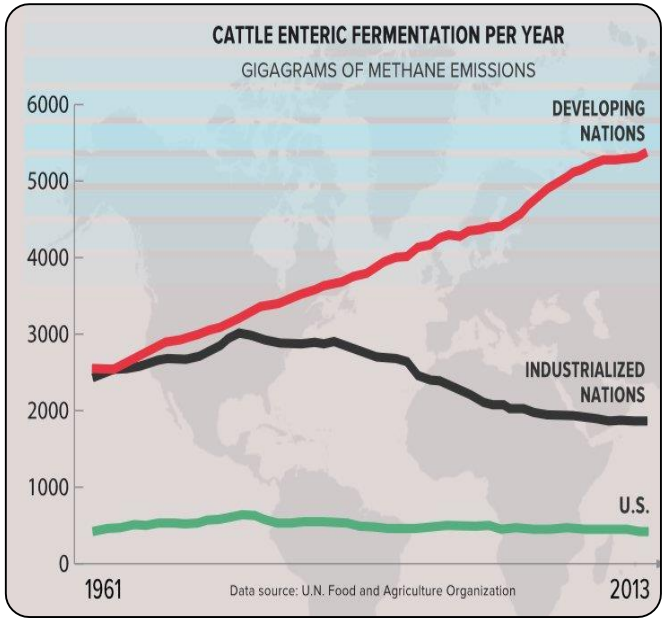
Robin R. White and Mary Beth Hall

PNAS published ahead of print November 13, 2017 https://doi.org/10.1073/pnas.1707322114

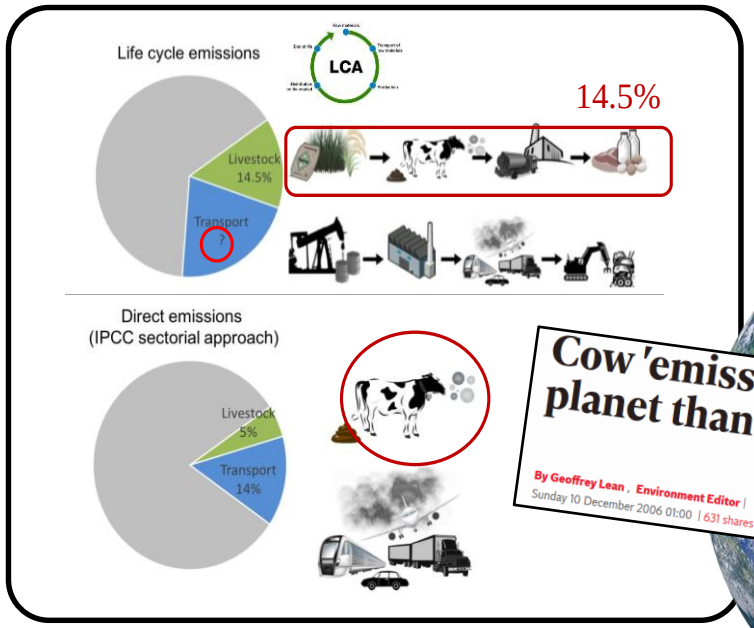


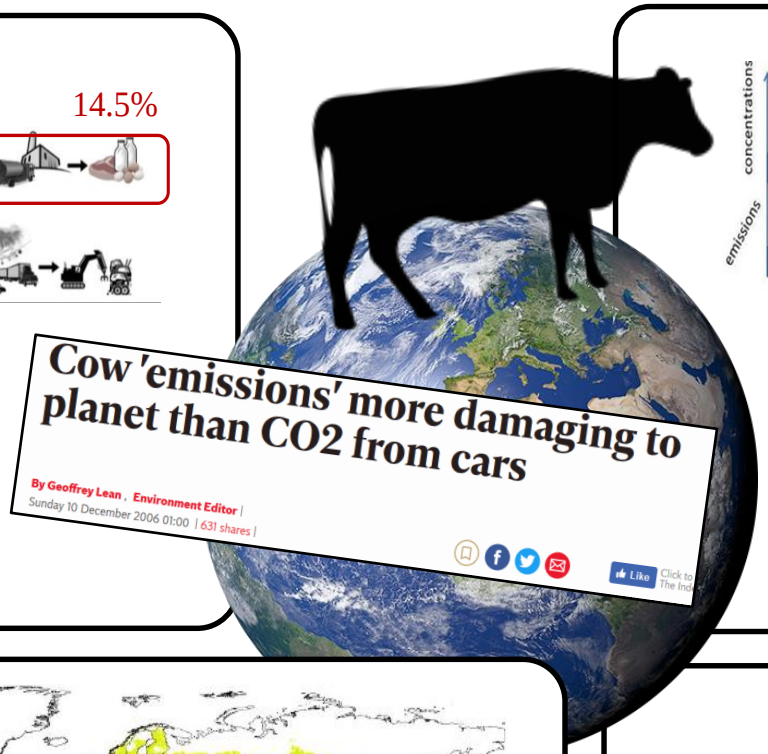
Compared with systems with animals, diets formulated for the US population in the plants-only systems had greater excess of dietary energy and resulted in a greater number of **deficiencies in essential nutrients**.





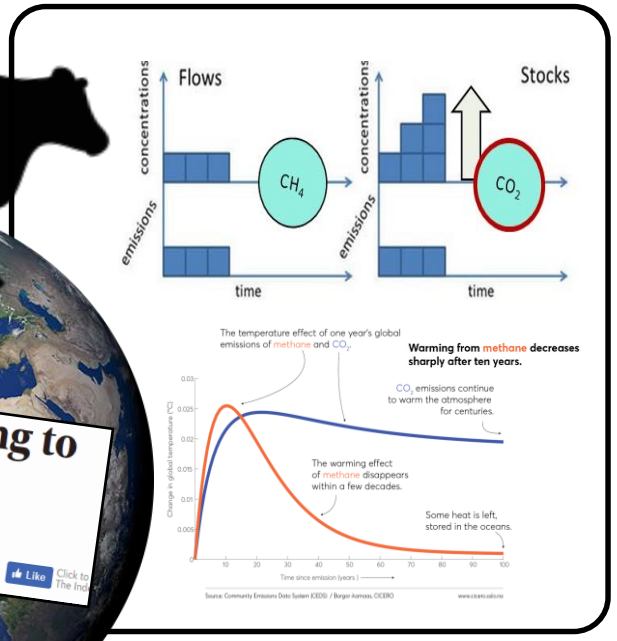
Blaming cows: not a fair game

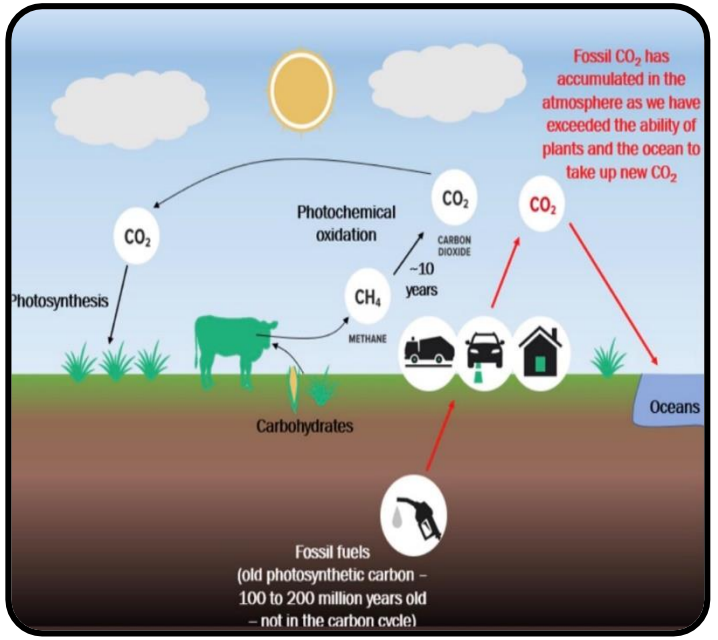


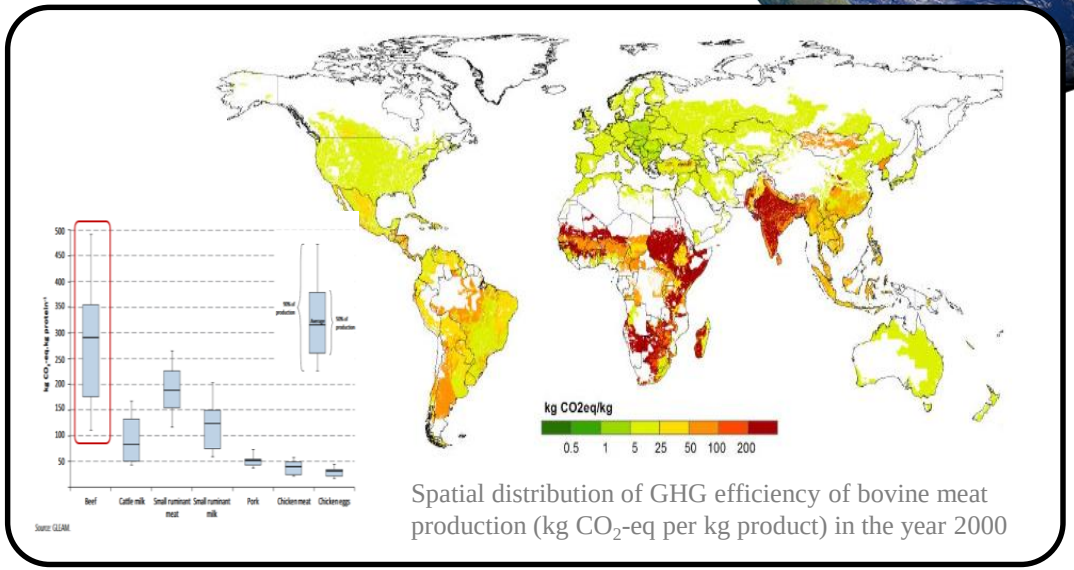


Cow 'emissions' more damaging to planet than CO2 from cars

By Geoffrey Lean , Environment Editor |
Sunday 10 December 2006 01:00 | 631 shares |







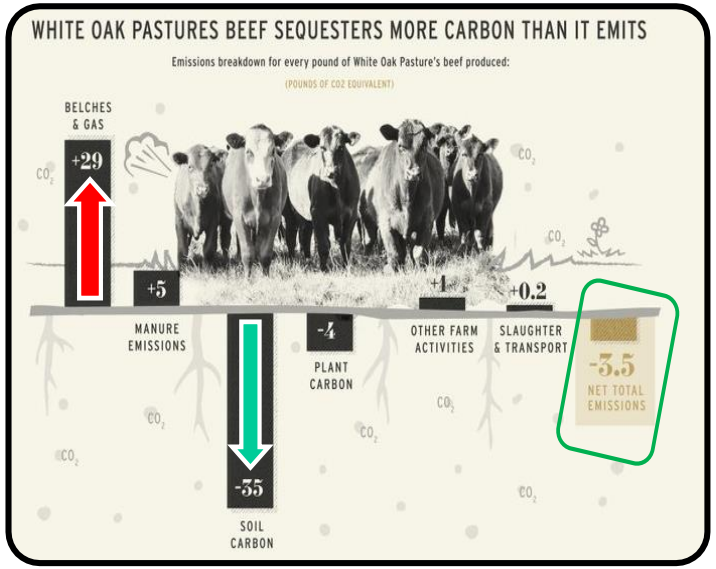
Spatial distribution of GHG efficiency of bovine meat production (kg CO_2-eq per kg product) in the year 2000

Energy and nutrient density of foods in relation to their carbon footprint FREE

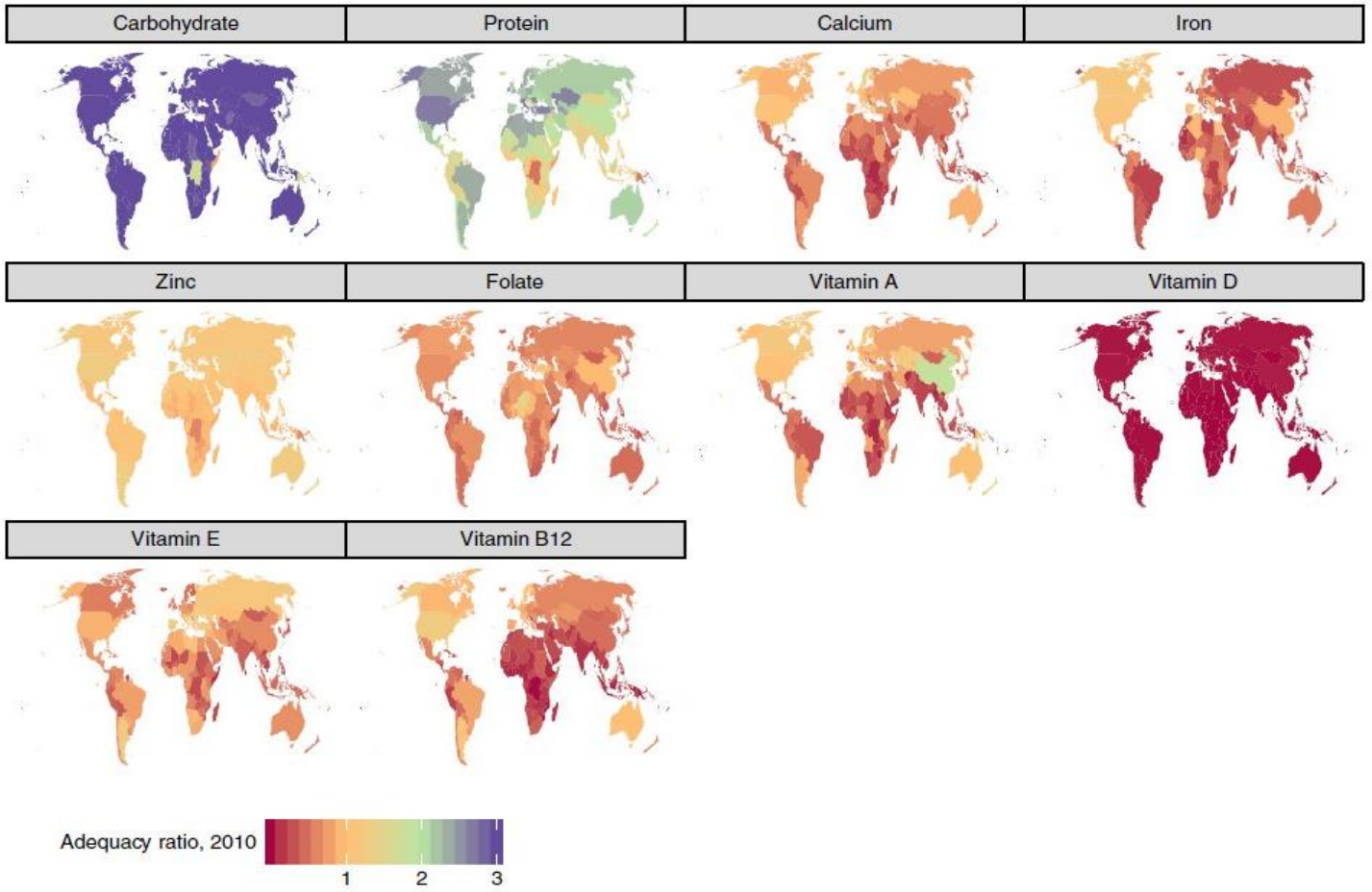
Adam Drewnowski ✉, Colin D Rehm, Agnes Martin, Eric O Verger, Marc Voinnesson, Philippe Imbert

The American Journal of Clinical Nutrition, Volume 101, Issue 1, 1 January 2015, Pages 184–191, https://doi.org/10.3945/ajcn.114.092486

One question is whether the higher GHGE cost of some foods can be offset by their **higher nutritional value**.



Global challenge is elsewhere: nutrient-dense food (not kcals, carbs or total 'protein')



Income growth and climate change effects on global nutrition security to mid-century

Gerald Nelson, Jessica Bogard, Keith Lividini, Joanne Arsenault, Malcolm Riley, Timothy B. Sulser, Daniel Mason-D'Croz, Brendan Power, David Gustafson, Mario Herrero, Keith Wiebe, Karen Cooper, Roseline Remans & Mark Rosegrant

Nature Sustainability **1**, 773–781 (2018) | Download Citation

One question is whether the higher GHGE cost of some foods can be offset by their **higher nutritional value**.

Food-First Approach to Enhance the Regulation of Post-exercise Skeletal Muscle Protein Synthesis and Remodeling

Burd et al. 2019 Sports Medicine

Table 2 **Impact of using either the protein digestibility corrected amino acid score or digestible indispensable amino acid score for determining protein content claims for nonanimal foods identified as protein foods or meat alternatives within US national dietary standards**

Protein food categories (NDB)[a]	RACC (g)[b]	Application of PDCAAS method			Application of DIAAS method		
		PDCAAS	Corrected protein content in RACC (g)[c] (%DRV)[d]	Permitted protein claim[e]	DIAAS[f]	Crude protein content in RACC (g)[g] (%DRV)[d]	Permitted protein claim[h]
Nuts and seeds							
Almonds (12 061)	30 g	39	2.5 (5.0)	No claim	40	6.3 (12.7)	No claim
Sunflower seeds (12 036)	30 g	66	4.1 (8.2)	No claim	67	6.2 (12.5)	No claim
Peanut butter (16 167)	32 g	45	3.2 (6.3)	No claim	46	7.0 (14.0)	No claim
Legumes/pulses[i]							
Navy beans	35 g dry	67	5.7 (11.5)	Good source	51	8.6 (17.2)	No claim
Whole green lentils	35 g dry	63	5.8 (11.6)	Good source	65	9.2 (18.4)	No claim
Split red lentils	35 g dry	54	5.6 (11.2)	Good source	50	10.3 (20.7)	No claim
Split yellow peas	35 g dry	64	5.7 (11.4)	Good source	73	8.8 (17.7)	No claim
Chickpeas (16 057)	35 g dry	74	5.9 (11.8)	Good source	83	7.7 (15.3)	Good source
Soy products							
Tofu (16 426)	85 g	56	8.22 (16.4)	Good source	52	14.7 (29.4)	No claim

Abbreviations: DIAAS, digestible indispensable amino acid score; DRV, daily reference value; NDB, USDA nutrient database; PDCAAS, protein digestibility-corrected amino acid score; RACC, reference amount customarily consumed.

[a]NDB is the Nutrient Database Number from the USDA Nutrient Database USDA National Nutrient Database for Standard Reference: Release 28. http://www.ars.usda.gov/Services/docs.htm?docid=8964. Accessed August 12, 2016.

[b]RACC from FDA: 21CFR101.12.[2]

[c]Corrected protein content = crude protein content in RACC × PDCAAS.

[d]Values in parentheses reflect % DRV, where the DRV for protein = 50 g[2]

[e]5–9.9 g = good source; ≥10 g = excellent source.[2]

[f]DIAAS calculated using available digestibility coefficients (ileal or fecal) or using

[g]Crude protein content per RACC, based on proposed approach in Fo report.[6]

[h]Claim based on both quantity (if crude protein, 5–9.9 g = good sour is ≥100.[6]

[i]Data from pulses, unless noted, are derived from the author's (J.D.H.)

Soy = 0.8-0.9
Legumes = 0.6
Cereals = 0.3-0.5
Animal-derived ≥1

Global challenge is elsewhere: nutrient-dense food (not kcals, carbs or total 'protein')

Meat Supplementation Improves Growth, Cognitive, and Behavioral Outcomes in Kenyan Children

Charlotte G. Neumann ✉, Suzanne P. Murphy, Connie Gewa, Monika Grillenberger, Nimrod O. Bwibo

The Journal of Nutrition, Volume 137, Issue 4, April 2007, Pages 1119–1123, https://doi.org/10.1093/jn/137.4.1119

Consumption of Animal-Source Protein is Associated with Improved Height-for-Age *z* Scores in Rural Malawian Children Aged 12–36 Months

by Yankho Kaimila [1], Oscar Divala [1], Sophia E. Agapova [2], Kevin B. Stephenson [2], Chrissie Thakwalakwa [1], Indi Trehan [2,3], Mark J. Manary [1,2] and Kenneth M. Maleta [1,*]

High protein intake from meat as complementary food increases growth but not adiposity in breastfed infants: a randomized trial

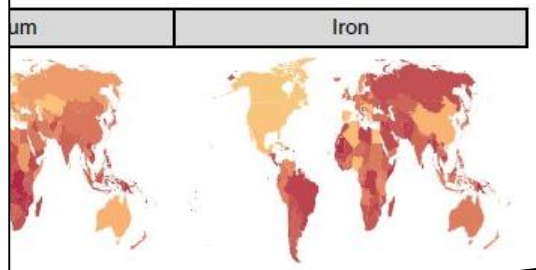
Minghua Tang ✉, Nancy F Krebs

The American Journal of Clinical Nutrition, Volume 100, Issue 5, November 2014, Pages 1322–1328, https://doi.org/10.3945/ajcn.114.088807

Income growth and climate change effects on global nutrition security to mid-century

Gerald Nelson ✉, Jessica Bogard, Keith Lividini, Joanne Arsenault, Malcolm Riley, Timothy B. Sulser, Daniel Mason-D'Croz, Brendan Power, David Gustafson, Mario Herrero, Keith Wiebe, Karen Cooper, Roseline Remans & Mark Rosegrant

Nature Sustainability **1**, 773–781 (2018) | Download Citation ↓



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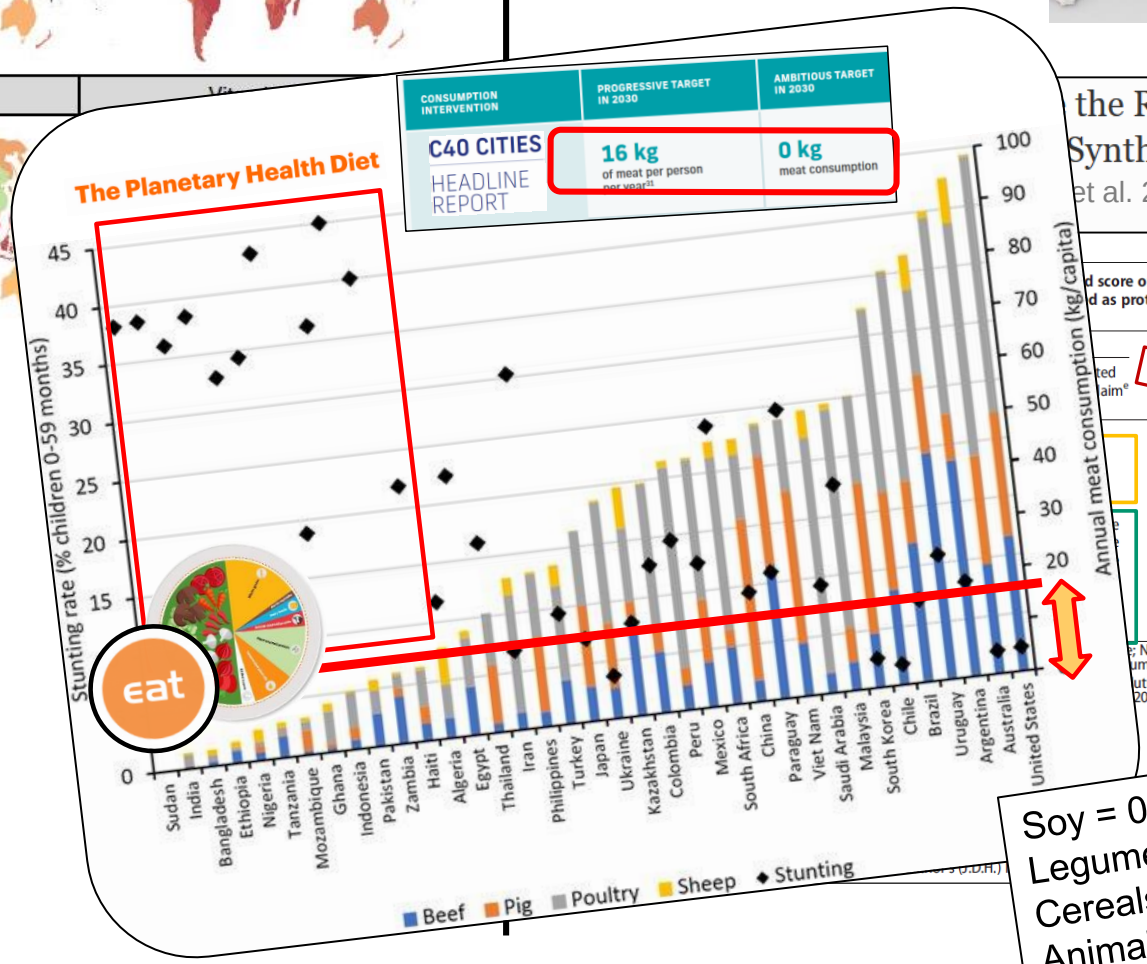


the Regulation of Post-Synthesis and

et al. 2019 Sports Medicine

d score or digestible indispensable amino acid d as protein foods or meat alternatives within

	Application of DIAAS method		
	DIAAS[f]	Crude protein content in RACC (g)[g] (%DRV)[d]	Permitted protein claim[h]
		40	6.3 (12.7)	No claim
		67	6.2 (12.5)	No claim
		46	7.0 (14.0)	No claim
		51	8.6 (17.2)	No claim
		65	9.2 (18.4)	No claim
		50	10.3 (20.7)	No claim
		73	8.8 (17.7)	No claim
		83	7.7 (15.3)	Good source
		52	14.7 (29.4)	No claim

NDB, USDA nutrient database; PDCAAS, umed.
utrient Database for Standard Reference: 2016.

Soy = 0.8-0.9
Legumes = 0.6
Cereals = 0.3-0.5
Animal-derived ≥1

Is livestock (meat/dairy) used as a scapegoat?

The cement industry produces 7% of man-made CO_2. If it were a country, it would trail only the US and China in emissions of CO_2. China used more cement between 2011 and 2013 than the U.S. used in the entire 20th Century.

The carbon footprint of global tourism

Manfred Lenzen, Ya-Yen Sun, Futu Faturay, Yuan-Peng Ting, Arne Geschke & Arunima Malik

Nature Climate Change **8**, 522–528 (2018) | Download Citation

Global tourism accounts for 8% of the world's GHGE

Assessing ICT global emissions footprint: Trends to 2040 & recommendations

Lotfi Belkhir, Ahmed Elmeligi

ICT is expected to reach >14% by 2040
(by 2020, the footprint of **smart phones** alone would surpass the individual contribution of desktops, laptops and displays)

IF FOOD WASTE WERE A COUNTRY

Producing food that's never eaten creates 3.3 Gigatonnes of climate change pollution per year, according to the FAO. If all of that food waste were a country, it would be the world's third biggest annual greenhouse gas emitter.

FAO: 30% of the world's agricultural land is currently occupied to produce food that is never eaten; food waste is up to 20% of purchases

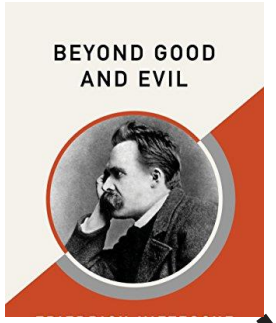
Environmental impacts of food consumption by dogs and cats

Gregory S. Okin

Published: August 2, 2017 • https://doi.org/10.1371/journal.pone.0181301

US pet feed impact is 25–30% of the environmental impact from animal production

Where next? Optimisation and - especially - avoidance of binary simplisms



Plant
Animal

Basis of the evolutionary, species-adapted diet

Genetic adaptations

Neolithic additions

Contemporary additions

Prevalence of Optimal Metabolic Health in American Adults: National Health and Nutrition Examination Survey 2009–2016

Metabolic Syndrome and Related Disorders

Only 12% of the US adult population is at optimal metabolic health level, based on waist circumference, blood pressure, blood glucose, HgA1c, triglycerides, HDL, and absence of medication for pressure, glucose, or cholesterol