# Plant-based diets: any key benefits?

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Plant-based diets in the news

Hillary: Bill's not a 'smug vegan'

BY MARK HENSCH - 04/19/16 09:49 AM EDT

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Stephen Interviews Hillary Clinton At Carnegie Deli

So what's the matter with all those plant-eaters?

- Health implications
- Environmental implications
- Future food systems

Health implications

Imbalanced diets are responsible for the greatest health burden globally and in most regions (Lim et al, 2013).

	Global	High-income Asia Pacific	Western Europe	Australasia	High-income North America	Central Europe	Southern Latin America	Eastern Europe	East Asia	Tropical Latin America	Central Latin America	Southeast Asia	Central Asia	Andean Latin America	North Africa and Middle East	Caribbean	South Asia	Oceania	Southern Sub-Saharan Africa	Eastern Sub-Saharan Africa	Central Sub-Saharan Africa	Western Sub-Saharan Africa
Dietary risks	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	3	4	4	
High blood pressure	2	2	2	2	3	2	2	2	2	2	2	2	2	2	2	2	5	1	1	3	3	
Smoking	3	3	3	3	2	3	4	4	3	3	5	3	3	4	4	3	4	4	6	8	9	9
Household air pollution	4	23	24	24	24	10	14	13	5	11	9	4	9	8	13	7	3	6	8	2	2	2
High fasting plasma glucose	5	6	7	6	6	7	6	8	6	5	4	5	6	5	6	4	5	1	5	6	7	7
High body-mass index	6	7	4	4	4	4	3	5	9	4	3	9	4	3	3	5	12	3	3	10	15	10
Ambient PM pollution	7	5	8	11	8	8	11	9	4	12	10	7	7	13	7	11	6	16	15	12	12	8
Physical inactivity	8	4	5	5	5	5	5	6	7	7	7	6	5	7	5	6	7	7	7	9	8	11
Alcohol use	9	8	9	8	9	9	8	3	8	6	6	8	10	6	10	8	9	8	4	5	6	5
High total cholesterol	10	9	6	7	7	6	7	7	10	8	8	10	8	9	8	9	11	9	12	17	19	19
Childhood underweight	11	22	21	19	20	20	20	21	21	19	14	14	15	16	14	14	10	10	10	4	1	1

Leading risk factors for death in 2010 (GBD, 2013)

Associations of risk factors and disease mortality:

Risk factor	Statistics	CHD	Stroke	Cancer	T2DM	Other	Colon and rectum cancers	Mouth and oropharynx cancers	Oesophagus cancer	Stomach cancer	Trachea, bronchus, lung cancers
red meat	mean	1.00	1.13	1.00	1.13	1.00	1.29	1.00	1.00	1.00	1.00
red meat	high	1.00	1.23	1.00	1.23	1.00	1.60	1.00	1.00	1.00	1.00
red meat	low	1.00	1.03	1.00	1.03	1.00	1.04	1.00	1.00	1.00	1.00
processed meat	mean	2.02	1.23	1.00	1.74	1.00	1.46	1.00	1.00	1.00	1.00
processed meat	high	3.57	1.44	1.00	2.19	1.00	2.02	1.00	1.00	1.00	1.00
processed meat	low	1.15	1.04	1.00	1.42	1.00	1.08	1.00	1.00	1.00	1.00
fruit	mean	0.93	0.90	1.00	1.00	1.00	1.00	0.72	0.56	0.67	0.93
fruit	high	0.96	0.93	1.00	1.00	1.00	1.00	0.87	0.74	0.76	0.96
fruit	low	0.90	0.86	1.00	1.00	1.00	1.00	0.59	0.42	0.59	0.88
vegetable	mean	0.90	1.00	1.00	0.88	1.00	1.00	0.52	0.48	0.49	1.00
vegetable	high	0.95	1.00	1.00	0.99	1.00	1.00	0.67	0.69	0.62	1.00
vegetable	low	0.84	1.00	1.00	0.77	1.00	1.00	0.40	0.34	0.38	1.00

Associations of diets and disease mortality (Aleskandrowicz et al, 2016):

Table 2. Health effects of sustainable dietary patterns.

Study		Country	Sustainable diet type	Health indicator	Change in health indicator (95% CI)*
Sabate 2015	74	US/Canada	Vegan	All-cause mortality rate	19.2%
Soret 2014	50	US/Canada	Vegetarian	All-cause mortality risk	9% (0–17)
Tilman 2014	8	Globally	Vegetarian	All-cause mortality risk	<1% (0–2)**
Sabate 2015	74	US	Vegetarian	All-cause mortality rate	15.9%
Aston 2012	21	UK	Meat partially replaced by mixed food	CHD risk (men)	9.7% (-3.5–22)
Aston 2012	21	UK	Meat partially replaced by mixed food	CHD risk (women)	6.4% (-1.8–14.3)
Aston 2012	21	UK	Meat partially replaced by mixed food	Diabetes mellitus risk (men)	12% (-4.5–22.7)
Aston 2012	21	UK	Meat partially replaced by mixed food	Diabetes mellitus risk (women)	7.5% (0.5–14.5)
Aston 2012	21	UK	Meat partially replaced by mixed food	Colorectal cancer risk (men)	12.2% (6.4–18.0)
Aston 2012	21	UK	Meat partially replaced by mixed food	Colorectal cancer risk (women)	7.7% (4.0–11.3)
Soret 2014	50	US/Canada	Meat partially replaced by mixed food	All-cause mortality risk	14% (4–23)
Sabate 2015	74	US/Canada	Meat partially replaced by mixed food	All-cause mortality rate	7.2%
Biesbroek 2014	25	Netherlands	Meat partially replaced by plant-based food	All-cause mortality risk	10% (3–16)
Biesbroek 2014	25	Netherlands	Meat partially replaced by dairy	All-cause mortality risk	6% (-4–14)
Tilman 2014	8	Globally	Mediterranean	All-cause mortality risk	18% (17–19)
Sabate 2015	74	US/Canada	Pescatarian	All-cause mortality rate	17.6%
Milner 2015	79	UK	Healthy guidelines	Years of life lost†	6%
Milner 2015	79	UK	Healthy guidelines + further optimisation	Years of life lost†	7%
Scarborough 2012	80	UK	Meat, dairy partially replaced by plant-based food	Deaths averted	6%
Scarborough 2012	80	UK	Ruminants replaced by monogastric	Deaths averted	<1%

*Percentages refer to reductions in health indicators, except for deaths averted

**Mortality risk reduction by cause: cancer 10%, coronary heart disease 20%, type 2 diabetes 42%

†Years of life lost, at year 30 (after adoption of the sustainable diet scenario)

Health implications

Statement of the American Dietetic Association (2009):

ABSTRACT

It is the position of the American Dietetic Association that appropriately planned vegetarian diets, including total vegetarian or vegan diets, are healthful, nutritionally adequate, and may provide health benefits in the prevention and treatment of certain diseases. Well-planned vegetarian diets are appropriate for individuals during all stages of the life cycle, including pregnancy, lactation, infancy, childhood, and adolescence, and for athletes. A vegetarian diet is defined

Environmental implications

The food system is responsible for $> 25\%$ of all GHG emissions (Vermeulen et al, 2012).
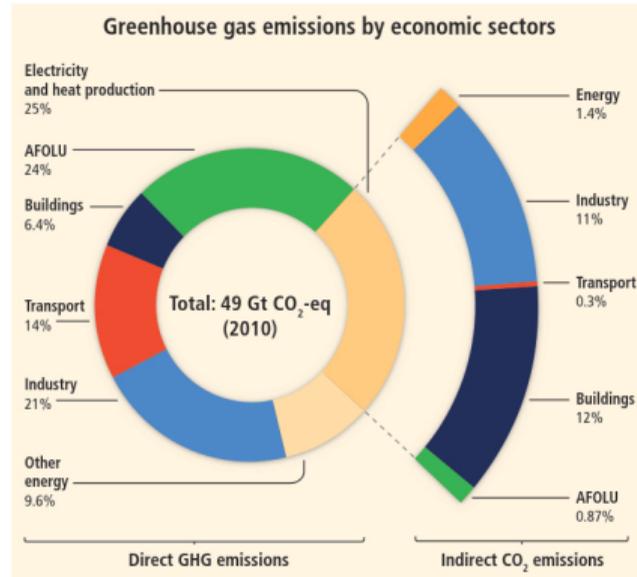
Total GHG emissions (IPCC AR5, 2015),
including agriculture, forestry and other land use (AFOLU)

Environmental implications

Most food-related emissions are associated with livestock production (Steinfeld et al, 2006; Tubiello et al, 2014).
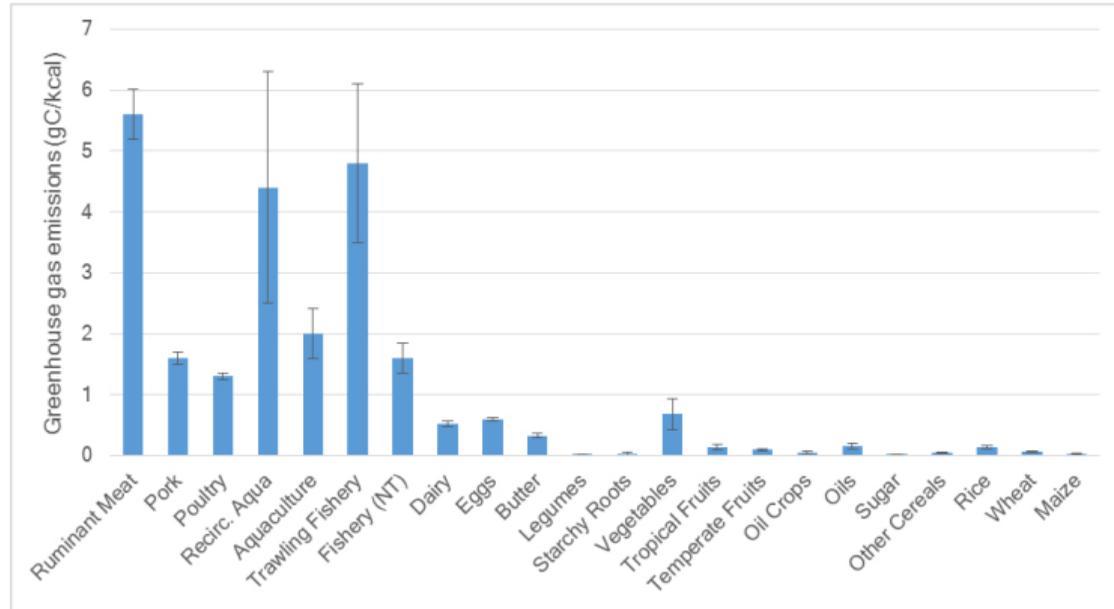
Greenhouse gas emissions intensities (Tilman and Clark, 2014)

Where do livestock emissions come from (Gerber et al, 2013)?
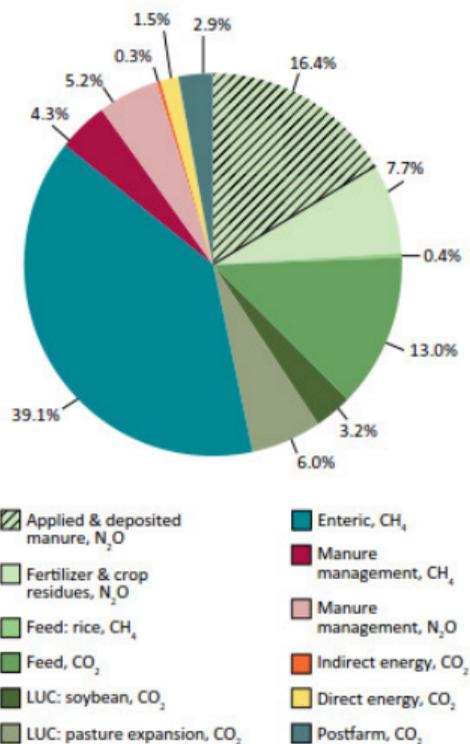
Environmental implications

GHG emissions reductions associated with dietary change (Aleskandrowicz et al, 2016)
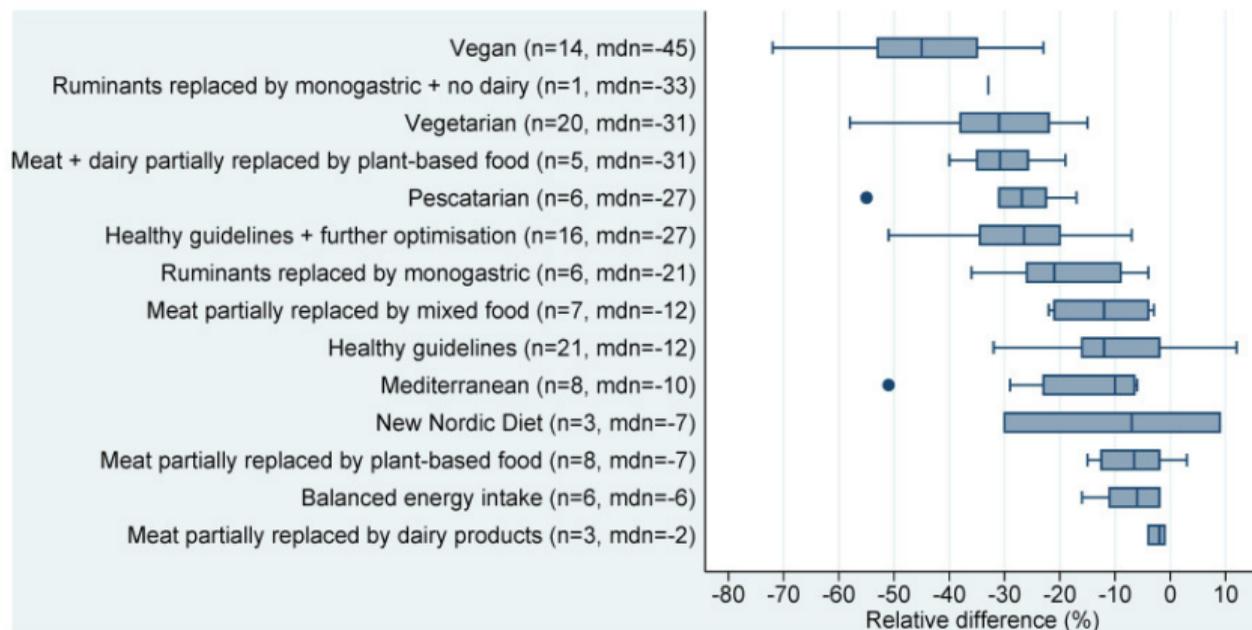
Fig 2. Relative differences in GHG emissions (kg CO$_2$eq/capita/year) between current average diets and sustainable dietary patterns. Note: n = number of studies, mdn = median.

Environmental implications

Land-use change associated with dietary change (Aleskandrowicz et al, 2016)
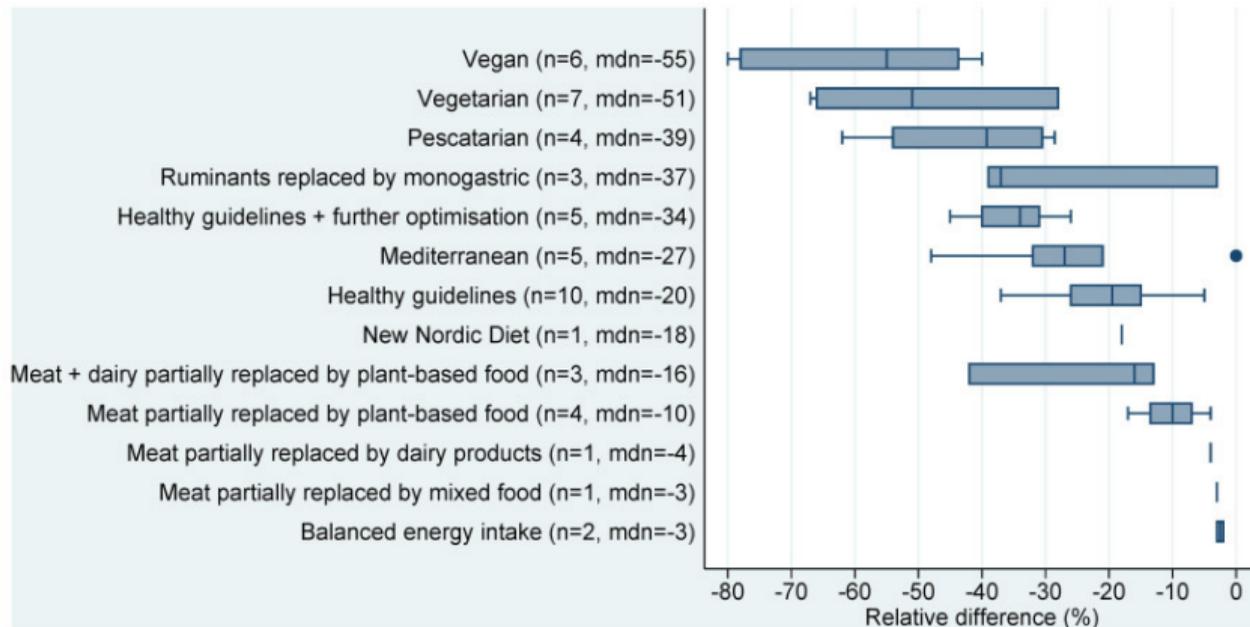
Fig 3. Relative differences in land use (m²/capita/year) between current average diets and sustainable dietary patterns. Note: n = number of studies, mdn = median.

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Take-away message so far:

- (Well-planed) plant-based diets are more environmentally friendly and likely healthier than omnivorous diets.
- Future socio-economic developments could change plant-based diets from a luxury and personal choice to a necessity.

# Analysis and valuation of the health and climate change cobenefits of dietary change

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Observations and projections:

- Globalization and urbanization have led to Western dietary habits, and to greater availability of energy-dense foods and more sedentary lifestyles (Popkin, 2006).
- Population and income growth will require 60% more food to be produced in 2050, and result in continued dietary changes (FAO, 2012):
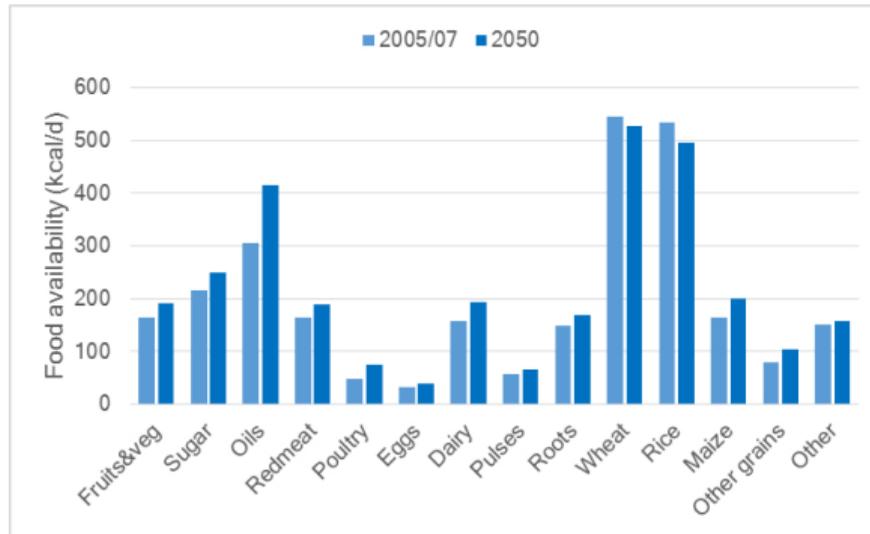
Less countries expected to meet basic dietary guidelines:
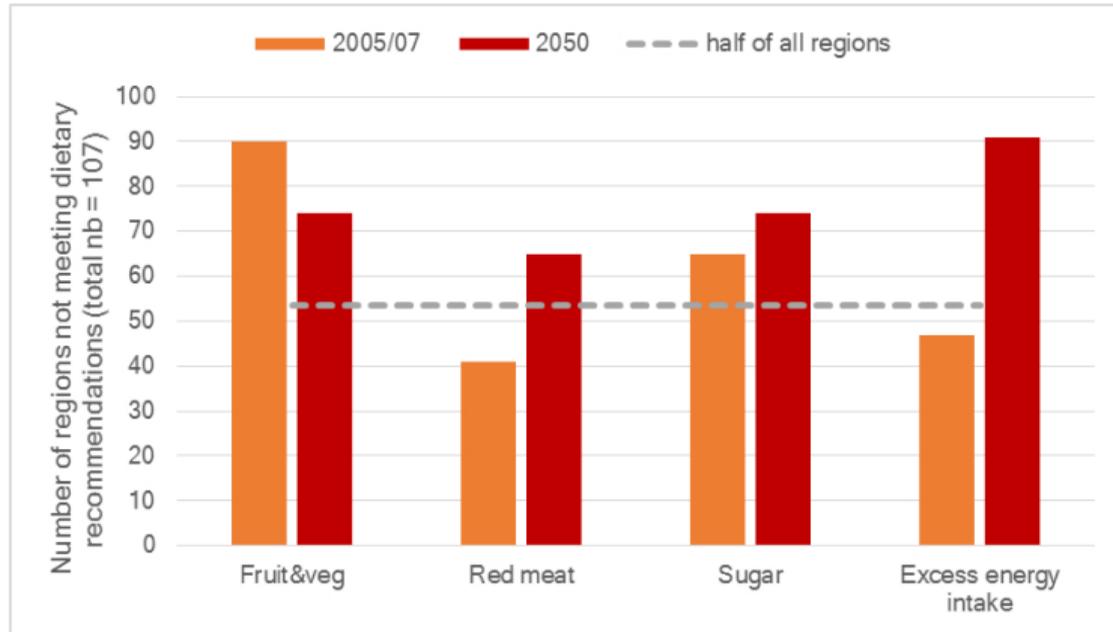
Harder to keep global warming to below 2 degrees C:
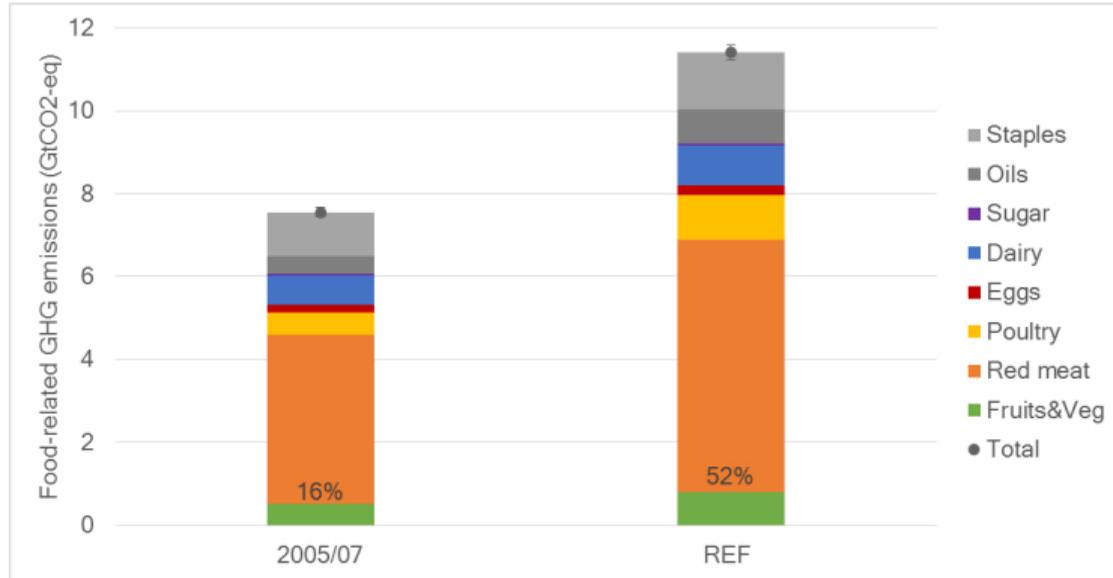
Dietary scenarios for 2050

Scenarios	Features	Comments
Reference (REF)	Global energy intake per capita increases by 13% between 2005/07 and 2050; per-capita consumption (in grams) increases by 15% for fruits and vegetables, 15% for sugar, 35% for oils, 13% for red meat, 63% for poultry, 19-21% for eggs and dairy, 14% for roots and pulses, 20% for maize, and 32% for other grains, except wheat and rice whose consumption stays constant (wheat) or decreases by by 5% (rice).	Based on projections by the Food and Agriculture Organization of the United Nations (FAO) (26), adjusted for food waste and food conversion into edible parts (27).
Global dietary guidelines (HGD)	Min five portions per day of fruits&veg, max 300 grams per week of red meat, less than 50 grams per day of sugar, total energy intake as recommended for moderately active population (2200-2300 kcal per day).	Based on global dietary recommendations by the World Cancer Research Fund (28) and WHO/FAO Expert Consultations on diet and nutrition (16) and human energy requirements (29).
Vegetarian (VGT)	Min six portions per day of fruits&veg, one portion per day of legumes, no red meat or poultry (or fish), sugar and total energy intake as recommended in HGD scenario.	Based on observed dietary patterns (30-31)
Vegan (VGN)	Min seven portions per day of fruits&veg, one portion per day of legumes, no red meat, poultry, dairy, or eggs (or fish), sugar and total energy intake as recommended in HGD scenario.	Based on observed dietary patterns (30-31).

Research objective

This study:

- Link and compare the health and environmental consequences of changing diets on a region, risk factor, and commodity-specific level.

Methods:

1. Health analysis:
    - Global comparative risk assessment of changes in dietary and weight-related risk factors (fruit & veg, red meat, overweight, obesity) on NCD mortality (CHD, stroke, cancer, T2DM);
2. Environmental analysis:
    - Life-cycle analysis of food consumption based on a recent meta-analysis (Tilman and Clark, 2014);
3. Economic valuation:
    - Social cost of carbon (IAM comparison), value of statistical life (OECD review), cost-of-illness studies (EU-level)

# Results: Health Analysis

Avoided deaths globally:
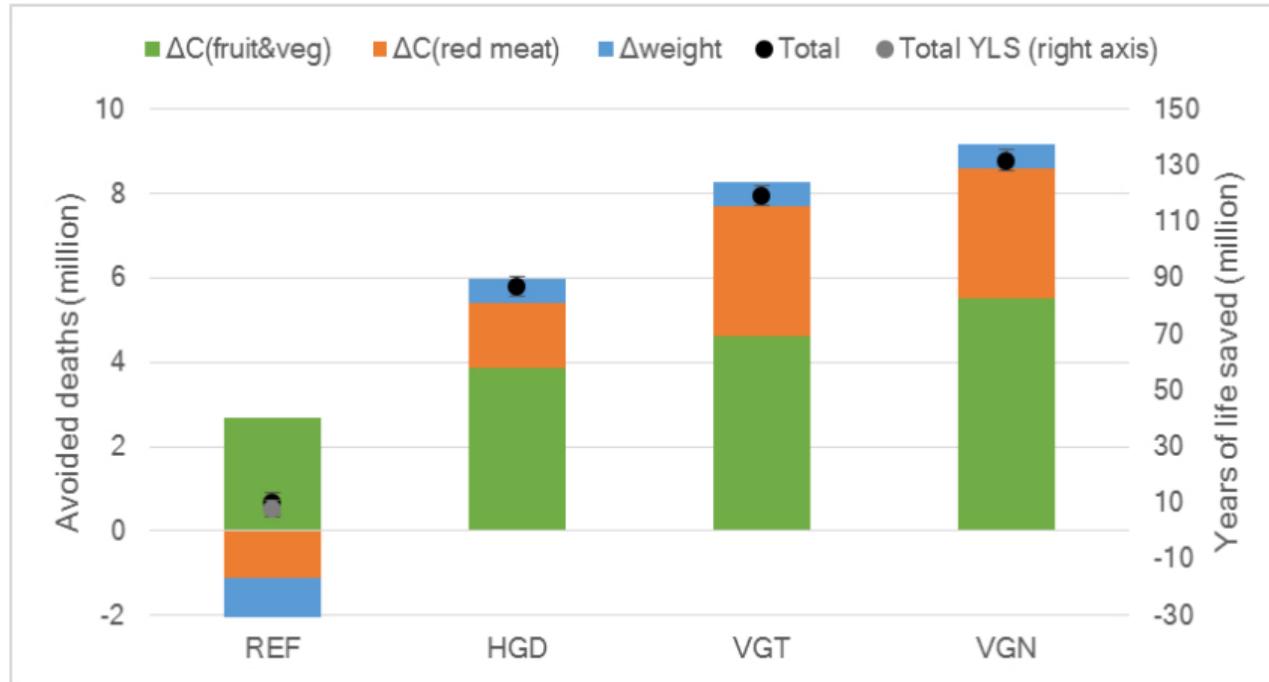
Results: Health Analysis

Avoided deaths by region:
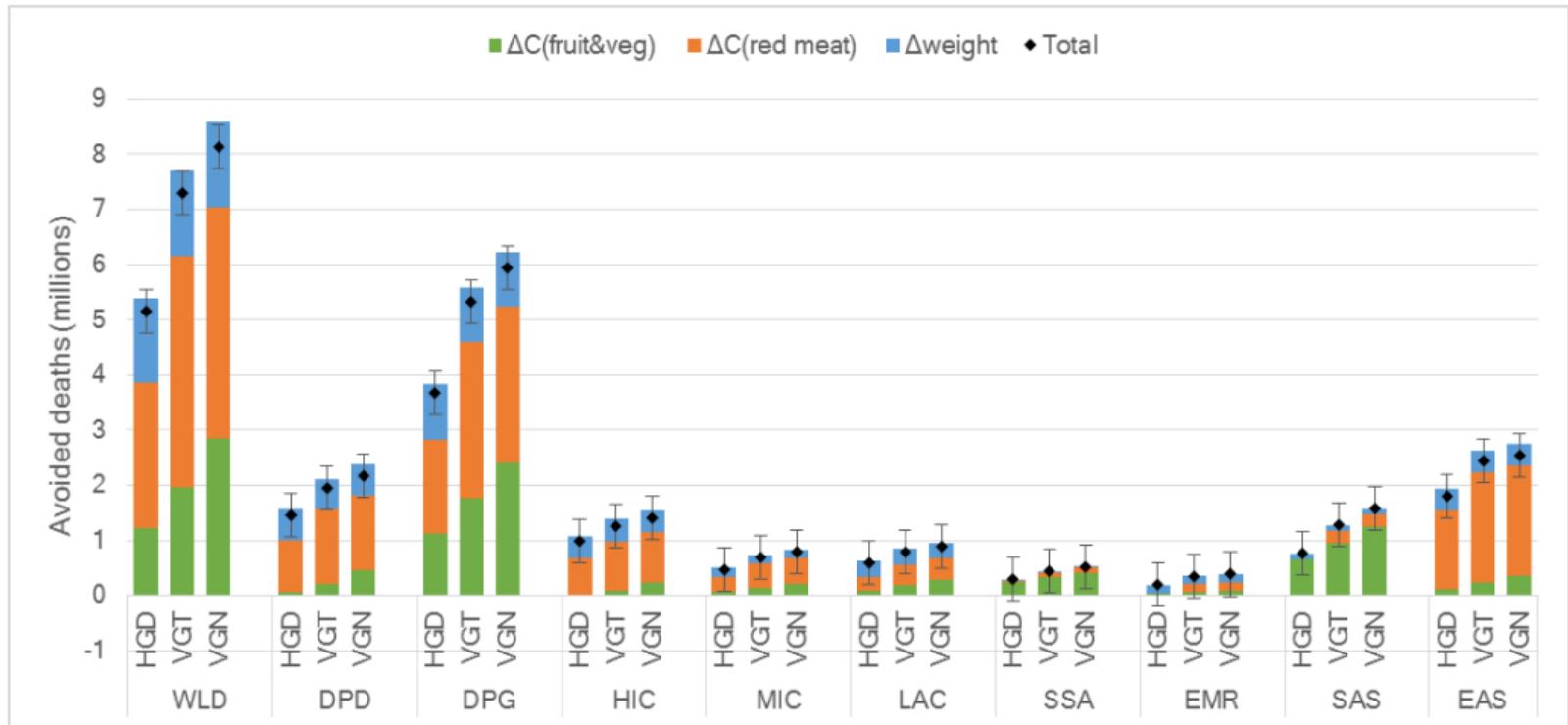
Results: Health Analysis

Avoided deaths by region per capita:
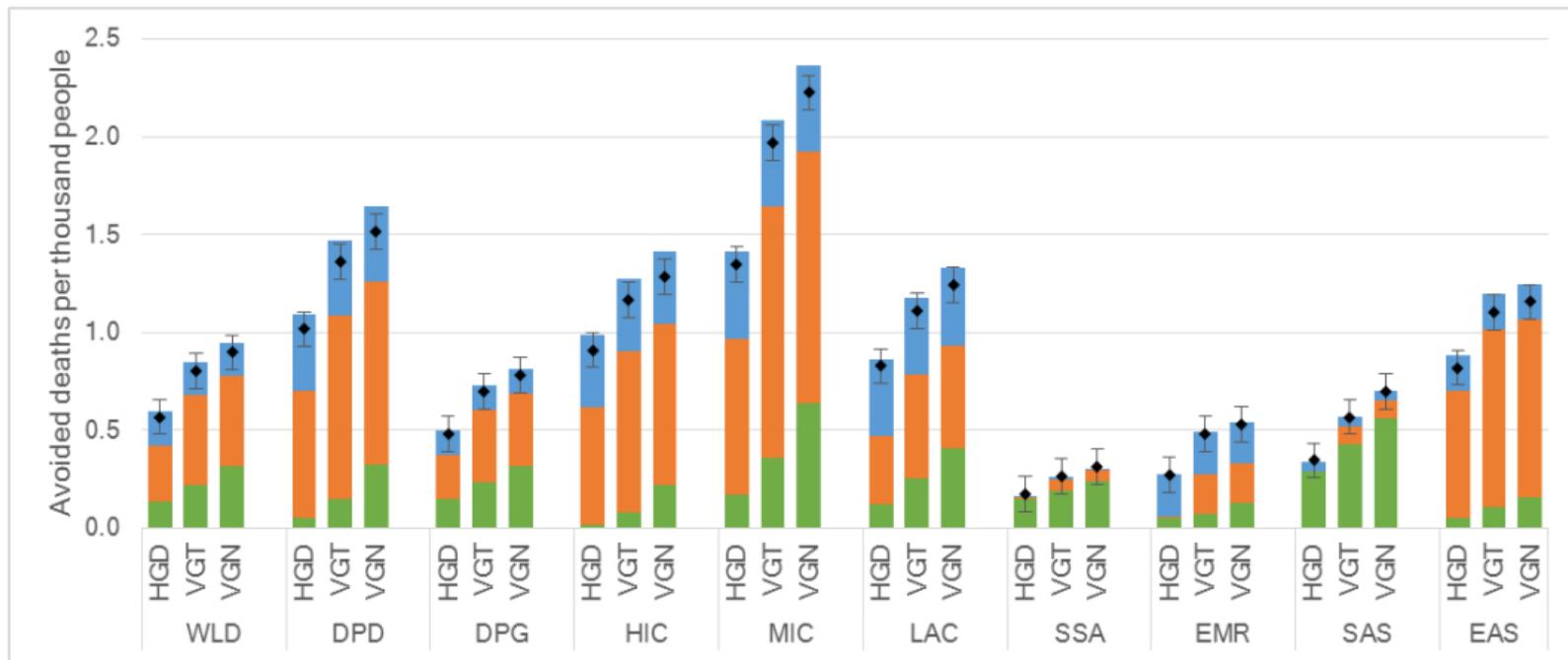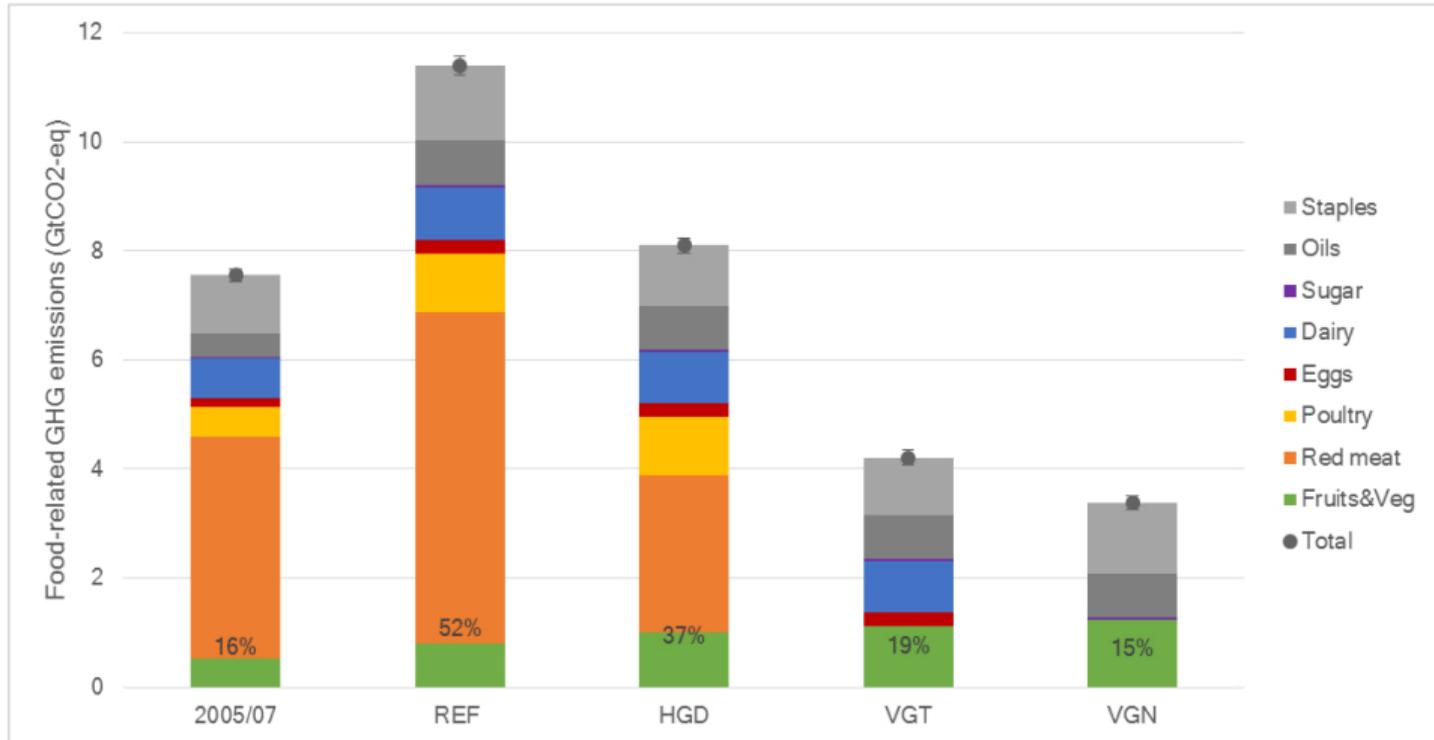
Food-related GHG emissions:

Food-related GHG emissions per capita (HGD vs REF):

GHG emissions (tCO2-eq) per cap. (HGD vs REF)

- -3.06 - -1.75
- -1.74 - -1.25
- -1.24 - -0.75
- -0.74 - -0.25
- -0.24 - 0.00
- 0.01 - 1.25
- No data
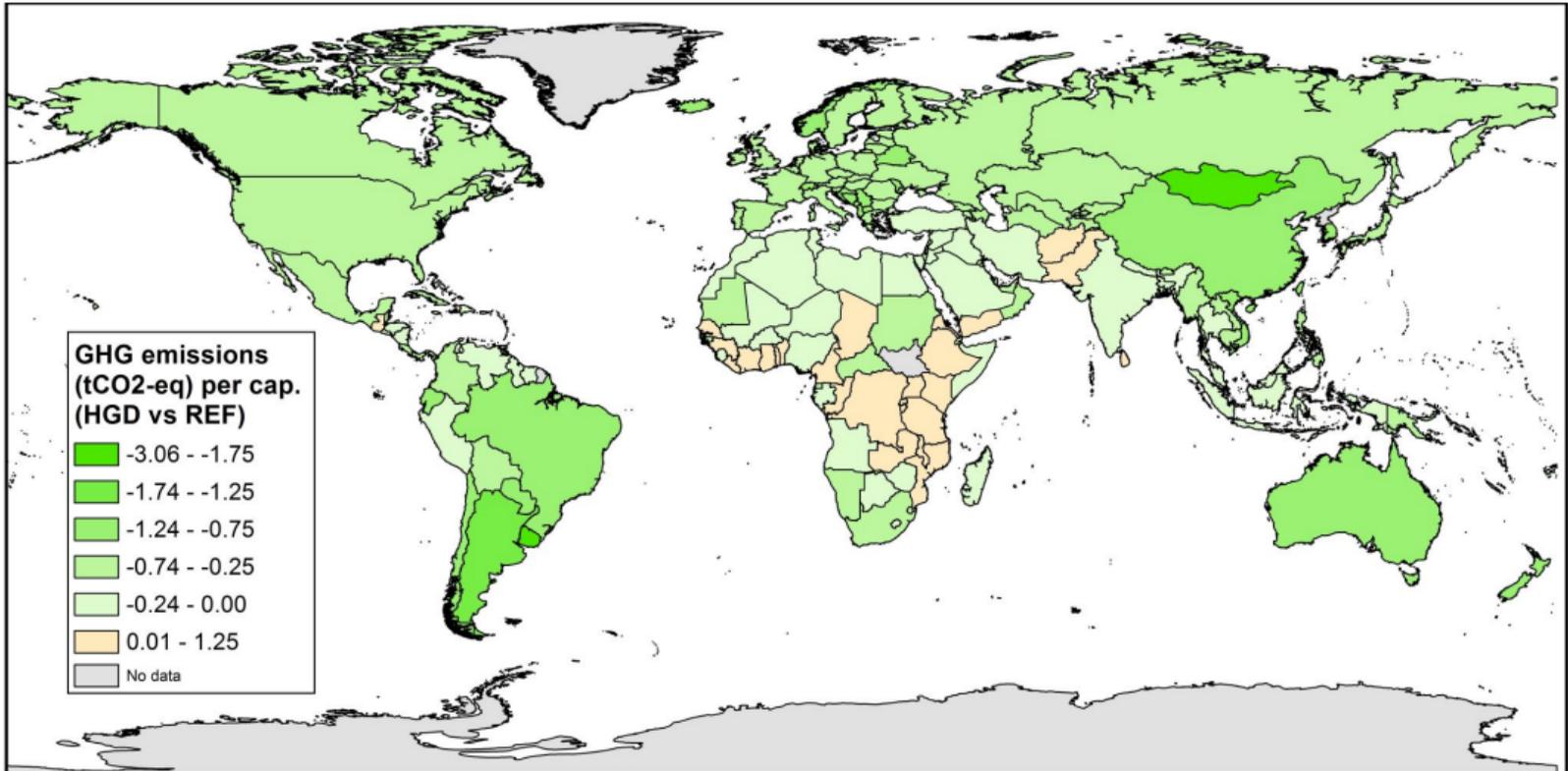
Results: Environmental Analysis

Food-related GHG emissions per capita (VGT vs REF):

GHG emissions (tCO2-eq) per cap. (VGT vs REF)
- -3.70 - -1.75
- -1.74 - -1.25
- -1.24 - -0.75
- -0.74 - -0.30
- -0.29 - 0.00
- 0.01 - 0.00
- No data
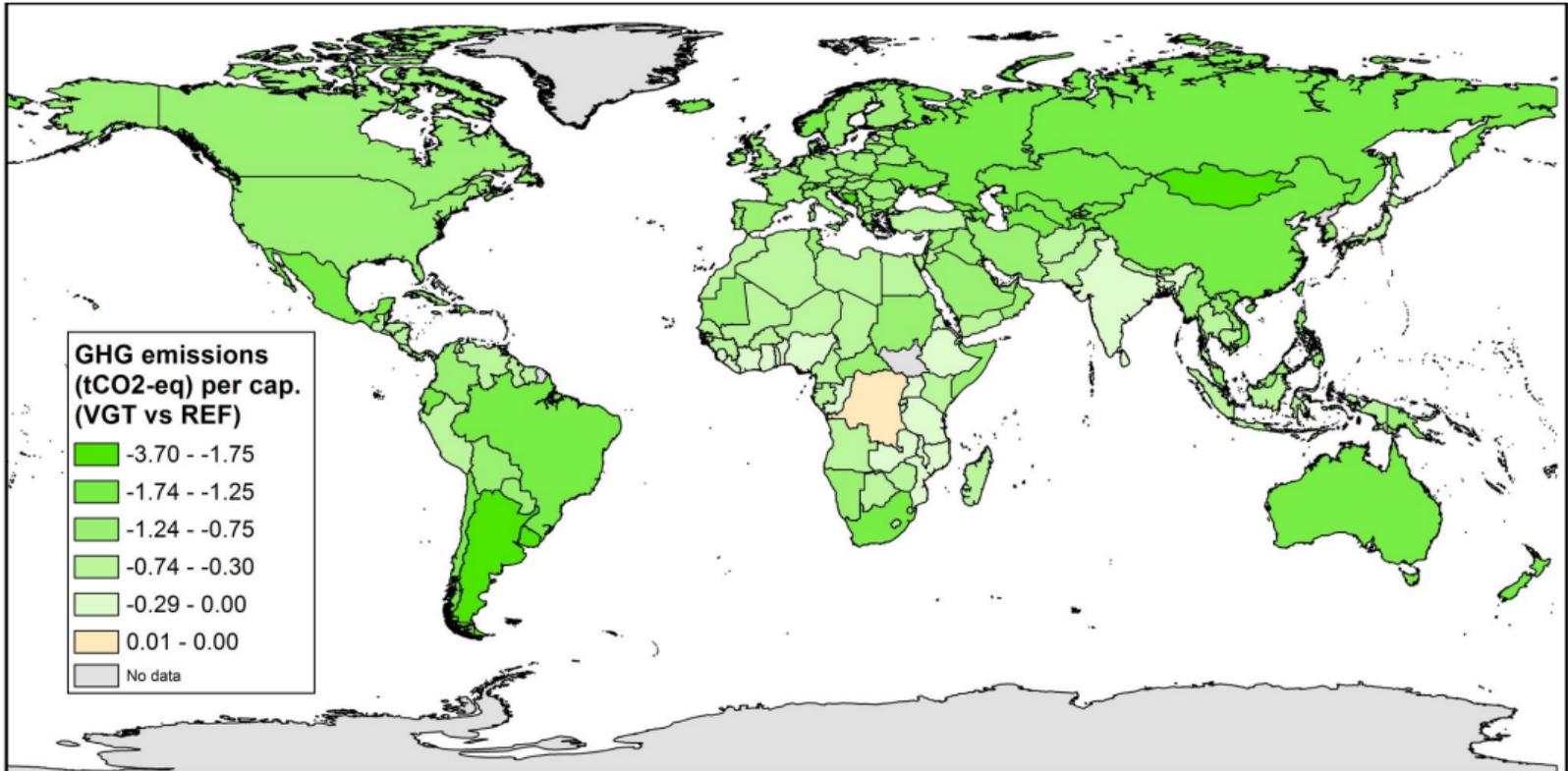
Results: Environmental Analysis

Food-related GHG emissions per capita (VGN vs REF):

GHG emissions
(tCO2-eq) per cap.
(VGN vs REF)

- -3.82 - -1.75
- -1.74 - -1.25
- -1.24 - -0.75
- -0.74 - -0.25
- -0.24 - 0.00
- 0.01 - 0.02
- No data
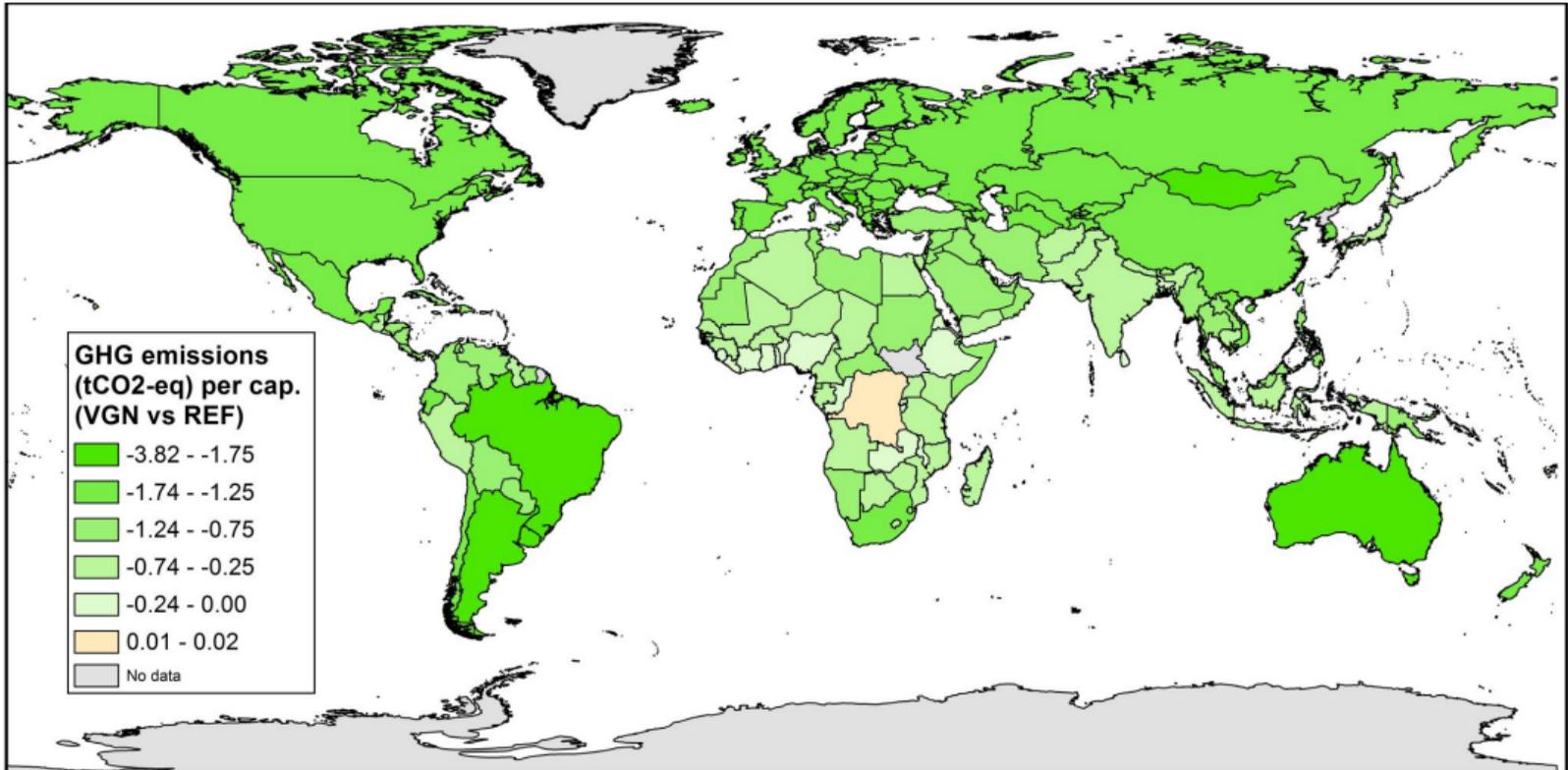
Value of environmental and health benefits:
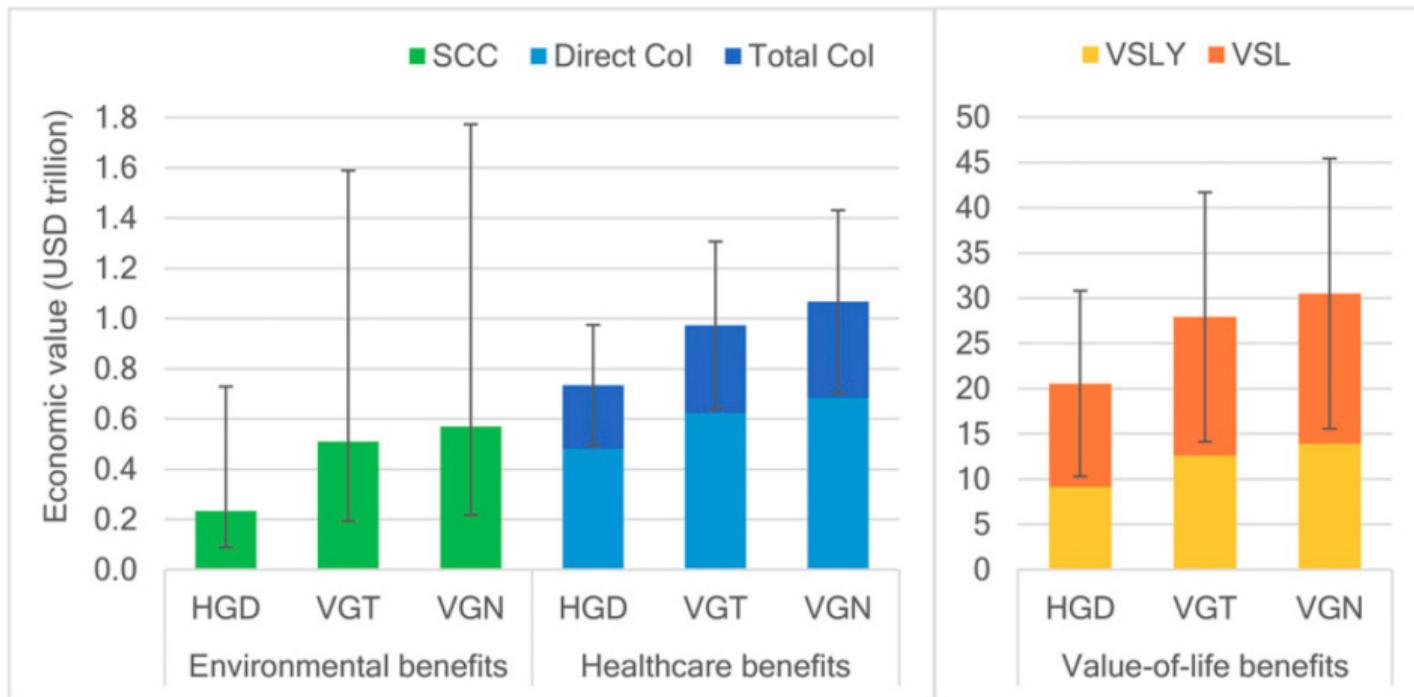
Take-away messages:

- Dietary change towards more plant-based diets could be beneficial for health and the environment, and necessary for avoiding dangerous levels of climate change.

- The size of the projected benefits should encourage individuals, industry, and policy makers to act decisively to make sure that what we eat preserves our environment and our health.

- Not a small task: to achieve minimum global dietary guidelines (HGD) would require 25% increase in global fruit & veg consumption, 56% reduction in red meat consumption, and 15% reduction in energy intake.

If you consider to adopt a plant-based diet, don't be stupid…

LIVING

My vegan diet almost killed me

By Jane Ridley   November 4, 2015 | 6:00am

A fit Jordan Younger today (right), and at 105 pounds two years ago (left). The former vegan now eats eggs, fish and, on occasion, red meat.
Photo: Tynan Daniels

Contact

Thank you for your attention.

Comments and suggestions:

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Back-up slides

Comparative risk assessment model:

- 4 risk factors (fruit&veg, red meat, overweight, obesity)
- 5 causes of death (CHD, stroke, cancer, T2DM, other)
- mortality and weight data from UNPD and WHO
- relative risks from meta-analyses of cohort studies

Risk factor	Relative risk per cause of death			
	CHD	Stroke	Cancer	T2DM
Fruit and vegetable consumption	0.96 (0.93-0.99)	0.95 (0.92-0.97)	0.93 (0.84-0.99)*	0.96 (0.92-0.99)
Red meat consumption	1.25 (1.21-1.29)	1.10 (1.05-1.15)	1.01 (1.00-1.05)*	1.15 (1.07-1.24)
Overweight	1.31 (1.24-1.39)	1.07 (0.73-1.59)	1.10 (1.04-1.17)	1.54 (1.42-1.68)
Obese	1.78 (1.64-1.92)	1.55 (1.14-2.11)	1.40 (1.30-1.50)	7.37 (5.16-10.47)

* global average, actual relative risk is region-specific.

Sources: Dauchet et al (2005, 2006), Micha et al (2010), Chen et al (2013), WCRI/AIC (2007), Li et al (2014), Feskens et al (2013), Prospective Studies Collaboration (2009), Berrington de Gonzales et al (2010).

Life-cycle analysis:

- Use of commodity-specific GHG emissions factors from meta-analysis of life-cycle analyses (Tilman and Clark, 2014);
- Excludes land-use emissions and post-farm gate activities;
- Adjusted for future productivity improvements based on FAO data from 1961-2010.

Economic analysis
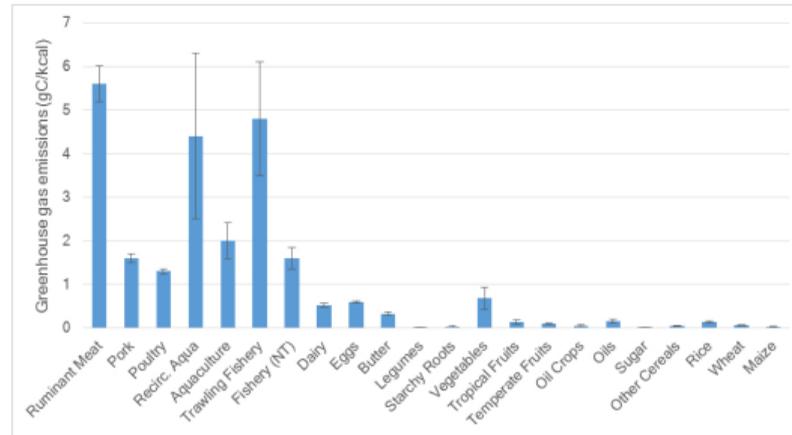
Environmental valuation:

- Social cost of carbon estimates with discount rates 2.5%, 3%, 5%, 95th percentile of 3% from IA model comparison for US Gov;

Health evaluation:

1. Value of statistical life estimates based on meta-analysis of stated preference surveys of morality risk valuation for OECD; EU-27 base value and benefit-transfer method with GDP projections.

2. Cost of illness estimates based on EU-wide assessment of CVD and cancer; use of cost transfer method with health expenditure projections for direct costs and GDP projections for indirect costs.

⇒ Exploratory approach; not full economic analysis (prices, supply-demand interactions).

Discussion

Dietary changes towards more plant-based diets could:

- Reduce mortality by 6-10% compared to what would be expected in 2050;
- Reduce food-related GHG emissions by 30-70%;
- Result in avoided climate damages and healthcare savings of up to USD 1.5 trillion.

Implications:

- The size of the projected benefits should encourage individuals, industry, and policy makers to act decisively to make sure that what we eat preserves our environment and our health.
- Not a small task: to achieve minimum global dietary guidelines (HGD) would require 25% increase in global fruit & veg consumption, 56% reduction in red meat consumption, and 15% reduction in energy intake.
- The regional detail of our study can be used to identify the most appropriate interventions for both the production and consumption sides of the food system.