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Sustainable diets

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LONDON SCHOOL of HYGIENE &TROPICAL MEDICINE

KNOWLEDGE TO ACTION phfi PUBLIC HEALTH FOUNDATION OF INDIA

UNIVERSITY OF ABERDEEN

LCIRAH Leverhulme Centre for Integrative Research on Agriculture and Health

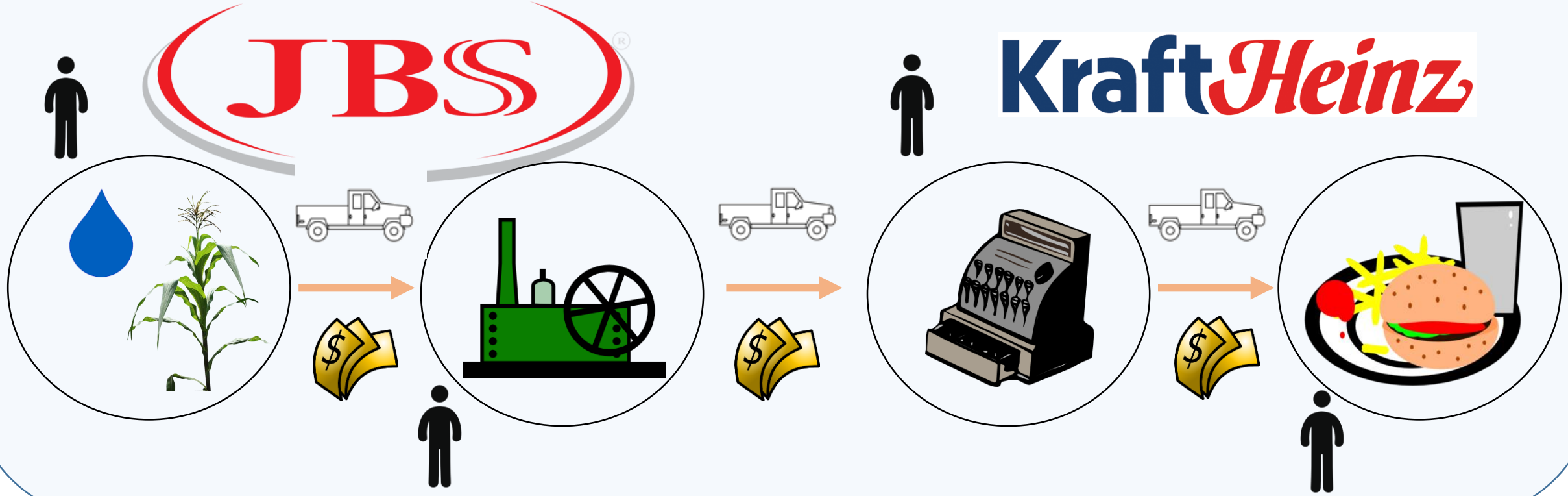
Session outline

- What is a food system?
- What is sustainability?
- [Break]
- Quantifying environmental impacts of diets
- Sustainable food systems - what are the solutions?
- Discussion

Food system

Sociocultural, economic, institutional & governance environment

All the actors and activities involved in the production, processing, transport and consumption of food.



Adapted from The Future of Food: http://www.futureoffood.ox.ac.uk/what-food-system.

Food system maps

- Groups of ~5

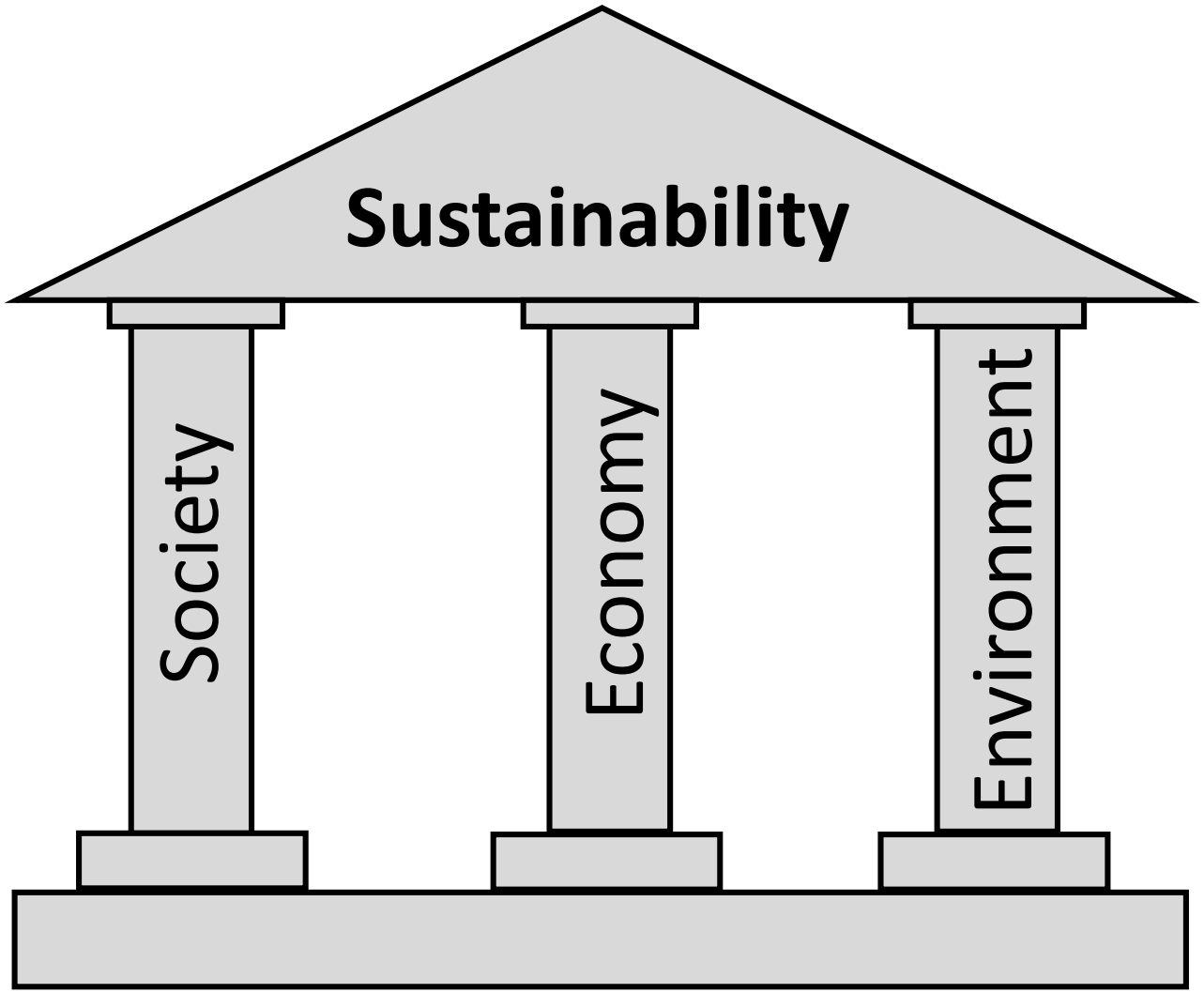
- Map out actors and activities for a food system of your choice

The importance of food and agriculture systems - activity

- Agriculture is responsible for ____ % of global greenhouse gas emissions and ____ % of global freshwater consumption
- Agriculture contributes ____ % of global GDP and ____ % of jobs
- Diets underlie ____ % of global disease burden

The importance of food and agriculture systems - activity

- Agriculture is responsible for 33% of global greenhouse gas emissions and 70% of global freshwater consumption
- Agriculture contributes 3.8% of global GDP and 30% of jobs
- Diets underlie 21% of global disease burden



<u>Sustainable development</u>
(Brundtland Report, 1987)

Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs

Sustainable diets

Thus in bringing a larger share of our corn crop directly into human consumption and in giving to such perishable foods as milk, vegetables, and fruit a more prominent place in the diet, the food conservation movement has been working toward permanent improvements in our national food economy at the same time that it saved the wheat, meat, fat, and sugar needed for export to our armies and to hungry Europe.

HENRY C. SHERMAN

Sherman (1919)

Gussow & Clancy (1986)

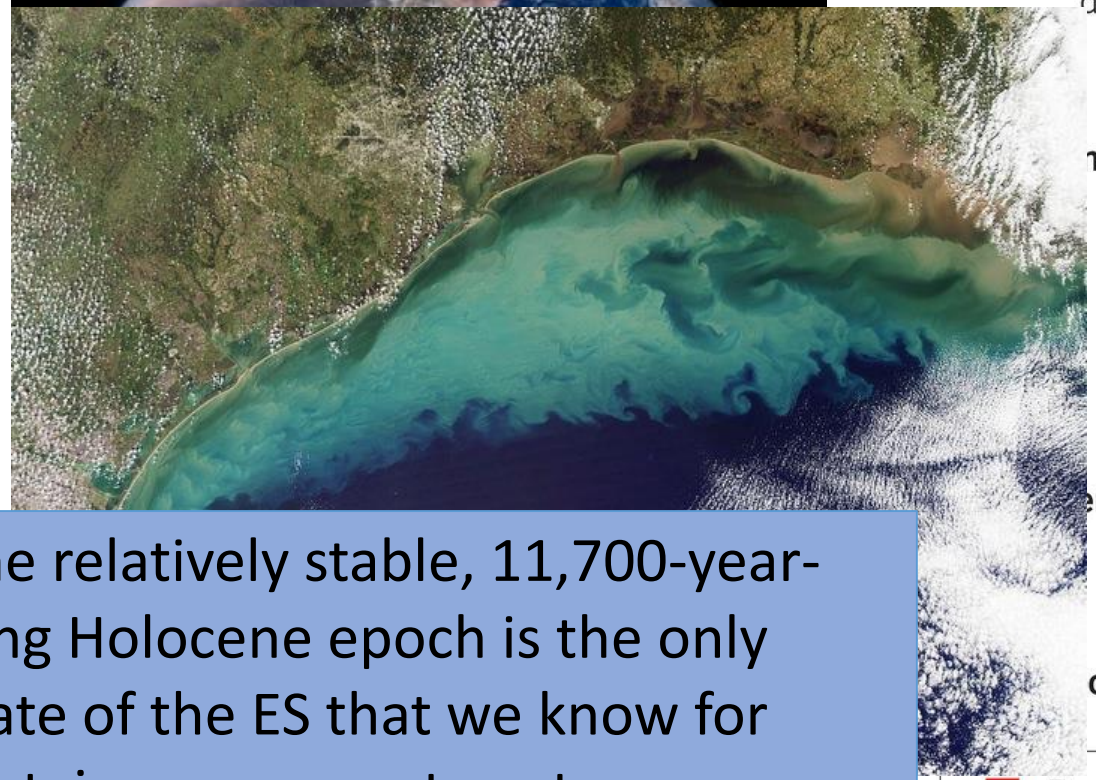
Sustainable diets (FAO, 2010, adapted):

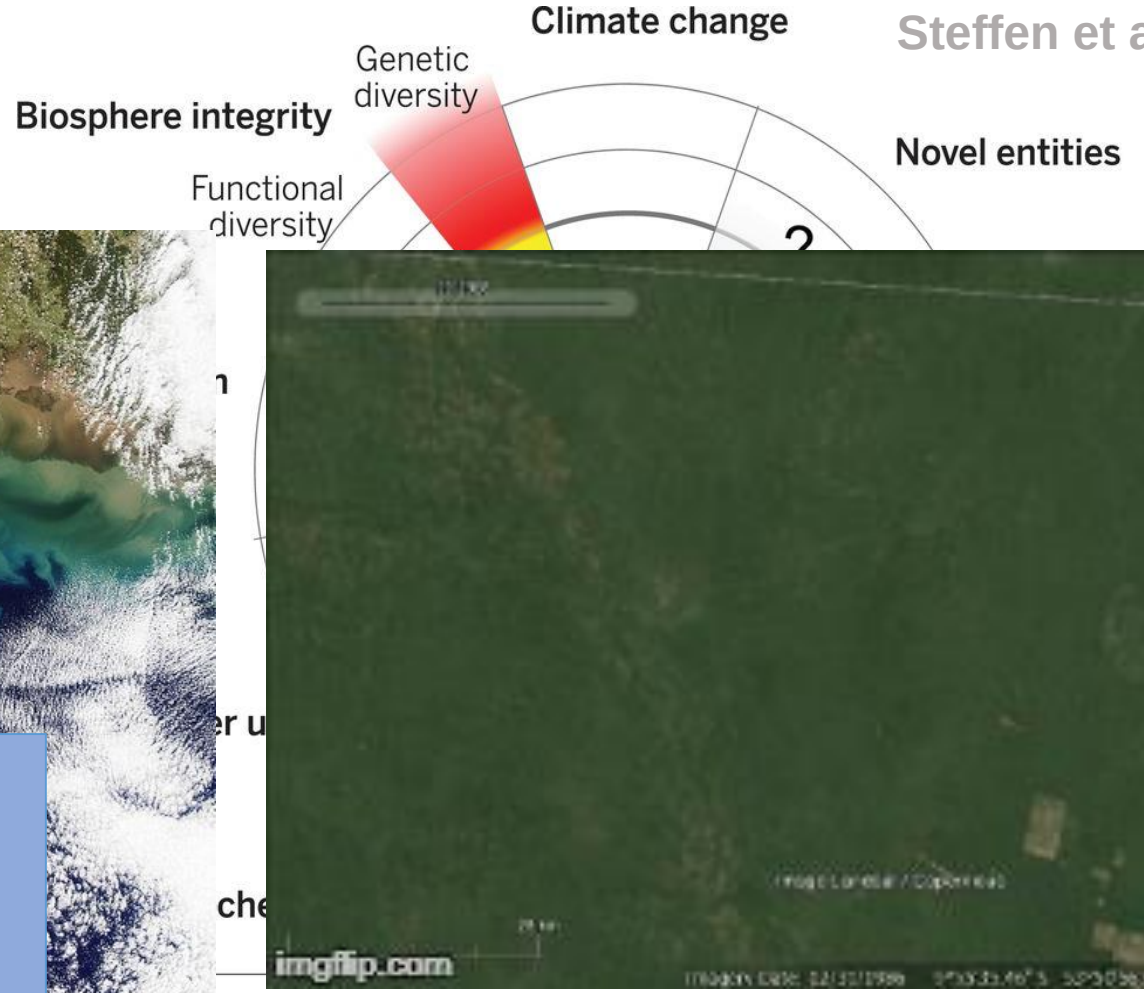
Sustainable diets are those diets with low environmental impacts which contribute to food and nutrition security and to healthy life for present and future generations.

Sustainable diets are:

1) protective and respectful of biodiversity and ecosystems;
2) culturally acceptable;
3) accessible, economically fair and affordable;
4) nutritionally adequate, safe and healthy;
5) optimize natural and human resources;
6) Resilient to shocks and change.

1) Protective and respectful of biodiversity and ecosystems





Steffen et al. Science 2015

The relatively stable, 11,700-year-long Holocene epoch is the only state of the ES that we know for certain can support contemporary human societies.

2) Culturally acceptable

HarvestPlus: http://bit.ly/2efCBct

Germany

Fearing for the wurst: German ministry under fire for meat-free buffets

Politicians attack environment ministry's decision to stop serving meat and fish at official functions as 'nanny state' move

Philip Oltermann in Berlin

Saturday 25 February 2017 06.00 GMT

In a country famous for its meat production, the ministry's move was revolutionary. Photograph: Alicia Canter for the Guardian

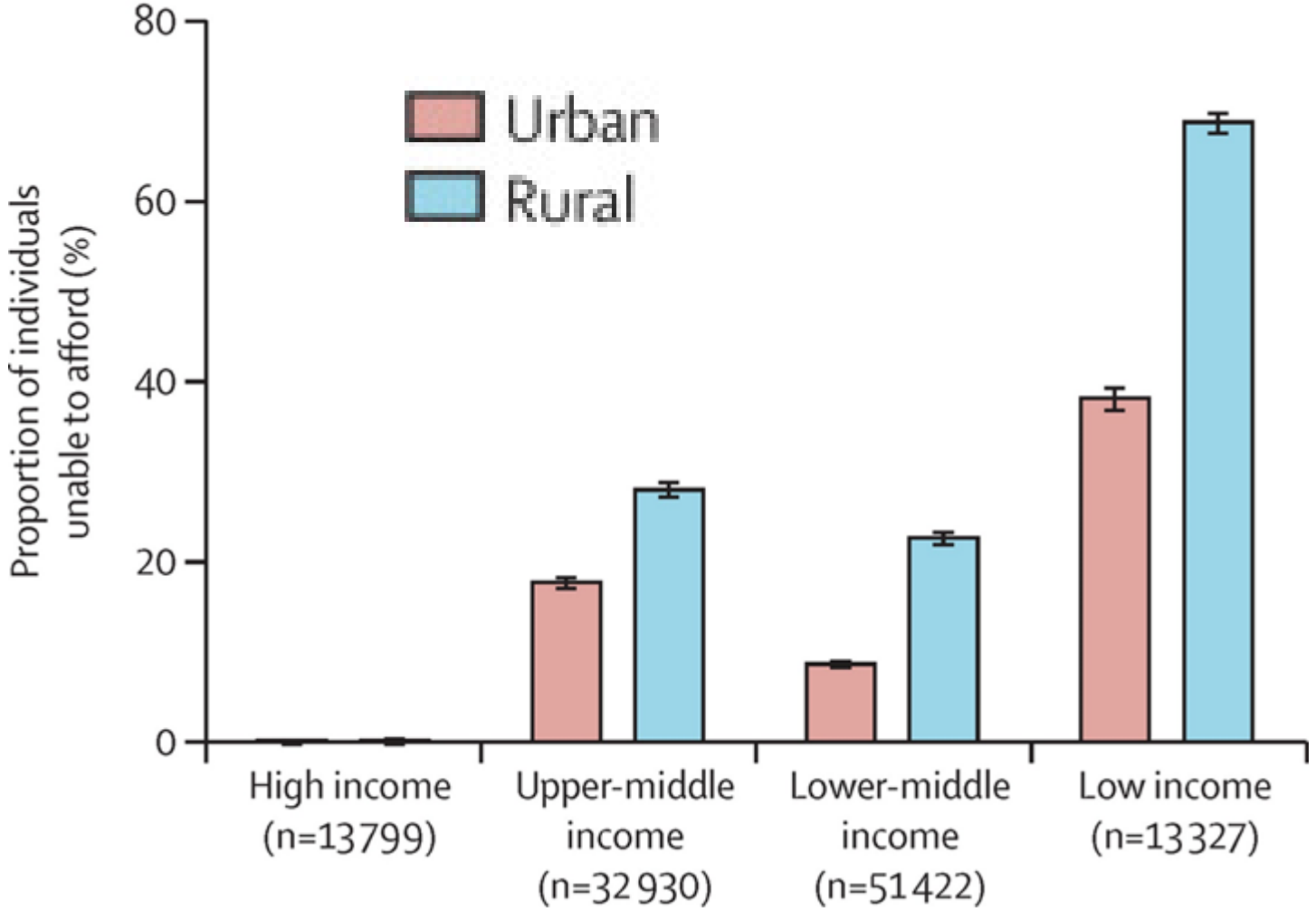
We decided to take the symbolic step to ban meat and fish at external events because we want to practise what we preach

Environment ministry spokesperson Michael Schroeren

No one would have problems with stricter regulations around mass livestock farming, but we shouldn't make the mistake to prescribe a lifestyle to people

Anton Hofreiter, former co-chair of the German Greens

3) Accessible, economically fair and affordable

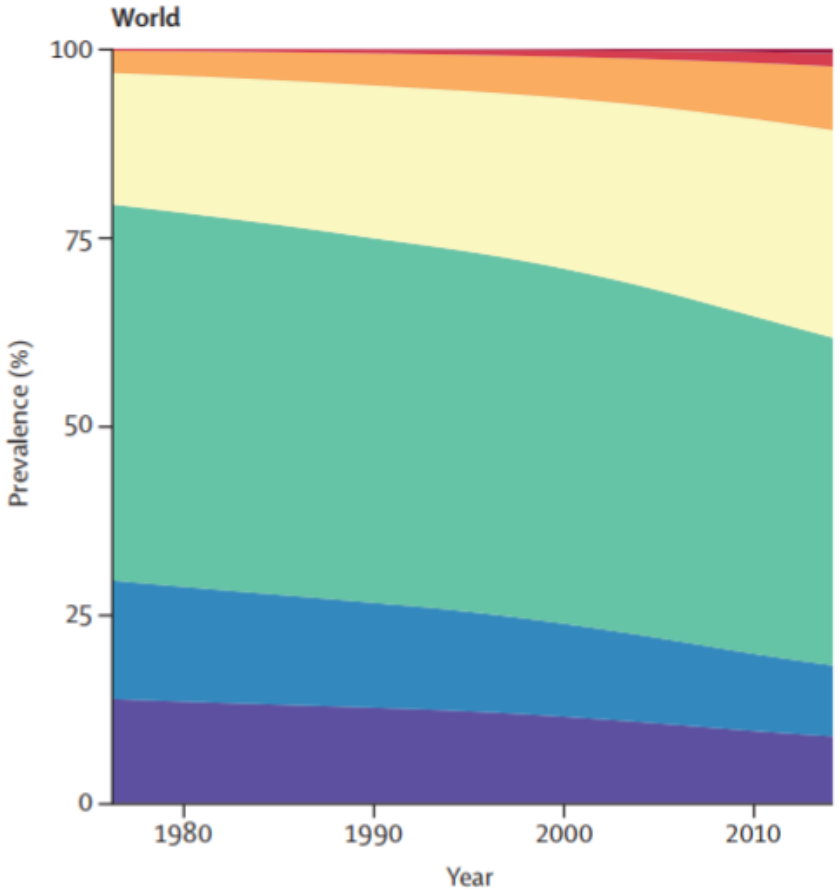


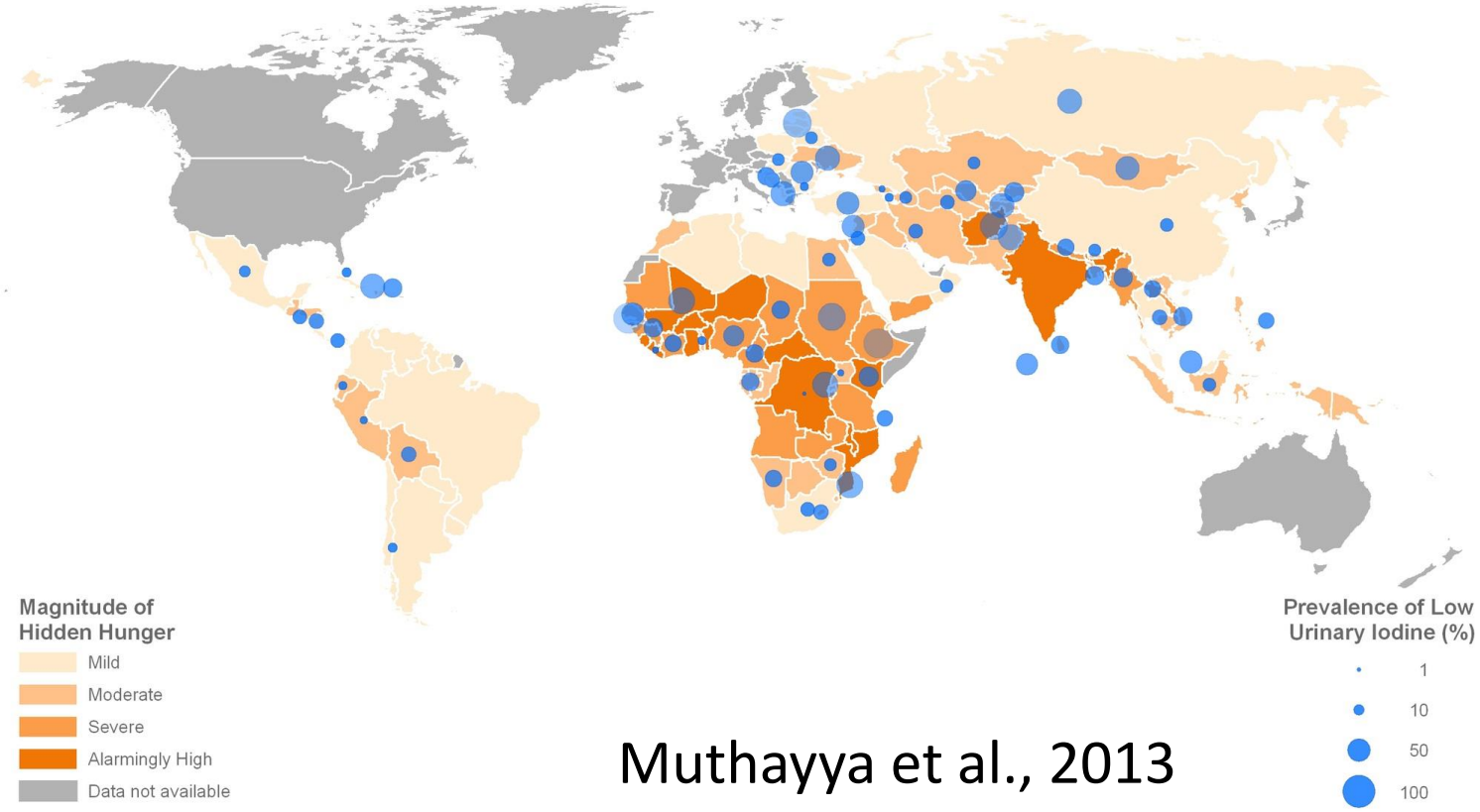
3 portions veg

2 portions fruit

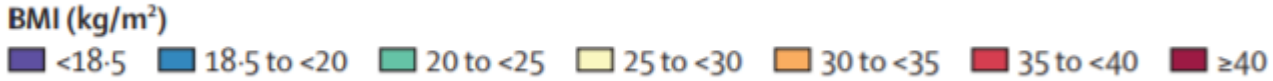
Miller et al. 2016

4) Nutritionally adequate, safe and healthy

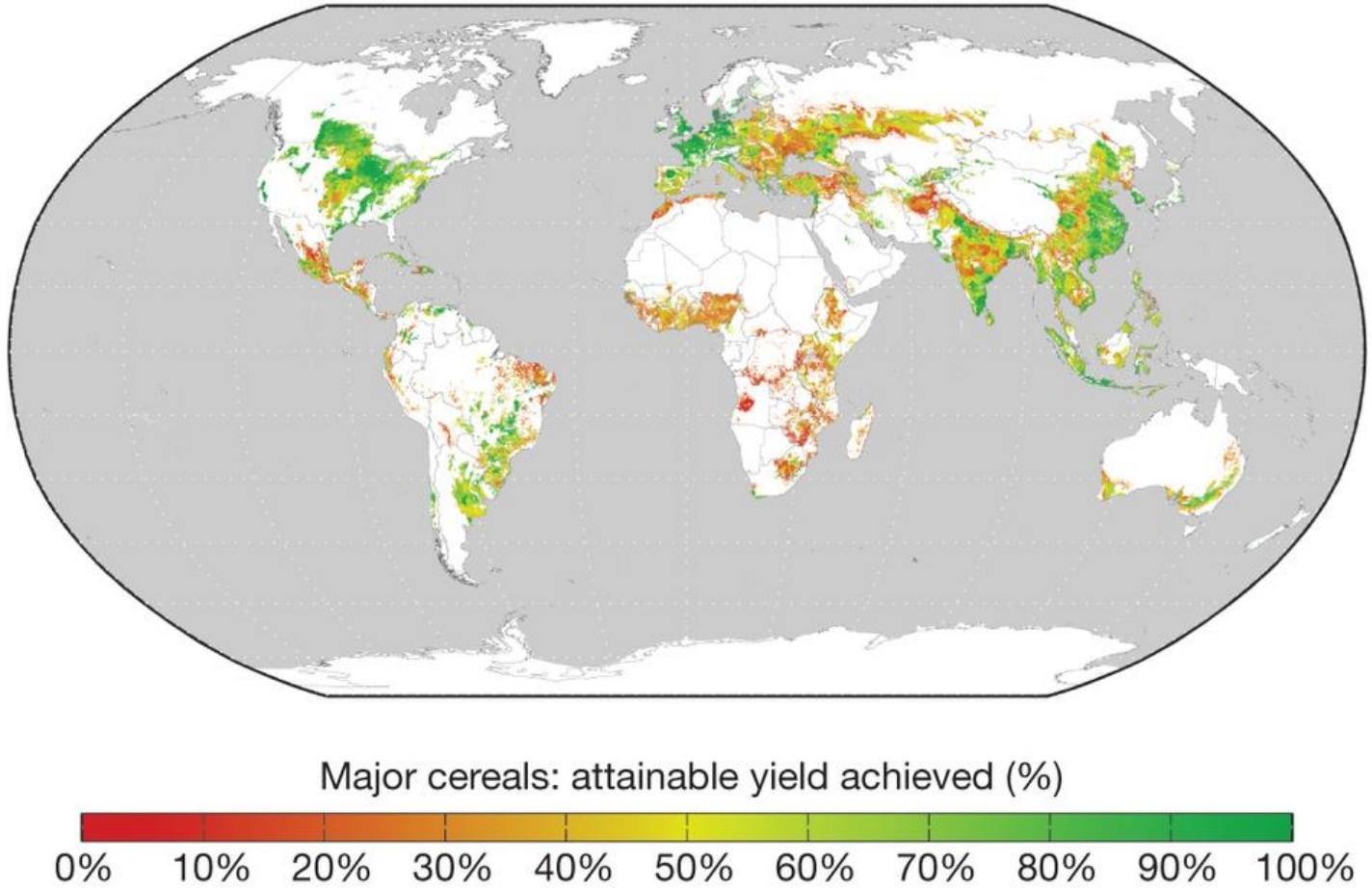




Muthayya et al., 2013



5) optimize natural and human resources



6) Resilient

Vegetables

What a pickle: UK gripped by courgette shortage

Cold and wet weather hits crops in Spain, sending prices soaring and customers bemoaning empty supermarket shelves

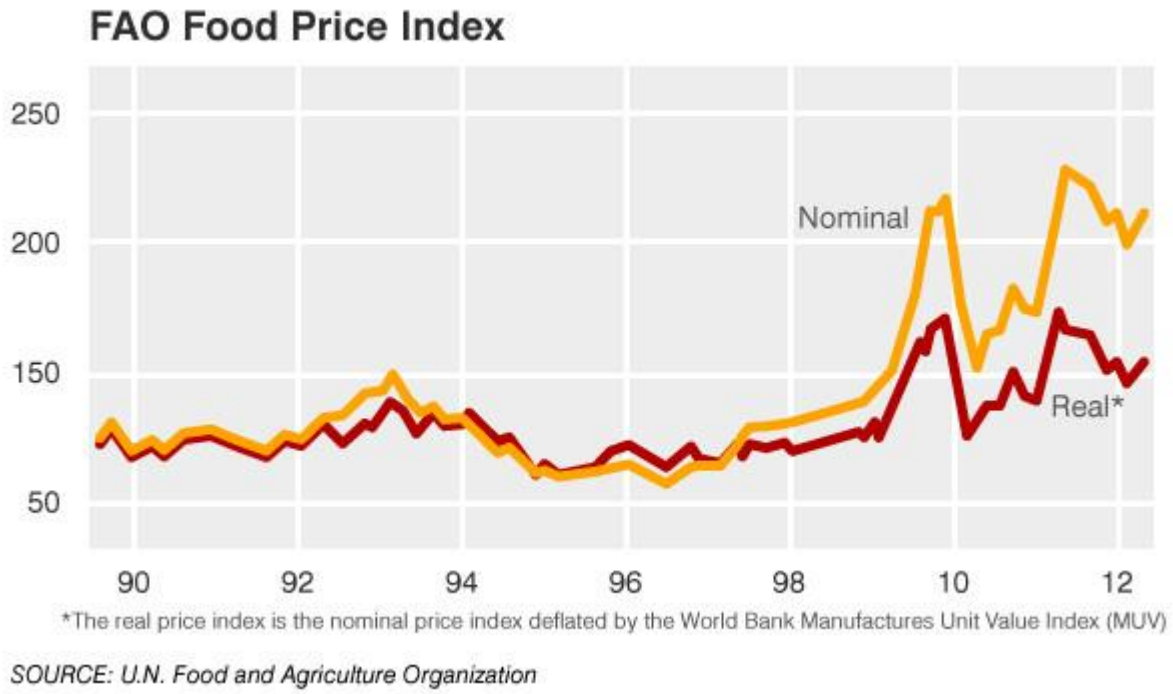
What will you give me for these? Some in-demand courgettes. Photograph: Alamy

This article is 1 month old

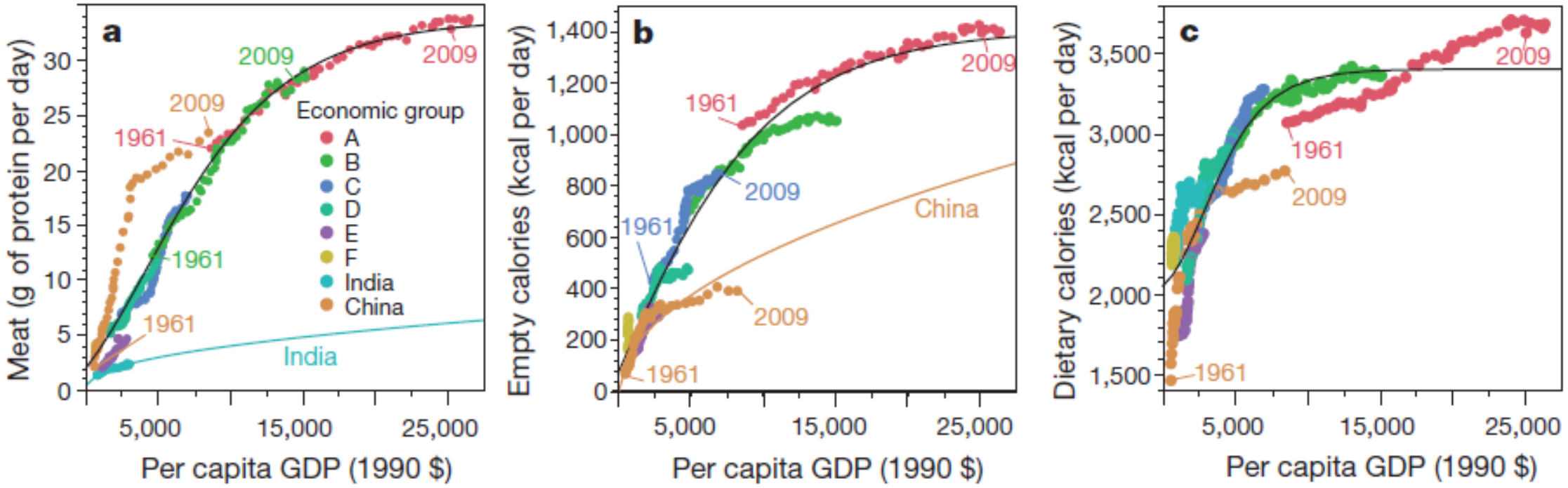
5,723

Matthew Weaver

Tuesday 17 January 2017 12.13 GMT

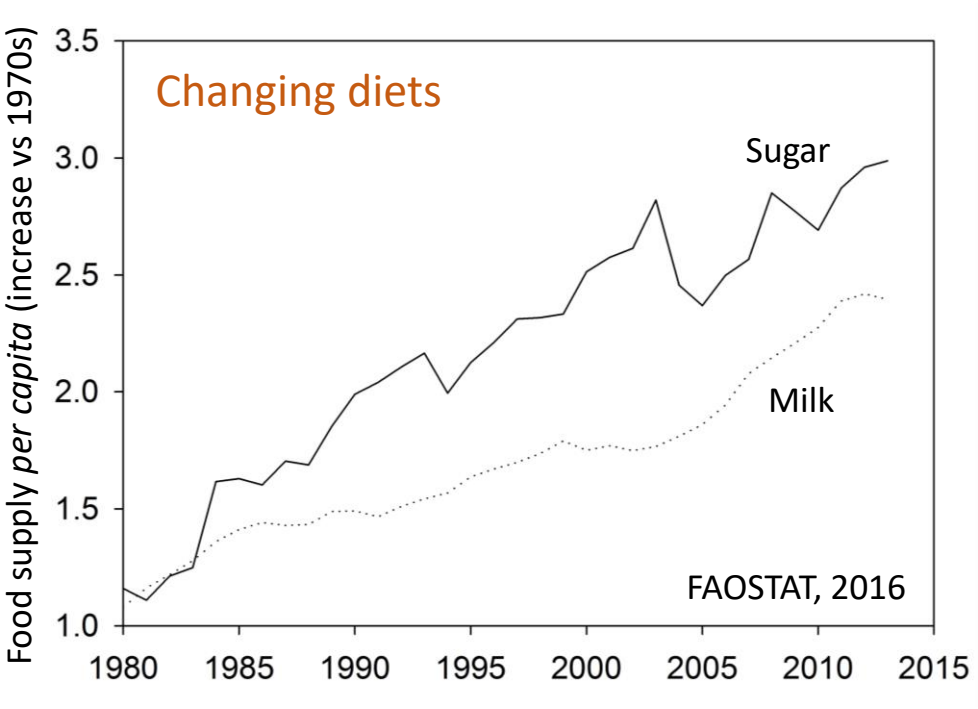


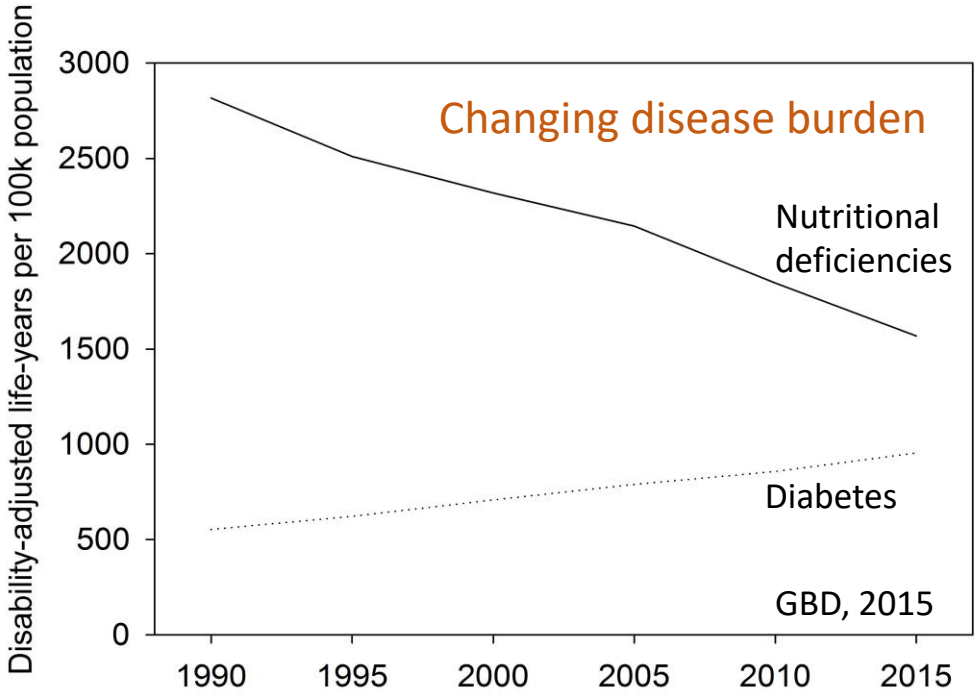
Where are we heading?



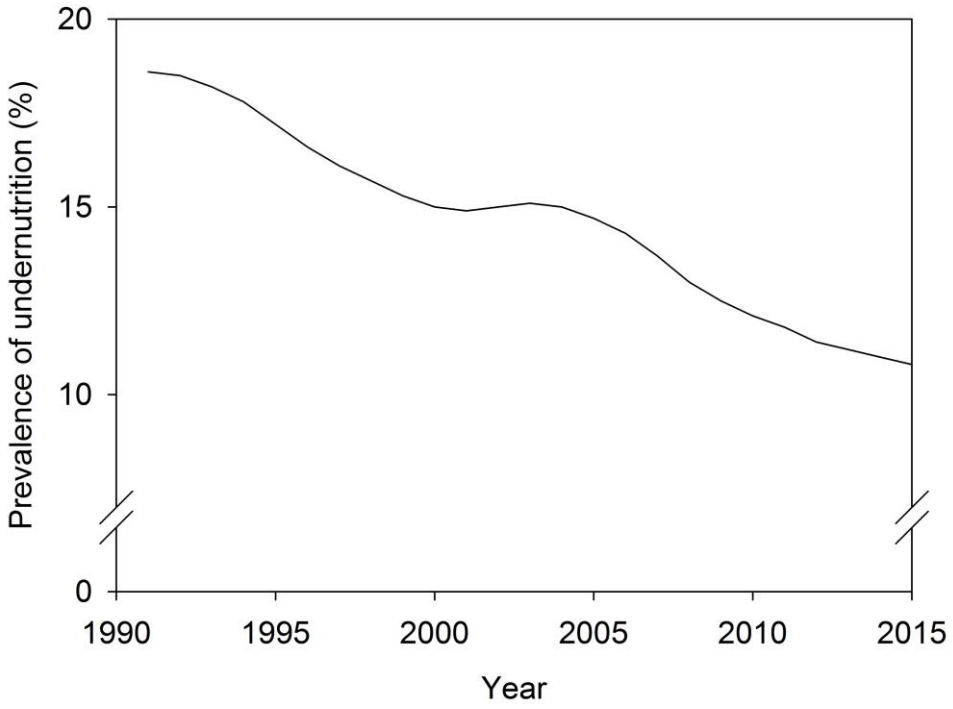
Tilman & Clark, 2014


Chicken
Maharaja Mac™
McDonald's

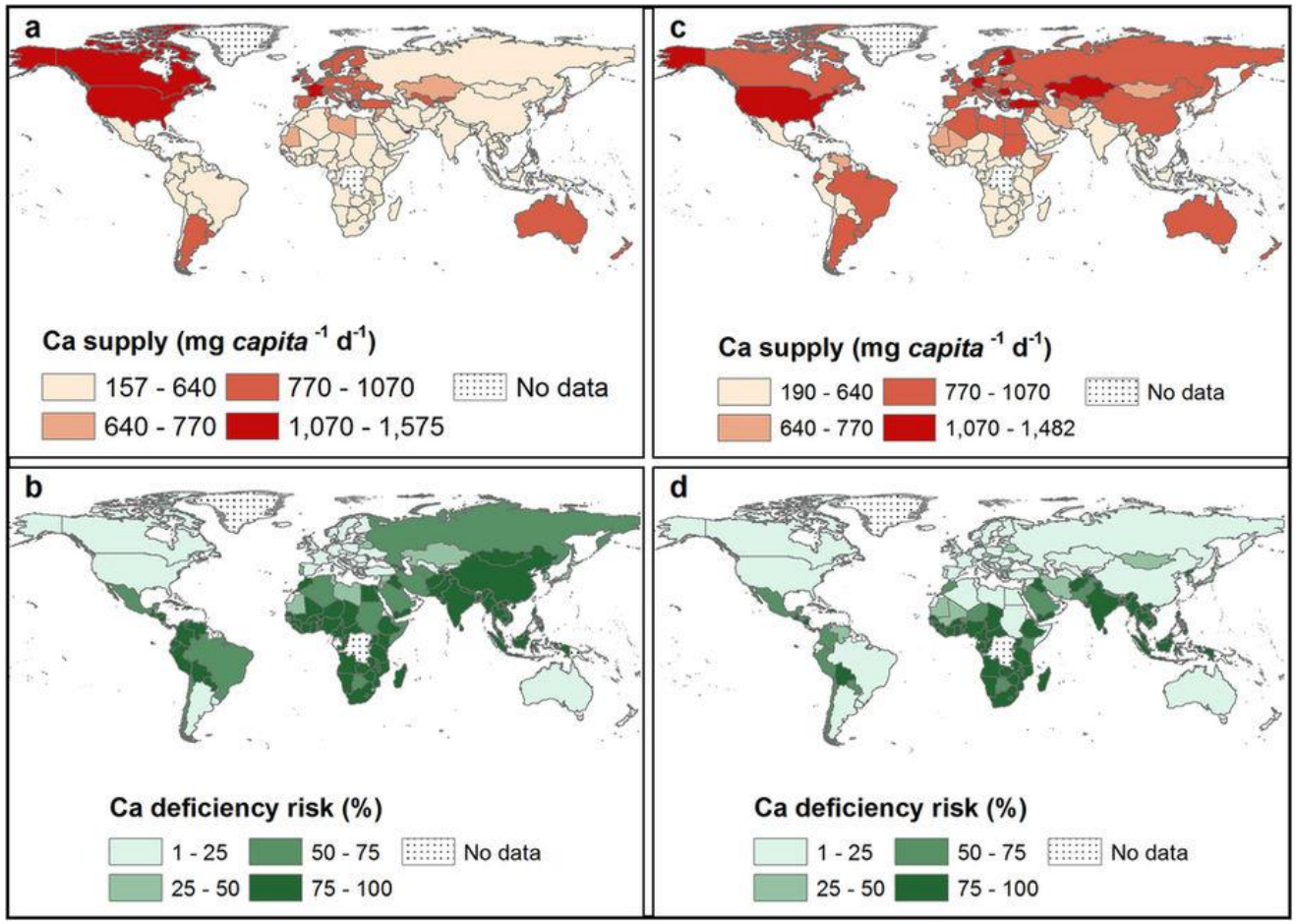

Changing diets
Food supply *per capita* (increase vs 1970s)
3.5
3.0
2.5
2.0
1.5
1.0
1980
1985
1990
1995
2000
2005
2010
2015
Sugar
Milk
FAOSTAT, 2016


Changing disease burden
Disability-adjusted life-years per 100k population
3000
2500
2000
1500
1000
500
0
1990
1995
2000
2005
2010
2015
Nutritional deficiencies
Diabetes
GBD, 2015

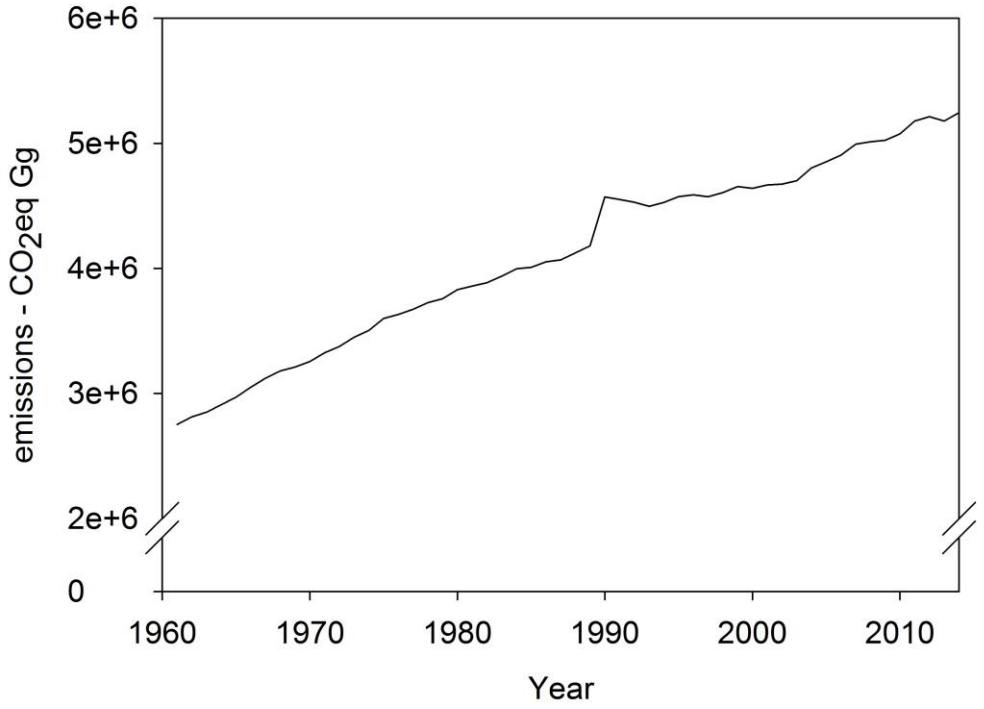
Global prevalence of undernutrition (FAOSTAT)



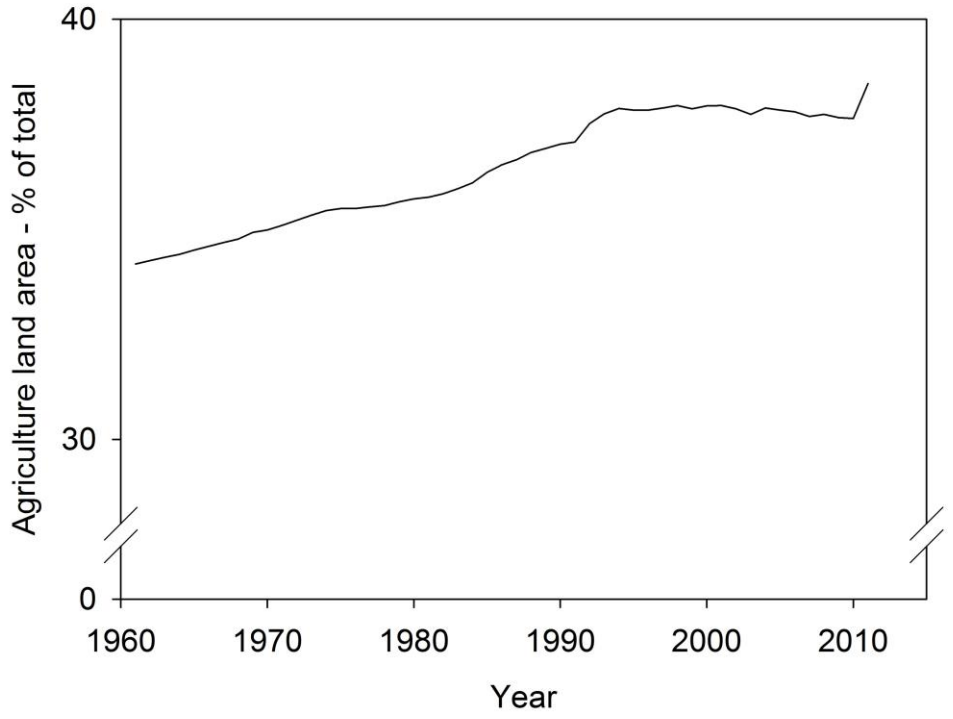
Global calcium supplies and prevalence of deficiency (Kumssa et al. 2015)



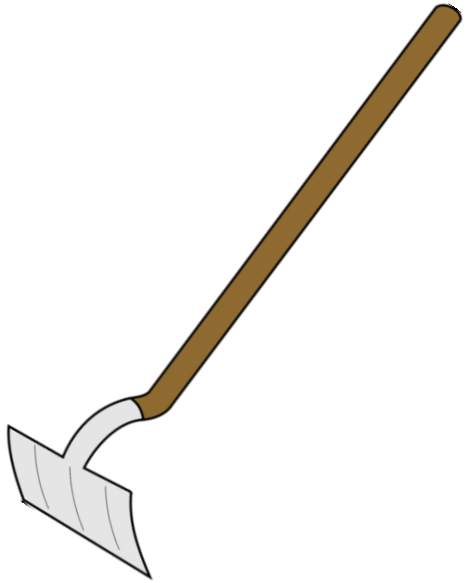
Global GHG emissions from agriculture (FAOSTAT)



Global agricultural land area (FAOSTAT)

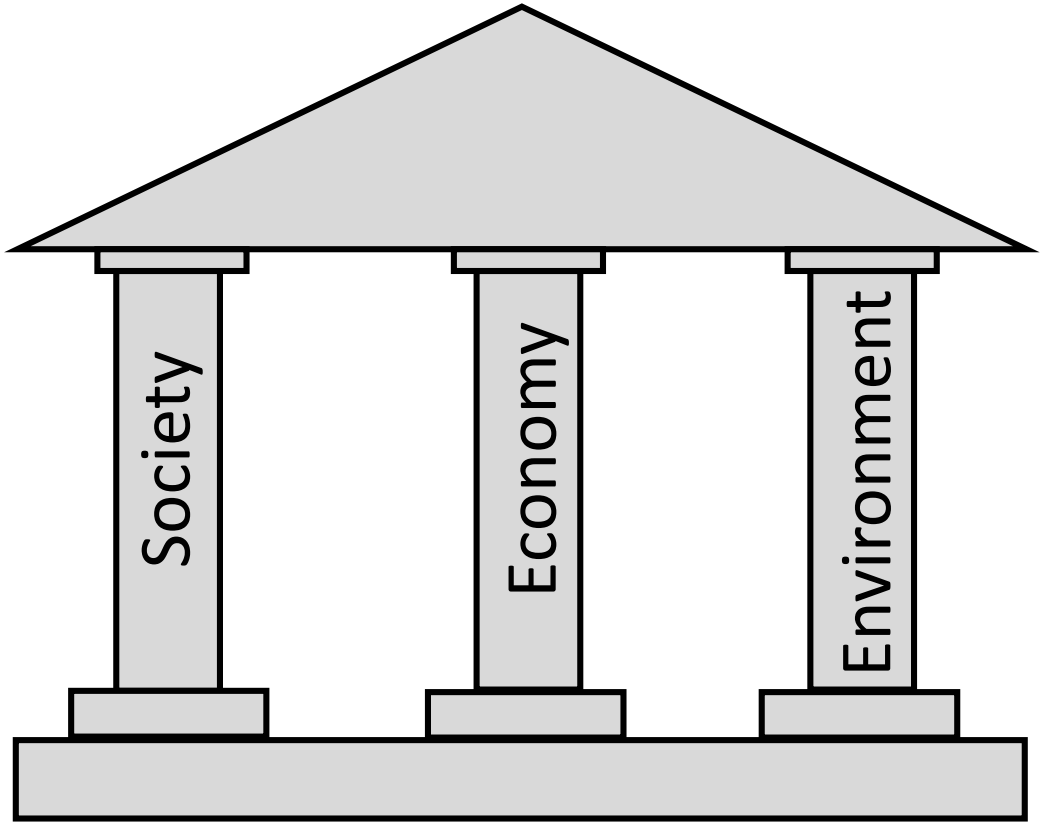


Wider food system changes



JBS

KraftHeinz


Society
Economy
Environment


THE GLOBAL GOALS
For Sustainable Development
1 NO POVERTY
2 ZERO HUNGER
3 GOOD HEALTH AND WELL-BEING
4 QUALITY EDUCATION
5 GENDER EQUALITY
6 CLEAN WATER AND SANITATION
7 AFFORDABLE AND CLEAN ENERGY
8 DECENT WORK AND ECONOMIC GROWTH
9 INDUSTRY, INNOVATION AND INFRASTRUCTURE
10 REDUCED INEQUALITIES
11 SUSTAINABLE CITIES AND COMMUNITIES
12 RESPONSIBLE CONSUMPTION AND PRODUCTION
13 CLIMATE ACTION
14 LIFE BELOW WATER
15 LIFE ON LAND
16 PEACE, JUSTICE AND STRONG INSTITUTIONS
17 PARTNERSHIPS FOR THE GOALS
THE GLOBAL GOALS

Food system maps

- Groups of ~6
- Map out actors and activities for a food system of your choice
- Identify sustainability concerns

Environment **Economy** **Society and health**

ENVIRONMENT

Bio-physical

Socioeconomic

Political/institutional/regulatory

Cultural

Low incomes among farming households

Increasing reliance on imports

Vulnerable to drought

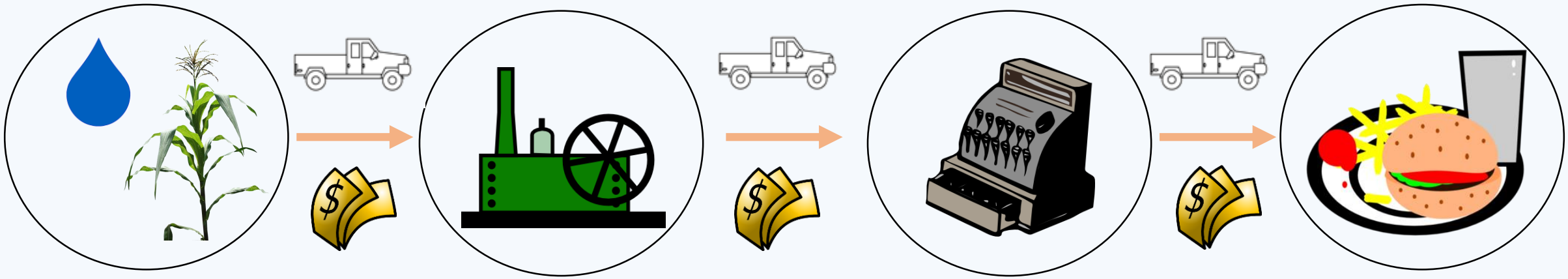
Methane from rice production

Low-tech value chains/storage → food waste

Unhealthy foods marketed to children

Increasing sugar consumption – health, water

Dual burden of malnutrition



Freshwater use in irrigation

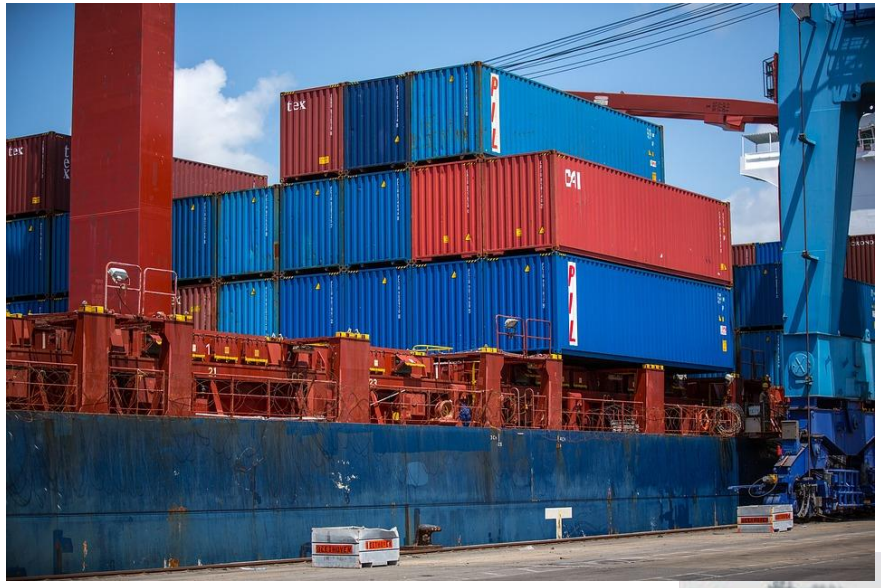
Low yields

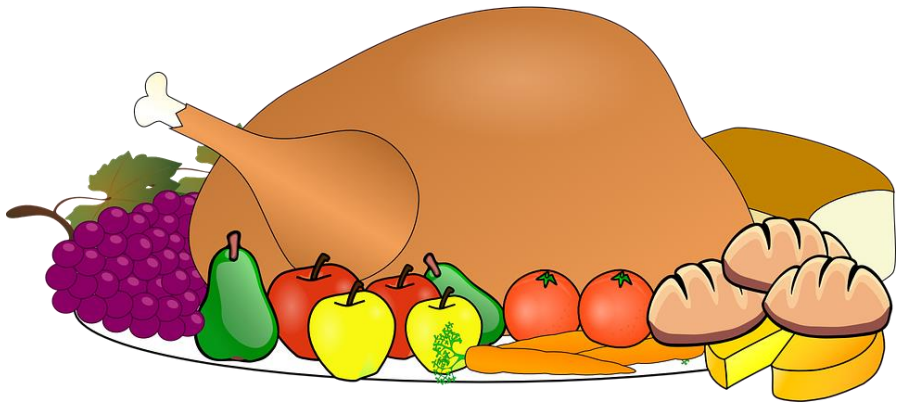
Processors exclude smallholders (quality, reliability, scale…)

Non-biodegradable packaging

Rapidly rising diabetes

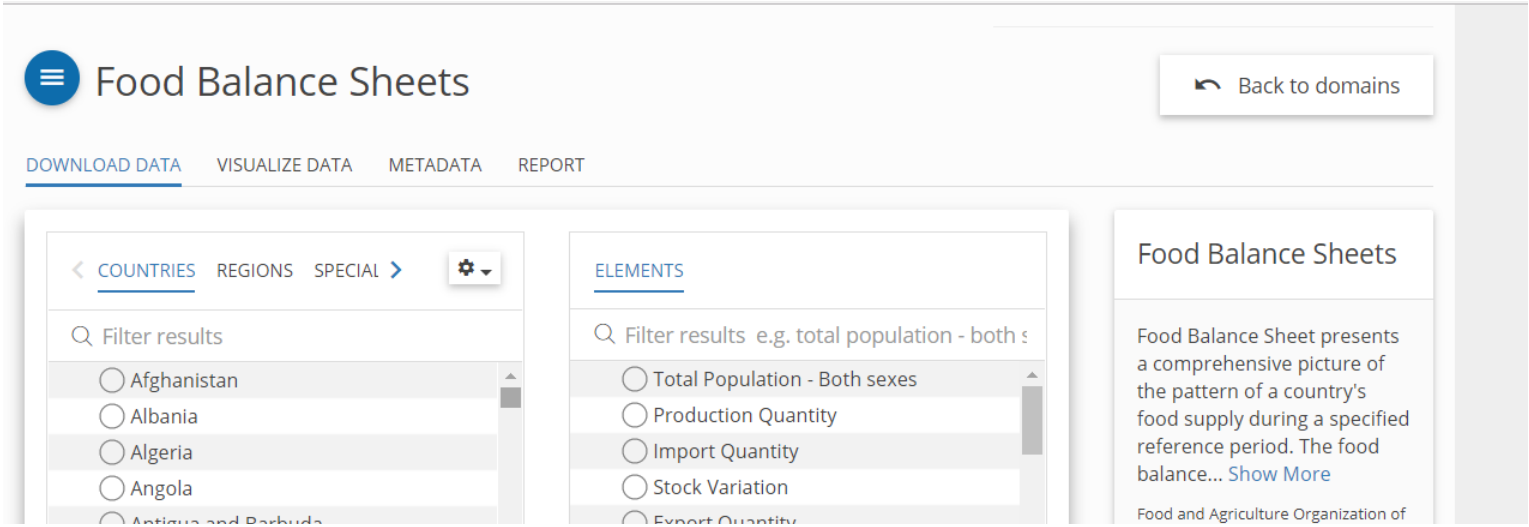
Quantifying environmental impacts of diets



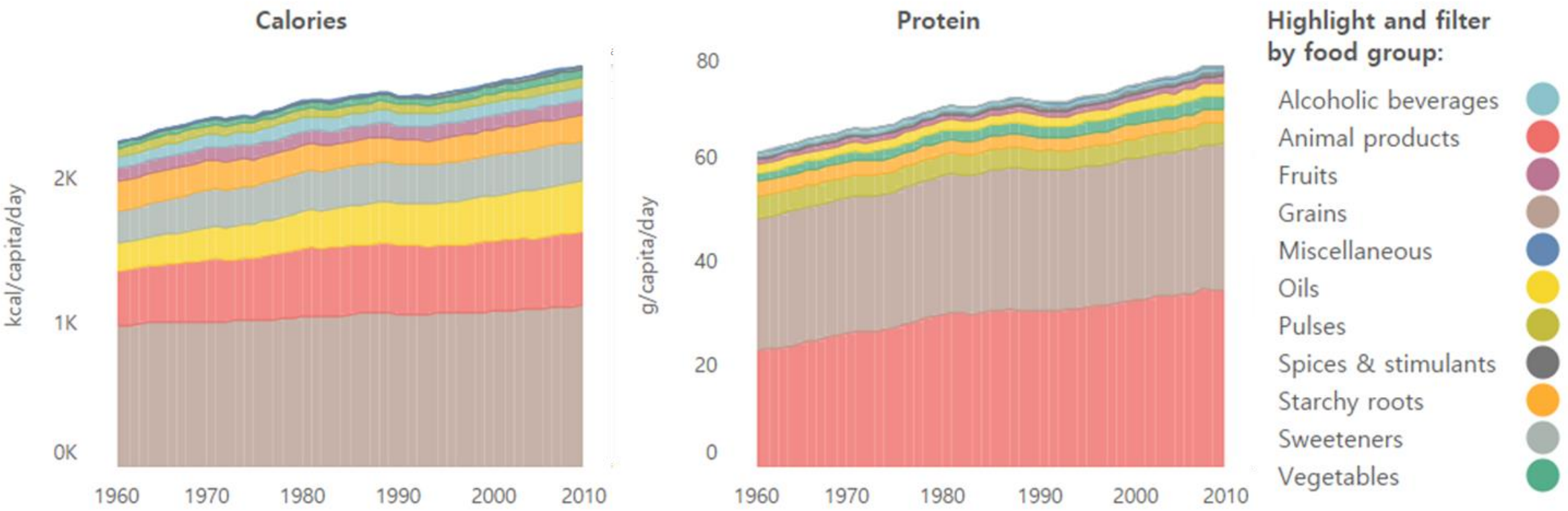


What are people eating?

- Food consumption diaries
- Food consumption recall
- Food frequency questionnaires
- Household surveys
- Food Balance Sheets

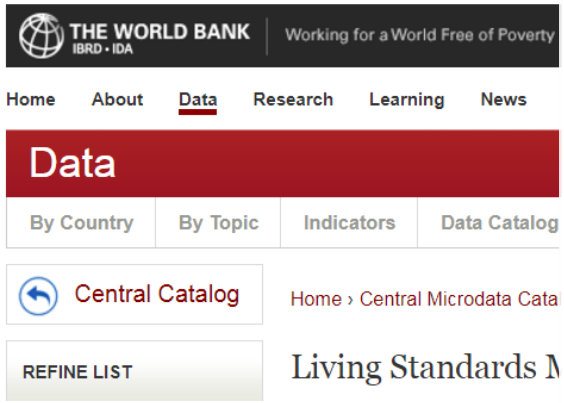


http://www.fao.org/faostat/en



http://blog.ciat.cgiar.org/author/cokhoury/

http://microdata.worldbank.org/index.php/catalog/lsms

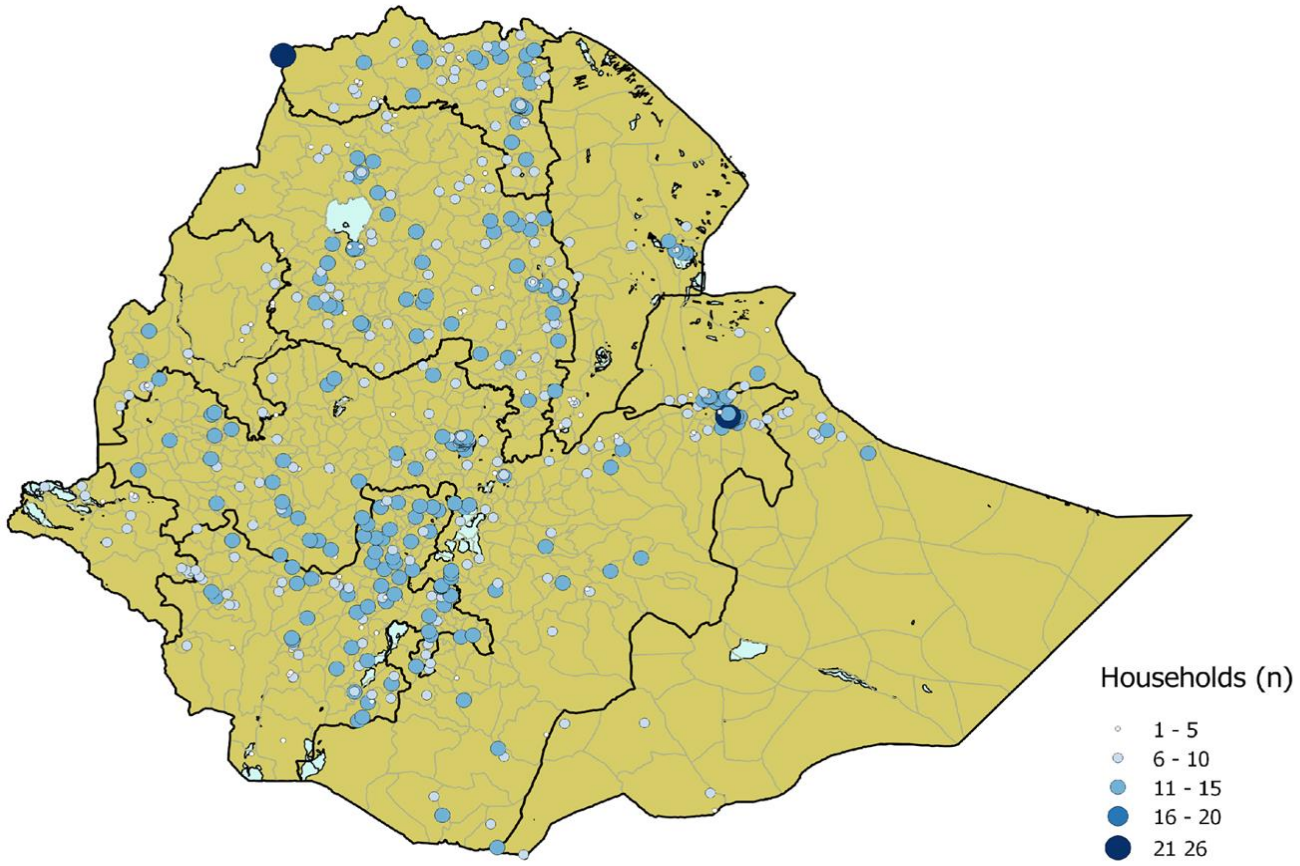


MODULE G: FOOD CONSUMPTION OVER PAST ONE WEEK

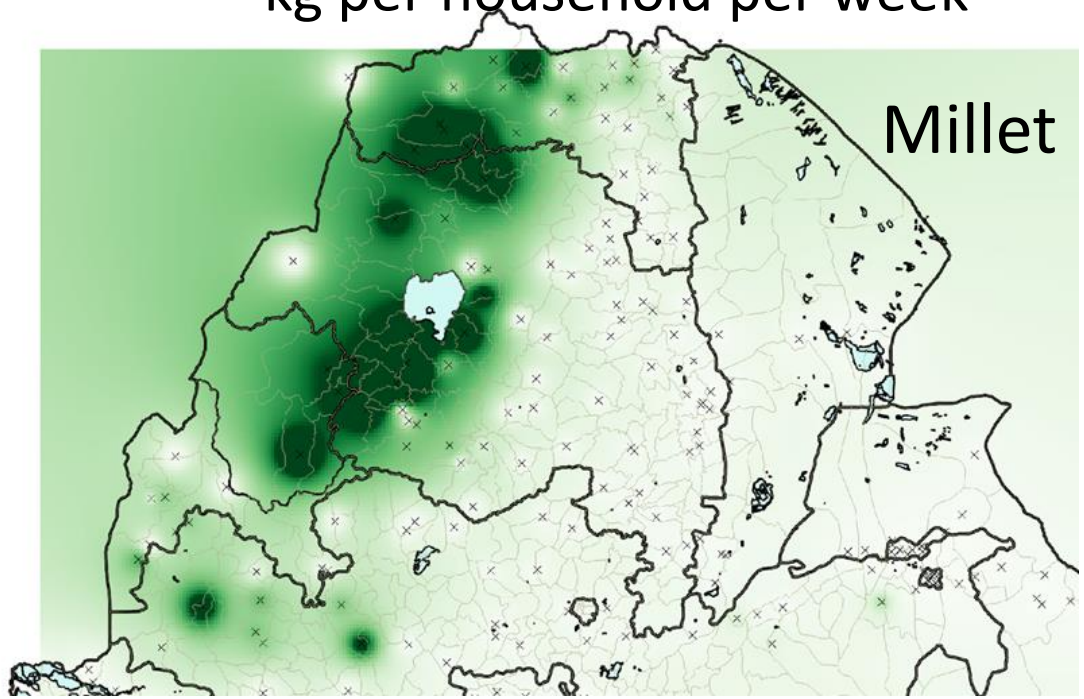
DATA ENTRY LINE NUMBER	Over the past one week (7 days), did you or others in your household consume any [. . .]? INCLUDE FOOD BOTH EATEN COMMUNALLY IN THE HOUSEHOLD AND THAT EATEN SEPARATELY BY INDIVIDUAL HOUSEHOLD MEMBERS.	G01 YES..1 NO...2>> NEXT ITEM	G02 ITEM CODE	G03 How much in total did your household consume in the past week? QUANTITY	G03 UNIT	G04 How much came from purchases? QUANTITY	G04 UNIT	G05 How much did you spend? MK	G06 How much came from own-production? QUANTITY	G06 UNIT	G07 How much came from gifts and other sources? QUANTITY	G07 UNIT
1	**Cereals, Grains and Cereal Products**											
2	Maize *ufa mgaiwa* (normal flour)		101									
3	Maize *ufa* refined (fine flour)		102									
4	Maize *ufa madeya* (bran flour)		103									
5	Maize grain (not as *ufa*)		104									
6	Green maize		105									
7	Rice		106									
8	Finger millet (*mawere*)		107									
9	Sorghum (*mapira*)		108									
10	Pearl millet (*mchewere*)		109									
11	Wheat flour		110									
12	Bread		111									
13	Buns, scones		112									
14	Biscuits		113									
15	Spaghetti, macaroni, pasta		114									
16	Breakfast cereal		115									
17	Infant feeding cereals		116									
18	Other (specify)		117									
19	**Roots, Tubers, and Plantains**											
20	Cassava tubers		201									
21	Cassava flour		202									
22	White sweet potato		203									
23	Orange sweet potato		204									
24	Irish potato		205									
25	Potato crisps		206									
26	Plantain, cooking banana		207									
27	Cocoyam (*masimbi*)		208									
28	Other (specify)		209									

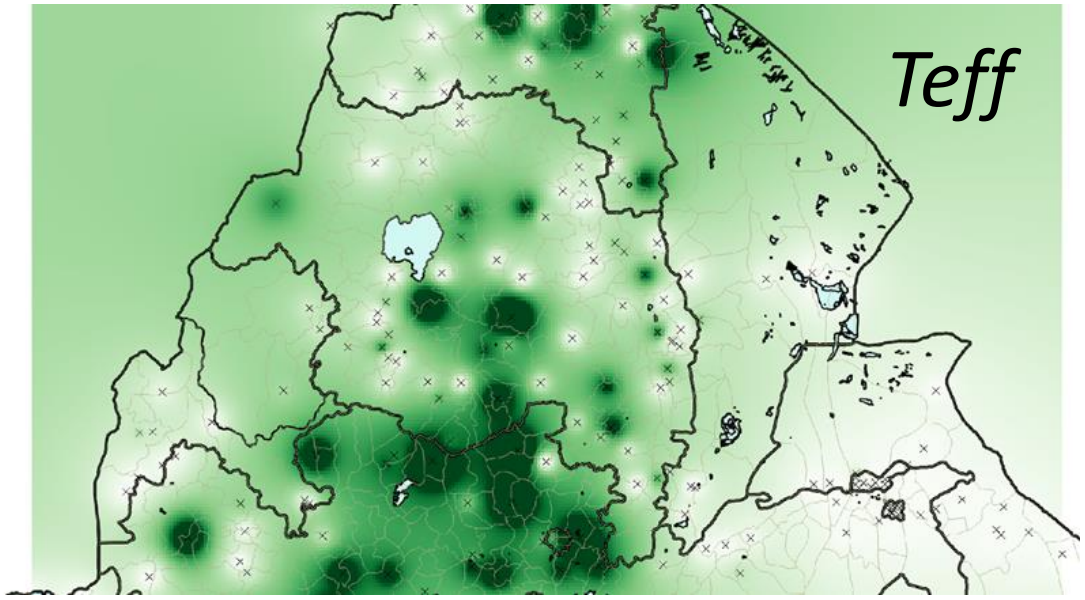
CODES FOR UNIT:

KILOGRAMME 1
50 KG. BAG 2
90 KG. BAG 3
PAIL (SMALL) . . .4
PAIL (LARGE) . . .5
No. 10 PLATE . . .6
No. 12 PLATE . . .7
BUNCH. 8
PIECE. 9
HEAP 10
BALE 11
BASKET (*DENGU*) (SHELLED). . . 12
BASKET (*DENGU*) (UNSHELLED) . . 13
OX-CART (UNSHELLED) . . 14
LITRE. 15
CUP. 16
TIN. 17
GRAM 18
MILLILITRE . . . 19
TEASPOON. 20
BASIN. 21
SATCHET/TUBE. . .22
OTHER (SPECIFY). 23

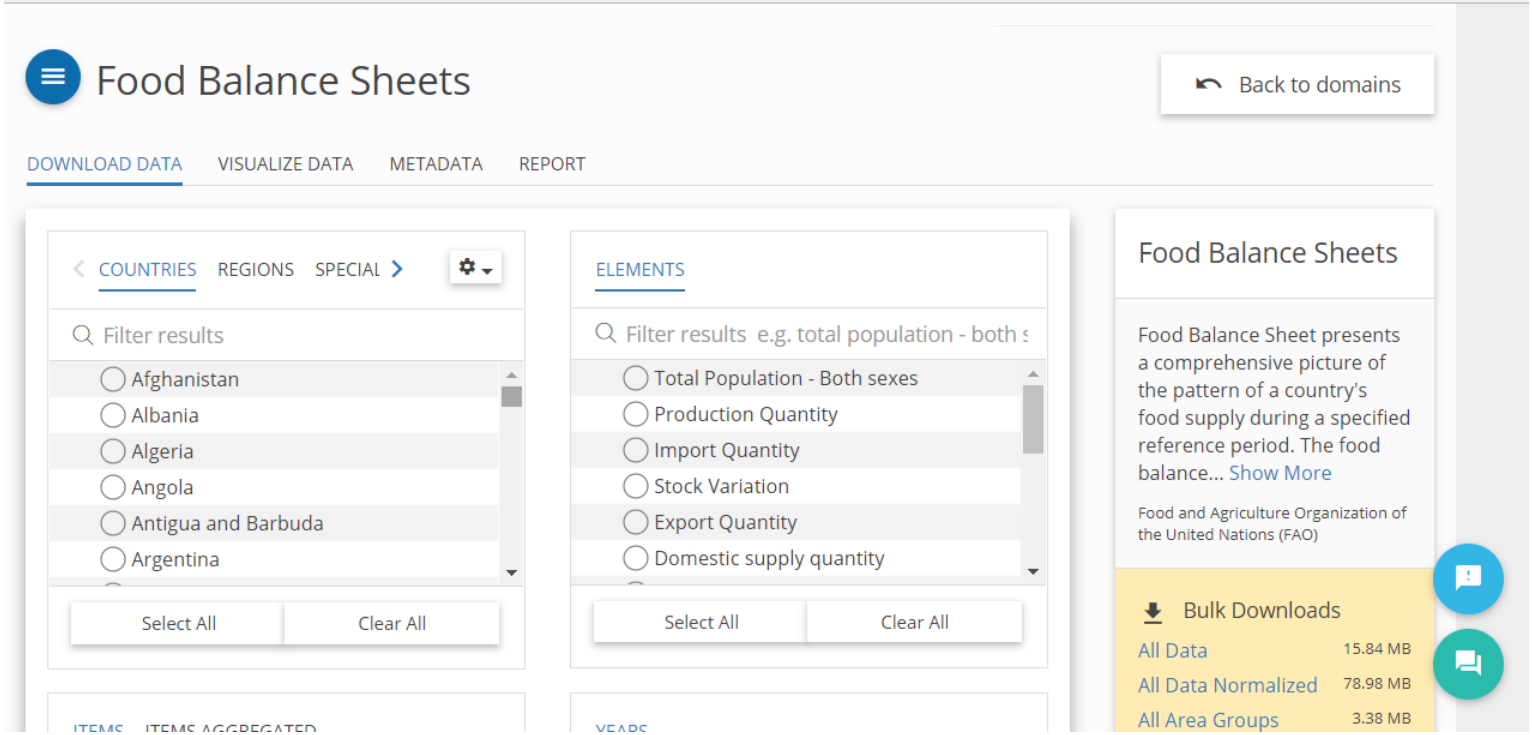


kg per household per week



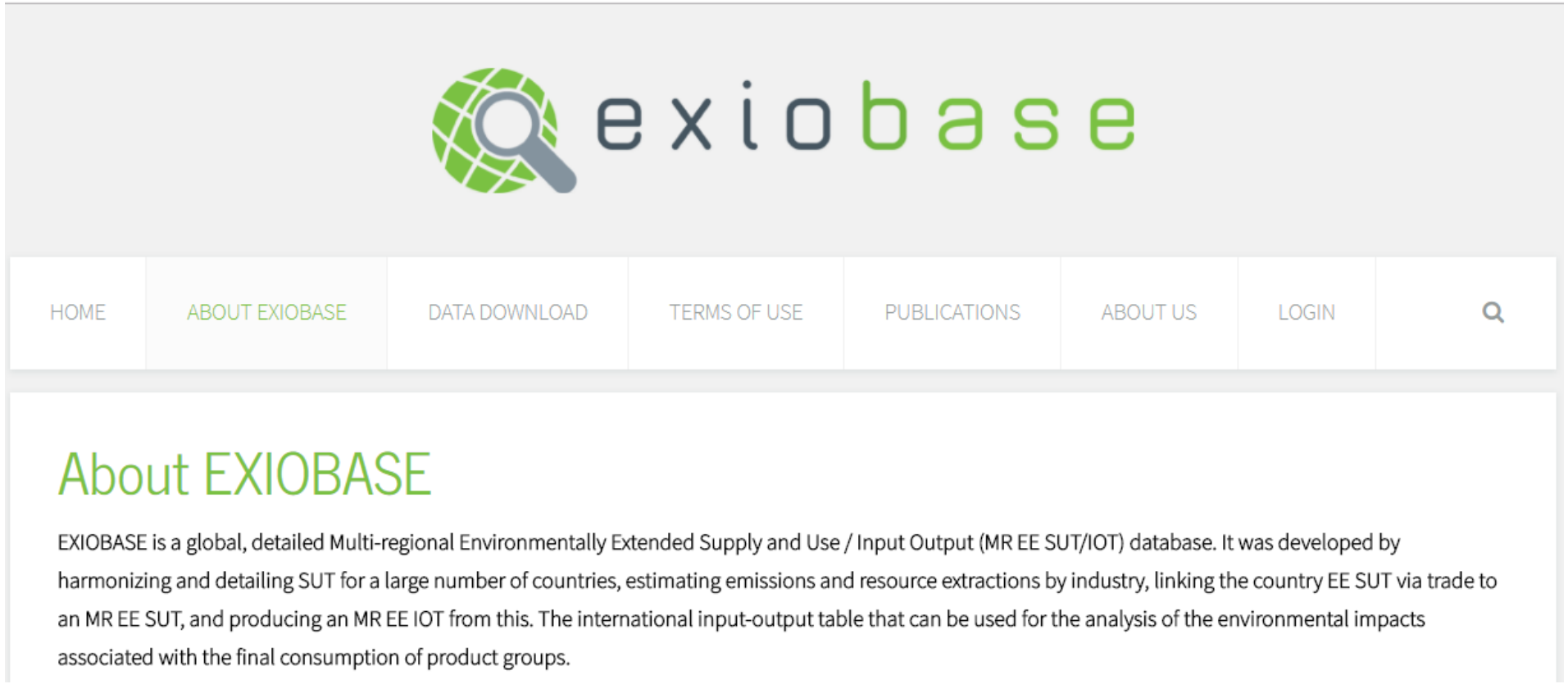


Where does the food come from?

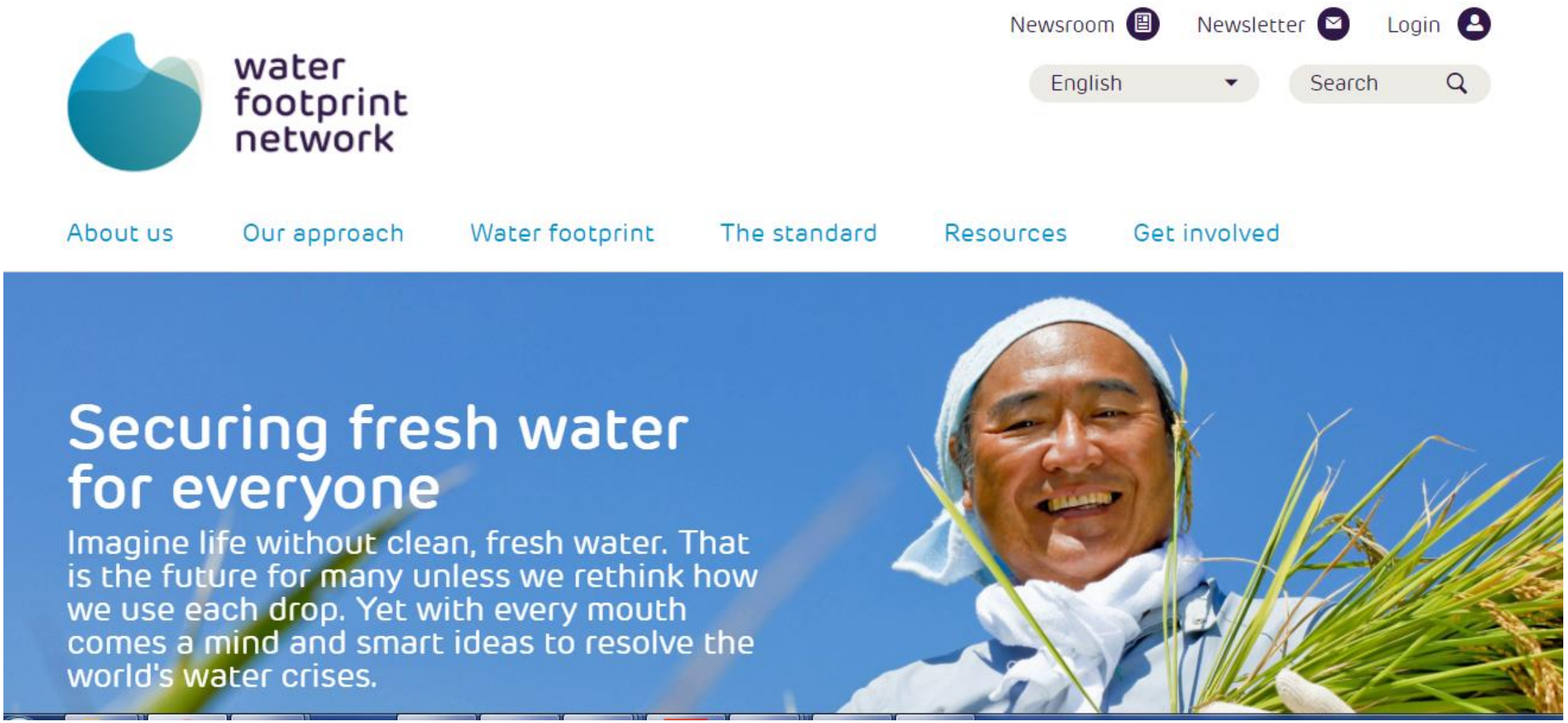


http://www.fao.org/faostat/en

What was the environmental footprint of the crop/livestock product?



http://www.exiobase.eu/



http://waterfootprint.org/en/

M. M. Mekonnen and A. Y. Hoekstra: The green, blue and grey water footprint of crops

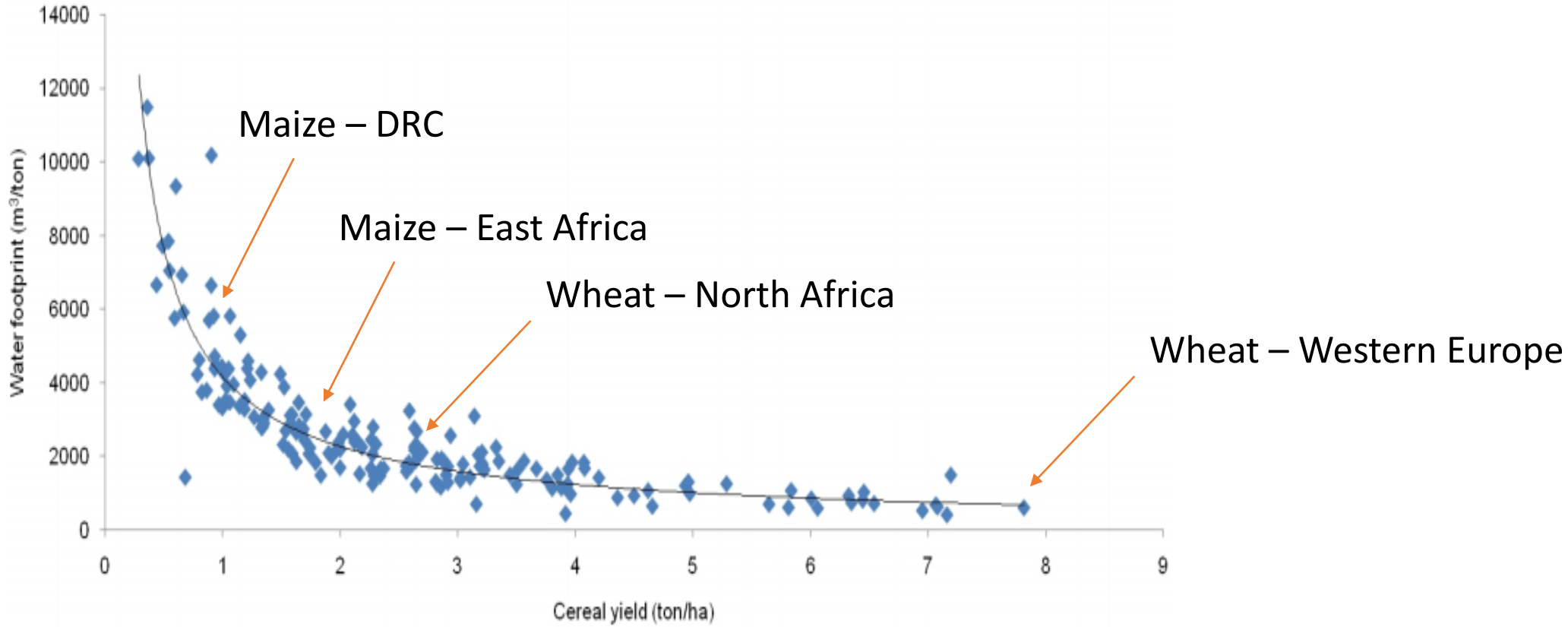


Fig. 4. The relationship between average cereal yield and water footprint per ton of cereal. Period: 1996–2005. The dots represent average country data.

Potential pitfalls

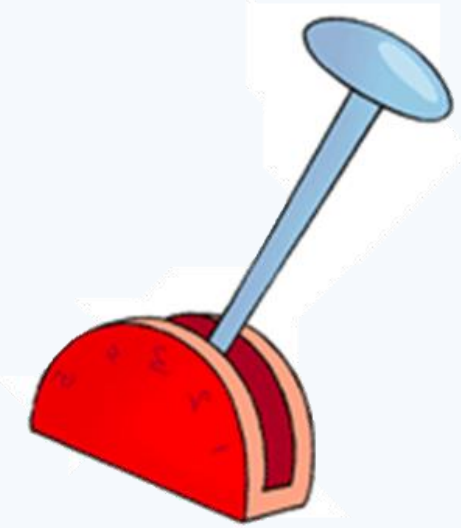
- Dietary data not representative of population
- Lack of data on intra-national trade
- Poor spatial resolution of production/environmental footprint data
- Moisture contents in harvested products *versus* food items
- Use ≠ impact

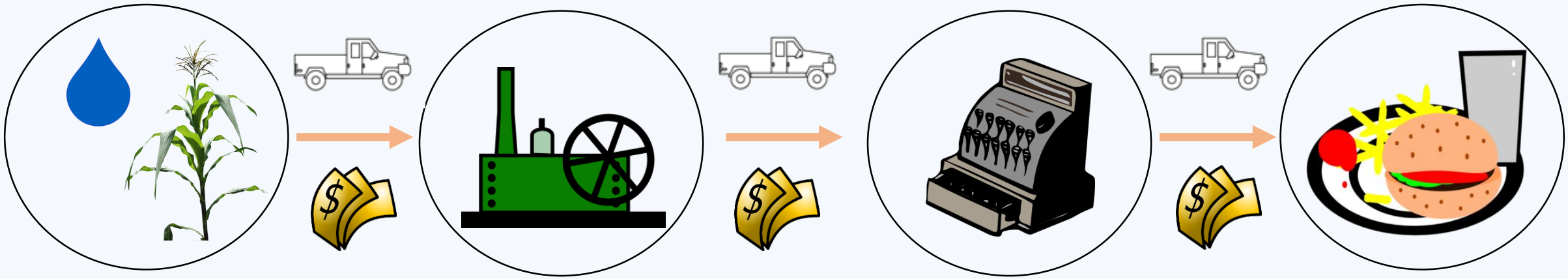
- A plate of food contains 200 g cooked rice and 100 g cooked beans. What is the blue water footprint?

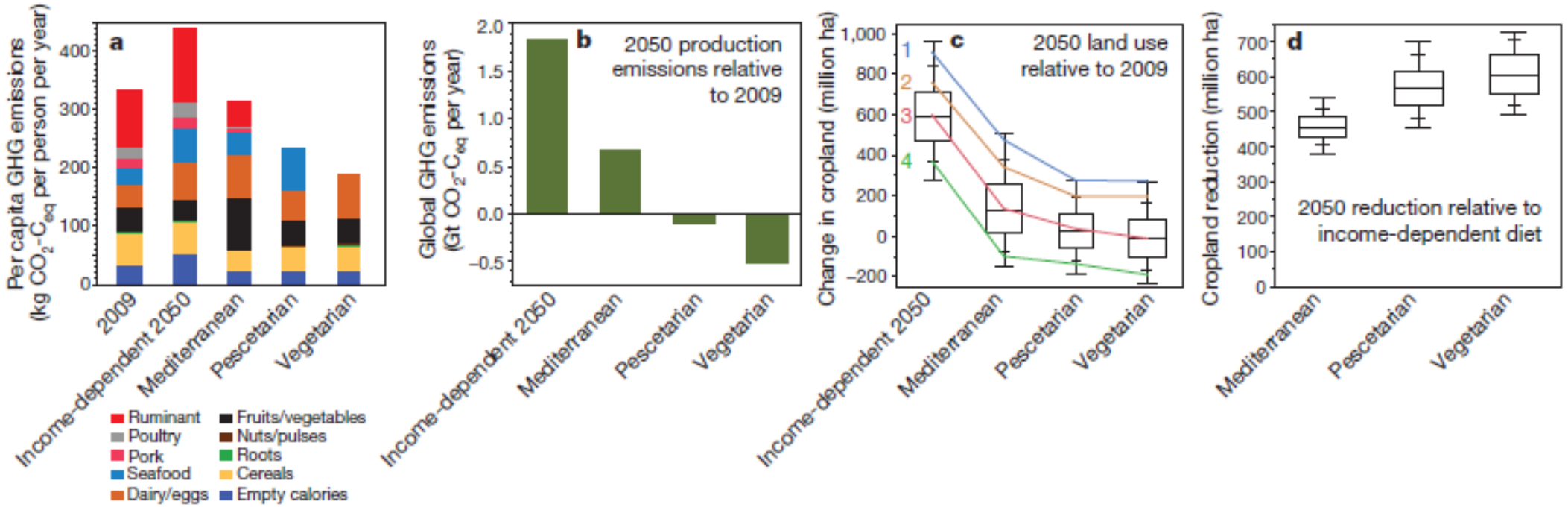
  - 70% of rice is domestically produced, 30% is imported
  - Domestic and imported rice have a blue WFs of 250 and 100 litres per kg, respectively.
  - 100% of beans are domestically produced with a blue WF of 80 litres per kg
  - Harvested and cooked rice have moisture contents of 10% and 40%, respectively.
  - Harvested and cooked beans have moisture contents of 10% and 30%, respectively.

	rice		beans
	domesic	imported	domestic
consumed weight (g)	140	60	100
harvested weight (g)	92.4	39.6	77.0
blue WF (L/g)	0.25	0.1	0.08
blue WF (L)	23.1	4.0	6.2
Total blue WF (L)	33		

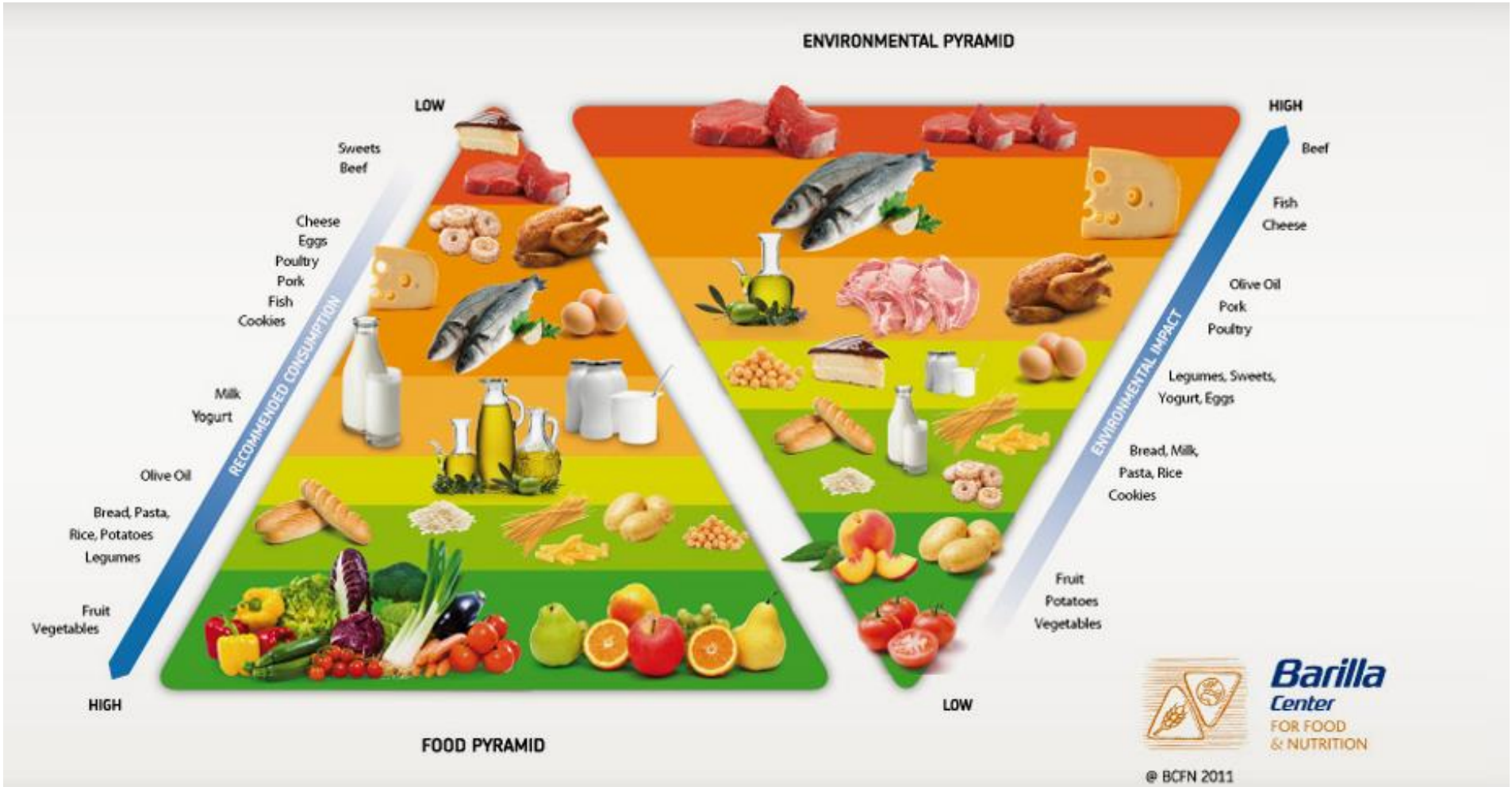
Solutions







Tilman & Clark, 2014

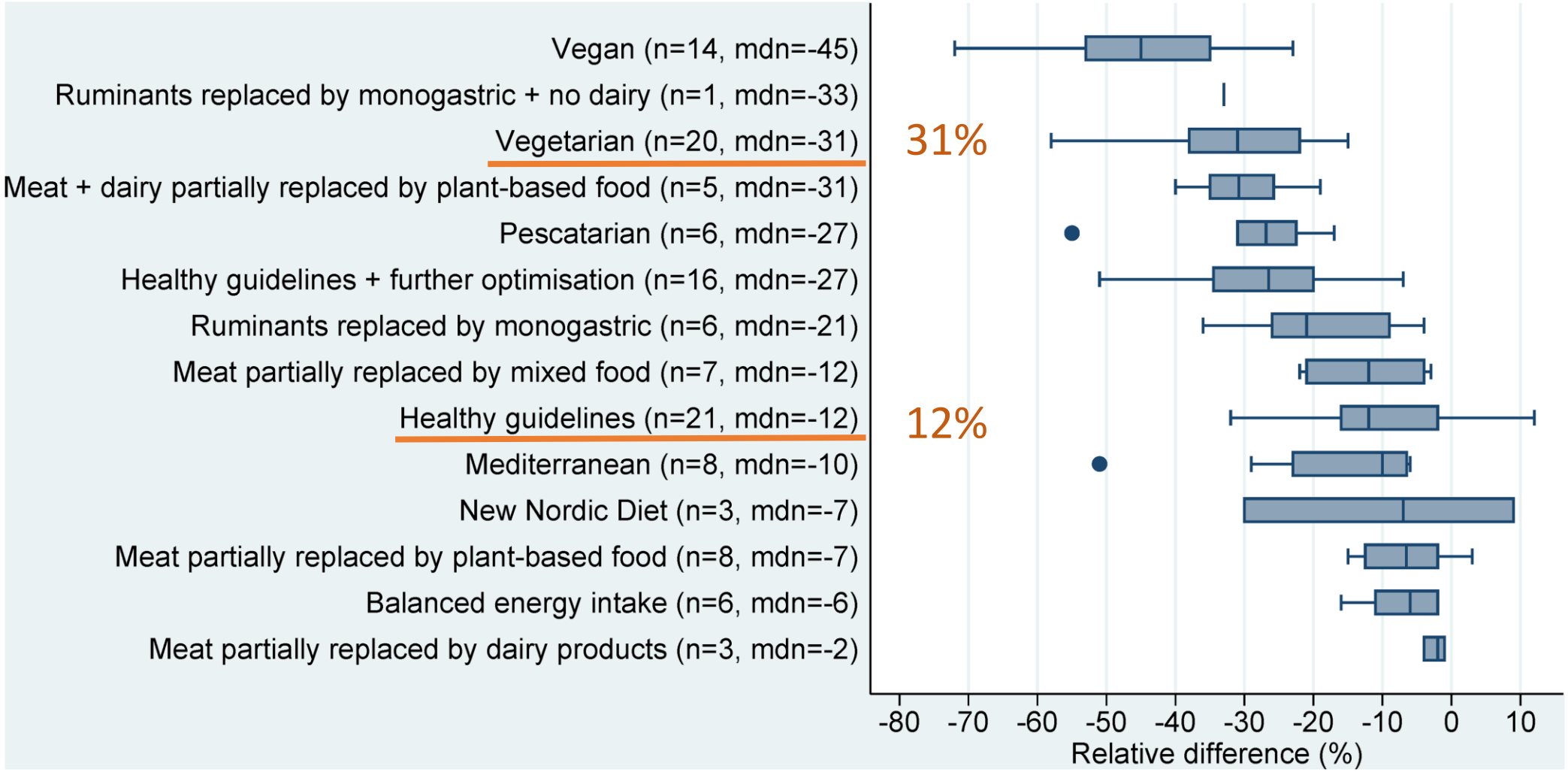


Barilla Center for Food & Nutrition

- Healthy diet = 17% lower GHG and +7m life years over next 30 years
- Co-benefits between diet, health and GHGs,
- Trade-offs when high emissions savings are required.
- Used to support PHE “sustainable food plate”

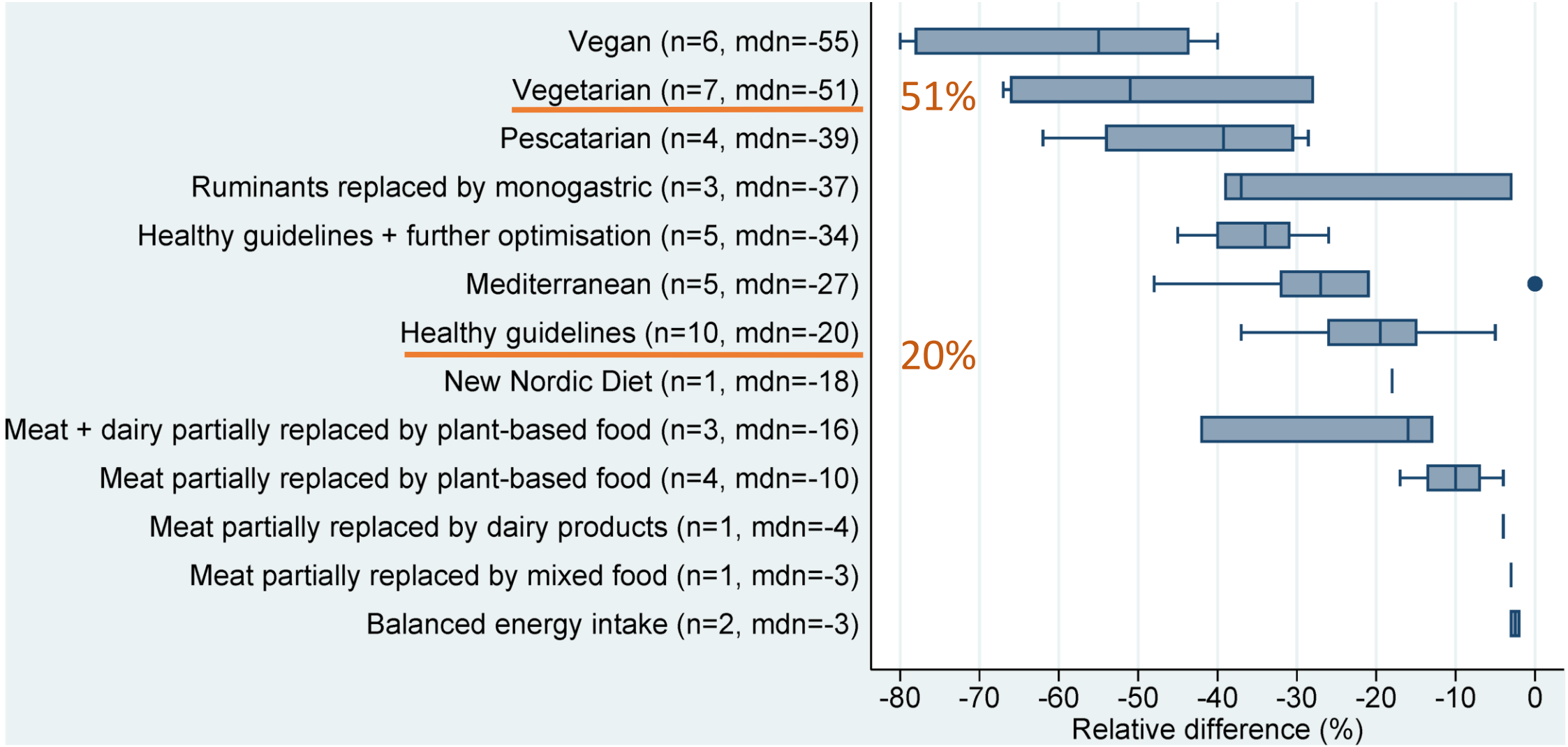
Green et al. 2015
Milner et al. 2015

Relative differences in GHG emissions (kg CO_2eq/capita/year) between current diets and sustainable diets



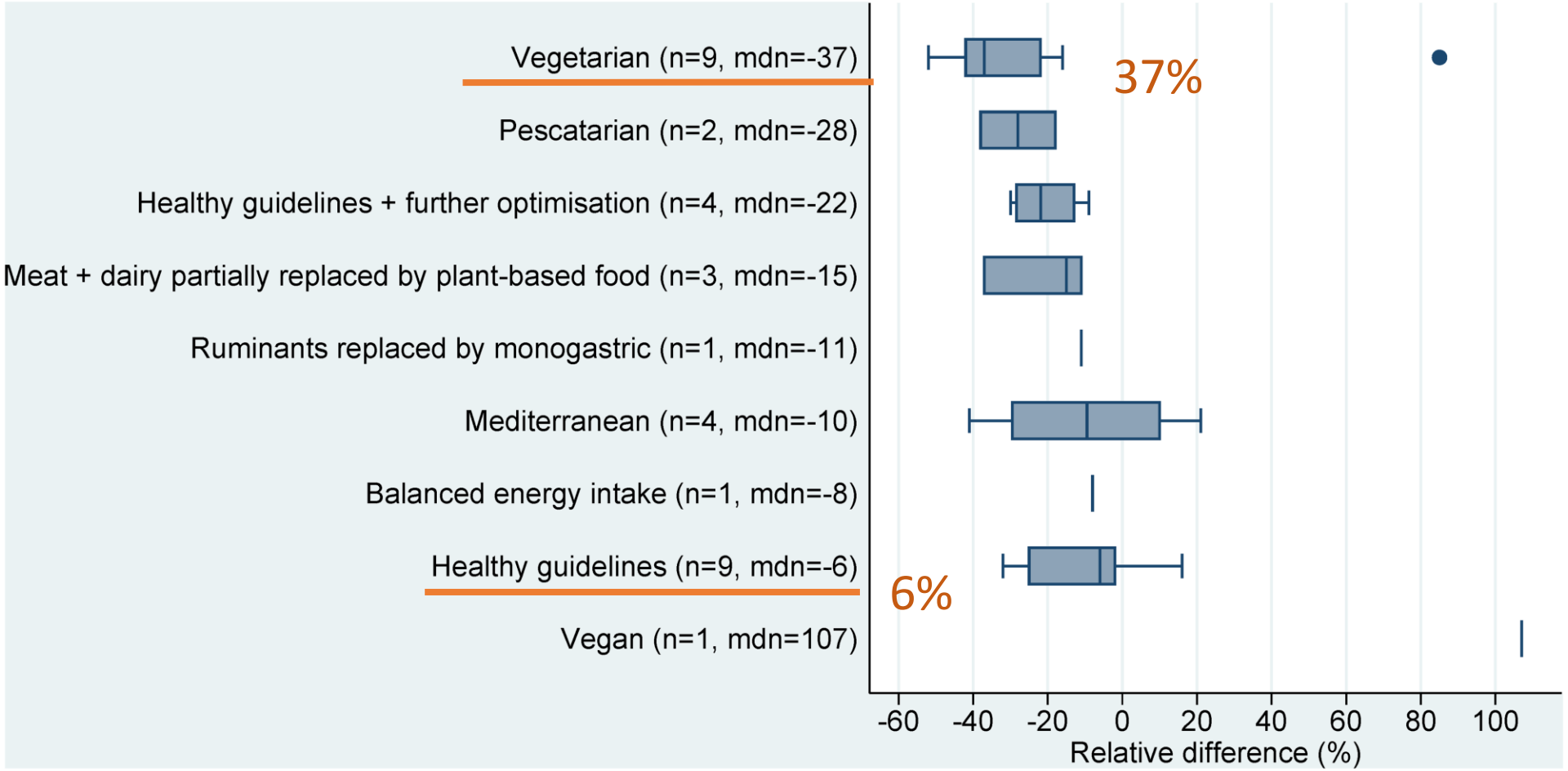
Aleksandrowicz et al., 2016

Relative differences in land use (m^2/capita/year) between current diets and sustainable diets

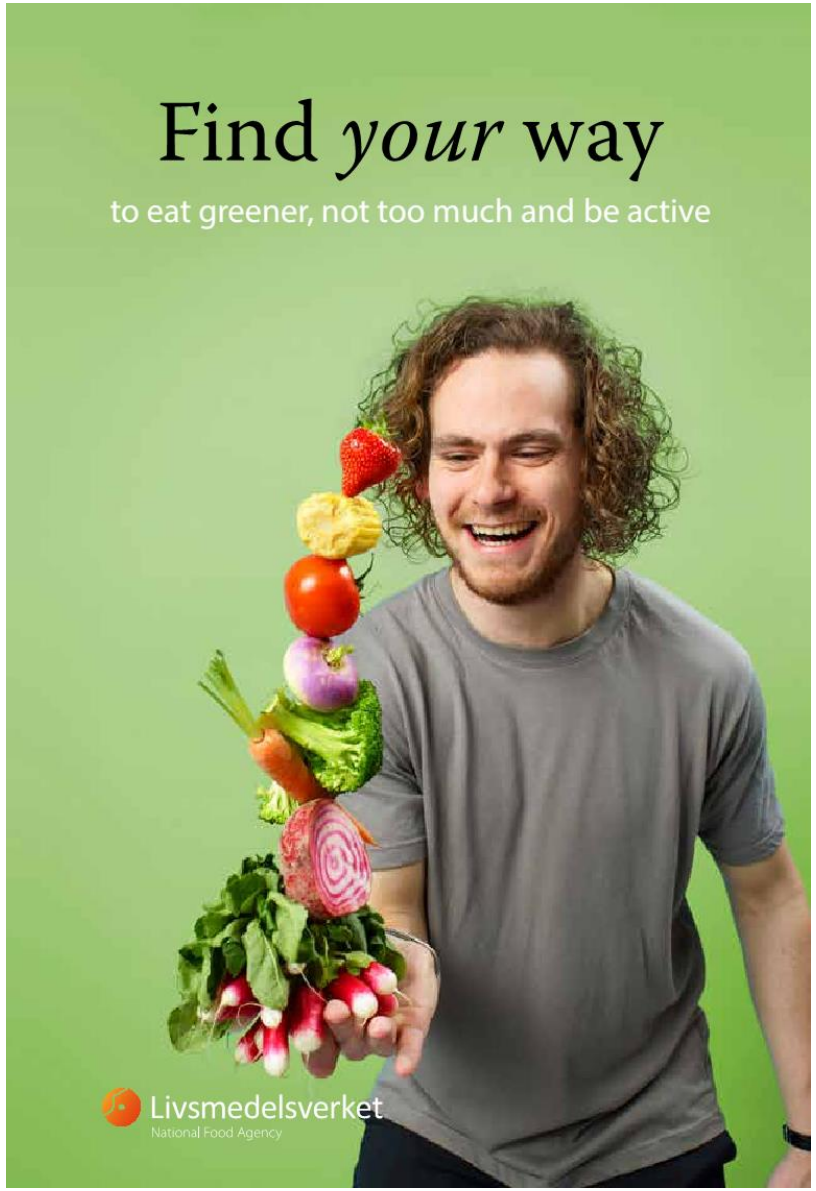


Aleksandrowicz et al., 2016

Relative differences in water use (L/capita/year) between current diets and sustainable diets



Aleksandrowicz et al., 2016



MINISTRY OF HEALTH OF BRAZIL

DIETARY GUIDELINES FOR THE BRAZILIAN POPULATION

2ª Edition

Brasília – DF
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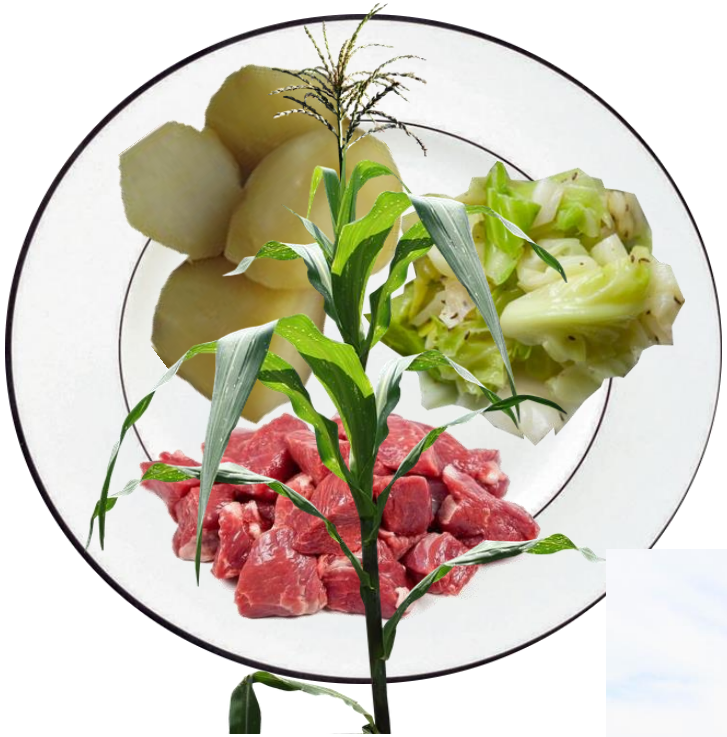
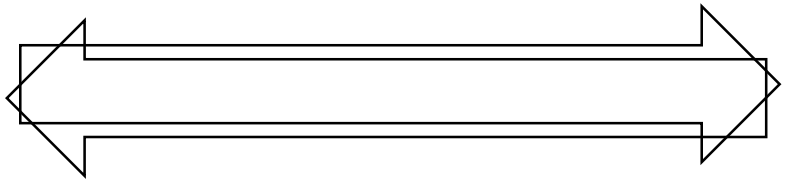


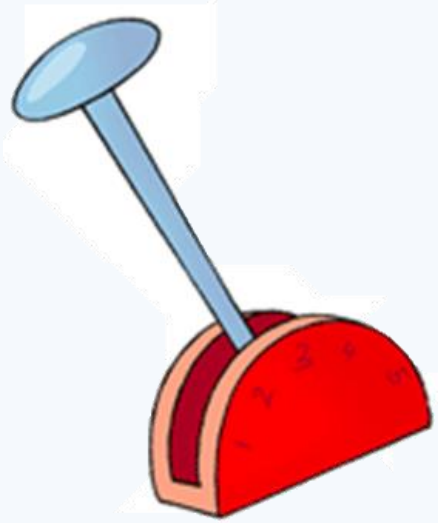
Predation drives dietary choices

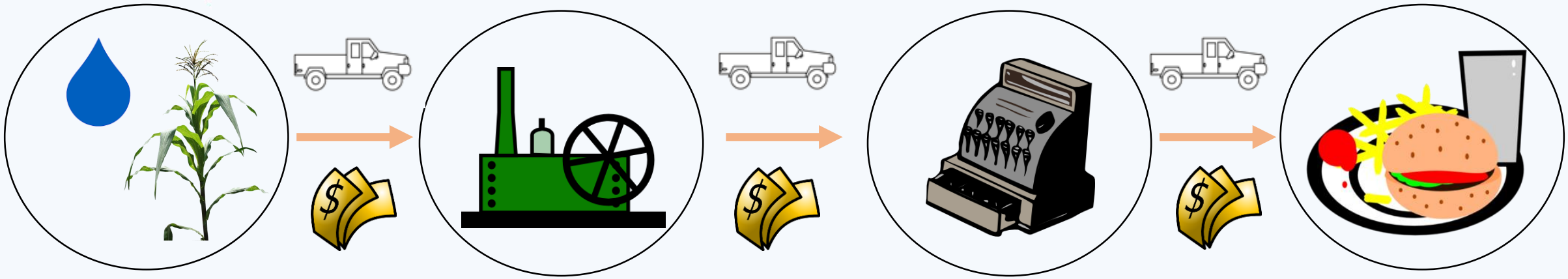


Developed consumer economies?

Subsistence settings?

Solutions



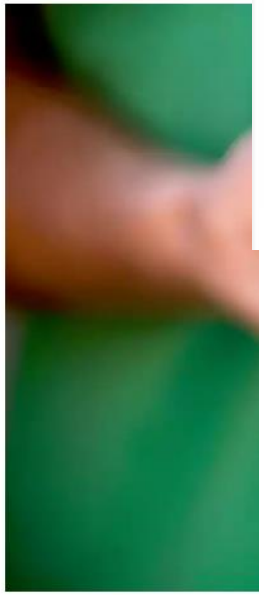


Sustainable intensification?

Vegetables

What a pic shortage

Cold and wet weath bemoaning empty s



What will you give me for t

Fruit

Strawberry deals forever? British fruit in shops two months early

Mild days and new glasshouse tech mean the summer fruit – a Wimbledon and Henley staple – is starting its season in March

British-grown strawberries will be in UK supermarkets this week. Photograph: Philip Toscano/PA

This article is 1 month old

5,723

Matthew Weaver

Tuesday 17 January 2017 12.13 GMT

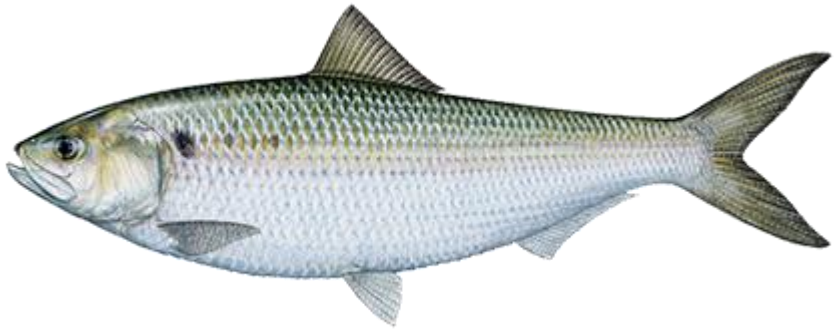
18 99

Caroline Davies

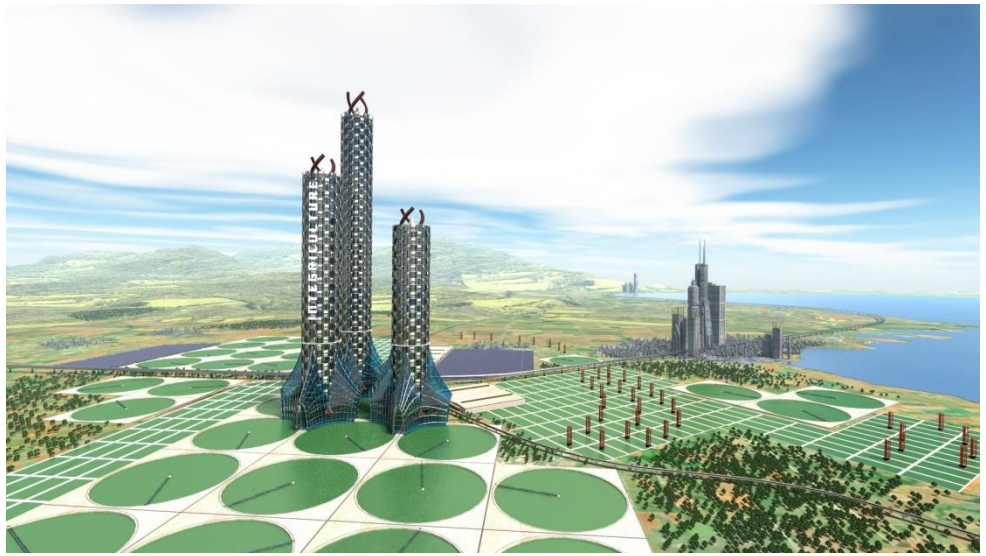
Monday 27 February 2017 00.01 GMT

Conservation agriculture

C storage
Resilience to drought/heavy rain

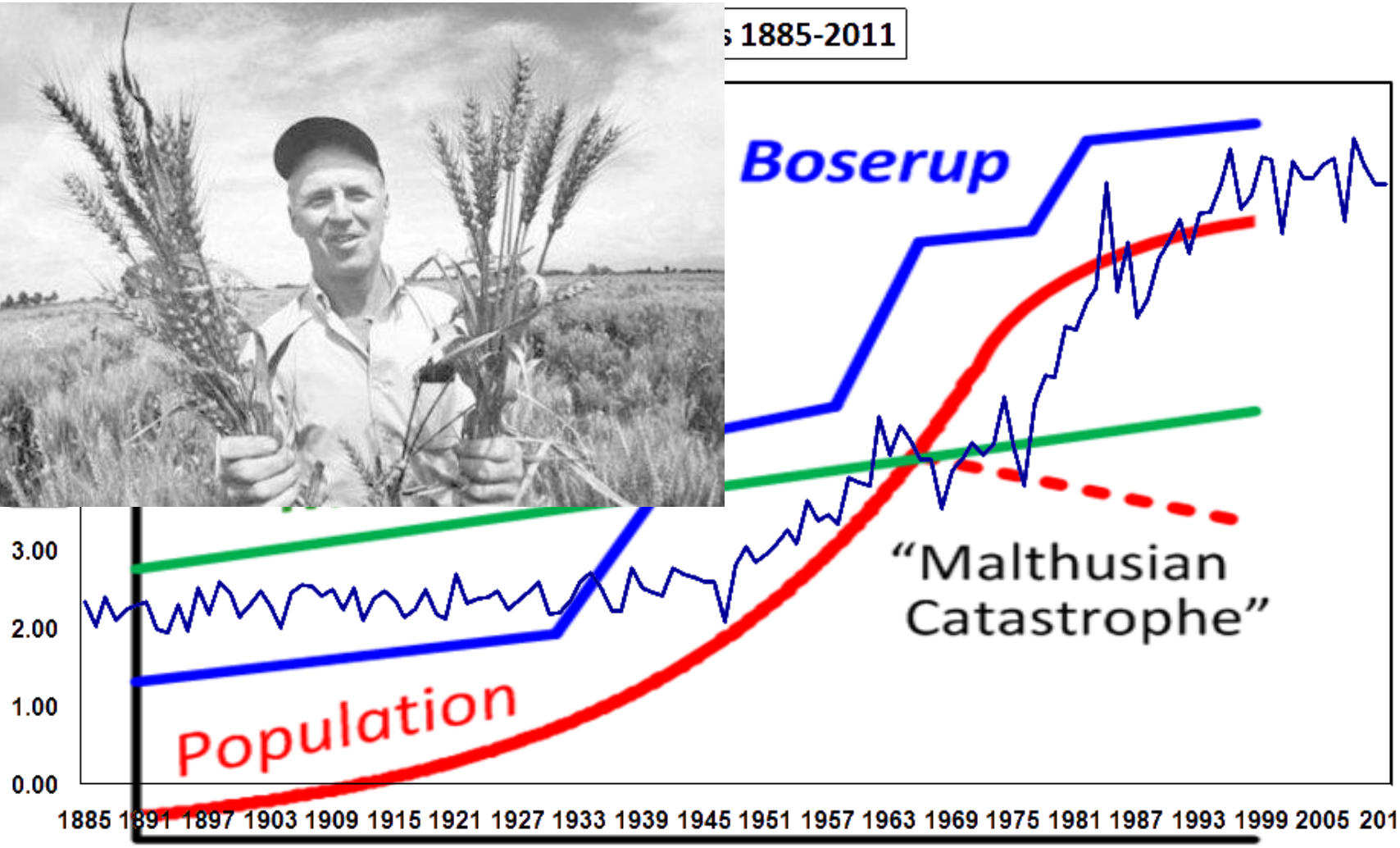


Future cellular agriculture production site (Shojinmeat)



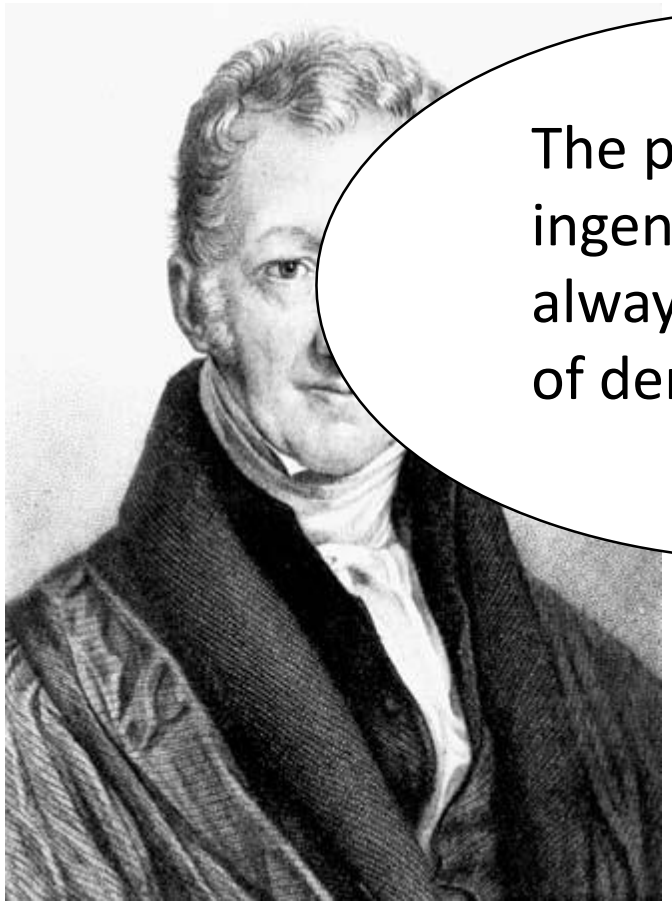
Feedlot, Texas (Mishka Henner)

Vertical farming (industrytap.com)



https://**davidruyet**.wordpress.com

Population



The power of ingenuity would always outmatch that of demand

The power of population is
eater than the power
oduce subsistence
an

Thomas Robert Malthus, 1766-1834

Ester Boserup, 1910-1999

Will Steffen

Ultimately, there will need to be an institution…operating, with authority, above the level of individual countries to ensure that the planetary boundaries are respected.

Some argue that humanity can now survive, and even thrive, in a rapidly destabilizing planetary environment, but that is a belief system based on supreme technological optimism…

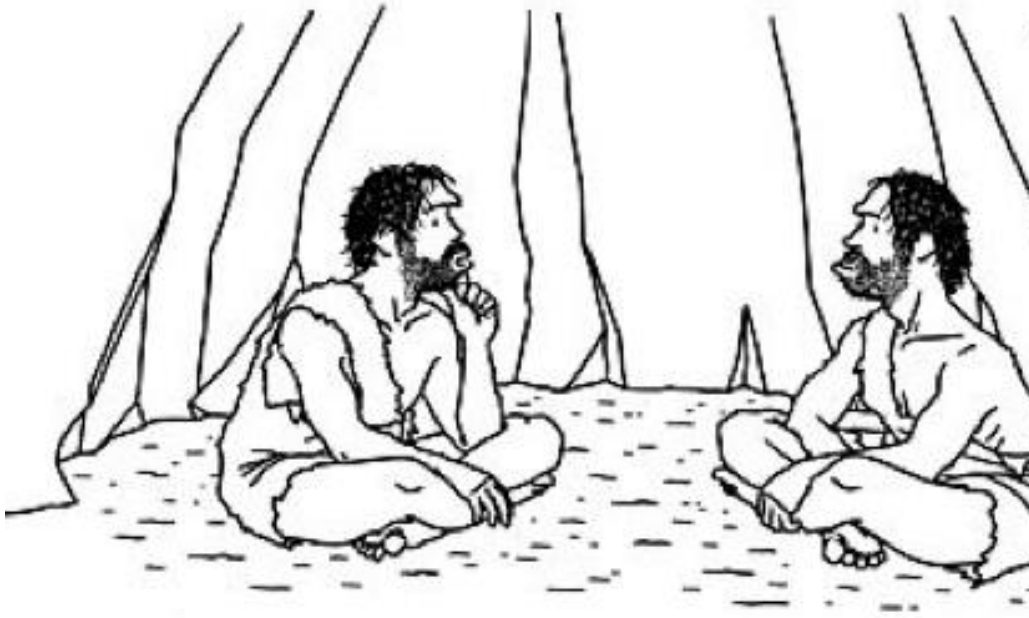
It is likely that a large fraction of people on Earth would not be alive today without the artificial production of fertilizer. How can such ethical and economic issues be matched with a simple call to set limits? [...] food is not optional.

Peter Brewer

Andrew Revkin

the human-altered ecosystems of the Anthropocene represent the only state of the planet that we know for certain can support contemporary civilization.

Critical (but not cynical)



"Something's just not right—our air is clean, our water is pure, we all get plenty of exercise, everything we eat is organic and free-range, and yet nobody lives past thirty."

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