LUXEMBOURG INSTITUTE OF HEALTH | DEPARTMENT OF PRECISION HEALTH DOPH

Nutrition & Health Research Group

# Sustainability of dietary patterns:
## How have their environmental and climate impact changed in participants of the ORISCAV-LUX studies during the last 10 years?


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LE GOUVERNEMENT
DU GRAND-DUCHÉ DE LUXEMBOURG
Ministère de l'Agriculture, de la Viticulture et du Développement rural

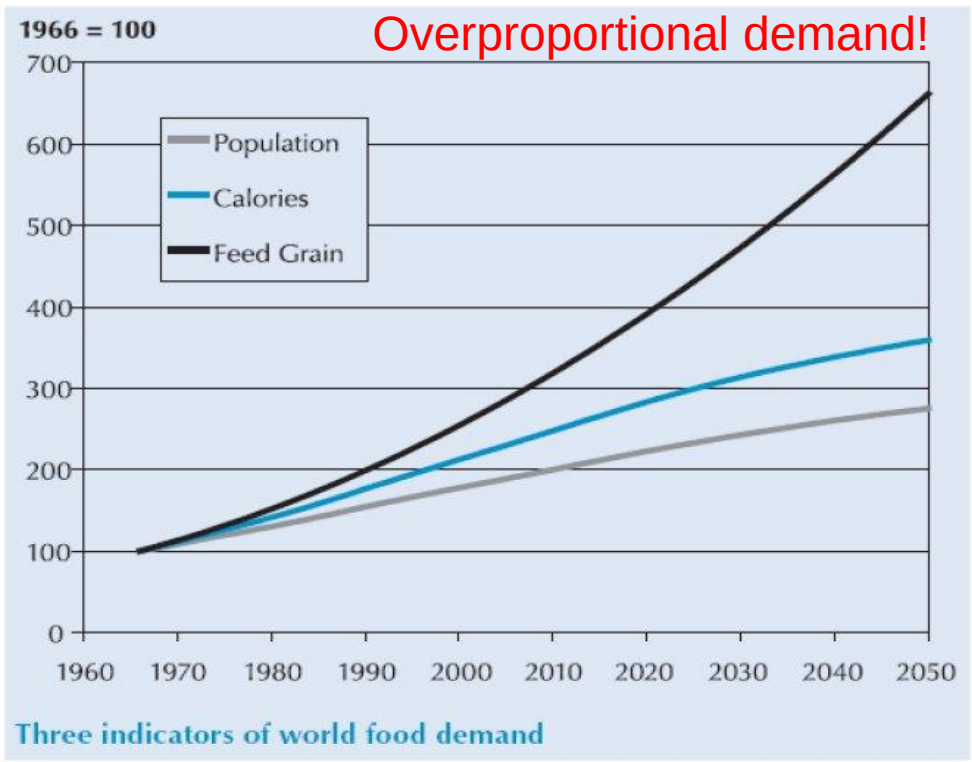
Administration luxembourgeoise vétérinaire et alimentaire

**Research in food safety**
**9th December 2022**

# Overview

- What are the challenges?
- What is sustainable?
- ORISCAV-LUX studies?
- What have we found so far?
- Is our diet sustainable?
- Suggestions/Solutions!?


# What are the challenges?

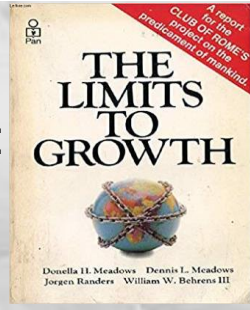



Source: Babcock, Bruce A. 2008. Charting Growth in Food Demand, *Iowa Ag Review Online*, Summer 2008, Vol. 14 No. 3. http://www.card.iastate.edu/iowa_ag_review/summer_08/article4.aspx

**Climate Change, Biodiversity, Land-System changes, Freshwater usability, N & P losses**

EAT-Lancet Commission *(Willet, Lancet, 2019*

1972:




**Until 2050:**

World population:

8 →10 bn (https://population.un.org/)

Increasing Demand:

- Calories (proteins)
- Cultivatable surface
- Water

→ Limited:

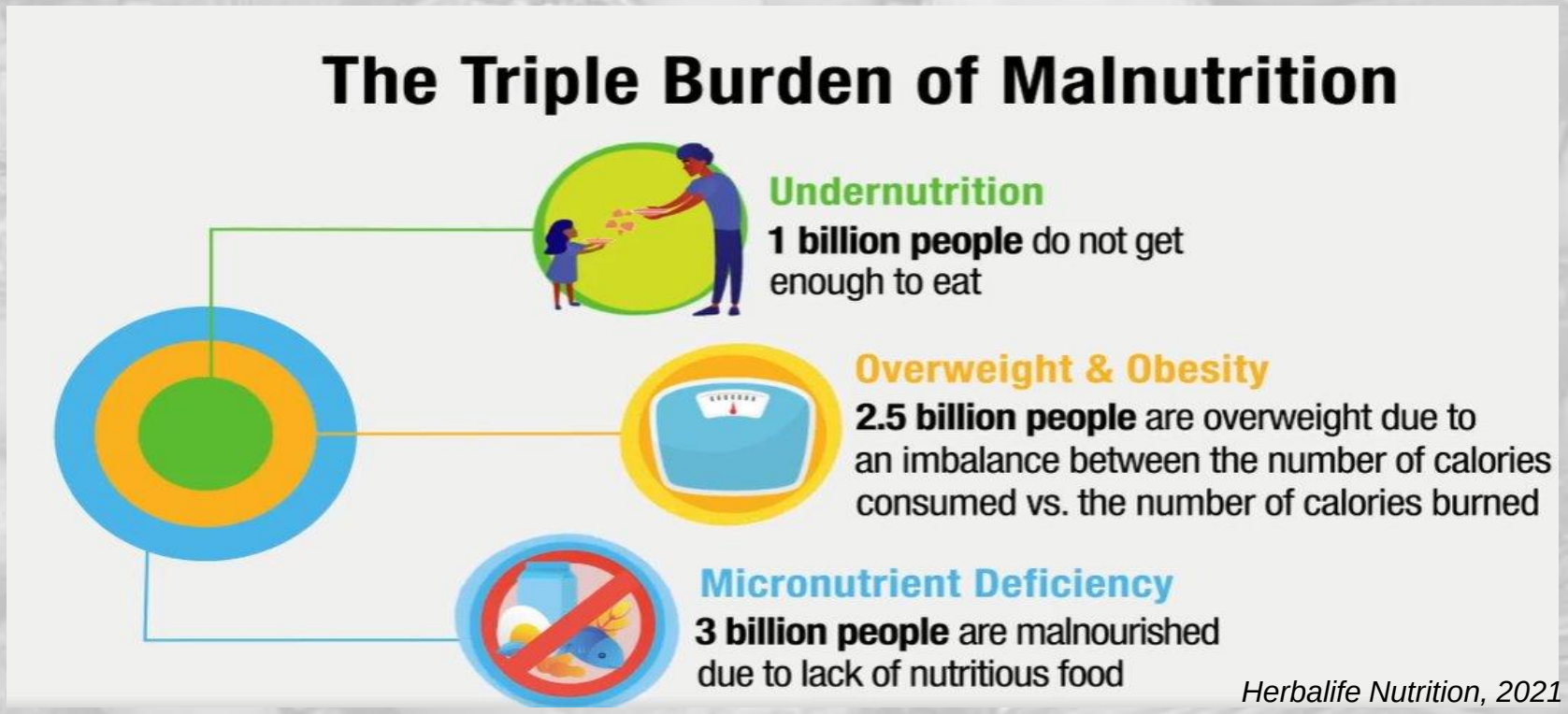
- Ressources
- Growth potential

**Concrete Challenges for Diet, Nutrition & Health!**

# What are the challenges?

**2030-2050: climate change causes ≈ 250 000 (per year) additional deaths from malnutrition, diarrhea, malaria, and heat stress.**

**The direct damage expenses to health to range between USD 2-4 billion per year by 2030.**

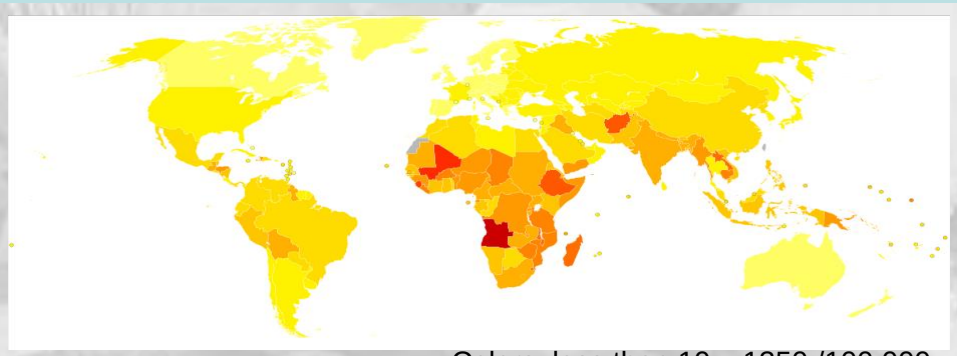



*Herbalife Nutrition, 2021*

**Several aspects may be found in same person!**

# What are the challenges?

Protein malnutrition: still the most common diet-related malnutrition (6 mio. deaths annually). 2 main forms :



Colors: less than 10 – 1350 /100,000

Kwashiorkor: sufficient calorie intake, but insufficient proteins
*oedema, dermatosis, "big belly"*

Marasmus: insufficient calorie & protein intake
*Severe underweight (<60% body weight rec), wasting, oedema…*

Carbohydrates: not essential
Fats: mostly not limiting nutrient

**Why is more food production difficult to achieve?**

# What are the challenges?

## Problem intensive agriculture!

1. Deforestation
2. Wildlife
3. Climate change
4. Water usage
5. Pandemics
6. Health

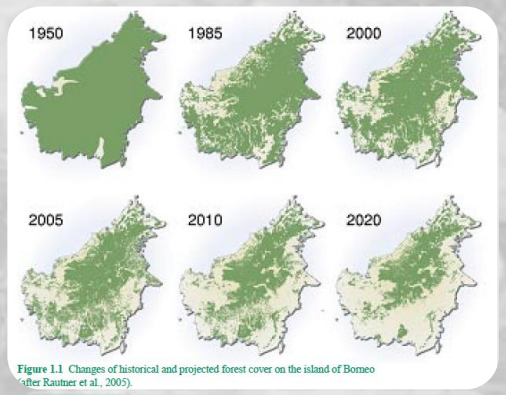
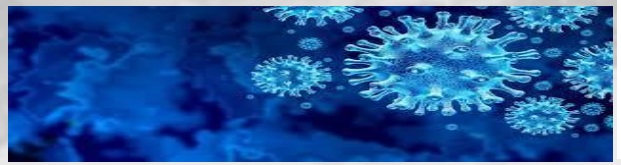
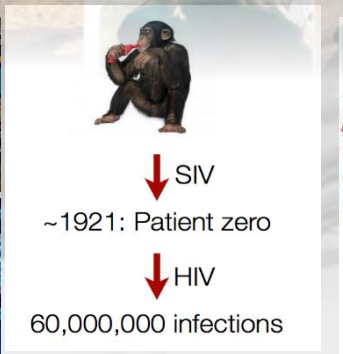
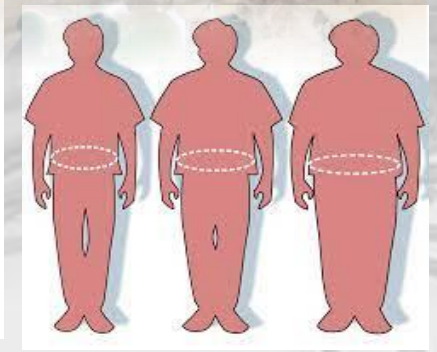


Figure 1.1 Changes of historical and projected forest cover on the island of Borneo (after Rautner et al., 2005).



# What are the challenges?

## Main goals for future (10 bn people; 2050):

# What is sustainable?

**Not a new concept…**

## Sustainability in Forestry

"Wird derhalben die gröste Kunst / Wissenschafft / Fleiß / und Einrichtung hiesiger Lande darinnen beruhen / wie eine sothane *Conservation* und Anbau des Holtzes anzustellen / daß es eine *continuirliche* beständige und nachhaltende Nutzung gebe / weiln es eine unentberliche Sache ist / ohne welche das Land in seinem *Esse* [im Sinne von Wesen, Dasein, d. Verf.] nicht bleiben mag."

Sylvicultura Oeconomica (1713).

Hans Carl von Carlowitz (1645-1714).
*SaxonTax accountant and mining administrator.*

Carlowitz formulated ideas for the "sustainable use" of the forest.
His view was that only so much wood should be cut as could be regrown through planned reforestation projects.

# What is sustainable?

Gro Harlem Brundtland
3 x Norwegian Prime Minister

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

Save natural ressources for future

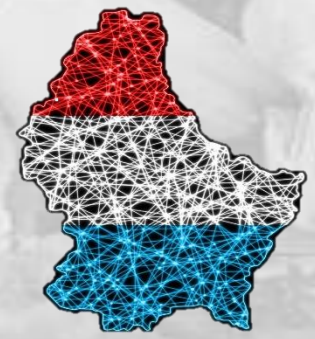
Avoid extremes (climate): unforseeable consequences

Maintaining living conditions now & for future generations

## Observation of Cardiovascular Risk Factors in Luxembourg

ORISCAV-LUX

**2007-2008**
**n= 1432 participants**
134-item FFQ



ORISCAV-LUX

**2016-2017**
**n= 1558 participants**
174-item FFQ

A total of 660 individuals participated in both studies.

**Various data were collected:**

- **Anthropometric, demographic, socioeconomic measures, …**
- **Serum measurements: FBG, Lipid profile, …**
- **Physical activity (IPAQ)**
- **Food frequency questionnaire (FFQ)**
- **…**

# FFQ at a Glance

FFQ consists of a list of foods/beverages with response categories to indicate the usual frequency/portion size of consumption over the time period queried.

FFQ frequency ranges from “never or rarely”, …, and “1 to 3 times/month”.

We link the data extracted from the FFQ to the food compositions databases to extract macro- and micronutrient intake (unit/day):

The obtained data are used to examine dietary patterns and food intakes.


ANSES-CIQUAL French Food Composition Table for Nutritional Intakes Calculation. Available online: https://ciqual.anses.fr/

# What have we found so far?

nutrients

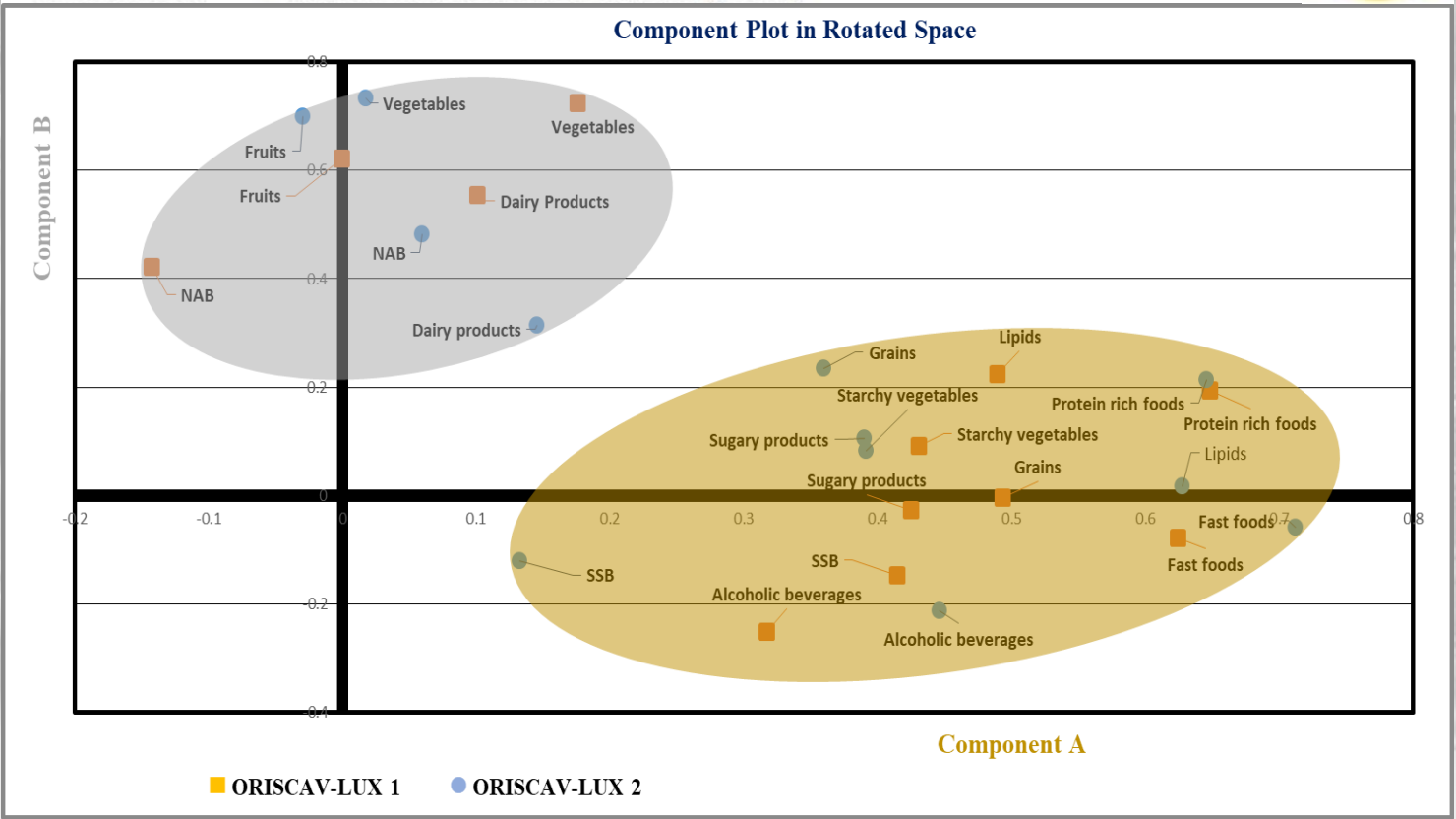
MDPI

Article

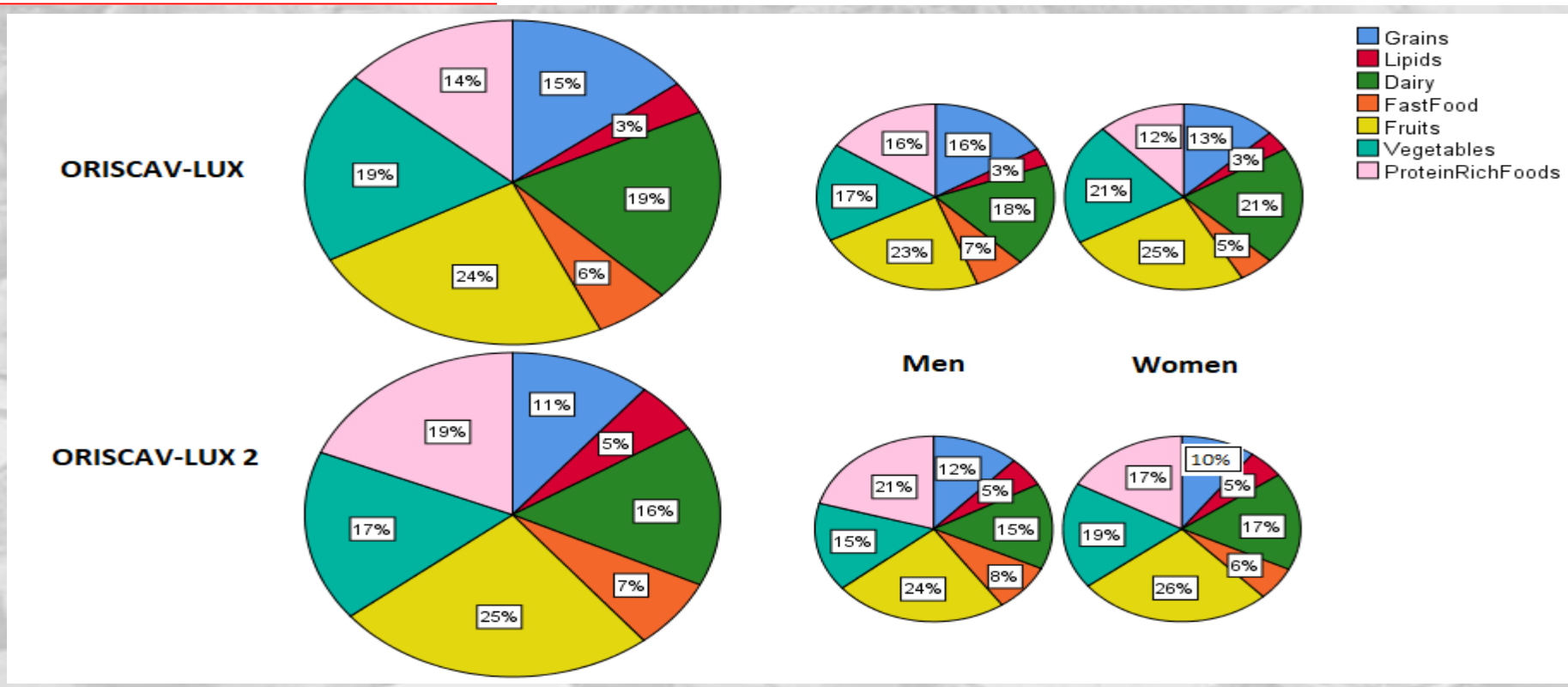
## Dietary Intake of Adult Residents in Luxembourg Taking Part in Two Cross-Sectional Studies—ORISCAV-LUX (2007–2008) and ORISCAV-LUX 2 (2016–2017)

Farhad Vahid [1], Alex Brito [2,3], Gwenaëlle Le Coroller [4], Michel Vaillant [4], Hanen Samouda [1,†], Torsten Bohn [1,*,†] and on behalf of ORISCAV Working Group [‡]

IMPACT FACTOR 6.706



# What have we found so far?




Comparing ORISCAV-LUX with ORISCAV-LUX 2

A significant ▼:

- Grains
- Vegetables/starchy VEG
- Dairy products
- Sugary products

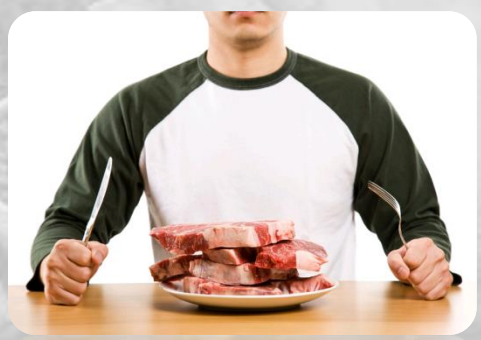

A significant ▲:

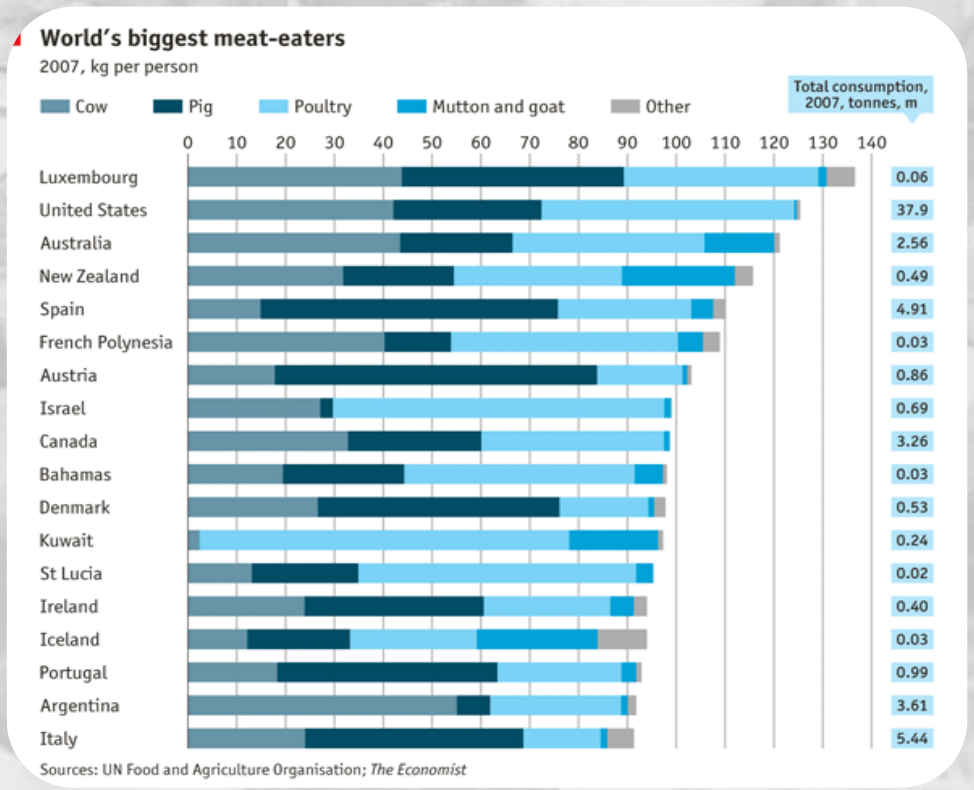
- Protein-rich foods
- Ready-to-eat/fast food
- Lipids
- Non-caloric beverages
- Alcoholic beverages

# Country with the highest meat consumption/capita?

"One of the smallest countries in the world, Luxemburg, is per capita the biggest meat eater. Luxembourgers eat on average ~300 pounds of meat/(y*person).
US. comes in 2nd with ~ 276 pounds of meat-mostly beef/y".

[e] Kennedy, Lesley. "Which Country Eats the Most Meat? It's Not U.S." Recipe. May 4, 2012. Accessed: October 23, 2012.







**Is it healthy?!**

**Is it healthy?!**

Frontiers in Nutrition Sections Articles Research Topics Editorial Board About journal

ORIGINAL RESEARCH article

Front. Nutr.
Sec. Nutrition and Metabolism
doi: 10.3389/fnut.2022.1087985

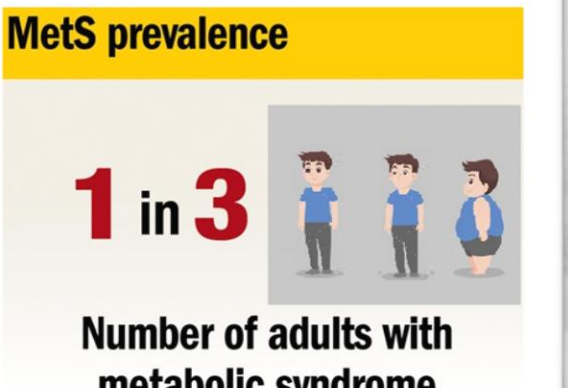
This article is part of the Research Topic
Adherence to the Mediterranean Diet: Microbiota and Non-Communicable Diseases
View all Articles >

## High Adherence to the Mediterranean Diet and Alternative Healthy Eating are Associated with Reduced Odds of Metabolic Syndrome and its Component in Participants of the ORISCAV-LUX 2 Study

Kinda Al Kudsee[1], Farhad Vahid[1] and Torsten Bohn[1]*

[1] Luxembourg Institute of Health, Luxembourg

6.590
Impact Factor




nutrients

MDPI

Article

## Association between Dietary Factors and Constipation in Adults Living in Luxembourg and Taking Part in the ORISCAV-LUX 2 Survey

Maurane Rollet, Torsten Bohn *, Farhad Vahid and on behalf of the ORISCAV Working Group †

IMPACT FACTOR 6.706

**Is it economical??!**

# Economic impact of unhealthy diet

*Public Health Nutrition: 20(3), 515–523* doi:10.1017/S1368980016002846

The economic burden of inadequate consumption of vegetables and fruit in Canada

John Paul Ekwaru[1], Arto Ohinmaa[1,*], Sarah Loehr[1], Solmaz Setayeshgar[1], Nguyen Xuan Thanh[2] and Paul J Veugelers[1]
[1]School of Public Health, University of Alberta, 3–50 University Ter
Canada, T6G 2T4: [2]Institute of Health Economics, Edmonton, Albe

**Costs of low fruit/vegetable consumption in Canada: 3.3 billion Can $/y**
**Luxembourg: 60 million Euro**

(*Ekwaru et al. Publ Health Nutr 2016*)

PLOS ONE

RESEARCH ARTICLE

The economic burden of not meeting food recommendations in Canada: The cost of doing nothing

**Jessica R. L. Lieffers*, John Paul Ekwaru, Arto Ohinmaa, Paul J. Veugelers***
berta, Edmonton,
askatoon,

**Costs of not following recommendations for 8 major food groups in CN: 13.8 billion Can $/y**
**Luxembourg: 250 million Euro**

*(Lieffers, PlosOne, 2018)*

**Is it sustainable?!**

**Is it sustainable?!**

# Database and calculation method:

https://agribalyse.ademe.fr/

## Explorer la base Agribalyse

Cette application présente les résultats de la base de données Agribalyse, selon les indicateurs ACV. Ceci ne corres… al ou un « éco-score » pour le grand-public.

4003

Ciqual
French food composition table

Appuyez sur Entrée

**Catégories**

- Viandes, œufs, poissons
- Fruits, légumes, légumineuses et oléagineux
- Produits céréaliers
- Entrées et plats composés
- Lait et produits laitiers
- Boissons
- Aides culinaires et ingrédients divers
- Matières grasses
- Produits sucrés
- Aliments infantiles
- Glaces et sorbets

Résultats de votre recherche pour 4003 (1 résultat) :

Pomm…
pomm…

Score environnem…
0.12
par kg de produit

+ Infos

DQR : 2.63

PEF:
Product Environmental Footprint

| Indicateur | Mesure | Unité |
|---|---|---|
| Score unique EF | 0.12 | mPt/kg de produit |
| Changement climatique | 0.95 | kg CO2 eq/kg de produit |
| Appauvrissement de la couche d'ozone | 0.16 | E-06 kg CVC11 eq/kg de produit |
| Rayonnements ionisants | 0.69 | kBq U-235 eq/kg de produit |
| Formation photochimique d'ozone | 2.76 | E-03 kg NMVOC eq/kg de produit |
| Particules | 0.04 | E-06 disease inc./kg de produit |
| Acidification terrestre et eaux douces | 0 | mol H+ eq/kg de produit |
| Eutrophisation terreste | 0.02 | mol N eq/kg de produit |
| Eutrophisation eaux douces | 0.14 | E-03 kg P eq/kg de produit |
| Eutrophisation marine | 1.93 | E-03 kg N eq/kg de produit |
| Utilisation du sol | 26.73 | Pt/kg de produit |
| Écotoxicité pour écosystèmes aquatiques d'eau douce | 21.87 | CTUe/kg de produit |
| Épuisement des ressources eau | 1.11 | m3 depriv./kg de produit |
| Épuisement des ressources énergétiques | 26.59 | MJ/kg de produit |
| Épuisement des ressources minéraux | 2.4 | E-06 kg Sb eq/kg de produit |

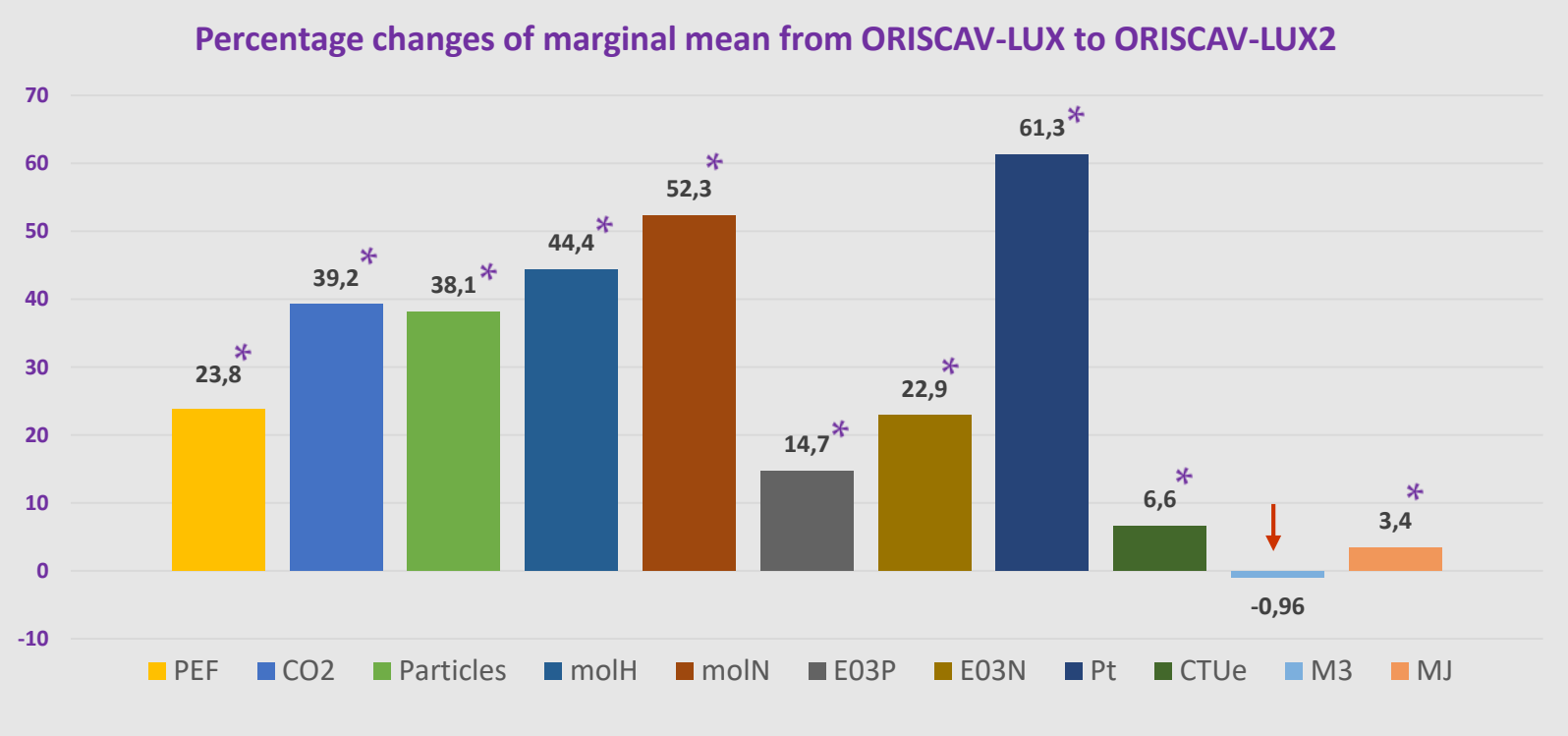
We created our own database

**Is it sustainable?!**

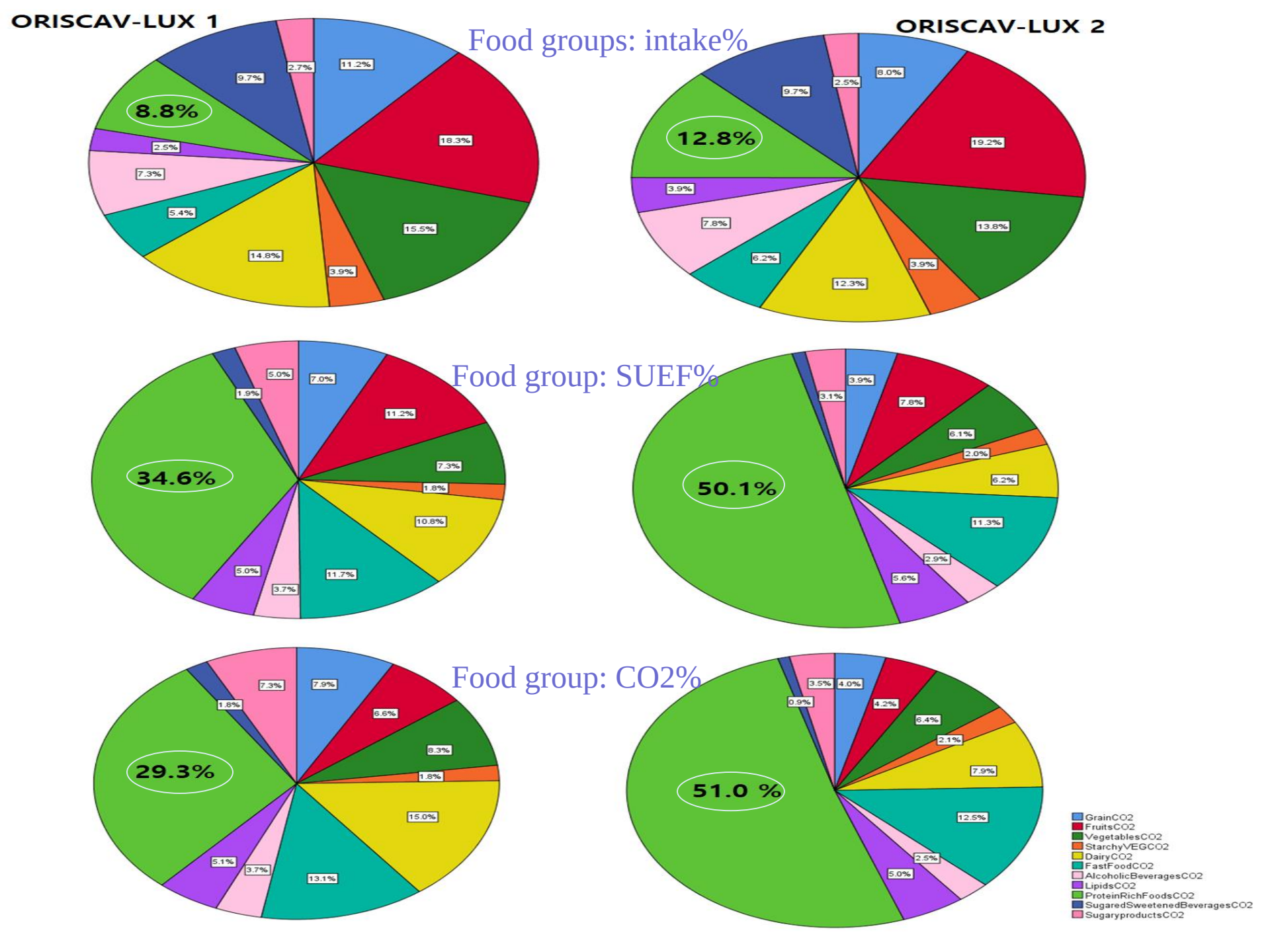
## Database and calculation method:

1. **Environmental footprint unique score (SUEF): This score (without unit) is a weighted average of the 16 indicators, calculated according to the European "PEF" (Product Environmental Footprint) methodology; the lower the score, the lower its impact on the environment.**
2. **Climate change (kg $CO_2$ eq/kg product)**
3. *Particles (disease incidence/kg product)*
4. *Land and freshwater acidification (mol H+ eq/kg product)*
5. *Land eutrophication (mol N eq/kg product)*
6. *Freshwater eutrophication (kg P eq/kg product)*
7. *Marine eutrophication (E-03 kg N eq/kg product)*
8. *Land use (Pt/kg product)*
9. *Ecotoxicity for freshwater aquatic ecosystems (CTUe/kg product)*
10. **Depletion of water resources (m3 depletion/kg product)**
11. *Depletion of energy resources (MJ/kg product)*

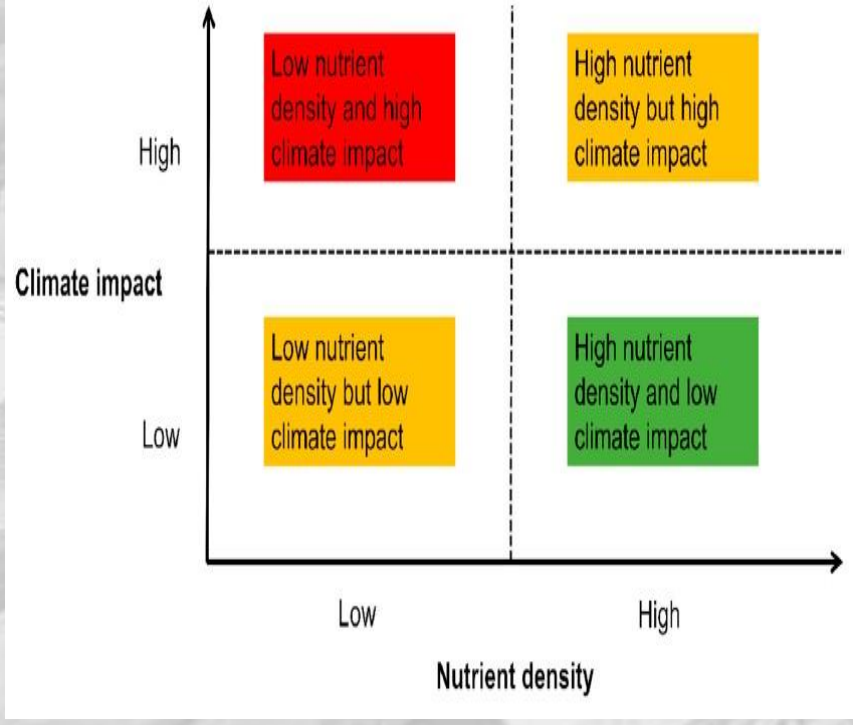
# Preliminary results[a]

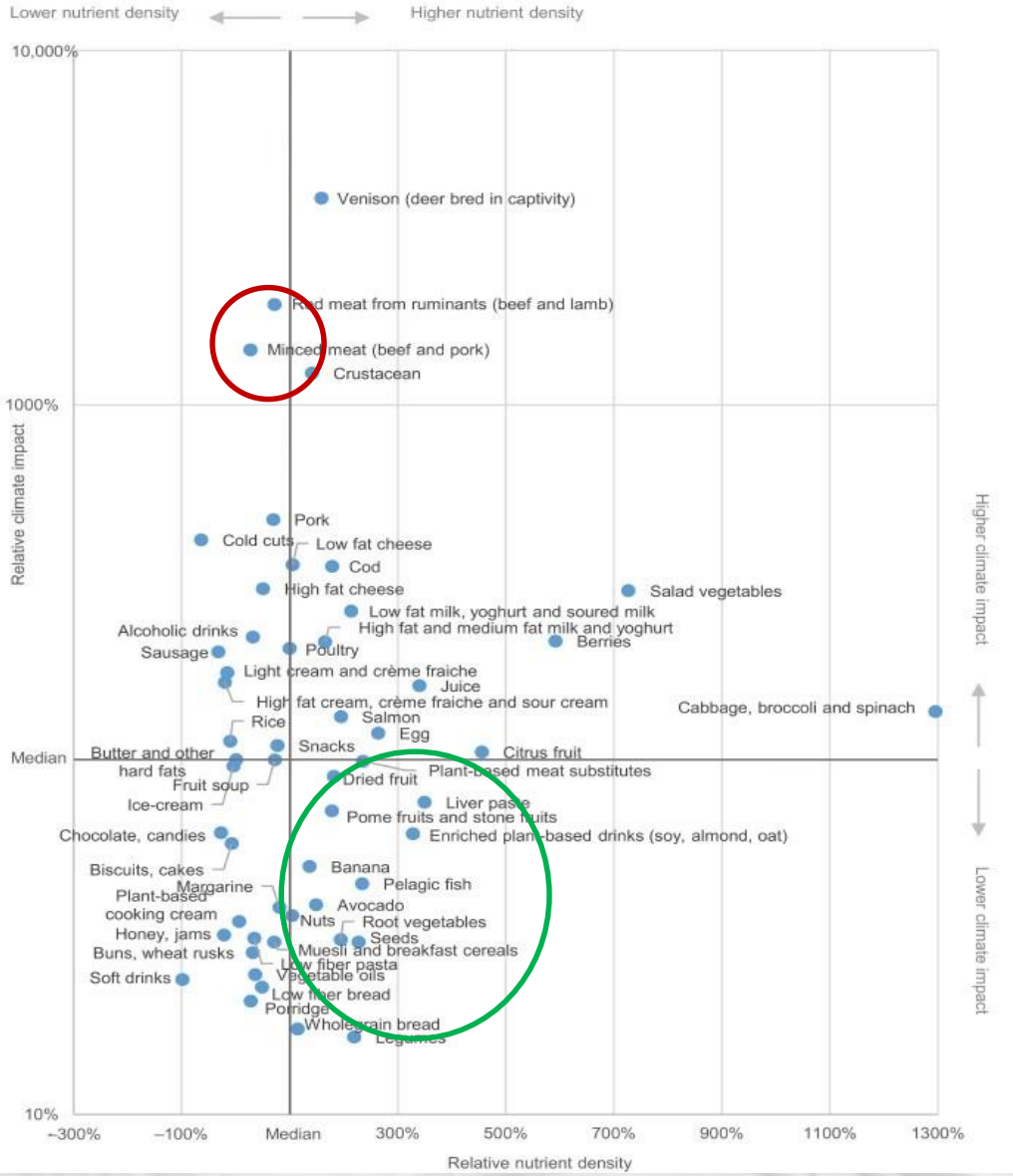



[a] Linear mixed model adjusted for age, marital status, education, job, income, number of persons living in the same household.
* Significant p-values after Benjamini-Hochberg correction.


ORISCAV-LUX 1
Food groups: intake%
11.2%
18.3%
15.5%
3.9%
14.8%
5.4%
7.3%
2.5%
8.8%
9.7%
2.7%
ORISCAV-LUX 2
8.0%
19.2%
13.8%
3.9%
12.3%
6.2%
7.8%
3.9%
12.8%
9.7%
2.5%
Food group: SUEF%
7.0%
11.2%
7.3%
1.8%
10.8%
11.7%
3.7%
5.0%
34.6%
1.9%
5.0%
3.9%
7.8%
6.1%
2.0%
6.2%
11.3%
2.9%
5.6%
50.1%
3.1%
Food group: CO2%
7.9%
6.6%
8.3%
1.8%
15.0%
13.1%
3.7%
5.1%
29.3%
1.8%
7.3%
4.0%
4.2%
6.4%
2.1%
7.9%
12.5%
2.5%
5.0%
51.0 %
0.9%
3.5%
GrainCO2
FruitsCO2
VegetablesCO2
StarchyVEGCO2
DairyCO2
FastFoodCO2
AlcoholicBeveragesCO2
LipidsCO2
ProteinRichFoodsCO2
SugaredSweetenedBeveragesCO2
SugaryproductsCO2

# How can we judge fairly?




→ **Meat not sustainable & Health concerncs**

→ So where to get sustainable protein?

→ So where to get sustainable protein?

# Novel protein sources: In addition to more soy, legumes…

## In-vitro meat:

- Also cells need food, costly
- Same taste?
+ No pollutants

## Algae:

The “green gold”
- Sunny places needed
- Toxins?
- Rich: nucleic acids (gout)
+ High protein mass

## Mushrooms:


- Low biological value
+ Meaty flavour
+ Protein content

## Insects:


- Problem allergies?
- Microbiological safety?
- Novel foods (EFSA!)
+ High protein content

## Fish-farming:

+ More sustainable than ocean-fishing
- Still loss of energy from fish-feeding
- Clean water issues

# Sustainable and healthy recommendations

EAT Lancet Commission:
Sustainable diet would cover all essential nutrients, except perhaps B12

Health-wise: less meat, expecially processed meats

Fish, 1-2/week: healthier than meat.
Larger amounts: not necessarily better

~ 60% of world fish stocks are fully fished!

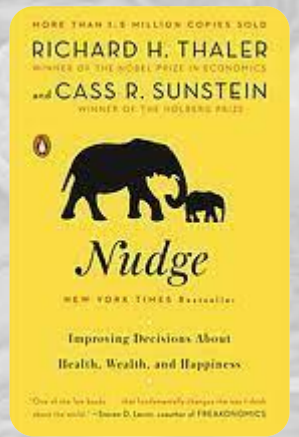
Less meat & low fish consumption: more sustainable:
water ↓, $CO_2$ ↓, usable surface for agriculture↑, calories available↑, climate change ↓: → Food security ↑

Alternative protein sources: plants, algae, insects…

# Combined activities needed



- **Education**
- **Politicial incentives**
- **Psychological aspects**
- **Availability of decision aids**

# Thank You
## For Your Attention!

Any Questions

?

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