

Food and sustainability

Exercise 1 : The 5 dimensions of environmental sustainability

We hear a lot about greenhouse gas emissions and climate change, but in the meta-analysis by Poore and Nemecek (2018), four other dimensions are taken into account for environmental sustainability.

1.1 Fill the following table.

Dimension	Unit	What does it measure? What is it?	Causes	Effects
ghg Emissions	1 kg N ₂ O = 298 kgCO ₂ kg CO ₂ eq 1kg methan = 84kgCO ₂	Emission of CO ₂	Antropic reject (like use of fuel)	acidification of ocean impact on equilibrium contribute to global warming
land use	m ² year	the aero of land used by year for the type of food	need place for retail or plantation	exhaustion of soil, kill biodiversty and wild life

Acidifying emission	g SO ₂ eq	Emission of SO ₂ (use of fuel for example)	Industrial process or consumption of C	Hazardous for people, or life in general acid rain : acidifying the soil
Eutrophying	gPO ₄ -2 eq	Reject of phosphate causing eutrophication	Reject by industrial process, or even fertilizer	Cause a big bloom of algae, can destroy the equilibrium of a lake or river for example
water use	kL eq	Ratio of freshwater consumed about freshwater resources use of water on plantation	Use of water to irrigate field or to feed retail	A loss of freshwater in the world, and in groundwater table

(FU = retail weight functional unit, typically kg or L)

1.2 From the above table, what is the other major concern, beyond climate change?

biodiversity collapse

Exercise 2 : Food as a lever for action

2.1 Why should we care about food? If we can lower the environmental impact of food production, would it help or not, compared to other human activities? To answer these questions, read Poore and Nemecek's paper and fill the following sentences.

Food production currently requires 0.37% of the world's ice- and desert-free land.

Food production is currently responsible for 26. % of total anthropogenic greenhouse gas emissions.

Food production is currently responsible for 32 % of total terrestrial acidification.

Food production is currently responsible for 78. % of total eutrophication.

Food production is currently responsible for 66% % of total freshwater withdrawals and 95 % of total scarcity-weighted water use.

2.2 According to DataS2 in the meta-analysis by Poore and Nemecek (2018), what is the protein source that has the largest (median) impact, for each dimension, per retail unit? per 100g of protein?

Per what?	Land use (m ²)	GHG emissions (kgCO ₂ eq)	Acidifying emissions (gSO ₂ eq)	Eutrophying emissions (gPO ₄ ³⁻)	Stress-weighted water use (L)
Retail unit (kg or L)	neef	beef	beef	beef	nut
100g of protein	beef	beef	beef	beef	lamb

2.3 Use your program to calibrate the following two meals for 803 kcal (note that they only differ by the source of protein):

- a) Bovine Meat (beef herd), Rice, Rapeseed Oil, Brassicas, Apples, Beet Sugar
- b) Peas, Rice, Rapeseed Oil, Brassicas, Apples, Beet Sugar

Meal	Land use (m ²)	GHG emissions (kgCO ₂ eq)	Acidifying emissions (gSO ₂ eq)	Eutrophying emissions (gPO ₄ ³⁻)	Stress-weighted water use (L)
a), with bovine meat	9;41	3.8	18.5	19.1	1019
b), with peas	0.89	0.58	4.36	2.25	817