

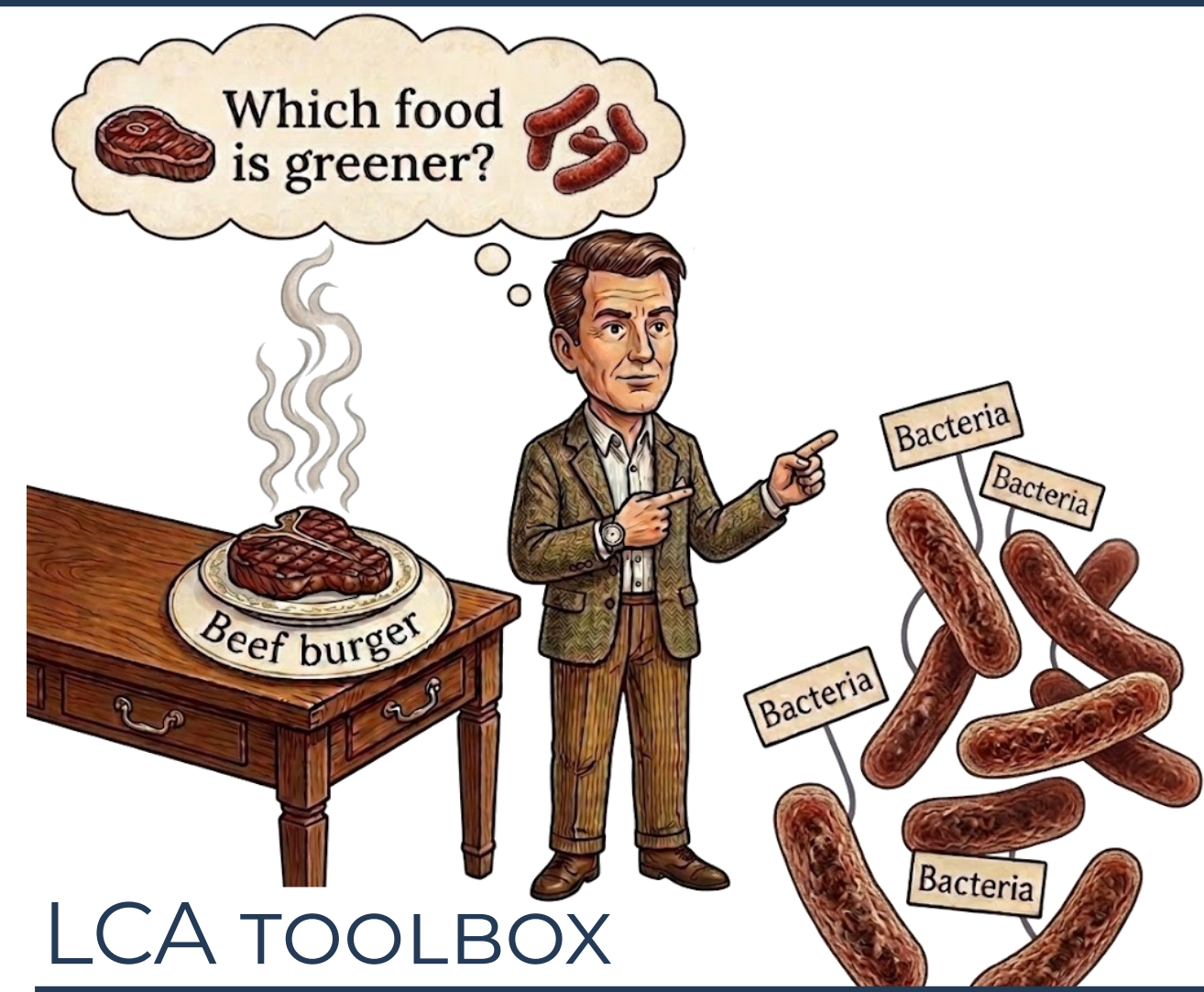


NUTRITIONAL LCA OF NOVEL PROTEIN FOODS

INFLUENCE OF THE CHOSEN APPROACH ON COMPARATIVE RESULTS

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LCA TOOLBOX

Software: Simapro 10.2
Background database: AGRIBALYSE version 3.2
LCIA method: EF 3.1
Selected indicators based on normalisation: climate change (CC), terrestrial eutrophication (TE), land use (LU), fossil resource use (RES-f), freshwater ecotoxicity (FWT).

GOALS OF THE STUDY

- Compare the environmental footprint of a burger based on purple bacteria biomass (**PBB**) to already marketed protein-rich food products, a beef burger (**BB**) and a soy-based vegetable burger (**VB**).
- Investigate whether different n-LCA approaches lead to similar trends or divergent conclusions.

SELECTION OF N-LCA APPROACHES

The 3 products are modelled in a cradle-to-gate perspective. Only the product level approach is used here, but with 6 different functions considered as a basis for comparison. The 3 burgers are compared based on mass, on protein content, on energy content and on 3 composite nutritional indices. Those are averages of the ratios between the supply of various nutrients by food and the recommended daily intakes. The selected indices are NRF9[†], a generic index, FNIprot7[‡], an index specific for protein food and WNI[‡], a weighted index developed for this study.

[†] as described in e.g. Saarinen et al., Journal of Cleaner Production 149 (2017) 828-844
[‡] weighting of nutrient groups based on Beal et al., The Journal of Nutrition 156 (2026) 101443 - (20% for proteins, 10% for fatty acids, 35% for vitamins and minerals)

NUTRITIONAL VALUES

Nutrient	DRI	Unit	BB	VB	PBB	Index
Proteins°	84.4	g	20.6	10.4	21.9	NRF, FNI, WNI
Fibres*	30	g	0	5.9	5.54	NRF, FNI, WNI
Mono-unsaturated fatty acids°	37.5	g	1.1	5.5	2.8	FNI
Poly-unsaturated fatty acids°	18.8	g	0.2	1.8	5.1	FNI, WNI
Calcium°	0.75	g	0.004	0.058	0.067	NRF, FNI, WNI
Iron°	6	mg	2.4	5.4	4.3	NRF, FNI, WNI
Magnesium°	380	mg	22.9	53.3	112.2	NRF, WNI
Potassium°	3.5	g	0.39	0.58	0.61	NRF, WNI
Vitamin A*	580	µg	14.9	0	0	NRF, WNI
Vitamin C*	90	mg	28.3	0.2	0.4	NRF, WNI
Vitamin E*	10	mg	0	2.8	4.6	NRF, WNI
Vitamin B2*	1.3	mg	0.18	0.04	0.06	FNI, WNI
Vitamin B9*	250	µg	7.9	68.2	52.1	FNI, WNI
Energy content / 100 g		kcal	104	176	237	
NRF9			12.9	20.9	24.3	
FNIprot7			12.2	23.4	23.9	
WNI			13.6	18.7	24.1	

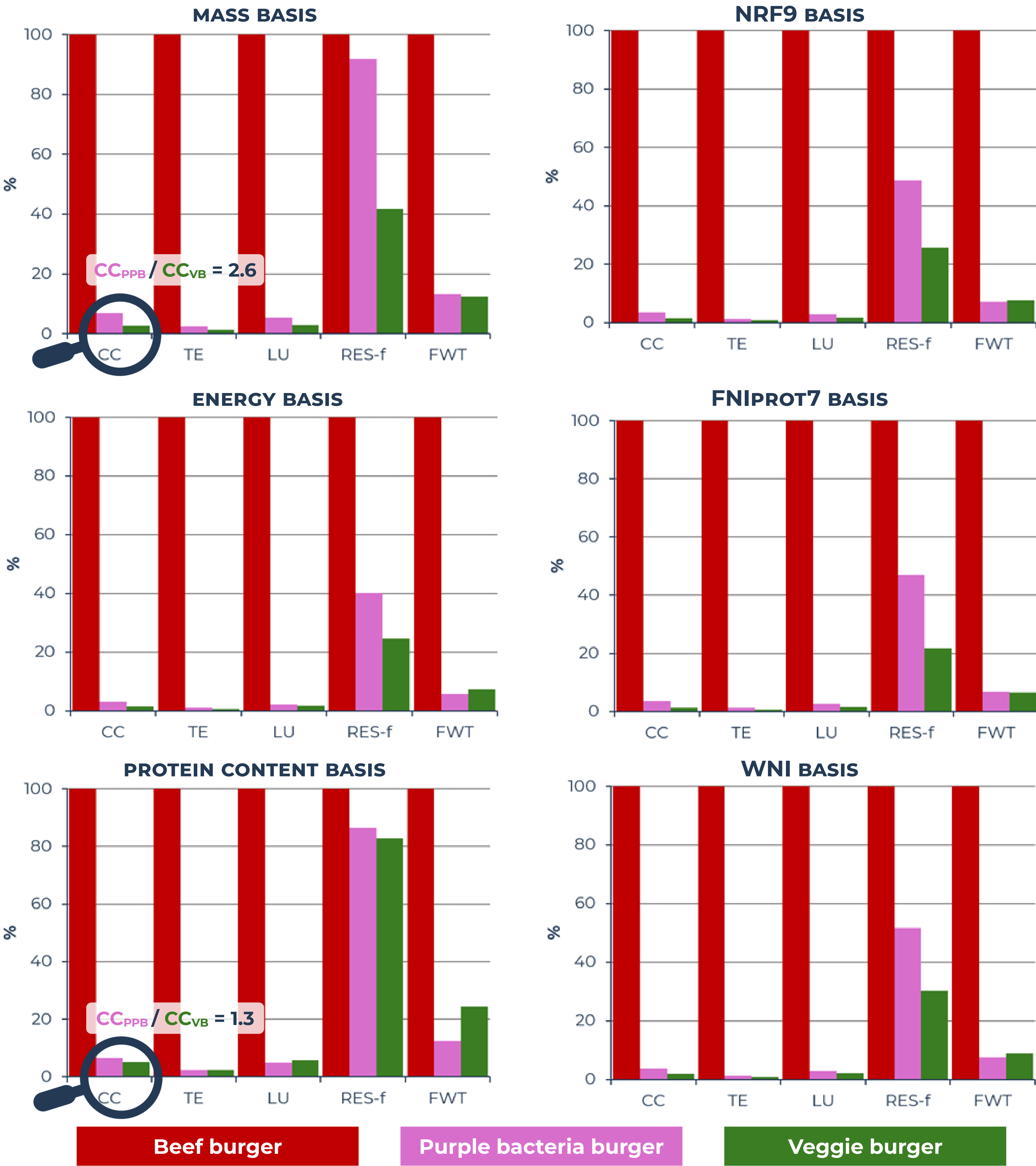
DRI: daily recommended intake based on ANSES data - ° measured data - * value estimated based on composition

CONCLUSIONS

- Alternatives to meat based on purple bacteria biomass have a clear potential to be environmentally relevant .
- The impacts of such products may however remain slightly higher than those of already available vegetable alternatives to meat.
- In this case study the general trends remain consistent for all approaches.
- The definition of the functional unit for food products can however lead to significantly different absolute values and comparative results.
- The highest transparency is needed in n-LCA, not only for the LCA part but also for the definition and the motivation of the functional approach.

RESULTS

IMPACTS OF A BACTERIAL BURGER COMPARED TO BENCHMARKS



Whatever the selected basis for comparison, **PBB** appears as significantly less impacting than **BB**. The magnitude of the benefit is however depending on the defined functional unit, being always around 95% for CC but ranging from 10% (mass basis) to 60% (energy basis) for RES-f.

The comparison between **PBB** and VB is mostly in favour of **VB**, though their environmental performances are rather close for energy-, WNI- and protein-based comparisons. **PBB** has even a significantly lower FWT impact than **VB** on a protein content basis.

