An index combining environmental and nutritional aspects of foods

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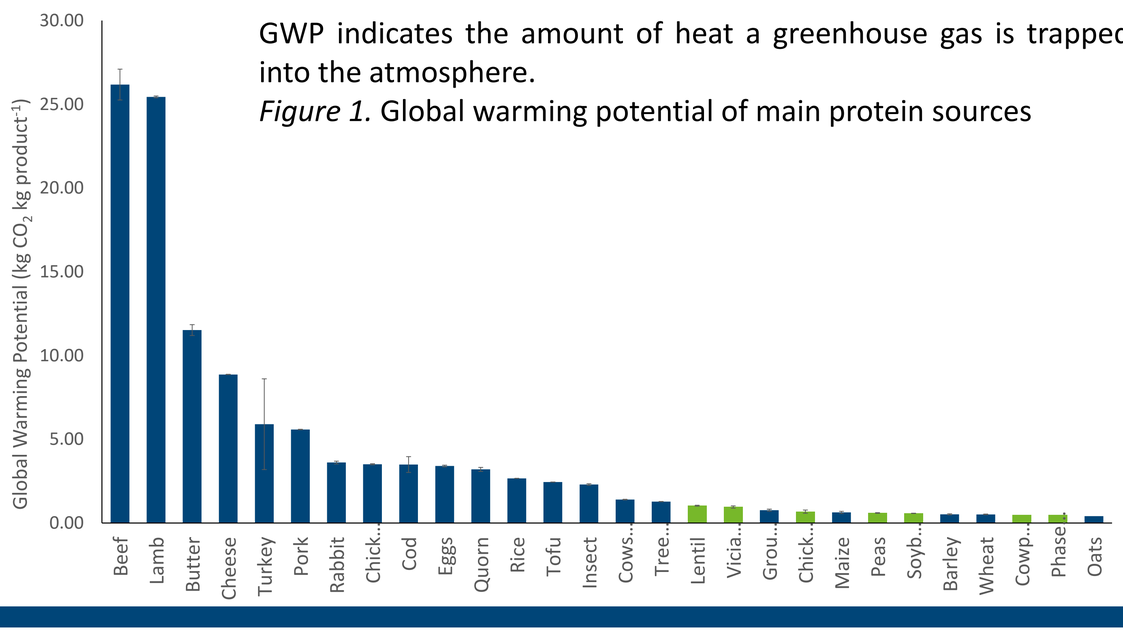
Abstract

Sustainably intensifying food production and implementing healthy diets are two major global challenges to tackle agricultural dependence on resources, soil degradation, greenhouse gas emissions, nutrient pollution and inefficiency, and the spread of unhealthy diets which are linked to type 2 diabetes, coronary heart problems and colon cancer (Huxley et al, 2009; Norat et al, 2005). It has been shown that increasing legume production and consumption provides a solution to both these issues (Foyer et al, 2016).
This research linked environmental impacts with nutrition to advise consumers and policy makers to develop optimal diets. An extensive database of main protein sources that combines nutrition with global impacts though the Nutrient Rich Foods (NRF) index (Drenowski et al., 2005; 2009; Drenowski, 2010) and Global Warming Potential (GWP), and local impacts through NRF and Eutrophication Potential (EP), was successfully developed for products at farm gate. Diet substitution scenarios were then performed with differing percentages of animal products substitutions with legumes. We found that animal products generally showed the lowest score in the NDEP and NDGWP, while legumes were among the highest scores. Diet substitutions showed the best results when 50% of all animal sources were substitutes with legumes.

Global Warming Potential (GWP)

GWP indicates the amount of heat a greenhouse gas is trapped into the atmosphere.

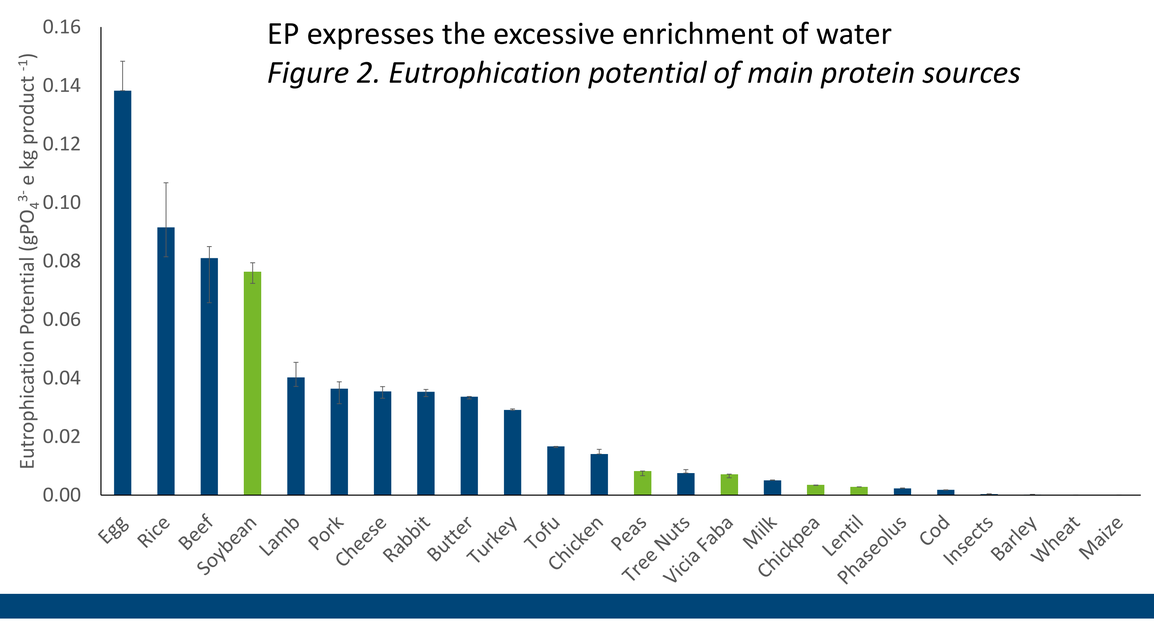
Figure 1. Global warming potential of main protein sources



Eutrophication Potential (EP)

EP expresses the excessive enrichment of water

Figure 2. Eutrophication potential of main protein sources



Nutrient Rich Foods 9.3

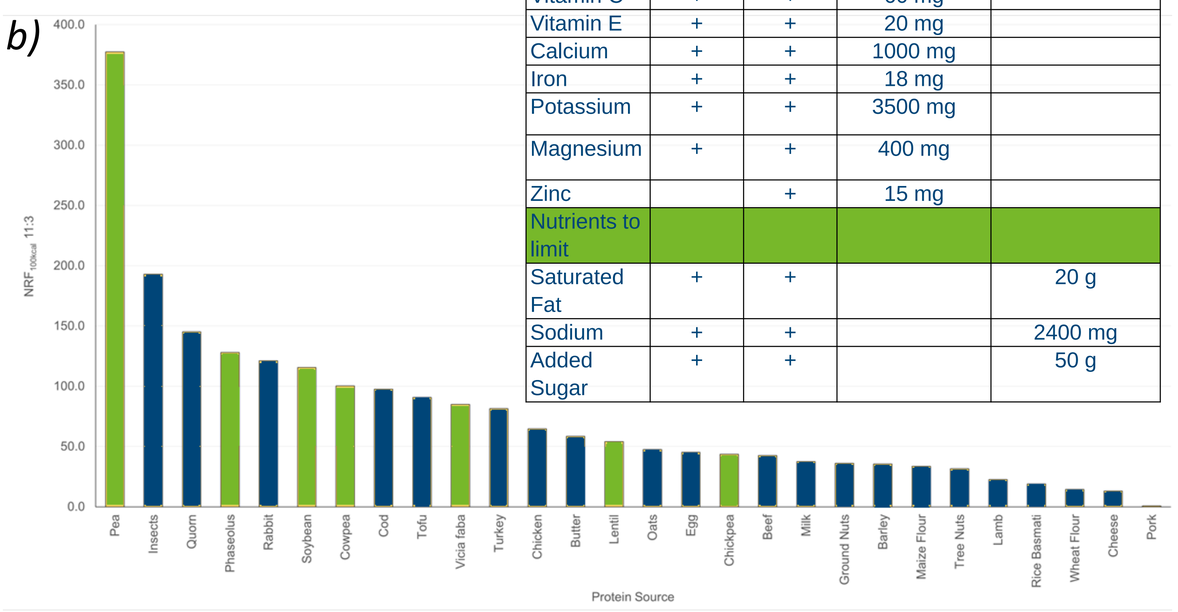
Figure 3. NRF Index a) NRF is an index that integrates nutrient contents to encourage and limit of food items as a proportion of a person's daily recommended intake

b) NRF 11.3 of main protein sources.

a)

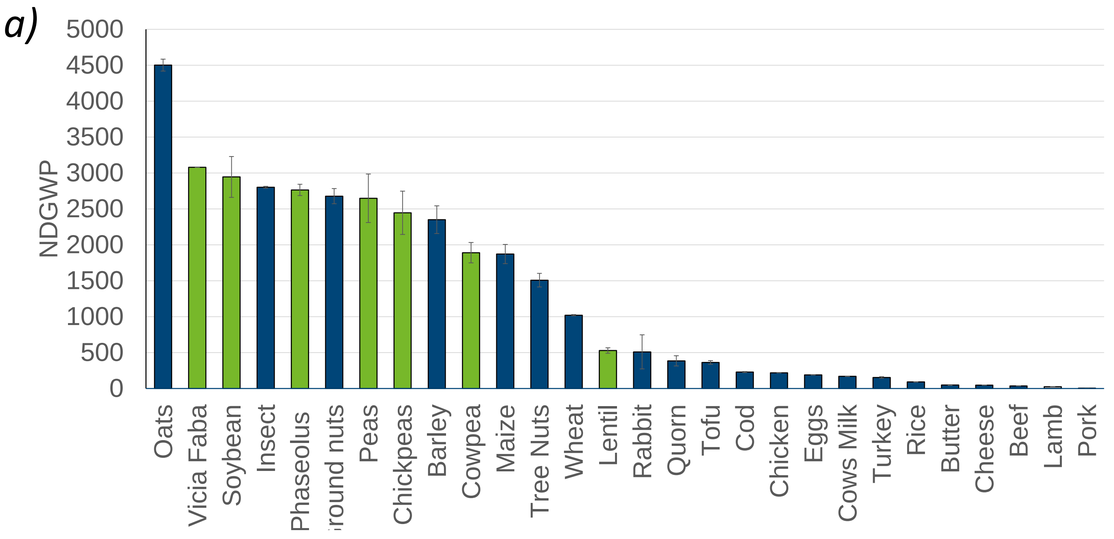
Nutrients to encourage	NRF 9:3	NRF 11:3	Recommended Daily Value (RDV)	Maximum Recommended Value (MRV)
Protein	+	+	50 g	
Fibre	+	+	25 g	
Vitamin A	+	+	5000 IU	
Vitamin B-12		+	6 µg	
Vitamin C	+	+	60 mg	
Vitamin E	+	+	20 mg	
Calcium	+	+	1000 mg	
Iron	+	+	18 mg	
Potassium	+	+	3500 mg	
Magnesium	+	+	400 mg	
Zinc		+	15 mg	
Nutrients to limit				
Saturated Fat	+	+		20 g
Sodium	+	+		2400 mg
Added Sugar	+	+		50 g

b)



Nutrient density: environmental impact indices

a)



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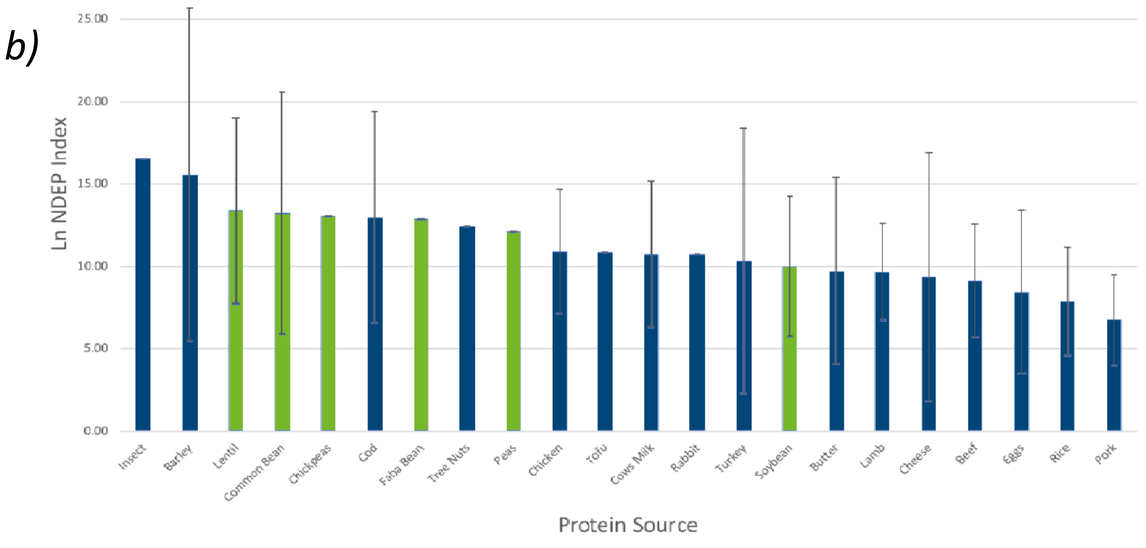


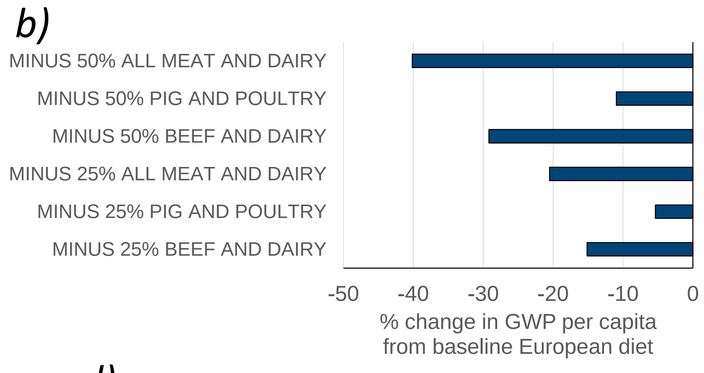
Figure 4. Nutrient density environmental impacts of main protein sources. a) NDGWP b) NDEP

Diet substitution scenarios

a)

FOOD GROUP	CONSUMPTION (g food items day^{-1})	INDICATOR FOOD
Cereals	256	Wheat
Legumes	4	Soy Bean
Dairy	554	Milk
Beef	23	Beef
Poultry	32	Chicken
Pork	62	Pork
Sheep and Goat	3	Lamb
Eggs	28	Eggs

b)



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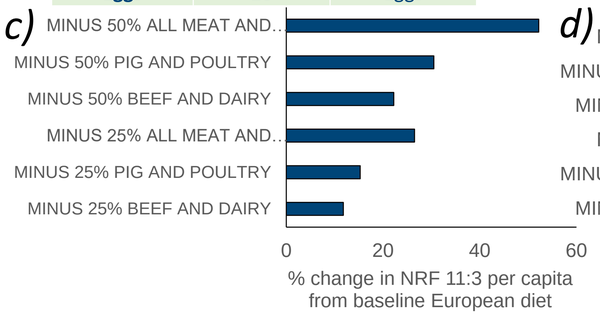

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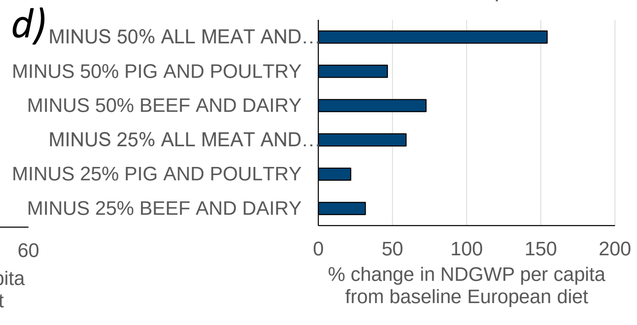

Figure 5. Diet substitution effects. a) Average European daily diet with indicator food used in substitution scenarios b) Change in GWP per capita from baseline European diet c) Change in NRF 11.3 per capita d) Change in NDGWP per capita.

Conclusions

- Nutrient richness Environmental Impact Index showed that ruminant meats score poorly as a commonly consumed protein source, whereas legumes score high.
- Diet substitution scenarios showed that the more animal products intake was substituted with legumes, the more sustainable and healthy the diet was.

Future work

- Develop a nutritional functional unit to be used in Life Cycle Assessments (LCA) of food products.
- Compare farm gate values with store gate values.
- Use this nutritional functional unit to evaluate legumes-based processed foods in attributional and consequential LCAs.

References

1- Drewnowski, A., 2010. The Nutrient Rich Foods Index helps to identify healthy, affordable foods. The American Journal of Clinical Nutrition, 91(4),1095-1101.
2- Foyer, C.H., Lam, H.M., Nguyen, H.T., Siddique, K.H., Varshney, R.K., Colmer, T.D., Cowling, W., Bramley, H., Mori, T.A., Hodgson, J.M. and Cooper, J.W., 2016. Neglecting legumes has compromised human health and sustainable food production. Nature plants, 2(8), p.16112.