Comparison of Greenhouse Gas databases using FoodEx2 codes

Parallel thematic session: Resilience, vulnerability, human and planetary health

From: 28 June 2022, 15:10 to 16:25 BST British Summer Time

Christian Reynolds, Jacqueline Tereza da Silva, Josefa Maria Fellegger Garzillo, Angelina Frankowska, Alana Kluczkovski, Diego Rose, Berill Takacs, Victoria Padula de Quadros, Bridget Anna Holmes, Ximena Schmidt Rivera, Sarah Bridle

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Centre for Food Policy

Shaping an effective food system

Who am I?

Senior Lecturer at the Centre for Food Policy

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University of South Australia · University of Aberdeen · The University Of Sheffield. Institute for Sustainable Food. · UK Data Service

Focus: healthy sustainable diets and food consumption (including waste)

Contents lists available at ScienceDirect

Food Policy

journal homepage: www.elsevier.com/locate/foodpol

Review

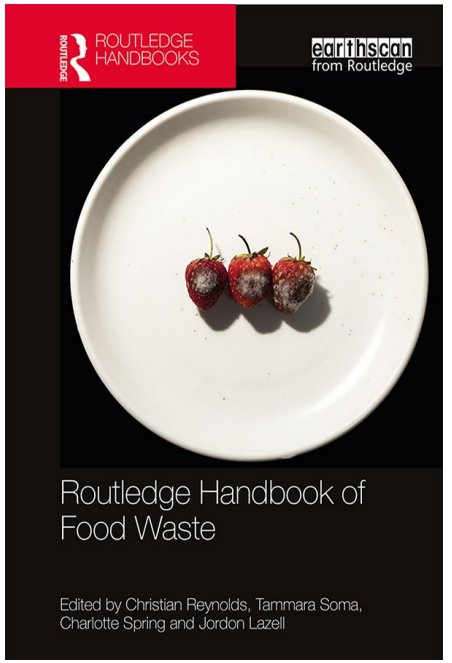
Review: Consumption-stage food waste reduction interventions – What works and how to design better interventions

Christian Reynolds[a,b,*], Liam Goucher[c], Tom Quested[b], Sarah Bromley[b], Sam Gillick[b], Victoria K. Wells[d], David Evans[e], Lenny Koh[c], Annika Carlsson Kanyama[f], Cecilia Katzeff[g], Åsa Svenfelt[f], Peter Jackson[a]

Public Health Nutrition: 22(8), 1503–1517 doi:10.1017/S1368980018003774

Healthy and sustainable diets that meet greenhouse gas emission reduction targets and are affordable for different income groups in the UK

Christian J Reynolds[1], Graham W Horgan[2], Stephen Whybrow[1] and Jennie I Macdiarmid[1,*]
[1]The Rowett Institute University of Aberdeen, Aberdeen AB25 2ZD, UK: [2]Biomathematics & Statistics Scotland, Aberdeen,UK



Previously: Food waste politics/history, social sciences approaches

Shameless plug for FLW text book – if you want open access let me know ☺

Part of ongoing research…

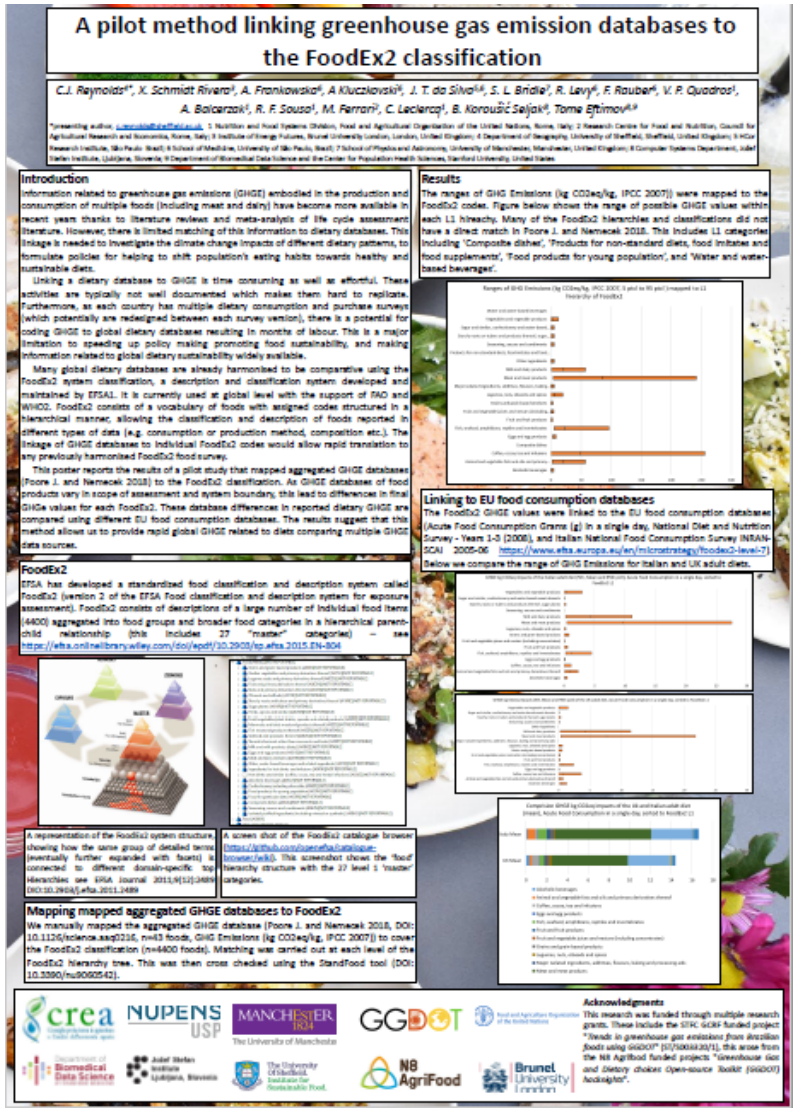
frontiers in Artificial Intelligence

PERSPECTIVE
published: 23 February 2021
doi: 10.3389/frai.2020.621577

Using Natural Language Processing and Artificial Intelligence to Explore the Nutrition and Sustainability of Recipes and Food

Marieke van Erp[1†], Christian Reynolds[2†], Diana Maynard[3], Alain Starke[4], Rebeca Ibáñez Martín[5], Frederic Andres[6], Maria C. A. Leite[7], Damien Alvarez de Toledo[6], Ximena Schmidt Rivera[8], Christoph Trattner[4], Steven Brewer[9], Carla Adriano Martins[10], Alana Kluczkovski[10], Angelina Frankowska[10], Sarah Bridle[10], Renata Bertazzi Levy[11], Fernanda Rauber[11], Jacqueline Tereza da Silva[10] and Ulbe Bosma[12]*

https://doi.org/10.3389/frai.2020.621577



http://dx.doi.org/10.13140/RG.2.2.15990.34889

The problem: lack of comparable GHGE data

- Multiple Greenhouse Gas Emissions (GHGE) databases exist (Each describes the impacts of different agricultural production systems around the world).
- There is a growing need to capture the environmental impacts of dietary choices.
- Direct matching of GHGE databases to dietary databases is very time consuming.
- However, there are standards for comparing dietary databases – one of these is FoodEx2.

Can a harmonised dietary classification system be used to compare/allocate GHGE impacts to food categories?

In this presentation, we aim to assess the reliability of the linking a GHGE database to FoodEx2, by comparing it to similar databases.

What is FoodEx2?

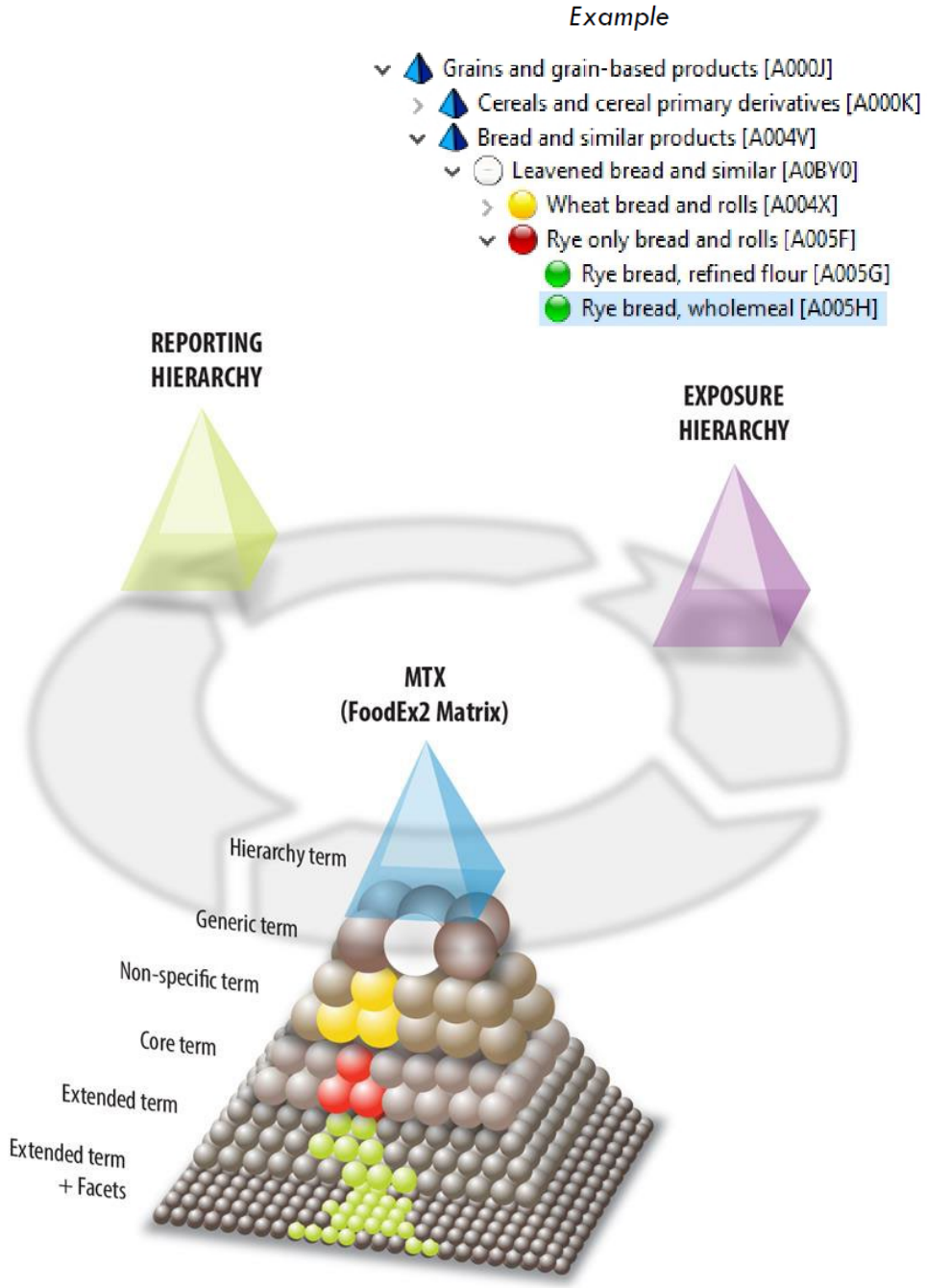
- A comprehensive food classification and description system
- A common language
- Developed and maintained by EFSA

- Clearly defined
- Hierarchical structure
- A food fits in one group only
- For every food there is a group

21 Food groups in total for 4558 FoodEx2 codes

At least 56 food consumption databases have been coded with FoodEx2. see https://www.globaldietarydatabase.org/

FoodEx2
efsa



Example of FoodEx2 coding

Source: https://www.hapih.hr/wp-content/uploads/2019/11/Ioannidou_FoodEx-2-klasifikacija-hrane.pdf

FoodEx2 is linked to many global dietary datasets

33 countries via FAO/WHO GIFT https://www.fao.org/gift-individual-food-consumption/en/

21 countries via The EFSA Comprehensive European Food Consumption Database https://www.efsa.europa.eu/en/data-report/food-consumption-data#the-efsa-comprehensive-european-food-consumption-database

407 data sets via https://www.globaldietarydatabase.org/

FoodEx2 offers an opportunity to link many datasets to environmental impacts in a quick and comparable manner.

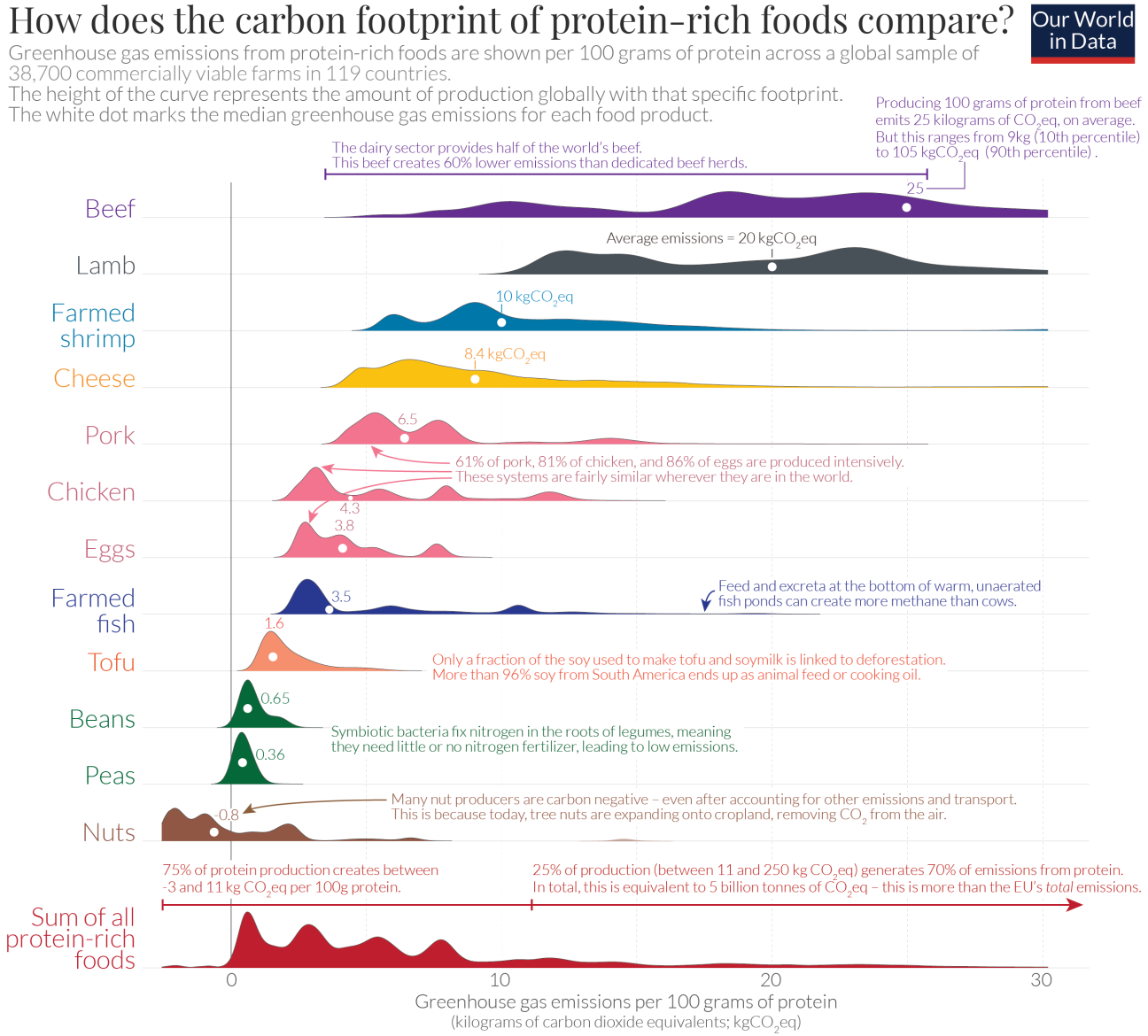
Global Dietary DATABASE

The advantage of Poore and Nemecek (2018)

The Poore and Nemeck (2018) database provides 5% and 95% confidence intervals as well as **mean global impacts**

43 food categories meta-analysis comparing various types of food production systems.

Impact can vary 50-fold among producers of the same product, creating substantial mitigation opportunities



Matching P&N (2018) to FoodEx2

43 food categories matched to 4558 FoodEx2 code (Kg of Co2e per 100g)

All products were matched by hand, using the closest raw product; if it was a product with multiple ingredients, we took the largest ingredient by weight. GHGE Values corrected for hydration and processing.

N	O	P	Q
L7_Foo	L7_FoodEx2_desc	level	Category
A000J	Grains and grain-based products	1	Wheat & Rye (Bread)
A000K	Cereals and cereal primary derivatives	2	Wheat & Rye (Bread)
A000L	Cereal grains (and cereal-like grains)	3	Wheat & Rye (Bread)
A001X	Mixture of grains	4	Wheat & Rye (Bread)
A0D9Y	Barley and similar-	4	Barley (Beer)
A000P	Barley grains	5	Barley (Beer)
A002K	Barley grain, pearled	6	Barley (Beer)

N	O	P	Q
L7_Foo	L7_FoodEx2_desc	level	Category
A00ZT	Potatoes	4	Potatoes
A011P	Potato boiled	5	Potatoes
A011R	Potato baked	5	Potatoes
A00ZX	Main-crop potatoes	5	Potatoes
A00ZV	New potatoes	5	Potatoes
A0DPM	Andigena	4	Potatoes
A00ZY	Tropical root and tuber vegetables	3	Cassava
A04JX	Cassava roots and similar-	4	Cassava
A00ZZ	Cassava roots	5	Cassava

GHGE Databases matched to FoodEx2

Reducing food's environmental impacts through producers and consumers

J. POORE AND T. NEMECEK

SCIENCE · 1 Jun 2018 · Vol 360, Issue 6392 · pp. 987-992 · DOI: 10.1126/science.aaq0216

https://doi.org/10.1126/science.aaq0216

"City"

43 food categories matched to 4558 FoodEx2 code

matched by authors

Data Article

SHARP-Indicators Database towards a public database for environmental sustainability

Elly Mertens [a], Gerdine Kaptijn [a], Anneleen Kuijsten [a, b], Hannah van Zanten [c], Johanna M. Geleijnse [a, b], Pieter van 't Veer [a, b]

https://doi.org/10.1016/j.dib.2019.104617

"SHARP"

945 food categories matched to FoodEx2

Carbon footprint of self-selected US diets: nutritional, demographic, and behavioral correlates

Donald Rose, Martin C Heller, Amelia M Willits-Smith, Robert J Meyer

The American Journal of Clinical Nutrition, Volume 109, Issue 3, March 2019, Pages 526–534, https://doi.org/10.1093/ajcn/nqy327

https://doi.org/10.1093/ajcn/nqy327

"Rose/Heller"

608 food categories

357 categories linked to FICD to National Health and Nutrition Examination Survey (NHANES), this resulted in 608 linked to FoodEx2 (using Global Dietary Database concordance).

Footprints of foods and culinary preparations consumed in Brazil

Josefa Maria Fellegger Garzillo, Priscila Pereira Machado, Maria Laura da Costa Louzada, Renata Bertazzi Levy, Carlos Augusto Monteiro,
https://doi.org/10.11606/9788588848405

"Garzillo"

329 food categories

linked to the Brazilian Food Consumption Survey which was matched to FoodEx2

(All databases normalised to kg of Co2e per 100g)

Correlations

Database	n	Spearman correlation	p-value
Sharp	945	0.699	< 0.001
Rose/Heller	608	0.572	< 0.001
Garzillo	329	0.610	< 0.001

Table 1. Correlation between “City” database to other databases

Visualisation of matches

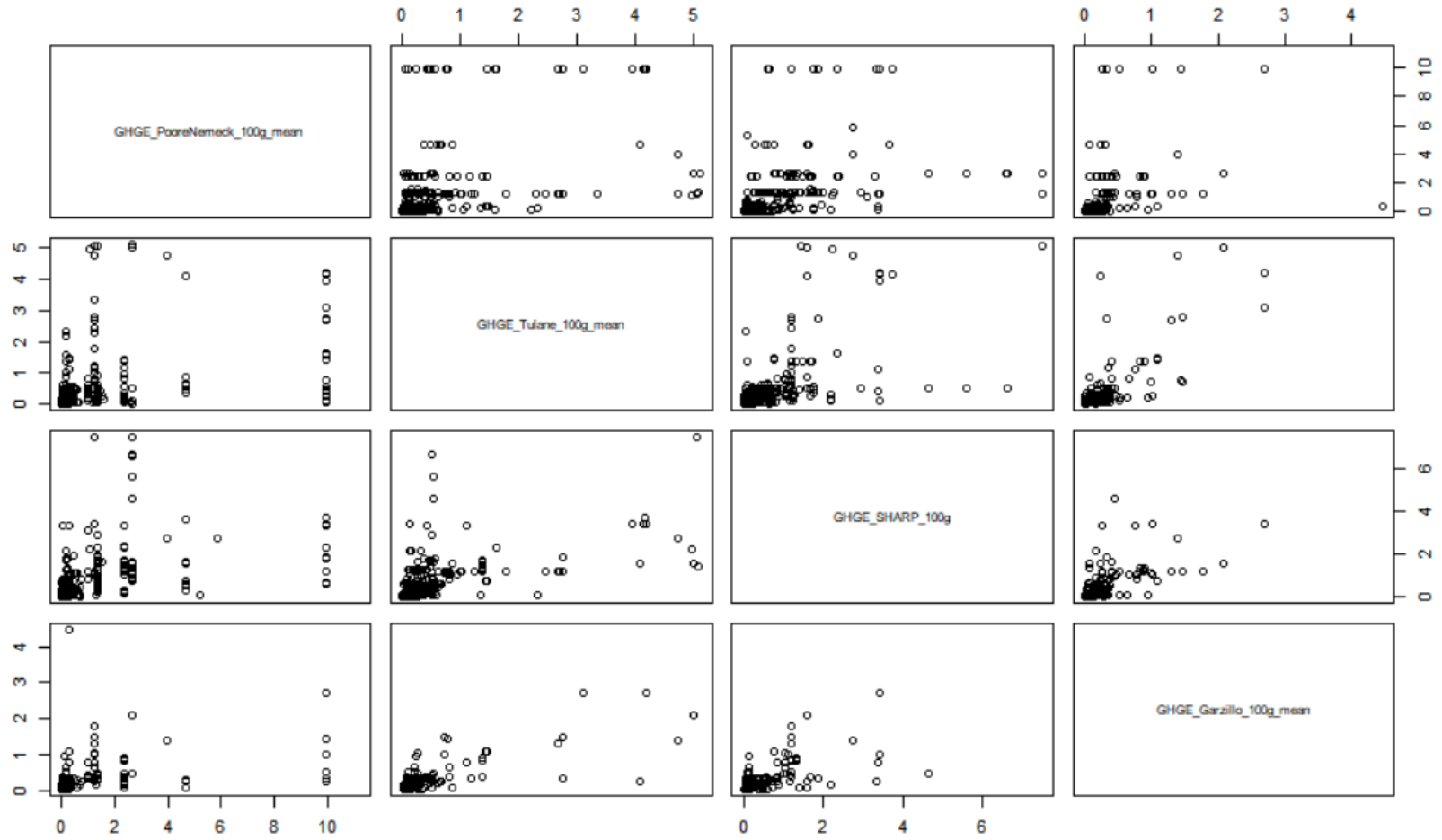


Figure 1. Scatterplot displaying the relationship between GHGE from multiples sources (Reynolds/Takacs, Rose/Heller, Sharp, Garzillo)

Differences in “City” and SHARP

Of the 945 food items with GHGE in “City” and SHARP, 50% (n = 476) were ranked in the same quintile. The kappa statistics was 0.536 ($p < 0.001$).

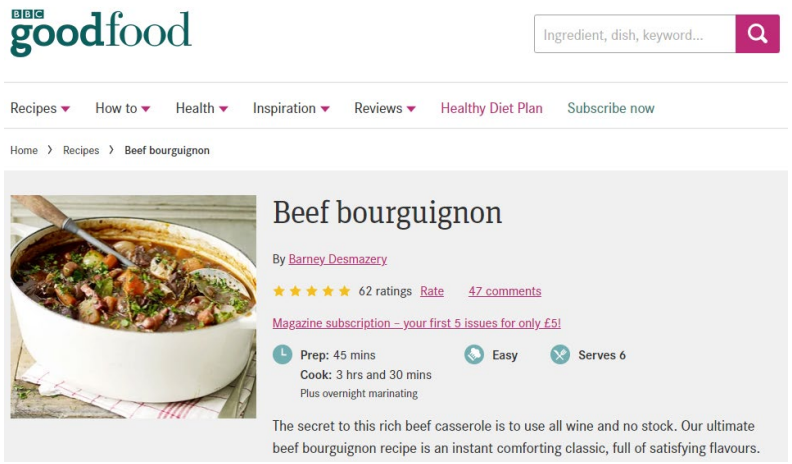
Of the 469 food items not ranked into the same quintiles,

- 44% (n=206) were within p5 and p95 confidence interval values of City
- 31% (n=144) were lower than the p5 confidence interval values of City
- 25% (n= 119) were higher than p95 confidence interval values of City.

The food items with the biggest differences between mean values for “City” and SHARP are wheat and rye; fish and seafood; pig meat; fruits; nuts and pulses.

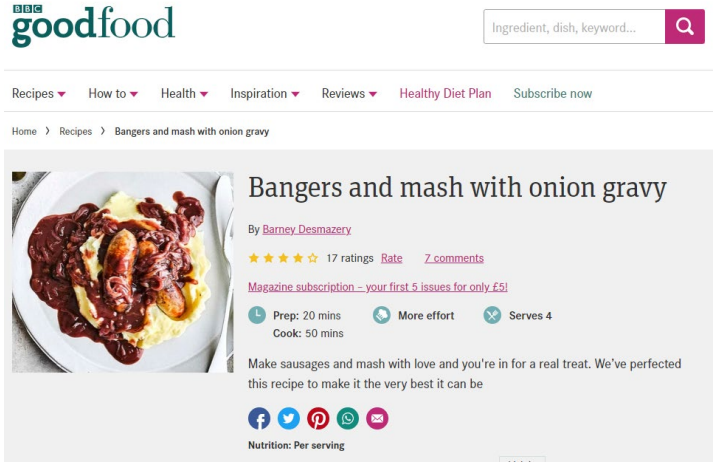
These food items will be further investigated in the next update of the data, aiming to increase reliability to estimate GHGE from food consumption.

So what does this mean practically?



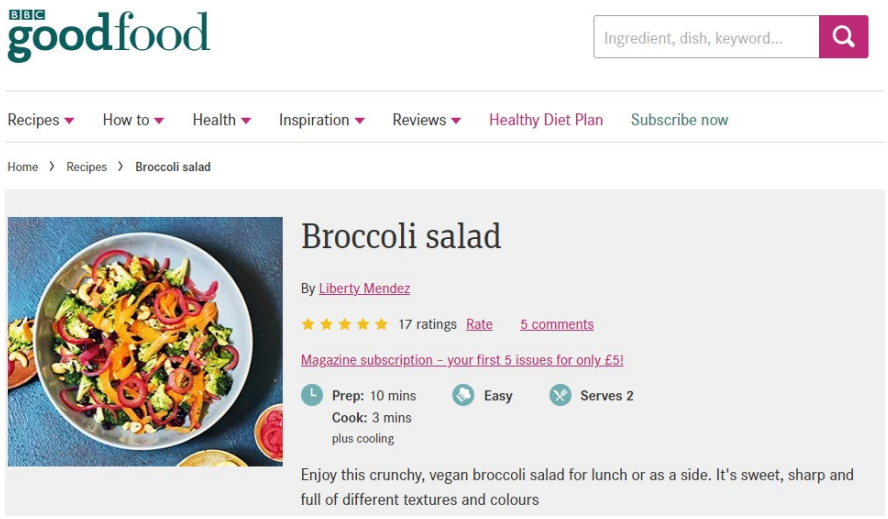
SHARP 62.76kg of Co2e (Beef is 87% of the footprint)

City 166.58kg of Co2e (Beef is 95% of the footprint)



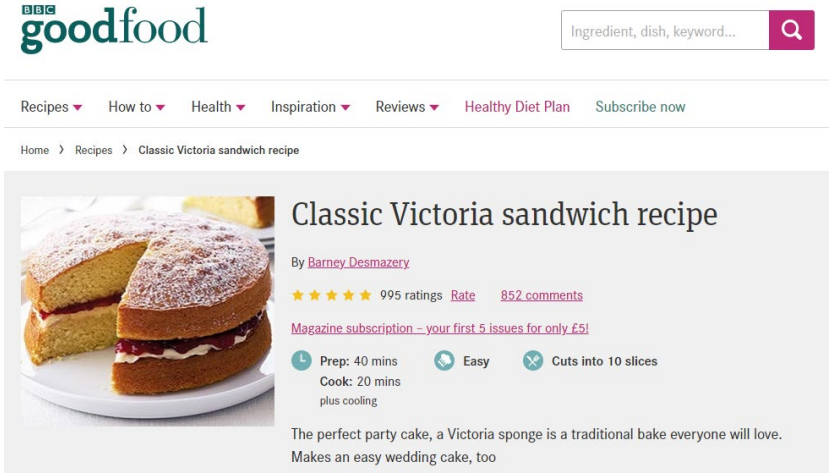
SHARP 8.77kg of Co2e (Sausages is 62% of the footprint)

City 7.11kg of Co2e (Sausages is 77% of the footprint)



SHARP 0.95kg of Co2e (Broccoli is 30% of the footprint)

City 1.07kg of Co2e (Broccoli is 14% of the footprint)



SHARP 11.34kg of Co2e (Butter is 88% of the footprint)

City 3.77kg of Co2e (Butter is 24% of the footprint)

Many thanks to all the co-authors

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https://www.city.ac.uk/prospective-students/courses/postgraduate/food-policy

Parallel thematic session: Resilience, vulnerability, human and planetary health

From: 28 June 2022, 15:10 to 16:25 BST British Summer Time

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