Cookbook analysis and other methods to assess the Environmental Impact of Sustainable and Vegetarian recipes (video presentation)

Centre for Food Policy
Shaping an effective food system

Presented at Designing Regenerative Food Cultures: An online workshop discussing food culture, green transition and sustainability
4 Dec 2023 2:00 PM – 4:00 PM CET

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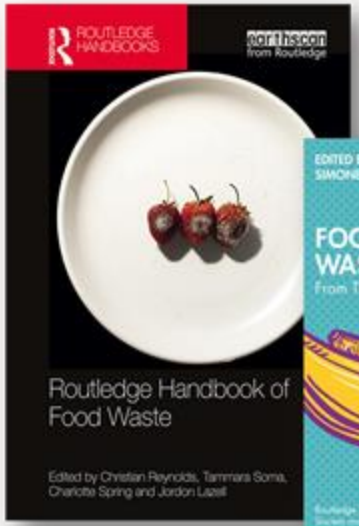
ISGSS | International Society for Gastronomic Sciences and Studies

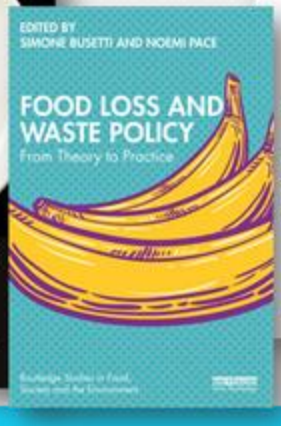
This research and the GATE NLP tool have been developed with a research grant from the alpro foundation

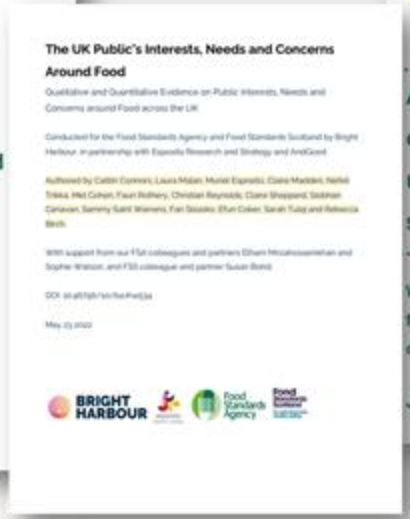
Who am I?

Reader at the Centre for Food Policy.

- Focus on sustainable food systems and food waste.
- Supporting the FSA/Defra through research projects. Scottish food systems research (ZWScotland). Household Simulation modelling (WRAP). Local food strategy development.
- Nutrition Society Food Systems theme lead. IFST Sustainability working group.
- Recent publications







THE NUTRITION SOCIETY
Advancing Nutritional Science

Institute of Food Science + Technology ifst

What is regenerative and sustainable cooking?

Two approaches to look at answering this question.

- Bibliographic analysis of historic cookbooks
- Recipe analysis using NLP

A Leap of Faith: Regenerative Agriculture as a Contested Worldview Rather Than as a Practice Change Issue

by Camille Page * and Bradd Witt

School of Earth and Environmental Science, The University of Queensland, Brisbane, QLD 4072, Australia

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Sustainability **2022**, *14*(22), 14803; **https://doi.org/10.3390/su142214803**

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The Observer
Food

'Sustainable isn't a thing': why regenerative agriculture is food's latest buzzword

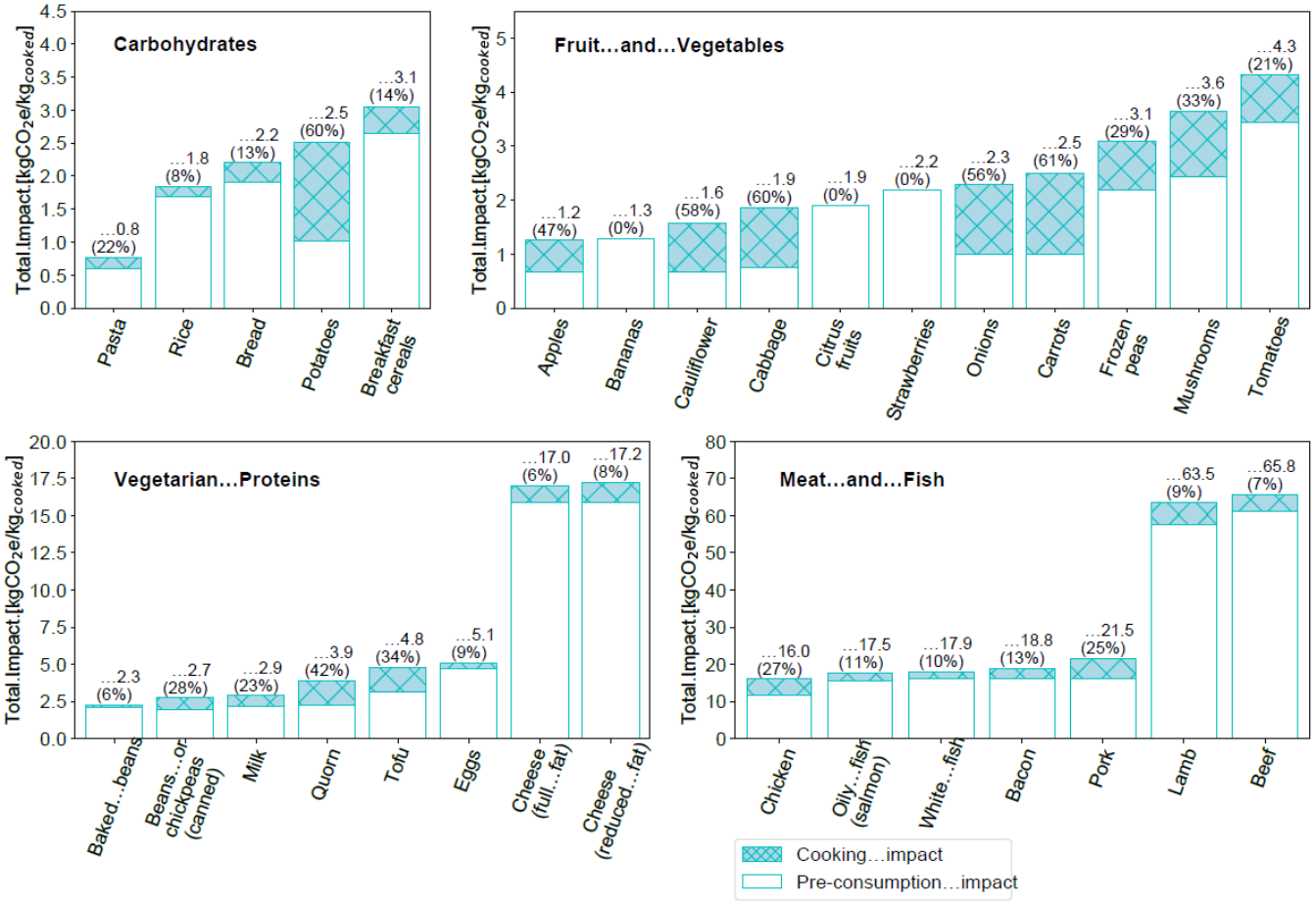
Tim Lewis
Sun 18 Jul 2021 08.00 BST

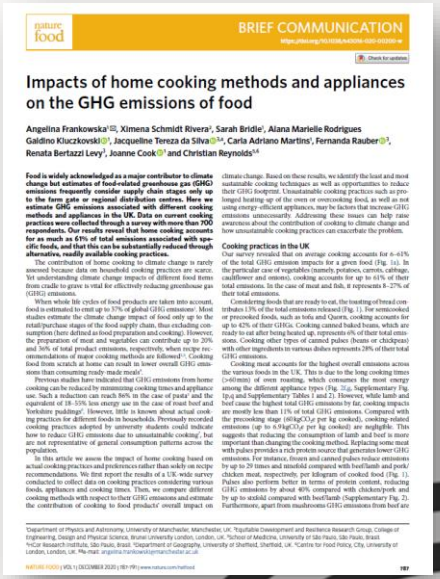
235

Calixta Killander photographed at Cooks Pen Farm, Hildersham, Cambridgeshire on 25 Ju

Everyone from small farms to McDonald's is getting involved in regenerative agriculture. Could it point the way to a better future for farming?

How we cook matters! Up to 61% of GHGE impacts




nature food

BRIEF COMMUNICATION

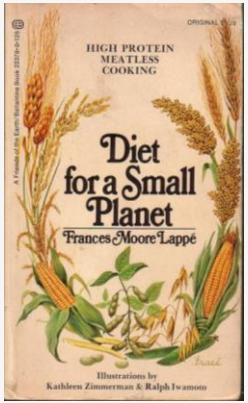
Impacts of home cooking methods and appliances on the GHG emissions of food

Angelina Frankowska, Ximena Schmidt Rivera, Sarah Bridle, Alana Marielle Rodrigues Galdino Kluczkovski, Jacqueline Tereza da Silva, Carla Adriano Martins, Fernanda Rauber, Renata Bertazzi Levy, Joanne Cook and Christian Reynolds

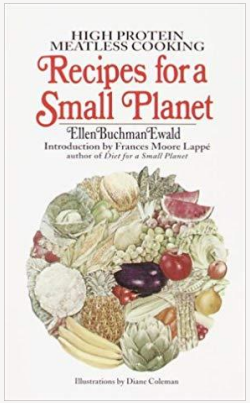
Frankowska, A., Rivera, X.S., Bridle, S. *et al.* Impacts of home cooking methods and appliances on the GHG emissions of food.
Nat Food **1,** 787–791 (2020). https://doi.org/10.1038/s43016-020-00200-w

Is there such a thing as a sustainable cookbook?

Earliest English language “modern” “cookbook” rather than book on food?
1971 (Diet for a Small Planet) -> 1973 (Recipes For A Small Planet)



1971 0 recipes
1992 152 recipes
2022 85 recipes

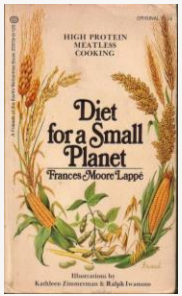


1973 202 recipes

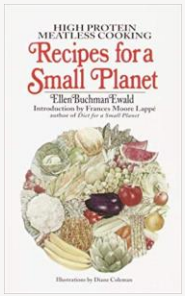
- Shifting of diet towards environmental vegetarianism (not carbon focused)
- Lentil and nuts – focused
- Large geography of cuisine styles: middle eastern, Indian, Brazilian, Mexican, Greek, Italian and ‘oriental’.
- Oven (and other high energy use methods) used.

A timeline of sustainable cookbooks

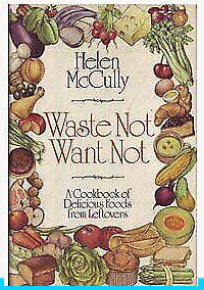
I searched https://www.eatyourbooks.com/* to find **278 cookbooks** that had titles including "sustainable", "eco", "planet", "climate", "carbon", "waste", and "flexitarian" 1973-2022



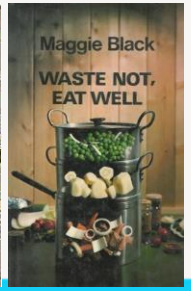
1971/2021
30 editions



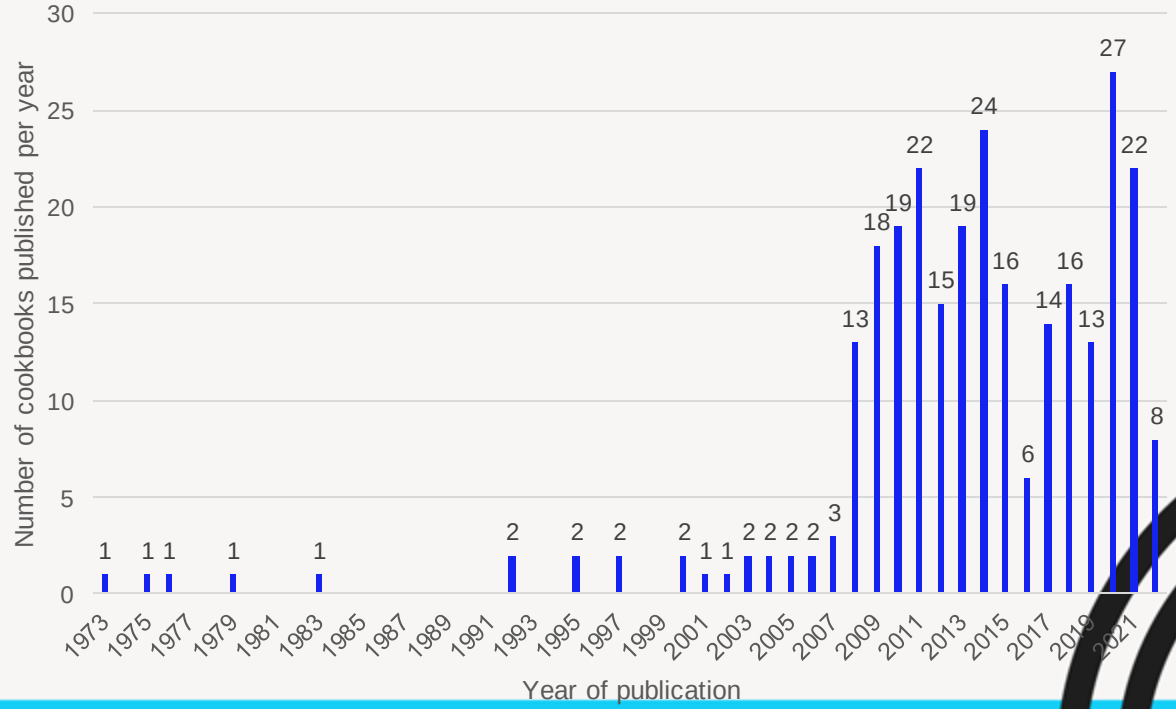
1973/1985

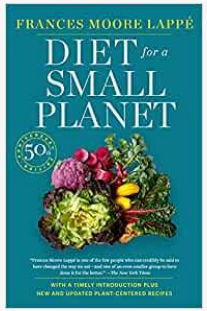


1975



1976



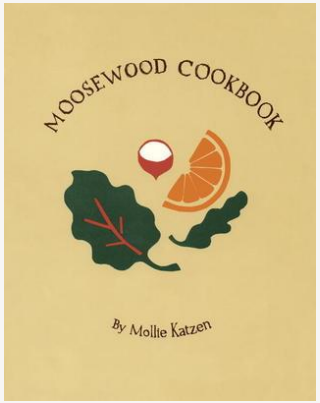


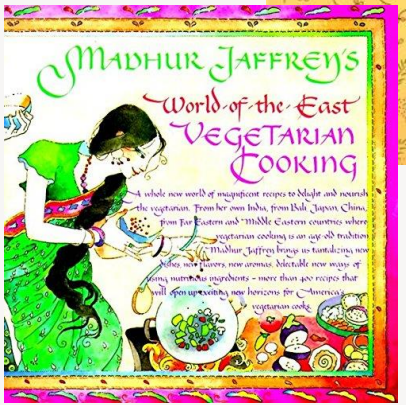
2021

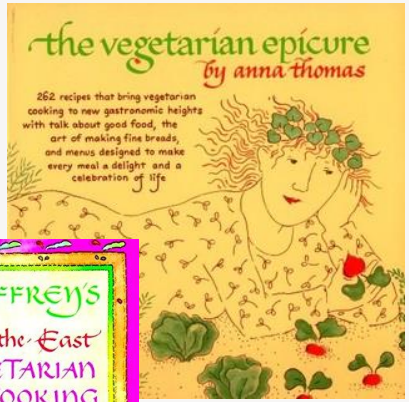
* https://www.eatyourbooks.com/ has n=160,943 books in its database (oldest book 1833), vegetarian n=5,428 (oldest book 1950) , vegan n=1,433

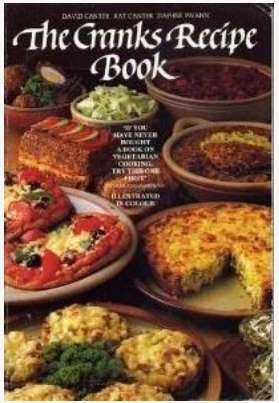
This did not include other “classics”

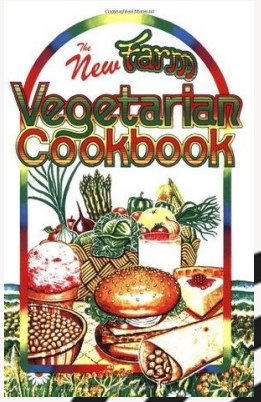
A limitation of this survey was that it missed many classic books that might also be considered sustainable such as vegetarian or vegan cookbooks that do not mention “sustainability” etc. in their title (but do in the text). This method also misses non English language cookbooks.





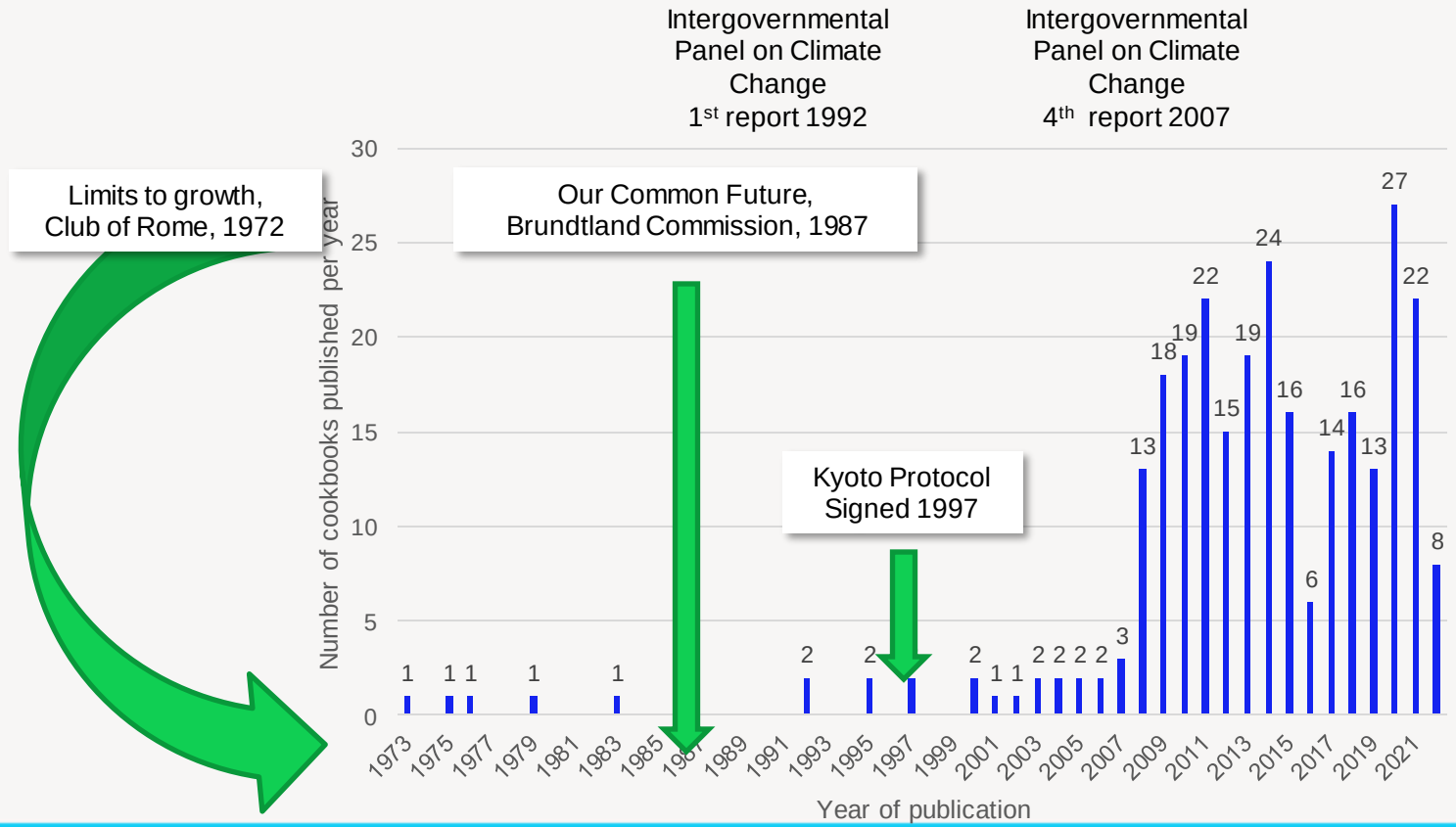




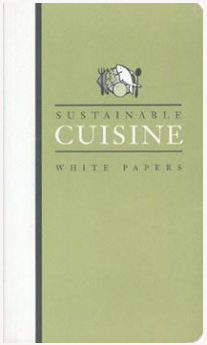


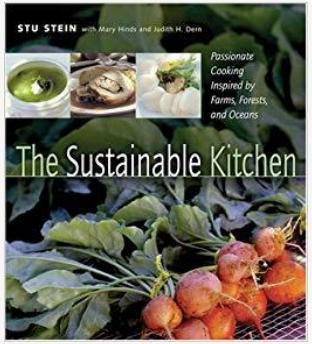
Context for sustainability and climate change

2007, the IPCC and U.S. Vice-President Al Gore were jointly awarded the Nobel Peace Prize



2000-2007





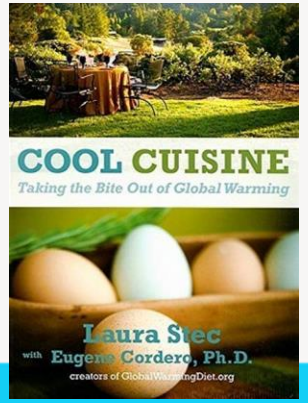
15 titles including…

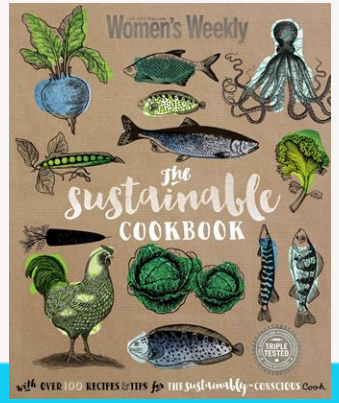
2000 Planet Organic: Organic Cookbook by Eric Treuille and Renee Elliot
2000 Sustainable Cuisine: White Papers by Earth Pledge
2004 The Sustainable Kitchen: Passionate Cooking Inspired by Farms, Forests and Oceans

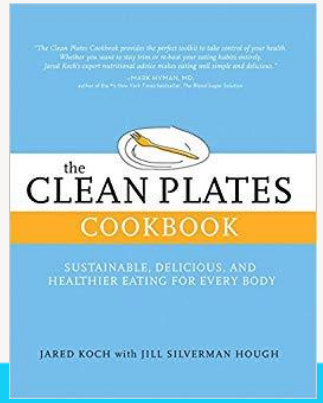
- 'Local' and small scale (supporting CSA) Understand ingredients (and their complex production processes and histories).
- Highlighted sustainable food is more than low environmental impact, needed to sustain heritage and community economies.
- No mention of cooking impacts
- Contains beef, lamb etc.

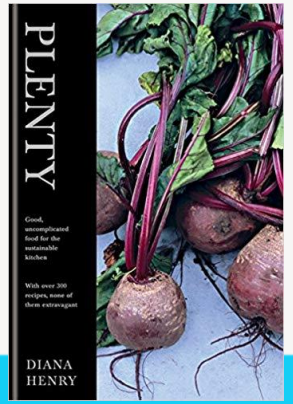
2008-2022

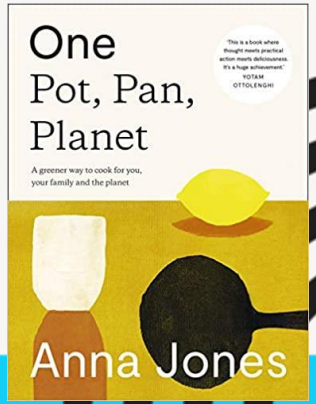
- 252 books, average of 16 published per year!
- Majority omnivorous recipes (containing beef or lamb), Become more plant based as time goes on…
- Rise and fall of sustainable seafood.
- Some read like “wellness” books.
- None of the books give the amount of carbon embodied in their recipes.
- All ask the reader to change behaviour: using leftovers, shopping organic, buying local, mindful eating, and eating seasonally.
- Books mention cooking impacts, but still use oven recipes and use beef/lamb.











Recipe analysis using NLP

We can now use Natural Language Processing to conduct analysis of how recipes from different sustainable cookbooks rate in terms of quantified sustainability impacts – e.g. Carbon footprint (kg of Co2e), water footprint etc.
However, our project's tool currently can only calculate the impacts of recipes from websites.

BBC goodfood

Coconut & squash dhansak

Prep: 5 mins
Cook: 15 mins

Easy

Serves 4

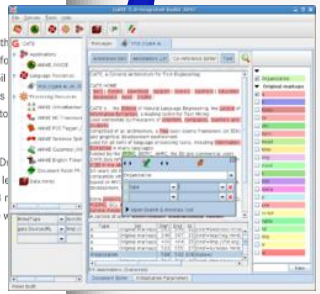
Ingredients

- 1 tbsp vegetable oil
- 500g butternut squash (about 1 small squash), peeled and chopped into bite-sized chunks (or buy a pack of ready-prepared to save time), see tip, below left
- 100g frozen chopped onions
- 4 heaped tbsp mild curry paste (we used korma)
- 400g can chopped tomatoes
- 400g can light coconut milk
- mini naan bread, to serve
- 400g can lentils, drained
- 200g bag baby spinach
- 150ml coconut yogurt (we used Rachel's Organic), plus extra to serve

Method

Step 1 Heat the oil in a large pan. Put the squash in a bowl with of water. Cover with cling film and microwave on High fo or until tender. Meanwhile, add the onions to the hot oil for a few mins until soft. Add the curry paste, tomatoes coconut milk, and simmer for 10 mins until thickened to sauce.

Step 2 Warm the naan breads in a low oven or in the toaster. D liquid from the squash, then add to the sauce with the l spinach and some seasoning. Simmer for a further 2-3 wilt the spinach, then stir in the coconut yogurt. Serve warm naan and a dollop of extra yogurt.



What recipe would you like to process?

URL: https://www.bbcgoodfood.com/recipes/coconut-squash-dhansak

PROCESS

Please be aware that some pages may be slow to process, especially if they contain multiple recipes.

Recipe for 'Coconut & squash dhansak recipe | BBC Good Food'

Ingredients	150ml coconut, butternut squash, coconut milk, lentils, onions, spinach, tomatoes, vegetable oil
GHGE	1.74 kg CO2eq (-1.76 kg CO2eq to 12.4400015 kg CO2eq)
GHGE per Portion	0.435 kg CO2eq (-0.44 kg CO2eq to 3.1100004 kg CO2eq)
Eutrophying Emissions	17.84 g PO43-eq (4.84 g PO43-eq to 52.99 g PO43-eq)
Eutrophying Emissions per Portion	4.46 g PO43-eq (1.21 g PO43-eq to 13.2475 g PO43-eq)
Acidifying Emissions	39.66 g SO2eq (14.56 g SO2eq to 98.56 g SO2eq)
Acidifying Emissions per Portion	9.915 g SO2eq (3.64 g SO2eq to 24.64 g SO2eq)
Freshwater Withdrawals	2555.65 L (52.63 L to 7625.27 L)
Freshwater Withdrawals per Portion	638.9125 L (13.1575 L to 1906.3175 L)
Stress Weighted Water Use	135247.9 L (742.7 L to 474483.9 L)
Stress Weighted Water Use per Portion	33811.977 L (185.675 L to 118620.98 L)

THIS TOOL HAS BEEN DEVELOPED WITH A RESEARCH GRANT FROM THE ALPRO FOUNDATION

GATE general architecture for text engineering

Generic Meals and carbon labels

Edamam, a provider of nutrition data and semantic solutions for businesses in the food, health, and wellness sectors (https://developer.edamam.com)

- Integrated a food environmental impact database of 2,842 ingredients (using the classification system of the USDA Nutrient Database for Standard Reference, Release 24). This food environmental impact database was based on environmental data from Poore and Nemecek (2018) and was supplied by City.
- For some items which are not part of USDA food list Edamam used in-house nutrition experts to map them to USDA items.
- Edamam has labeled about **5 million recipes in the English language web** with CO2 labels ranking from A+ (best) to G (worst) and is making those searchable via its Recipe Search API.

Edamam's Generic meals are a database of **180,000**+ recipes that encompass more than 90% of what restaurants offer/commonly cooked at home.

- Similar recipes are clustered based on titles after removing certain non essential words from the title. These recipes represent the initial generic meal set.
- Compare recipes based on nutrition and content and remove any outliers. From the rest of the recipes Edamam build a combined recipes for which they also create a distribution of labels and nutrition among the recipe population. CO2e is one of the values which is part of this calculation.
- Edamam matched the CO2e data and carbon labels to the Generic meals database.

EDAMAM
Food. Data. Health

Results: YES! Eat-Lancet compatible recipes!

196,005 recipes with 100% ingredients matched to CO2e data. Mean 2101.45g of CO2e per portion, (SD 3472.02g)

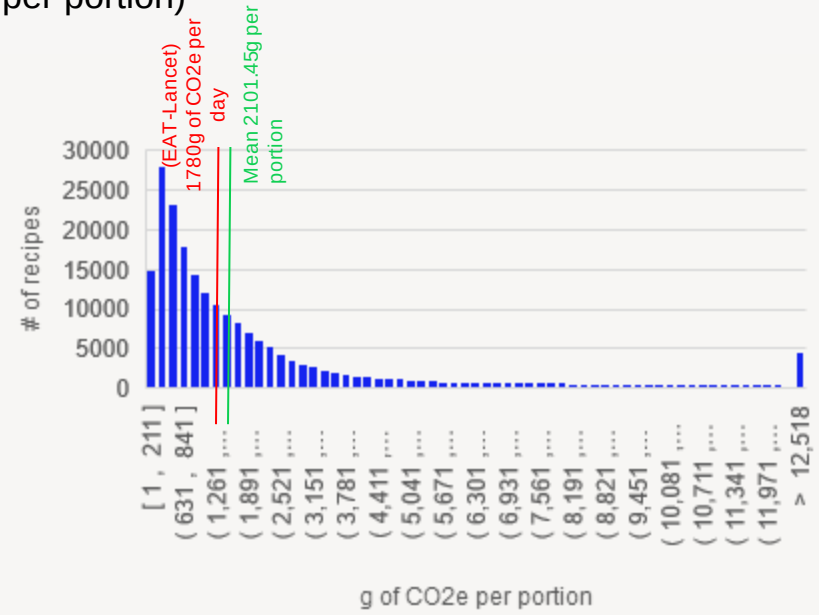
Information provided in grams of CO2e per **portion**, per **Kcal**, per g of **protein**

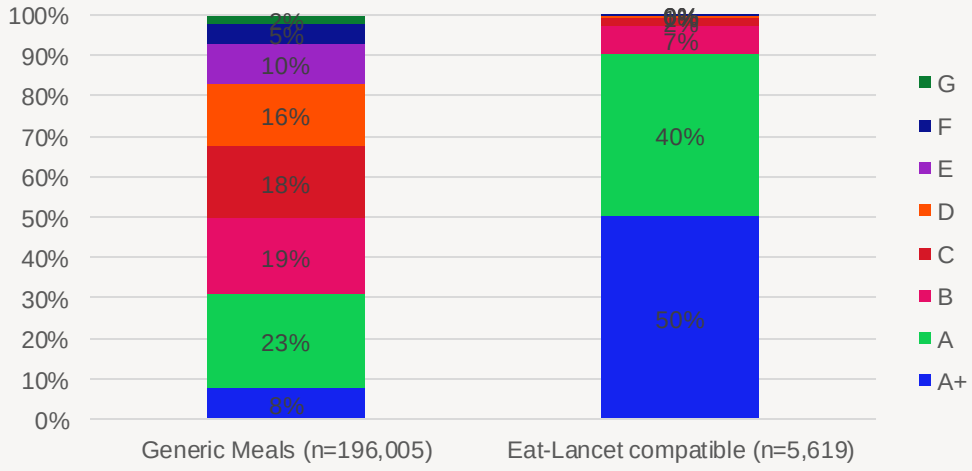
Eat-Lancet recipes: Assume consumption of this recipe is scaled to meet 2500 kcal, and protein 56g, is the scaled recipe below 1780g of CO2e.

Below 31.7g of co2e per g protein n=10,434

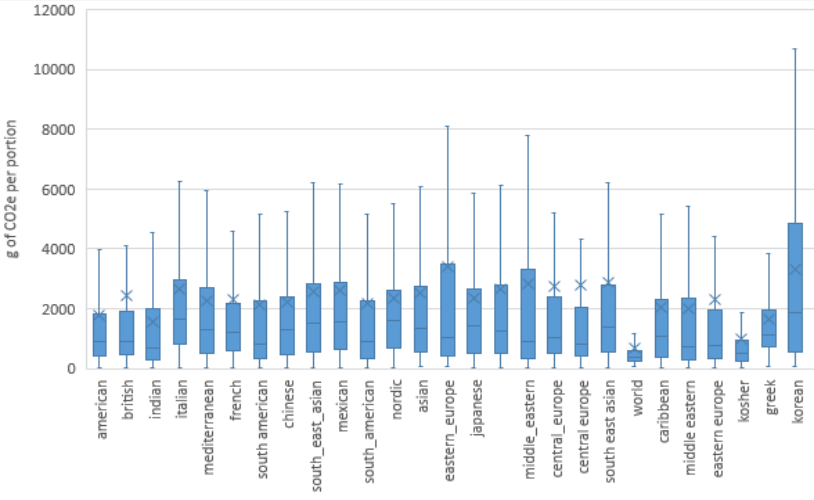
Below 71g of co2e per 100 KJ =8,015

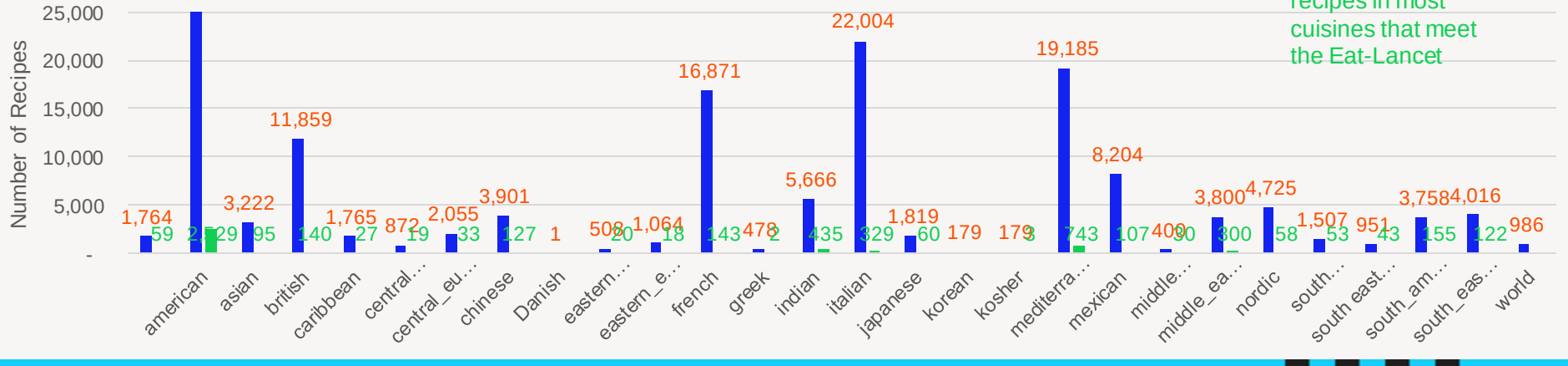
5,619 recipes met both criteria! (2.8%) Mean 180.87g of CO2e per portion, (SD 117.20g, max 1240g of CO2e per portion)





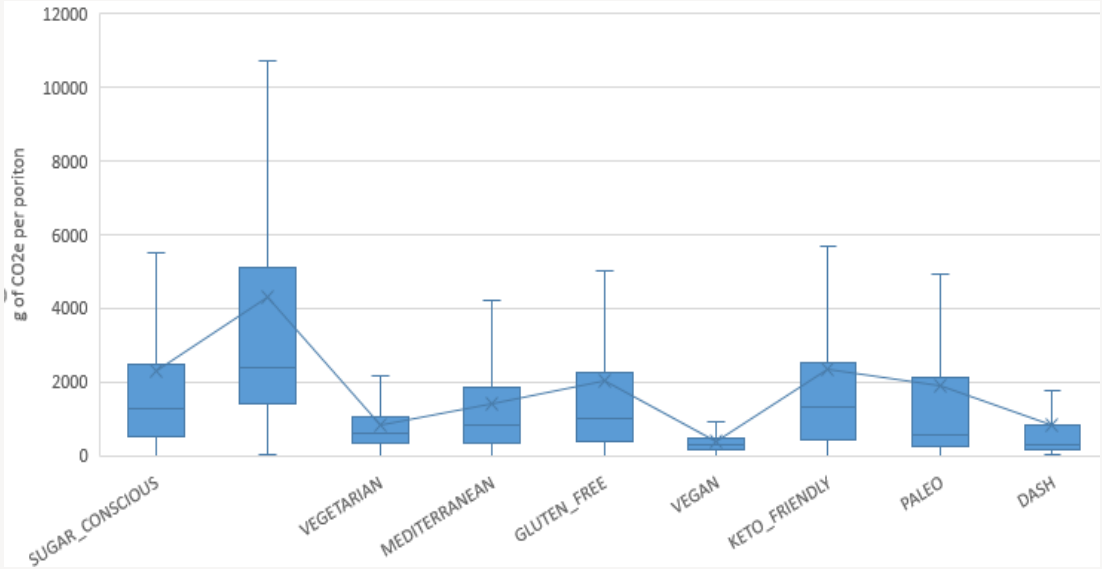
Different ways to cut the data… Cuisine type





Different ways to cut the data… Health/Diet

Metadata presented for Meal type, **Health/Diet** type, Cuisine type, Dish type, and Ingredients per recipe



Different carbon impact spreads across Diet choice types, but also the number of recipes matters!

DASH, Vegan, and Vegetarian recipes had the lowest mean, median and IQR of any specific health/diet type.

DASH= Dietary Approaches to Stop Hypertension, includes foods that are rich in potassium, calcium and magnesium. Limits foods that are high in sodium, saturated fat and added sugars.

Examples of DASH, Vegan, and Vegetarian recipes that meet Eat-Lancet

- Sweet Potato Flat Breads (44g of Co2e per portion)
- Curly Kale With Caramelized Onions (46g of Co2e per portion)
- Alfresco Friday Hummus (49g of Co2e per portion)
- Oatmeal Raisin Cookie Larabars (69g of Co2e per portion)
- Pasta With Lentil Soup Sauce (137g of Co2e per portion)
- Lentil And Spinach Salad With Onion, Cumin And Garlic (145g of Co2e per portion)
- Falafel Veggie Burgers (173g of Co2e per portion)
- Farro Salad With Winter Fruit, Pistachios And Ginger (175g of Co2e per portion)
- Kale, Quinoa And Roasted Pumpkin Pilaf (226g of Co2e per portion)
- Spicy Portabella Couscous (237g of Co2e per portion)
- …
- Cumin And Coriander Chickpea Salad (568g of Co2e per portion) etc.

- (note to self at least 100 variant recipes for hummus)

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https://www.city.ac.uk/about/schools/health-sciences/research/centre-for-food-policy

The Centre for Food Policy, City, University of London offers the following courses

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Undergraduate degree

Food Policy MSc/PGDip/PGCert/MSc Distance Learning
Postgraduate taught degree

PhD/MPhil Food Policy
Postgraduate research degree

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

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