



THE CARBON FOOTPRINT OF FOOD

The carbon footprint¹ of food is the greenhouse gas emissions produced by growing, rearing, farming, processing, transporting, storing, cooking and disposing of the food we eat.

Throughout any food's lifecycle different greenhouse gases may be emitted, such as carbon dioxide (CO₂), methane and nitrous oxide, each with a greater or lesser ability to trap heat in the atmosphere. The global warming potential of each gas can be expressed in CO₂ equivalents (CO₂e) and adding these up for any food gives its carbon footprint.

Carbon emissions from food account for as much as a quarter of all human carbon emissions. If the effect of deforestation to make space for farmland is included, food contributes over 30% to our individual carbon footprint. In the UK just under half of our food carbon footprint comes from producing food, about 25% from processing, 20% from transport and 10% from packaging.

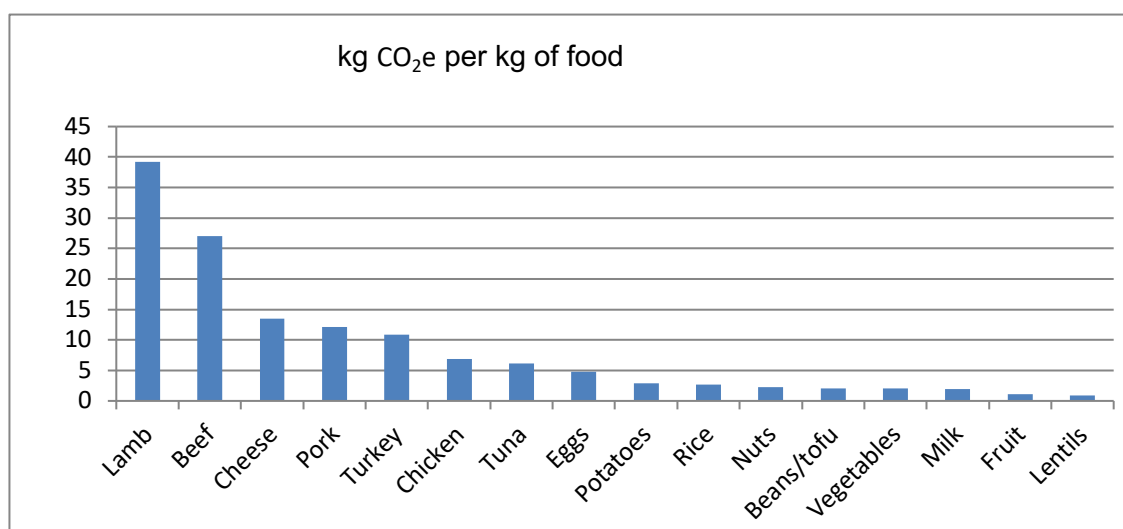
We can achieve big reductions in our personal carbon footprint by changing our diet, while helping to reduce pollution, preserve the environment and slow global warming. Many of these changes will also save money, improve our health and even keep us fit!

PRODUCTION AND PROCESSING OF FOOD

Approximately 1-2 acres of rainforest are destroyed every second to provide space for animal grazing or to grow animal feed, like soya beans. The food that animals eat does not translate directly into the same quantity of meat for human use. Meat and dairy products carry more emissions per kcal of food because animals have to be housed, kept warm and move about before we can eat them. All this takes energy. Some animals also produce methane, which has a very high climate warming effect.

Figure 1 shows the carbon footprint of different foods in carbon dioxide equivalents (CO₂e) per kg of food. The data shows that eating beef and lamb has a high impact on carbon emissions.

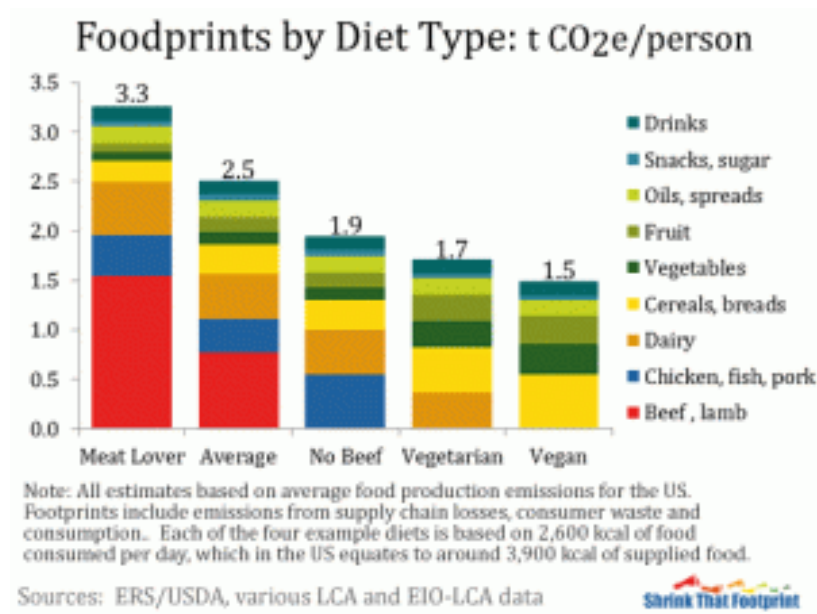
Figure 1: Overview over the carbon footprint of various foods; from source (1)



¹ A carbon footprint is the total greenhouse gas (GHG) emissions caused directly and indirectly by an individual, organization, event or product. It is calculated by summing the emissions resulting from every stage of a product or service's lifetime (material production, manufacturing, use phase, and end-of-life disposal). Throughout a product's lifetime, or lifecycle, different greenhouse gases (GHGs) may be emitted, such as methane and nitrous oxide, each with a greater or lesser ability to trap heat in the atmosphere. These differences are accounted for by calculating the global warming potential (GWP) of each gas in units of carbon dioxide equivalents (CO₂e), giving carbon footprints a single unit for easy comparison.

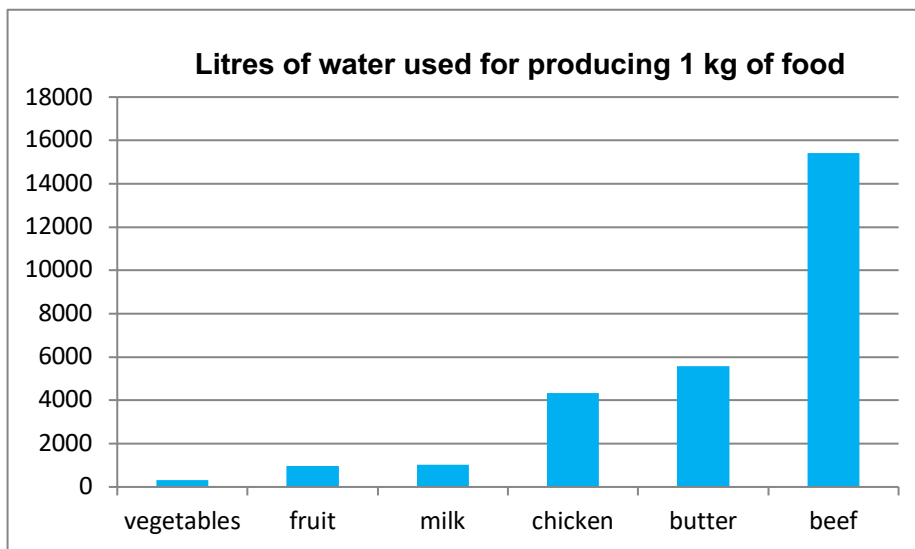
Figure 2 shows that the carbon footprint from food is much higher for meat lovers than for people who eat vegetarian and vegan food.

Figure 2. Carbon footprint for different eating habits; from source (1)



Another environmental impact from food production is water usage. Water is used at various stages of producing food. Figure 3 shows that producing red meat like beef uses much more water than other foods.

Figure 3: Water use for producing 1 kg of food; from source (2)

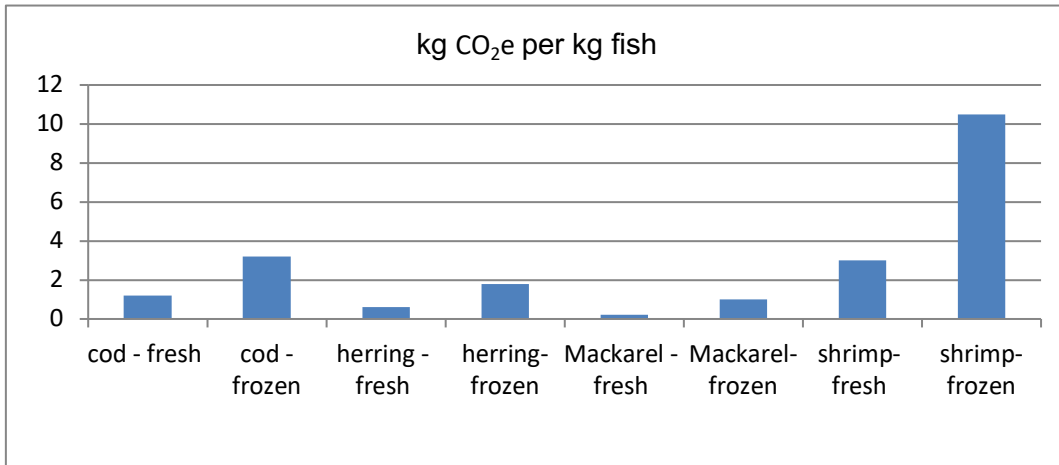


Therefore, reducing the amount of red meat and dairy produce in our diets would have a really big positive environmental impact, both on the carbon emissions we produce and on water use.

Fish is often frozen straight after fishing, which increases its carbon footprint because of the energy needed for the refrigeration (Figure 4). However, freezing avoids waste and therefore reduces the carbon footprint in the fisheries industry. There are some differences in carbon footprint between farmed and wild fish, with fish farms said to be emitting methane which has a high climate warming effect. However, altogether, fish carries a lower carbon footprint than red meat, and is roughly similar to poultry.²

² A word of warning: The CO₂e data for a particular food can vary between different sources. This is because there are differences in how the data has been calculated, and what has been taken into account in the calculations. For example, some sources state that lamb has a higher carbon footprint than beef, and in other sources it is the other way around. However, the general trend is consistent across all sources, and it is important to get a 'carbon instinct', and understand the orders of magnitude, rather than focus on the exact numbers.

Figure 4: Carbon footprint of fish (kg of CO₂e per kg of fish) from source (3)



Many people are concerned that a vegetarian or vegan diet will not provide enough protein and other essential nutrients. However, figure 5 shows that soy beans not only provide more calories than beef but also more protein and iron.

Figure 5: Nutrient content of soy beans and beef; from source (4)

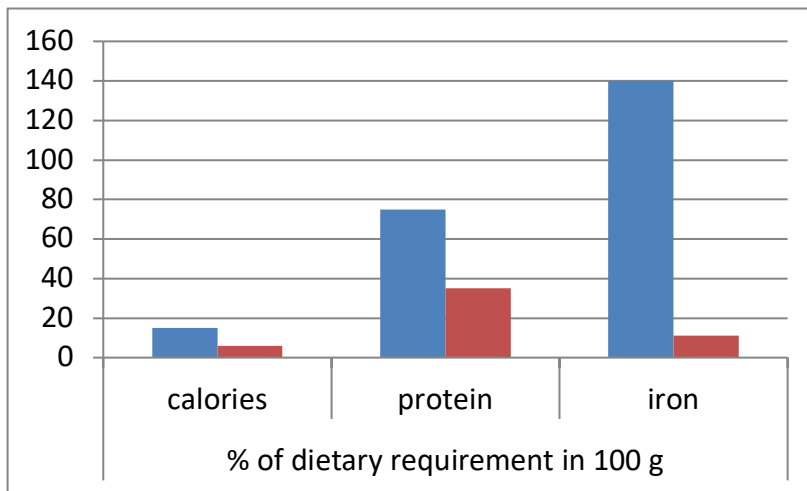
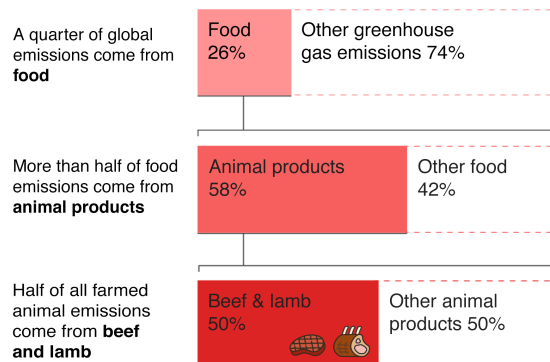


Figure 6 summarises the proportions of carbon emissions related to animal products and beef and lamb.

Figure 6: Impact of food on all global greenhouse emissions; from source (5)

How much impact does food have?

Proportion of total greenhouse gas emissions from food



Source: Poore & Nemecek (2018), Science



SEASONAL FOOD AND TRANSPORT OF FOOD

During the last few decades we have got used to eating any food at any time of the year; for example, it has become normal for us to eat summer fruit or vegetables in the winter. This however has a dramatic impact on the carbon footprint of food.

Foods that do not go off quickly are transported by sea (e.g. bananas and oranges), but soft fruit and vegetables are air-freighted to European countries from the Southern hemisphere in the winter. Air-freighting food causes approximately 100 times more CO₂e emissions than transporting food efficiently by sea. The examples in Figure 7 and Table 1 illustrate the big difference between air freighted food and that shipped by sea. Buying from the UK, or even better, more locally (or growing your own) decreases the carbon footprint of food and drink.

Figure 7: Grams of CO₂e for transporting 1 tonne of food for 1 km; from source (6)

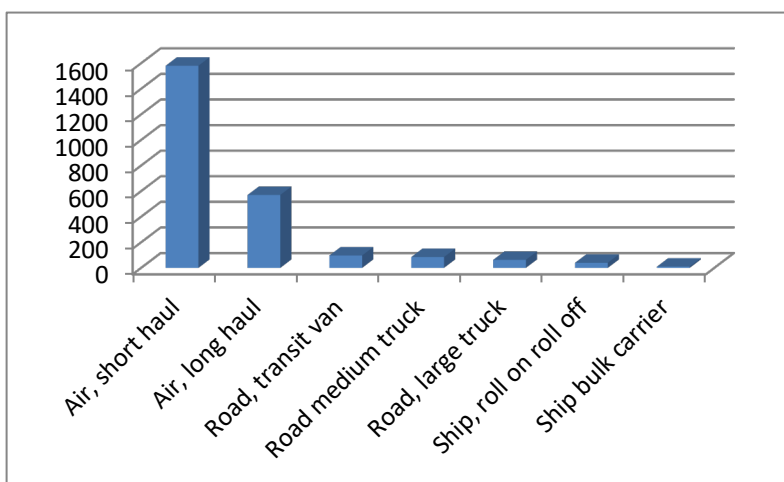


Table 1: Grams of CO₂e for transporting 1 kg of goods to Hertfordshire; from source (6)

Food	CO ₂ e in grams
Mange tout peas from Kenya, bought in a supermarket (air-freighted)	3998
Apples from New Zealand, bought in a supermarket (shipped by sea)	300
Apples from Kent, bought in a supermarket	120
Apples from Hertfordshire, bought at a farmers' market	109
Apples from Hertfordshire, bought in a local shop in walking distance	17
Apples from Hertfordshire, delivered by a local grower via a box scheme	10
Apples from your own garden	0

Adapted from Food and climate change. East Anglia Food Links www.eafl.org.uk

Eating food that is out of season has a very high carbon impact compared with eating seasonal food. Figures 8-10 show the carbon footprint of some vegetables in and out of season. Like all fruit and vegetables, tomatoes, carrots and asparagus have a very small carbon footprint when eaten in season. For carrots this changes only a little, because little energy is needed for storage over winter and spring. However, asparagus bought outside the short harvesting season has a huge carbon footprint because it is air-freighted, usually from South America. Buying tomatoes out of season can have an even higher carbon footprint because of the energy needed to heat greenhouses. The graph shows an extreme situation, for speciality tomatoes that usually do not have such a high yield as ordinary tomatoes.

Lettuce is another good example for the impact of green-housing (Figure 9), with the carbon footprint being 10 times higher out of season because of the green-housing. Buying vegetables from Southern European countries, that are normally transported by road to us, such as cucumbers, have a lower carbon footprint than eating locally produced cucumbers from heated green-houses. The carbon impact of green-housing of course

depends strongly on the source of energy used for heating the greenhouse - if this was entirely through renewable resources, the impact of green-housing would be much lower.

Figure 8: Carbon footprint of vegetables (g of CO₂e per 250g) from source (7)

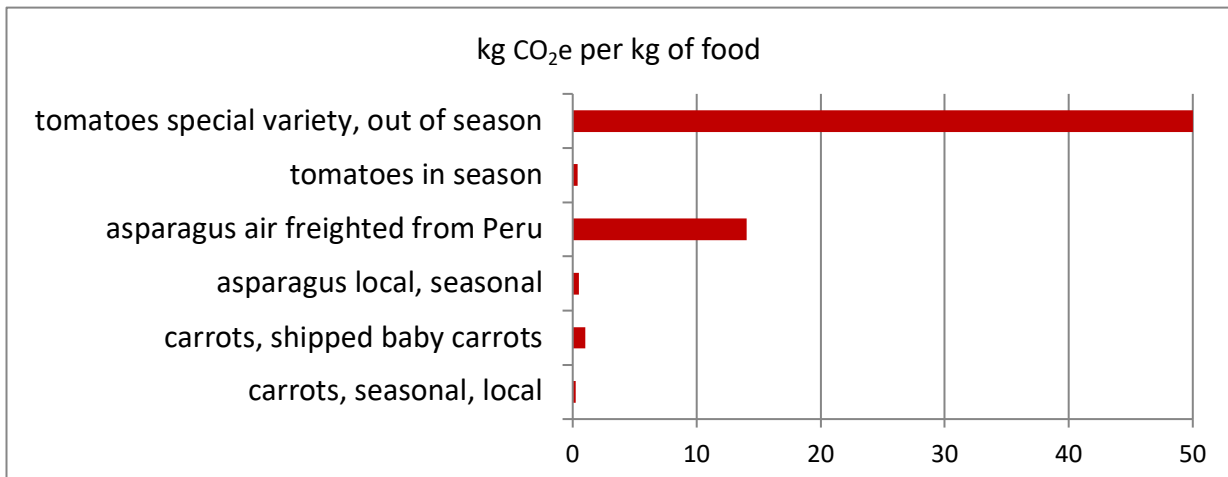


Figure 9: Carbon footprint of cucumber (kg of CO₂e per kg of product), from source (8)

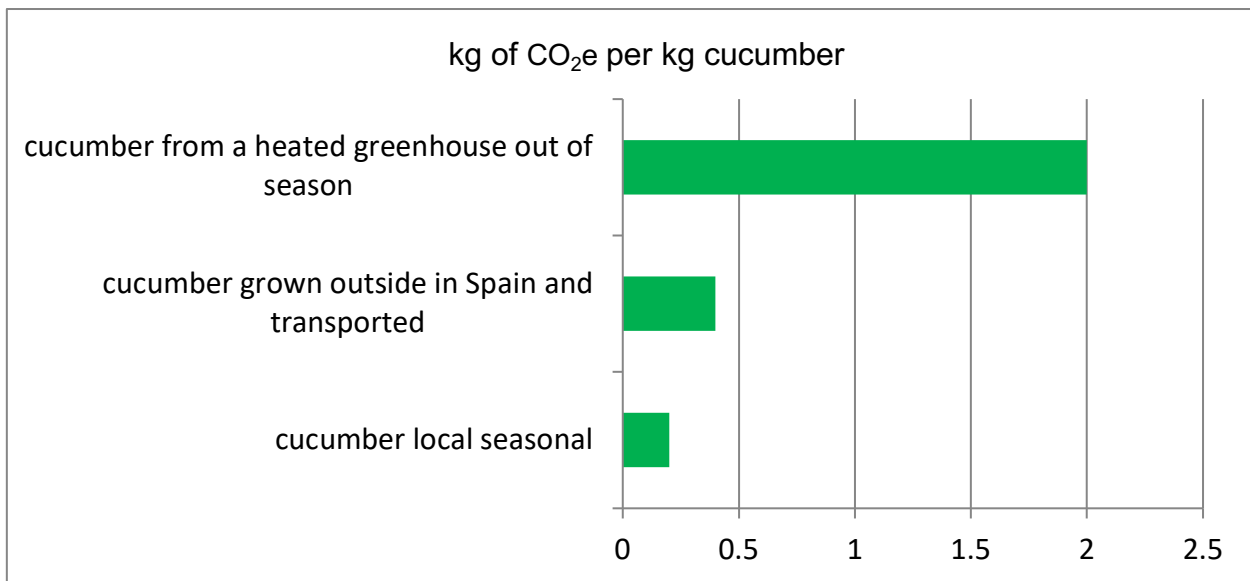
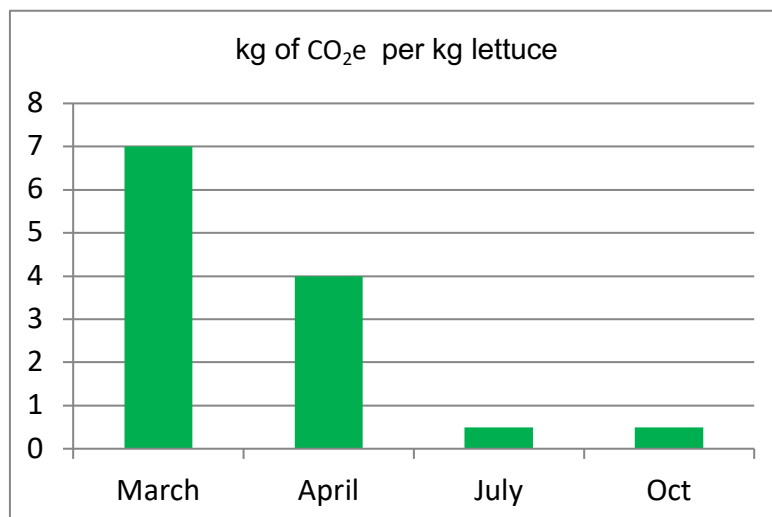


Figure 10: Carbon footprint of lettuce (kg of CO₂e per kg of product); from source (8)



Overall, however, vegetables have a low carbon footprint compared with meat and dairy!

DRINKS

Drinks can also carry a fairly high carbon footprint. For hot drinks this depends mainly on how much milk it contains (the more milk, the higher the footprint), and how much energy is used to heat the water (the less water is boiled the better) (Figures 11 and 12). Using milk alternatives, for example, soy or rice, reduces the carbon footprint (Figure 13), and these alternatives are also better for land and water use.

Figure 11: Carbon footprint of hot drinks (BBC), from source (9)

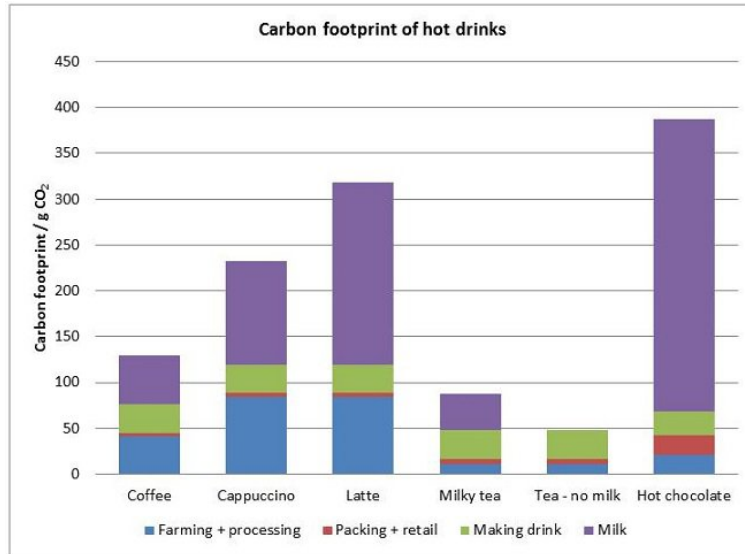


Figure 12: Carbon footprint of hot drinks; from source (7)

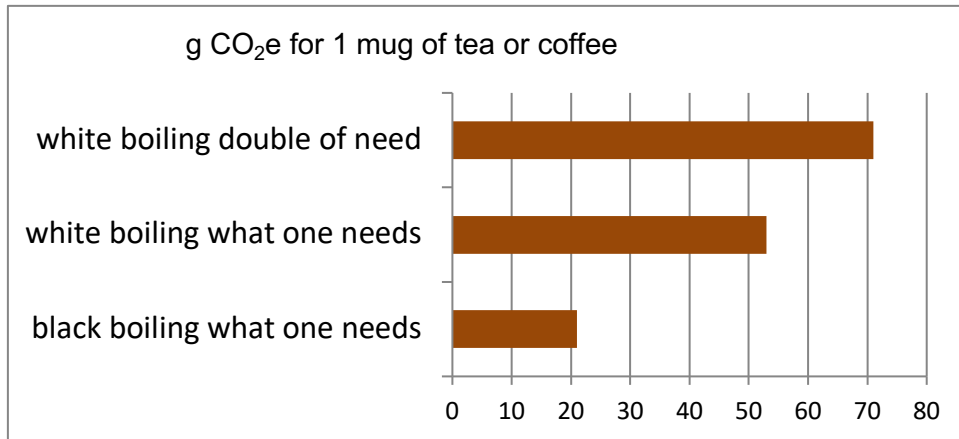
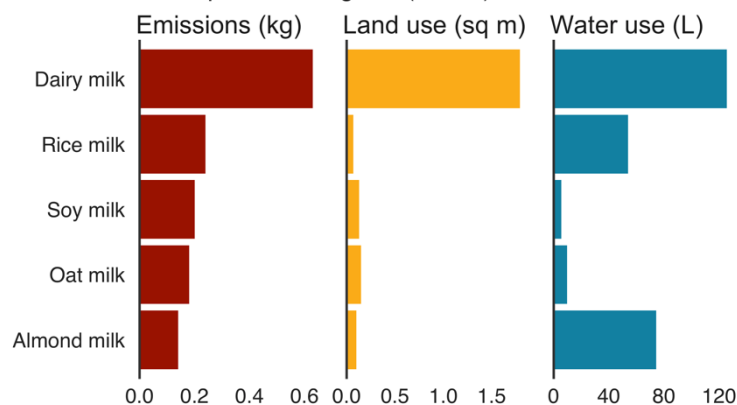


Figure 13: Carbon, land and water footprint of milk and its alternatives, from source (10)

Which milk should I choose?

Environmental impact of one glass (200ml) of different milks

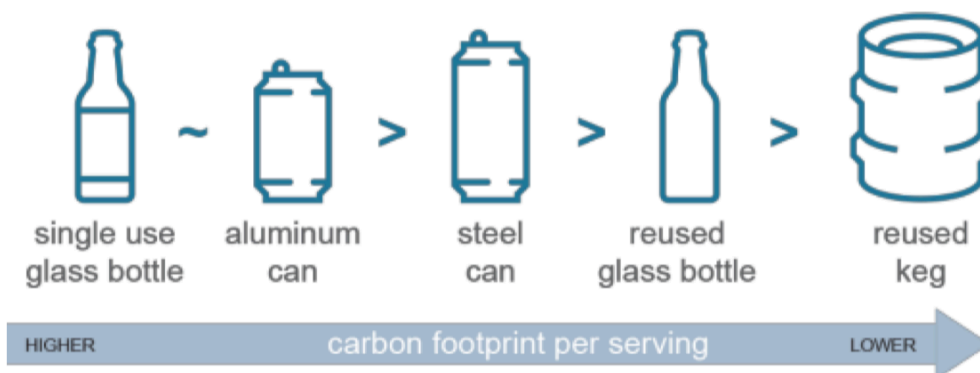


Source: Poore & Nemecek (2018), Science. Additional calculations, J. Poore **BBC**

For cold drinks, transport and packaging, particularly single use glass bottles, are the key contributors to their carbon footprint because these products are bulky and heavy (like wine and beer).

Figure 14 shows that from a carbon footprint point of view it is better to buy drinks in cans than in singly use glass bottles. This is because they are lighter to transport.

Figure 14: Carbon footprint associated with different drinks packaging, from source (11)

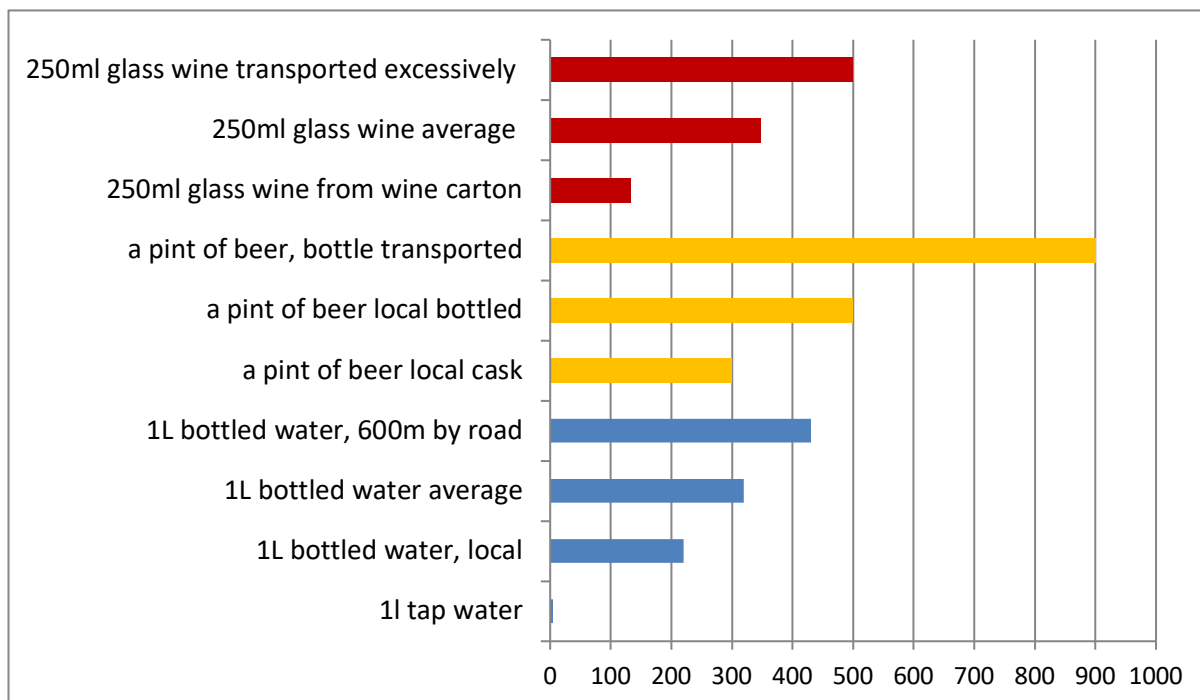


Over the last 30 or so years it has become very fashionable to drink bottled water. This has an enormous negative effect both on plastic use (and waste) and carbon footprint. Tap water has a miniscule carbon footprint (Figure 15), and it perfectly drinkable, and should be the choice for every carbon-conscious person.

Buying wine in cartons reduces the footprint because it is lighter and therefore less energy consuming to transport, and buying local wine, where possible, reduces the footprint.

This also applies to beer. Drinking beer that is local and not bottled is by far the best option. The transport of bottled beer is energy consuming because glass weighs a lot.

Figure 15: Carbon footprint (g CO₂e per drink) of cold drinks, from source (7)



Soft drinks and juices have a carbon footprint of about 1 -1.5 kg per litre (a bit more than bottled water), depending on how much fruit it contains, and if it is packaged in glass or plastic bottles.

In summary, here are the top tips for lowering your food carbon footprint:

Food

1. Reduce the amount of meat (particularly red meat), fish and dairy produce in your diet.
2. Choose seasonal food as much as you can, it won't have clocked up CO₂ through being transported, stored or produced in 'hot-houses'
3. Choose food that is produced locally or from the UK
4. Avoid air-freighted food
5. Try and grow some of your own salad, vegetables or fruit (even more local and seasonal!)

Drinks

6. Try use alternatives to single use glass bottles
7. Only boil as much water as needed when you make a hot drink
8. ...and don't buy bottled water!! The tap water in the UK is perfectly drinkable

And in general (but not covered in this article)

9. Eliminate food waste (in the Western World about 25% of all food produced gets thrown away!)
10. Buy the food with the least packaging

You could comfortably cut down the footprint of your food by 60% and reduce your total footprint by almost 20% (source 12).

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