# MERCHANT GOURMET SUSTAINABILITY REPORT

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A habitable stable climate and well-functioning natural systems are the foundation for a livable future.

To achieve the global climate goals of holding warming at 1.5 degrees by 2050 and avoid the worst impacts of climate change, carbon footprints must be dramatically reduced, including that of food and drink. Yet with factors from fertilisers to methane from animals, food transportation to packaging, coming with a carbon price tag, the transition is complex and challenging. Solutions will be needed at every stage of the food chain, production, consumption, and waste. It will no longer just be a case of how food is produced, but what and how much.

World meat production is projected to double by 2050, while the global population is expected to increase from 7.2 to 8.5 billion in 2030, 9.7 billion in 2050 and 10.9 billion in 2100. [1][2]Based on current food trends and increases in population, it will be impossible to fulfill everyone's nutritional needs, meet 1.5-degree climate goals, and restore biodiversity. The human population is expected to increase from 7.2 to 8.5 billion in 2030, rising to 10.9 billion by 2100[3]. As the global standard of living increases, demand for livestock products will continue to increase[4]. An estimated 69 billion chickens; 1.5 billion pigs; 656 million turkeys; 574 million sheep; 479 million goats; and 302 million cattle were killed for meat production in 2018[5]. As it stands, livestock production is already driving climate change and biodiversity loss[6]. Any increase in demand will exacerbate the problem.

Securing a climate friendly food supply chain is dependent on switching to nature positive farming, agroecological production systems, restoring fishing grounds and habitats, promoting agricultural diversity, changing our relationship to livestock and a switch to more plant-based eating throughout richer countries[7]. This will lead to a reduction in GHG emissions and increased carbon sequestration on land and in the seas. Reduced emissions will result in less extreme weather, and crops and livestock becoming more productive, and nutritious. The system will become more resilient to shocks and less vulnerable. These steps will make communities more resilient, self-sufficient and support livelihoods. A virtuous circle that links climate actions to biodiversity and nutritional outcomes to economic prudence[8].

Climate change is already taking effect. Human activities have caused global temperatures to rise by more than 1°C above pre-industrial levels[9]and the impacts are being felt. In 2021, there were record

1 FAO 2019 Meat and meat products https://www.fao.org/ag/againfo/themes/en/meat/home.html

2 United Nations, Department of Economic and Social Affairs, Population Division (2019). World Population Prospects 2019: Highlights (ST/ESA/SER.A/423) https://population.un.org/wpp/Publications/Files/WPP2019_Highlights.pdf

3 United Nations, Department of Economic and Social Affairs, Population Division (2019). World Population Prospects 2019: Highlights (ST/ESA/SER.A/423) https://population.un.org/wpp/Publications/Files/WPP2019_Highlights.pdf

4 Rojas-Downing. M, et al 2017 Climate change and livestock: Impacts, adaptation, and mitigation; Climate Risk Management Vol 16 P. 145-63 https://doi.org/10.1016/j.crm.2017.02.001

5 https://ourworldindata.org/meat-production#number-of-animals-slaughtered

6 Henchion M, Hayes M, Mullen AM, Fenelon M, Tiwari B. Future Protein Supply and Demand: Strategies and Factors Influencing a Sustainable Equilibrium. Foods. 2017;6(7):53. Published 2017 Jul 20. doi:10.3390/foods6070053

7 Searchinger. T, et al 2019 CREATING A SUSTAINABLE FOOD FUTURE: A Menu of Solutions to Feed Nearly 10 Billion People by 2050 (WRI) https://research.wri.org/wrr-food

8 Benton. T, Bailey. R, Lee. B. 2018 Breaking the Vicious Circle: Food, Climate & Nutrition. Chatham House https://accelerator.chathamhouse.org/article/breaking-the-vicious-cycle-food-climate-nutrition

9 IPCC *Climate Change 2014: Synthesis Report* (eds Core Writing Team, Pachauri, R. K. & Meyer L. A.)

temperatures recorded in Canada, the first extreme heat warnings in the UK, wildfires in the Western United States, flooding in Northern Europe and in China and ongoing famine in Madagascar. While 2020 was one of the hottest three years on record and the past six years have been the six warmest years on record[10]. This increase affects the global weather patterns that are essential to agriculture[11,12]

Global plans to reduce greenhouse gas emissions are wholly inadequate if warming is to be limited to 1.5C. We have already exceeded 1.1C and are on a path to 2.7C. To meet the 1.5 degrees, target global net zero must be achieved by 2050[13].

It is very difficult to measure the carbon footprint of a food product. Even with the same category, the footprint varies depending on the production systems, location, weather, species and whether the food is endemic. We see this most markedly in beef and lamb. For example: if you compare a cow reared on natural grassland to one reared on cleared grassland the first one will have a lower impact. Then if you compare these to cows in a feedlot, the results change again. It is due to these differences that it is important to be aware that global averages only give a partial picture

Using cows as an example: The emissions connected to cows come from many sources. The microbes in their stomachs produce methane, and their manure is a source of methane emissions. In the UK most cows are raised on pasture, while in the US, before cattle go to slaughterhouses, they are often sent to feedlots and fed grains to fatten them up. These grains need fertiliser and pesticides, both of which are large sources of emissions. Forty-five percent of the emissions attributed to livestock emissions come from feed[14]. Pesticides are often produced using non-renewable fossil fuels and additional land is cleared to grow them in countries like Brazil, huge swaths of rainforest and savannas continue to be cut down to make room for cattle or to grow the crops to feed them. Deforestation is one of the largest causes of climate change[15]. This includes historic deforestation, as is seen across Europe. The UK has some of the lowest tree cover in the world compared to what it was like over a thousand years ago and the reasons for this clearance are ship building and agriculture[16]. The forests have not returned due to the continued use of the land for livestock. Overgrazing is another source of emissions, too many animals or grazing in the wrong place, such as on recently forested land in the Amazon or overgrazing on hilltops.

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[10] State of the Global Climate 2020 https://library.wmo.int/doc_num.php?explnum_id=10618

[11] Lesk, C., Rowhani, P. & Ramankutty, N. Influence of extreme weather disasters on global crop production. *Nature* **529**, 84–87 (2016)

[12] Ray, D. K., Gerber, J. S., MacDonald, G. K. & West, P. C. Climate variation explains a third of global crop yield variability. *Nat. Commun.* **6**, 1–9 (2015)

[13] IPCC, 2018: Summary for Policymakers. In: *Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty* [Masson-Delmotte, V., P. Zhai, H.-O. Pörtner, D. Roberts, J. Skea, P.R. Shukla, A. Pirani, W. Moufouma-Okia, C. Péan, R. Pidcock, S. Connors, J.B.R. Matthews, Y. Chen, X. Zhou, M.I. Gomis, E. Lonnoy, T. Maycock, M. Tignor, and T. Waterfield (eds.)]. *World Meteorological Organization , Geneva, Switzerland, 32 pp. https://www.ipcc.ch/sr15/*

[14] Gerber, P.J., Steinfeld, H., Henderson, B., Mottet, A., Opio, C., Dijkman, J., Falcucci, A. & Tempio, G. 2013. Tackling climate change through livestock – A global assessment of emissions and mitigation opportunities. Food and Agriculture Organization of the United Nations (FAO), Rome https://www.fao.org/3/i3437e/i3437e.pdf

[15] Heidari, Hadi; Warziniack, Travis; Brown, Thomas C.; Arabi, Mazdak (February 2021). "Impacts of Climate Change on Hydroclimatic Conditions of U.S. National Forests and Grasslands". Forests. 12 (2): 139. doi:10.3390/f12020139

16 Forest research 2016 Forest Cover: International Comparisons https://www.forestresearch.gov.uk/tools-and-resources/statistics/forestry-statistics/forestry-statistics-2018/international-forestry/forest-cover-international-comparisons/

Another important element is the difference between emission intensity and total emissions. Many livestock producers only focus on the per unit emission intensity. These can be reduced through changes in feed and industrialisation. However, this can give a misleading picture. If herd or flock sizes keep increasing, then total emissions also rise. This is common in the poultry sector. Per unit, chickens have a very low footprint, even when taking account of the whole supply chain including feed. However, the number of chickens worldwide has more than doubled since 1990. In 2020, there were some 33 billion chickens in the world[17], almost 4 per person, and poultry is now the most produced meat in the world, ahead of pork. The poultry sector has not adequately responded to the growing climate crisis as the main focus of the debate around meat, for and against, is on red meat. The poultry industry focuses on units of production and fails to account for total impact. Even as EU cattle herds have declined, industrial feed has remained constant at 30%, in part due to the tremendous increase of poultry production in recent years[18].

Geography also plays a key role in the sustainability of a crop or animal. Farming methods are often adopted in line with local conditions such as soil fertility, terrain and temperature. Opportunities for food producers to reduce emissions are therefore very specific to local conditions. This can lead to specialist varieties such as the Puy lentil and the associated benefits for local communities, the environment and health.

One of the most effective ways people can reduce their carbon footprint is by switching to sustainable diets[19]. This often means eating more pulses, lentils, beans and vegetables and less meat and dairy. This switch will have a bigger impact than looking at food miles and choosing local or focusing on packaging. While these are all important elements and will have clear environmental and social benefits, change must start with food choices. A switch towards a more plant-based diet will reduce the demand for land, which will benefit biodiversity, forests and mitigate climate change. If the world population ate less meat and dairy the demand for land would go down even including the extra crops that would need to be grown to feed people.[20]

## The power of lentils

Lentils are originally from North Africa and Asia and are one of the world's first cultivated crops. They have a very low carbon footprint compared to beef. Through a process called nitrogen fixation, they can improve the physical property of soils, which can increase the yield of subsequent crops. This might also turn the soil into a better carbon sink. All the carbon in the plant material enters the soil and doesn't contribute to airborne carbon dioxide. Plant residue helps the soil trap water, and the water moves deeper into the ground, so soil moisture increases.

They are extremely nutritious with high amounts of protein, carbohydrates and fibre. As a food group, after soya and hemp, they have the highest protein amounts of any beans and provide up to 30% of their calories this way. This complex nutritional profile enhances their environmental credentials. Pretty simply you get a greater variety of benefits across the board.

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[17] https://www.statista.com/statistics/263962/number-of-chickens-worldwide-since-1990/
[18] IATP (2021) "Emissions Impossible Europe" https://www.iatp.org/emissions-impossible-europe
[19] Poore, J., & Nemecek, T. (2018). Reducing food's environmental impacts through producers and consumers. Science, 360(6392), 987-992
[20] Searchinger, T. D., Wirsenius, S., Beringer, T., & Dumas, P. (2018). Assessing the efficiency of changes in land use for mitigating climate change. Nature, 564(7735), 249-253 https://www.nature.com/articles/s41586-018-0757-z

Puy lentils have been produced in the area of Le Puy en Velay, in the Auvergne region of France, for more than 2,000 years now. They are produced in Auvergne without chemical fertilizers, and the volcanic soils of Le Puy are dark green in color. The area is formed from ancient volcanic lava domes, which make the land naturally incredibly fertile without the need for additional fertilizers. This and the high, even altitude of the valley, creates a uniquely dry and warm microclimate – the perfect conditions in which to grow the delicate Puy lentil. These unique conditions reduce the carbon footprint of the Puy lentil, compared to many other varieties.

Because of these unique growing conditions, the lentil has its own protected designation of origin status – which means that, to use the name Puy Lentils, the product must be grown, harvested and packed in the region of Puy.

## Carbon footprinting

The life cycle assessment (LCA) methodology is increasingly being used for evaluation of the environmental footprint of different food products and for identifying mitigation options in the supply chain. However, there are only a limited number of LCA studies on pulses of different origin have been undertaken, despite great variation in how and where they are produced, processed, packaged and their important role in achieving sustainable diets[21].

Processing and packaging of pulses are important steps in the supply chain that need to be considered as they can have a significant impact. Domestically grown pulses bought dry and cooked at home have been found to have the lowest environmental impact. Other important aspects to consider are transport distance and transport mode. However, 'food miles' are less important than transport mode and processing of the product. Production and waste management of packaging is another key consideration due to embedded energy use and GHG emissions. Packaging foods in glass bottles or steel tins has a larger footprint than other packaging. [22][23][24][25]

The data used comes from two sources. The first is an analysis of global food systems, looking at the environmental impacts of foods across more than 38,000 commercially viable farms in 119 countries, by Joseph Poore and Thomas Nemecek.[26] This is one of the most comprehensive and granular

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[21] Pernilla Tidåker, Hanna Karlsson Potter, Georg Carlsson, Elin Röös, Towards sustainable consumption of legumes: How origin, processing and transport affect the environmental impact of pulses, Sustainable Production and Consumption, Volume 27,2021,Pages 496-508, ISSN 2352-5509, https://www.sciencedirect.com/science/article/pii/S2352550921000178

[22] A. Del Borghi, C. Strazza, F. Magrassi, A.C. Taramasso, M. Gallo Life Cycle Assessment for eco-design of product–package systems in the food industry—The case of legumes Sustain. Prod. Consumption, 13 (2018), pp. 24-36 https://www.sciencedirect.com/science/article/abs/pii/S2352550917300520

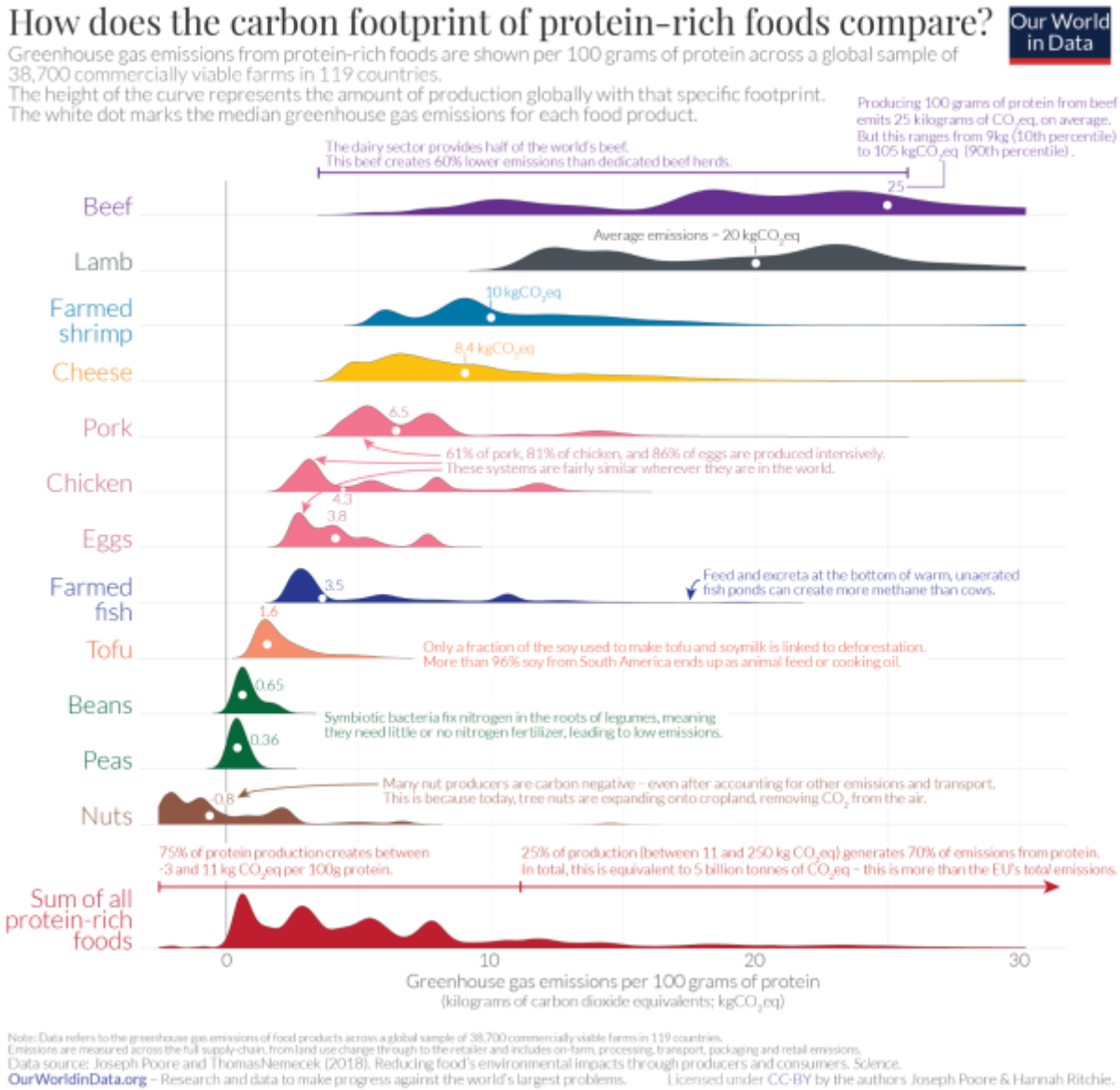
[23] Pernilla Tidåker, Hanna Karlsson Potter, Georg Carlsson, Elin Röös, Towards sustainable consumption of legumes: How origin, processing and transport affect the environmental impact of pulses, Sustainable Production and Consumption, Volume 27,2021,Pages 496-508, ISSN 2352-5509, https://www.sciencedirect.com/science/article/pii/S2352550921000178

[24] Del Borghi, C. Strazza, F. Magrassi, A.C. Taramasso, M. Gallo Life Cycle Assessment for eco-design of product–package systems in the food industry—The case of legumes Sustain. Prod. Consumption, 13 (2018), pp. 24-36 https://www.sciencedirect.com/science/article/abs/pii/S2352550917300520

[25] S. Markwardt, F. Wellenreuther Comparative Life Cycle Assessment of Shelf Stable Canned Food packaging. Final report. Commissioned by Tetra Recart ABIfeu - Institut für energie- und umweltforschung Heidelberg

[26] Poore, J., & Nemecek, T. (2018). Reducing food's environmental impacts through producers and consumers. Science, 360(6392), 987-992. https://www.science.org/doi/10.1126/science.aaq0216

assessments of the food systems. It highlights the different impact of a food depending on the size of the farm, where it is located, the production system and the type of plant or animal.




The second is from The Su-EATABLE LIFE (SEL) database. A harmonized compilation of 3349 carbon footprint values from 841 publications and 937 water footprint values extrapolated from 88 publications.

For both comparisons, the footprint is per 100 grams of protein. The results are similar, the median footprint of lamb or beef is twenty-five times that of lentils.

The figures are expressed as a carbon dioxide equivalent (CO2eq). This is a metric used to compare the emissions from different greenhouse gases by converting them to the equivalent amount of carbon dioxide with the same global warming potential. For example, the GWP for methane is 25. This means that emissions of 1 million metric tonnes of methane equivalent to emissions of 25 metric tonnes of carbon dioxide.

To stay within 1.5 degree, it is important to keep these emissions as low as possible. In the case of food, it tends to be livestock products which have the highest C02eq.

### Beef

According to both data sets the median footprint for beef is 25 kgCO2eq. But some producers have a much higher footprint up to 109 kgCO2eq per 100 grams. At the other end, some are much lower, down to 2.27 kgCO2eq. Most beef production lies in the range between 17 to 27 kgCO2eq. This is far higher than other foods.

### Lamb

For lamb the median is 25 kgCO2eq with the upper footprint reaching 56.70 and the lower 10.

### Pork

The variability for pork is far smaller, due to how the animals are reared, their lifespan and lifestyle, are they confined or free range and what they eat. The median is 5.72. However, the median footprint for process products is far higher, for example the median of sausages is 17.94.

### Chicken

Similar to pig meat, chicken has a lower median than beef and lamb, of 3.68. The emissions can range from 1 to 16.

| kg CO2 eq/ kg food | Mean | Median | Min | Max |
|---|---|---|---|---|
| Chicken | 4.24 | 3.68 | 1.06 | 16.29 |
| Chicken with bone | 3.25 | 2.82 | 0.85 | 12.57 |
| Pork with bone | 3.5 | 3.44 | 1.30 | 7.06 |
| Pork | 5.79 | 5.72 | 2.11 | 11.86 |
| Pork Sausages | 17.94 | 17.94 | 17.94 | 17.94 |
| Lamb | 27.21 | 25.23 | 10.05 | 56.70 |
| Lamb with bone | 18.01 | 16.70 | 6.68 | 37.47 |
| Beef | 27.72 | 25.75 | 2.27 | 109.35 |
| Beef with bone[27] | 19.54 | 17.96 | 7.51 | 76.04 |

Ref: Su-EATABLE LIFE [28]

[27] On the bone has a lower footprint than the same amount of meat not on the bone as you are getting less meat for the same weight, as you are including the bone.

## Plant protein sources

Plant proteins have a low carbon footprint and are far lower than livestock products. When you compare data from either data set, it is apparent that even when you compare the extremes as there is not much overlap in emissions between the worst producers of plant proteins, and the best producers of meat and dairy.

Lentils have a footprint between 1 and 1.6 KG CO2 eq, while chicken is between 1.06 and 16.29, and beef 2.27 and 109.35. For both chicken and beef the lower numbers are exceptional and do not reflect the majority of production systems.

Whole pulses such as lentils are better from an environmental and health perspective than the ultra-processed alternate meats. For example, the footprint of an impossible burger is 3.5 kg CO2 eq three times that of lentils[29].

| kg CO2 eq/ kg food commodity | Mean | Median | Min | Max |
|---|---|---|---|---|
| Bean | 0.67 | 0.43 | 0.22 | 1.55 |
| Chickpea | 0.67 | 0.77 | 0.45 | 0.80 |
| Cowpea | 0.48 | 0.49 | 0.33 | 0.61 |
| Green Bean | 0.73 | 0.52 | 0.20 | 1.55 |
| Lentil | 1.03 | 1.03 | 1 | 1.6 |
| Pea | 0.58 | 0.45 | 0.15 | 2.6 |
| Soybean | 0.6 | 0.56 | 0.38 | 1.01 |

Ref: SuItable LIFE database[30]

## Farmed fish

Reliable figures on the carbon footprints of different aquaculture species are hard to find – not least due to the variety of production systems[31]. Many estimates of carbon footprints for farmed finfish range between 4 and 6 (per kg carcass weight at the farm gate), and bivalves are lower and farmed shrimp higher[32]. These differences are due to feed composition, energy sources, transport methods, product forms and distribution. Rice methane emissions account for much of the carbon footprints of

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28 SU-EATABLE LIFE: a comprehensive database of carbon and water footprints of food commodities (figshare.com)

29 Khan. S, Dettling. J, Loyola. C, Hester. J, Moses. R, Comparative Environmental LCA of the Impossible Burger with Conventional Ground Beef Burger Impossible Burger Environmental Life Cycle Assessment 2019 (impossiblefoods.com)

30 SU-EATABLE LIFE: a comprehensive database of carbon and water footprints of food commodities (figshare.com)

31 https://thefishsite.com/articles/assessing-the-carbon-footprint-of-aquaculture

32 SU-EATABLE LIFE: a comprehensive database of carbon and water footprints of food commodities (figshare.com)

lower-value fish in Asia, such as carps and while salmon and other carnivorous farmed fish have footprints that include fishmeal production, either the use of feed fish or soy[33].

A 2016 study showed that land-based farm production of Atlantic salmon in the US had a carbon footprint of 7.01, compared to only 3.39 for Norwegian offshore net-pen production. Once other elements such as transport and refrigeration the carbon footprints became 7.41 and 15.22, respectively[34]. The same is true for other farmed fish such as tilapia and shrimp. Transport costs are significantly lower for frozen products than fresh and there is less waste, both of which reduce the footprint. Yet freezing incurs more greenhouse gasses due to the energy required for initial freezing and subsequently maintaining sub-zero temperatures and the need for more packaging.

## Dairy

Dairy farming has been part of agriculture for thousands of years. Dairy cows are bred specifically to produce large quantities of milk. Dairy cows are required to give birth to one calf annually to produce milk for 10 months of the year. Dairy cows can often only produce very high milk yields for an average of 3 years, after which they are slaughtered, and the meat is normally used for beef. The Holstein-Friesian, is the most common type of dairy cow in the UK, Europe and the USA. Milk production per cow has more than doubled in the past 40 years.

Cattle are ruminants that naturally graze or browse on grasses and other vegetation; therefore, they require lots of fibre in their diet. According to the FAO 150 million households around the globe are engaged in milk production. In most developing countries, milk is produced by smallholders, and milk production contributes to household livelihoods, food security and nutrition. Milk provides relatively quick returns for small-scale producers and is an important source of cash income.

Intensive or confinement systems are ones where cows are kept indoors for long periods of time or even all year round. This is known as 'zero grazing' and is increasingly used for large and high-yielding herds worldwide. These cows produce high yields of milk but have shorter lifespans and lack the ability to exhibit natural behaviour. To produce high yields of milk they require more nutrient-dense diets, so are fed more concentrates and less forage. This food is often imported.

Extensive livestock farming mainly involves grazing by native breeds that have adapted to the territory in which this farming takes place. Pasture systems provide animals with freedom of movement, the opportunity to graze, and a soft surface to walk on. They are less productive.

Most dairy cattle in North America and Europe are industrially reared, in confinement systems. Cows in confinement systems in general produce more milk than cows on pasture because they are fed a mixed ration balanced for more production per cow. They are usually milked two to three times per day and the method of milking depends on the housing type. In other areas of the world such as

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[33] SU-EATABLE LIFE: a comprehensive database of carbon and water footprints of food commodities (figshare.com)

[34] Yajie Liu, Trond W. Rosten, Kristian Henriksen, Erik Skontorp Hognes, Steve Summerfelt, Brian Vinci, Comparative economic performance and carbon footprint of two farming models for producing Atlantic salmon (Salmo salar): Land-based closed containment system in freshwater and open net pen in seawater, Aquacultural Engineering, Volume 71, 2016, Pages 1-12, ISSN 0144-8609, Comparative economic performance and carbon footprint of two farming models for producing Atlantic salmon (Salmo salar): Land-based closed containment system in freshwater and open net pen in seawater - ScienceDirect

South America, New Zealand, Australia, and India for example, extensive, pasture-intensive or semi-confinement systems are more common than confinement systems. In the UK most dairy cows are extensively reared, though this is starting to change.

The carbon footprint of dairy is high, and noticeably higher than non-dairy milks and plant-based foods. Increasingly companies are aiming to increase their output, while reducing overall emissions. This will only be achievable through increased intensification.

## Other environmental impacts

### Water

Lentils' low water consumption is important and will become increasingly more so as competition for freshwater resources increases. As demonstrated in the following table they require less water than any source of animal protein, and generally less than other crops. This is because their plants capture moisture from surface sources. Through rebuilding soils, they also help capture rainwater and reduce run off, a vital ecosystem service. Their ability to harness water, gives the advantage of lentils is that they do not require irrigation, which saves water. Lentils are relatively tolerant to drought, which is important as climate becomes more variable.

Water footprint calculated at the numbers of liters of water per product. Growing and processing crops and livestock consumes large quantities of water. Animal products tend to require more water than fruits, vegetables and beans and a higher water footprint. There are elements to water footprints:

Blue Water Footprint: The amount of surface water and groundwater required to produce an item. For food, this refers mainly to crop irrigation.
Green Water Footprint: The amount of rainwater required. For food, this refers to dry farming where crops receive only rainwater.
Grey Water Footprint: The amount of fresh water required to dilute pollutants and make water pure enough to meet water quality standards. For food, this includes agricultural runoff or leaching from the soil.

As water is a finite resource it is important to reduce people's use of water embedded in day to day choices.

| Litre of water per food | Mean | Median | Min | Max |
|---|---|---|---|---|
| Bean | 5053 | 5053 | 5053 | 5053 |
| Chickpea | 4177 | 4177 | 4177 | 4177 |
| Cowpea | 6906 | 6906 | 6906 | 6906 |
| Faba Bean | 2018 | 2018 | 2018 | 2018 |
| Lentil | 5874 | 5874 | 5874 | 5874 |
| Pea | 1979 | 1979 | 1979 | 1979 |

| | | | | |
|---|---|---|---|---|
| Soybean | 1920 | 1816 | 1800 | 2145 |
| Chicken bone free | 4888 | 3960 | 1746 | 14898 |
| Chicken with bone | 3330 | 3330 | 3330 | 3330 |
| Pork meat (with bone) | 4361 | 4361 | 4361 | 4361 |
| Pork Cuts | 5798 | 5798 | 5798 | 5798 |
| Pork Sausages | 15600 | 15600 | 15600 | 15600 |
| Sheep | 9256 | 8705 | 2839 | 19813 |
| Sheep with bone | 8320 | 8320 | 8320 | 8320 |
| Lamb | 10412 | 10412 | 10412 | 10412 |
| Lamb with bone | 5235 | 4362 | 2782 | 8561 |
| Beef | 16252 | 15139 | 3856 | 26465 |
| Beef with bone | 10943 | 10943 | 10943 | 10943 |
| Cured beef | 23799 | 23799 | 23799 | 23799 |

Water use of different foods
Ref: Su-EATABLE LIFE [35]

## Soil

Soils are the foundation of life, contain vast amounts of biodiversity and are a natural carbon sink. Plants suck in CO2 as they grow and then push extra carbon into the earth through their roots. The world's soils currently contain an estimated 2,500 billion tons of carbon[36]. Typical farming techniques such as ploughing and leaving soil bare between crops, releases carbon. Overgrazing does the same. Farmed soils around the world have lost 50-70% of the carbon they once contained. Techniques, like planting trees and shrubs or spreading compost on pasture, can help farms and ranches absorb more carbon.

Soil organic carbon stocks are very important when addressing climate change adaptation and mitigation. One of the most effective ways of storing carbon in soils is through growing lentils and other pulses. Increasing inputs of soil organic matter into the soil is the basis for boosting carbon sequestration. This will increase soil microbial mass and improve soil biodiversity. They can convert atmospheric nitrogen into nitrogen compounds that can be used by plants, while also improving soil Fertility. This improved biodiversity will soil resilience and resistance to disease.

As they fix their own nitrogen, they cost less to grow than other crops.

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35 SU-EATABLE LIFE: a comprehensive database of carbon and water footprints of food commodities (figshare.com)

36 Zomer, R.J., Bossio, D.A., Sommer, R. et al. Global Sequestration Potential of Increased Organic Carbon in Cropland Soils. Sci Rep 7, 15554 (2017). https://doi.org/10.1038/s41598-017-15794-8

## Land

Half of the world's habitable land is used for agriculture, with most of this used to raise livestock for dairy and meat. Livestock are fed from two sources – lands on which the animals graze or we grow feed. Currently less than half the world's cereals are eaten by humans. 41% is used for animal feed, and 11% for biofuels. Research suggests that if everyone shifted to a plant-based diet we would reduce global land use for agriculture by 75%[37]. This large reduction of agricultural land use would be possible thanks to a reduction in land used for grazing and a smaller need for land to grow crops.

## Plant-based eating is better for the planet

Plant-based is good for the planet. Moving towards a lower meat and dairy diet is the single most important action people can take to reduce their carbon footprint, even beyond driving less, if at all, and switching to smaller cars.

The term plant based can mean different things depending on who is using it. It was originally envisaged as a way of encouraging people to switch to more sustainable diets. The idea being that people put more of the first things on their plates. Instead of starting with protein or even carbohydrates, start with plants, then add carbohydrates and what room is left is for protein. The concept came from how people behave at buffets. If they come across a salad bar before the other items, they fill their plate with salad leaving less room for chips. [38]This is a simple way of helping people make a switch to healthy sustainable diets. However, the term can now mean vegan, it is used as a category for alternative protein products or as it was originally envisioned, a way of eating more plants. The message is still the same: moving to plant-based meals is good for the planet and health.

It is key that any movement towards sustainable plant-based diets are long term. They must be affordable, delicious and culturally appropriate. They should also be based on whole foods as opposed to ultra-processed foods such as some plant-based alternate meats and dairy, sausages, industrial bread, prepackaged meals and breakfast cereals. These are not necessarily healthier,[39] and due to the energy used throughout the processing cycle they have surprisingly high footprints

Whole plant-based foods are the cornerstone of a sustainable diet. They are better for the environment and contain nutrients that are often missing from diets such as fibre. Lentils are an excellent example of a staple, affordable food that sustainable diets can be built upon.

Since 2010, there has been a growing body of work that proves sustainable diets are key to tackling climate change. WWF produced its first livewell diet in 2010[40], the first time an organization demonstrated conclusively that healthy diets can be sustainable. The Barilla Foundation published its double pyramid[41], which have similar results and the UN has worked on the concept[42]. All these

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37 https://ourworldindata.org/land-use-diets

38 Castle. E, Chadborn. T 2017 Health Matters: Using behavior change strategies in catering outlets UK Health Security Agency https://ukhsa.blog.gov.uk/2017/03/31/health-matters-using-behaviour-change-strategies-in-catering-outlets/

39 Hu, F. B., Otis, B. O., & McCarthy, G. (2019). Can Plant-Based Meat Alternatives Be Part of a Healthy and Sustainable Diet?JAMA,322(16), 1547–1548.https://doi.org/10.1001/jama.2019.13187

40 Livewell - choosing sustainable diets | WWF

41 Double Pyramid - Dissemination - Barilla Foundation (barillacfn.com)

42 https://www.unep.org/news-and-stories/speech/healthy-diets-healthy-people-and-nature-positive-world

organizations have continued to build the evidence base. Since then Eat Lancet diet[43] was published in 2019 and the idea of sustainable diets has become mainstream.

In 2018 the UNFAO and WHO published a framework for healthy sustainable diets, that take account of income, culture, the environment and health. They take a whole life approach, recognising that food choices throughout our lives from the womb upwards affect how we behave, learn, and our wellbeing. The first four steps are:

1. Start early, as young as possible,
2. base diets on a wide variety of unprocessed or minimally processed foods, balanced across food groups, while restricting highly processed food and drink products
3. include wholegrains, legumes, nuts and an abundance and variety of fruits and vegetables.
4. include moderate amounts of eggs, dairy, poultry and fish; and small amounts of red meat.

The evidence is clear we need to move towards more plant-based eating in the UK and beyond.

## What would happen if everyone in the UK ate just one more meat free meal a week in 2022

The UK's carbon footprint is amongst the highest in the world. According to WWF and Leeds University 46% of its emissions come from overseas[44], which is why the most accurate way to calculate the footprint of a UK citizen is based on UK consumption and not UK production, which does not take account of imports. UK consumption emissions are noticeably higher than production-based ones.

If everyone in the UK swapped one more red meat based meal to a plant based one per week, the UK's GHGS would be cut by 50 million tonnes[45], based on the calculations by Poore and Nemecek. That is the same as taking 16 million cars off the road or, according to the World Land Trust's carbon calculator[46] 7,575,757 average round trips from London Heathrow to Sydney Australia. This change would also reduce the UK's water use by 2% and 23% reduction in land use, or 8 million hectares.

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43 The EAT-Lancet Commission on Food, Planet, Health - EAT Knowledge (eatforum.org)

44 Owen. A, Ivanova. D, Barrett. J, (2020) "Carbon Footprint: Exploring the UK's contribution to Climate Change." Sustainability Research Institute, School of Earth and Environment, University of Leeds FINAL-WWF-UK_Carbon_Footprint_Analysis_Report_March_2020 (003).pdf

45 https://meatlessfarm.com/meatless-consumption-calculator/

46 https://www.worldlandtrust.org/carbon-calculator/individual/flights/flights-calculator/