

NON-MEAT PROTEINS



THE RISE OF VEGANISM & VEGETARIANISM

The percentage of people in some European countries identifying as vegan or vegetarian has risen steeply in recent years. In 2018, it was reported that 7% of the UK's population were vegan (a 700% increase from 2016), and 14% were vegetarian. Up to 20% of young Swedes identify as vegan, and Germany accounts for close to 20% of all vegans in Europe.¹ In the US – the world's largest consumer of beef – a recent survey suggested that 16% of people now “avoid animal products for environmental reasons”. Before looking at some of the companies introducing so-called ‘vegan meats’, we consider some of the drivers behind demand for plant-based alternatives.

IMPLICATIONS FOR LAND USE

As the human population grows, there is widespread recognition of the need to place less strain on the ecosystems which ultimately support us; this includes using less land for our needs, and leaving more space for nature to thrive and flourish.²

Meat, aquaculture, eggs and dairy are estimated to use approximately 83% of the world's farmland, whilst only providing 37% of our protein and 18% of our calories.³ One of the authors of the study that reported these findings noted that a “vegan diet is probably the single biggest way to reduce your impact on planet Earth, not just greenhouse gases, but global acidification, eutrophication (excessive nutrients in watercourses which lead to plant blooms), land use, and water use.”⁴ Producing beef, on average, uses 20 times as much land as growing beans (per gram of protein).

Land-use change often results in the destruction of biodiversity. Recent decades have witnessed dramatic declines in species diversity and populations of wild animals and plants, as biodiversity hotspots – including the Amazon – have been destroyed for agricultural purposes. Much of this devastation can be put down to expansions in arable agriculture/oilseed plantations (such as palm oil)⁵, but the link between the expansion of soy (a high-quality animal feed) and



Latin America has witnessed high levels of deforestation to clear land for soy cultivation. Photo: Worldwildlife.org.

cattle ranching, and deforestation in the Amazon is well documented.⁶ This has major implications for biodiversity, flooding, indigenous peoples, and the rainforest's capacity to draw down atmospheric carbon.

GREENHOUSE GAS EMISSIONS AND WATER USE

In addition to emissions which may arise from clearing land for cattle grazing or growing of animal feed crops, animals themselves emit greenhouse gasses. Methane only lasts in the atmosphere for about ten years, but over that period, it has a considerably greater global warming potential (GWP) than carbon dioxide (CO₂). Over 20 years, methane's GWP is 80 times higher than that of CO₂. Of all livestock, cows produce the most methane, with the average cow producing upwards of 200kg of methane a year. With a global headcount of 1.5 billion, bovine methane emissions are considerable. A 2016 study by researchers at the University of Oxford estimated that a global shift to vegan diets could cut food-related emissions by over two-thirds.⁷ Such a shift would also have marked impacts in terms of reducing stress on other precious natural resources.

Animal products, particularly meat, also have high levels of embedded water (the amount of water used to produce one kg, kcal, etc.). The water footprint per calorie for beef, for instance, is on average *twenty* times larger than for cereals and starchy roots. From the perspective of prudent use of freshwater reserves, in almost all cases it is more efficient to

¹ <https://www.livekindly.co/75-million-vegans-vegetarians-europe/>

² See E.O. Wilson's *Half Earth: Our Planet's Fight for Life* (2016)

³ J. Poore & T. Nemecek. 'Reducing food's environmental impacts through producers and consumers', *Erratum*, 22 Feb. 2019.

⁴ Joseph Poore, as quoted in

<https://www.theguardian.com/environment/2018/may/31/avoiding-meat-and-dairy-is-single-biggest-way-to-reduce-your-impact-on-earth>

⁵ Erik Stokstad, 'New global study reveals the 'staggering' loss of forests caused by industrial agriculture', *Science*, 13 Sept. 2018.

⁶ <https://news.mongabay.com/2019/04/brazil-soy-trade-linked-to-widespread-deforestation-carbon-emissions/>

⁷ M. Springmann, H.C.J. Godfray, M. Rayner, and P. Scarborough, 'Analysis and valuation of the health and climate change co-benefits of dietary change', *Proceedings of the National Academy of Sciences of the United States of America*, Published 21 March 2016.

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obtain calories, protein and fat through crop products than animal products.⁸ As climate breakdown and changing weather patterns exacerbate droughts across the globe, minimizing embedded water in our diets will be increasingly important. As the table below shows, one of the simplest ways to do this is to reduce meat production and consumption.

	Litre per kilogram	Litre per kilocalorie	Litre per gram of protein	Litre per gram of fat
Sugar crops	197	0.69	0.0	0.0
Vegetables	322	1.34	26	154
Starchy roots	387	0.47	31	226
Fruits	962	2.09	180	348
Cereals	1644	0.51	21	112
Oil crops	2364	0.81	16	11
Pulses	4055	1.19	19	180
Nuts	9063	3.63	139	47
Milk	1020	1.82	31	33
Eggs	3265	2.29	29	33
Chicken meat	4325	3.00	34	43
Butter	5553	0.72	0.0	6.4
Pig meat	5988	2.15	57	23
Sheep/goat meat	8763	4.25	63	54
Bovine meat	15415	10.19	112	153

Source: M.M. Mekonnen & A.Y. Hoekstra, 'The Green, Blue, and Grey Water Footprint of Farm Animals and Animal Products', Vol.1: Main Report, Value of Water Research Report Series, No. 48. UNESCO-IHE Institute for Water Education (December 2010).

ANIMAL WELFARE

Animal welfare considerations are also prominent in arguments in favour of meat-free diets. The welfare issues associated with so-called 'battery chickens' are well known. Investigations into porcine slaughterhouses in the UK have shown widespread use of carbon dioxide poisoning to kill roughly two million pigs each year, despite this practice being known to cause burning sensations in the animals' lungs and high levels of distress.⁹ Separation of mothers from calves has also come under criticism from civil society, alongside concerns over giving cows proper access to outdoor spaces and the killing of male calves immediately after birth.¹⁰

As neuroscience begins to reveal the true depths of animals' sentience, intelligence, and emotional capacity, there is clearly

a moral imperative to prevent animal suffering wherever possible. Pigs, for instance, "exhibit emotional contagion, a capacity thought to be the basis for empathy"; in some ways, they are considered more intelligent than many breeds of dog.¹¹



HUMAN AND ECOSYSTEM HEALTH

The health benefits of a processed "fake meat" burger compared to a meat-based one seem quite contested, not least because the former is a relatively new invention. Processed meats have been associated with elevated risks of certain types of cancer, and other health conditions.¹² It's not clear what health risks – if any – may be associated with consumption of processed "fake meat" products. There does appear to be some consensus that the fake meat burgers are fine to eat from time to time.

Livestock in certain countries – particularly those animals that are intensively farmed – are also often fed high quantities of antibiotics to both prevent infection and stimulate faster growth. This is fuelling concerns around antibiotic resistance in bacteria strains, which could be passed to humans through meat, or through direct contact (i.e. farmers most at risk).

THE ALTERNATIVES

Non-meat products, which are designed to mimic the flavour and texture of meat products (despite being plant-based), are garnering significant interest from the public and investors alike, whether it's the "Impossible Burger" of Impossible Foods Inc., Greggs' vegan sausage roll, or Beyond Meat's plant-

⁸ <https://waterfootprint.org/en/water-footprint/product-water-footprint/water-footprint-crop-and-animal-products/>

⁹ <https://phillyplymbery.com/scandal-of-supermarket-gassing-of-pigs/>

¹⁰ <https://www.theguardian.com/environment/2019/jun/29/mums-ask-when-cows-and-their-calves-separated-rise-ethical-milk-vegan>

¹¹ Lori Marino & Christina Colvin, 'Thinking Pigs: Cognition, Emotion, and Personality' (2016). *The Humane Society Institute for Science and Policy*.

¹² <https://www.who.int/features/qa/cancer-red-meat/en/>

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based portfolio. Even Nestlé has announced a meatless ground meat product to be sold in Europe.



It is interesting to look into the business case of these companies, to see why their stakeholders consider non-meat products to have real potential. Beyond Meat, which IPO'd in 2019 and commands a valuation at time of writing of \$4.8bn, stresses the lower ecological footprint of one of its flagship products, the "Beyond Burger". The company cites a Life Cycle Analysis study (which it commissioned and was conducted by the University of Michigan) which suggested the Beyond Burger required 99% less water, 90% fewer GHG emissions, 93% less land, and 46% less energy than its 1/4lb US beef burger cousin.¹³

A similar analysis is used by California-based Impossible Foods Inc., which reports the far smaller ecological footprint of its products compared to the animal meat alternatives, and encourages customers to help "save the best planet in the known universe".¹⁴ Greggs', by contrast, highlights that the launch of its vegan sausage roll "followed strong consumer demand, including a petition signed by People for the Ethical Treatment of Animals (PETA) last year [2018], which was signed by more than 20,000 people".¹⁵

It seems, then, that their products' smaller ecological footprints and lower GHG emissions feature heavily in these companies' publicity materials, with less emphasis placed on animal welfare/suffering.

MIMICKING MEAT

Impossible Foods and Beyond Meat have garnered much attention due to the fact that what they offer mimics traditional meat-based products. The Impossible Burger achieves this because it contains leghaemoglobin – an ingredient from soybeans – which gives the Impossible Burger its beefy taste and colour.¹⁶ By contrast, the Beyond Burger uses pea-based proteins, beans, apples and rice to give it its flavour, plant fats that resemble the gristle and fat in ground beef for texture and

appearance, and powdered beetroot as a colourant. Additional technology used by Beyond Meat includes a so-called "e-mouth", which is like a mechanised jaw and quantifies how new versions of burger push back when you chew.¹⁷

TOO GOOD TO BE TRUE?

Despite the excitement over these products and companies, ecosystems and climate scientists have warned that they are not likely to be a panacea for environmental degradation. For instance, Marco Springmann of Oxford University notes that, whilst "it makes sense to develop alternatives to beef" on climate grounds, and "their processed products have about half the carbon footprint that chicken does, *they also have 5 times more of a footprint than a bean patty...* So Beyond and Impossible go somewhere towards reducing your carbon footprint, but saying it's the most climate friendly thing to do — that's a false promise."¹⁸

Moreover, it has been pointed out that Impossible Foods (unlike Beyond Meat) now uses genetically-modified soy in their products. Depending on land-use change and other factors, soy's ecological footprint, as indicated, can be quite high. As a considerable land area (mostly former prairie) in the US Midwest has been turned over for intensive, monoculture soy cultivation, biodiversity (primarily insects, ground-nesting birds, and, by extension the wider ecosystems) has suffered. This serves to highlight the complexity behind any products' lifecycle ecological footprint.¹⁹

CONCLUSIONS

Whilst there is growing appetite for non-meat proteins/meats in Europe and elsewhere, there are only a handful of publicly-listed, specialist companies focused on "vegan meats" (or similar). The environmental benefits of these products compared to their meat alternatives is clear, and they could also help to reduce the number of animals which are slaughtered for human consumption. But compared to other potential options for vegan diets, they still fall short on their environmental credentials. In an era of climate and ecological breakdown, it seems the question is really whether 'better' is good enough.

¹³ <http://css.umich.edu/publication/beyond-meats-beyond-burger-life-cycle-assessment-detailed-comparison-between-plant-based>

¹⁴ <https://impossiblefoods.com/mission/>

¹⁵ <https://www.greggs.co.uk/bakes/vegan-sausage-roll>

¹⁶ <https://theconversation.com/what-makes-the-impossible-burger-look-and-taste-like-real-beef-115027>

¹⁷ <https://www.cnet.com/news/new-beyond-burger-unveiled-that-tastes-looks-eerily-more-like-beef/>

¹⁸ <https://www.cnn.com/2019/09/02/beyond-meat-uses-climate-change-to-market-fake-meat-substitutes-scientists-are-cautious.html>

¹⁹ L.A. Schulte et al. 'Prairie strips improve biodiversity and the delivery of multiple ecosystem services from corn-soybean croplands', *Proceedings of the National Academy of Sciences of the United States of America* (PNAS). 17 October 2017, 114 (42): 11247-11252.

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THE EDENTREE RI TEAM



Neville White
Head of RI Policy
and Research



Esmé van Herwijnen
Responsible Investment
Analyst



Jon Mowll
Responsible
Investment Analyst

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