

The Vegan Society is a Registered Charity which advocates for plant-based food systems for the benefit of all. We consider the food system as a whole in the context of global environmental sustainability as health, food consumption, food production and the environment are inextricably linked. We also support people to practice their vegan beliefs, and work to end exploitation of non-human animals. We have made this submission because of the strong evidence that a plant-based food system can help reduce nitrogen pollution in England and across the UK.

General

1. What are the main sources of nitrogen pollution in the UK? How and why have these changed over time?

Agriculture is a major source of nitrogen pollution in the UK, accounting for 70% of nitrous oxide emissions, 49% of methane emissions and 87% of ammonia emissions in 2022.¹ Animal agriculture specifically is a driver of nitrous oxide, ammonia and methane in two principle ways: 1) through farmed animal excretions, and 2) the use of nitrogen-based fertilisers to grow feed, which demands more land and inputs than if food is grown directly for human consumption.²

Consequently, the nitrogen emissions footprint of animal products, when examined per gram of protein, is significantly larger than that of plant-based products.³ A WWF study found that cattle, goat and sheep meat have almost 100 times the nitrogen emissions per kilogram of nitrogen in the product, in comparison to pulses.⁴ Furthermore, even bird meat and eggs have over twice the footprint of the worst-performing plant products.⁵

Manure use:

Livestock excrete a significant portion of the nitrogen they consume. Depending on the animal species, only 5-45% of the nitrogen in plant protein with which they are fed is converted to and deposited in animal protein. The remaining 55-95% is excreted in gaseous form (methane from ruminants), urine and manure,⁶ which can leach into water,⁷ especially if soil health is poor, and nitrates fail to be retained.⁸ Plant-based proteins have higher “nitrogen use efficiency”, i.e. retain more nitrogen, limiting losses and pollution. For meat consumption, the average nitrogen use efficiency is only 8%, whereas the efficiency for plant-based foods is around 20%.⁹

Feed production

Reducing total demand for agricultural products, as well as improving the nitrogen efficiency of foods, will drive down nitrogen pollution. Growing crops to feed animals such as soy and maize often requires significant amounts of synthetic fertilisers which contain urea,

ammonium and nitrate. While fertilisers (natural and synthetic) are also applied to crops grown for direct human consumption, more crops are required to generate the same amount of calories and protein from animal-based foods than from plant-based foods¹⁰. This inefficiency in turn means greater demand for and use of fertilisers, covering more extensive areas of land.

Animal agriculture uses 85% of the land used to feed the UK population despite only producing a third of our calories.¹¹ A global study published in Nature Food in 2023 concluded that plant-based diets can reduce land use by up to 75% and eutrophication (of which nitrogen is a key driver) by a similar amount, in comparison to high meat diets.¹²

2. How could nitrogen pollution be mitigated from relevant sectors, how effective are these approaches, and are there any trade-offs?

Dietary change towards plant-based diets in order to secure a reduction in farmed animal numbers can and must play a key role in mitigating nitrogen pollution from the food system. In the UK, consumption of animal-derived products is not required for health or food security. Therefore, complete transition to fully plant-based diets and a concomitant managed transition entirely away from animal agriculture is a desirable and achievable goal.

Cutting meat and dairy consumption is widely endorsed in the expert literature as a means of addressing nitrogen pollution. In a 2023 report, the UN-affiliated Taskforce on Reactive Nitrogen examined twelve scenarios which would achieve the EU's target of reducing nitrogen loss by 50%: eleven involved dietary change towards more plant-based diets. The authors concluded that "Full exclusion of meat and dairy products from human diet combined with ambitious technical measures could ... reduce nitrogen waste by up to 84%," although they endorsed a "balanced" pathway that recommended a lower but still significant target of halving meat and dairy consumption in the EU.¹³

WWF has also recommended a 50% cut in meat consumption by 2050 to address nitrogen loss, in addition to other environmental harms arising from animal agriculture, including climate change and biodiversity loss.¹⁴ Its analysis of the evidence concluded that "All studies reviewed showed that a reduction in animal product consumption brings reduction in emissions of Nr and GHGs, as well as health benefits, relatively independent of which assumptions were made."

In its Seventh Carbon Budget, published in February 2025, as in previous budgets, the Climate Change Committee concluded that dietary change must play an essential role in reaching the UK's Net Zero targets, and recommends cutting dairy consumption by 20% by 2035, overall meat consumption by 35% by 2050 and red meat consumption by 40% by 2050 (compared to 2019 levels).¹⁵ The climate change benefits derive from reducing the number of farmed animals in the UK, leading to reduced methane emissions from ruminant digestion,

reduced nitrous oxide emissions due to lower levels of manure production and use, and the conversion of land currently used to grow feed to climate-friendly activities such as reforestation.

The choice and method of the type of protein consumed has a large effect on nitrogen efficiency. Opting to consume legumes directly, as opposed to feeding them to livestock first and then consuming the animal product, would improve the nitrogen use efficiency significantly,¹⁶ and decrease nitrogen pollution. Legumes have huge potential to improve the nation's water quality, soil nitrogen retention, crop yields and plant-based protein supply due to their ability to fix atmospheric nitrogen for crops. When appropriately grown - for example by being inter-cropped with a second crop that can use surplus soil nitrogen - microorganisms and legumes symbiotically fix atmospheric nitrogen for crops, and this biological nitrogen fixation can significantly reduce nitrate pollution of water compared to chemical fertilizer or bulk manure application.¹⁷ Replacing animal protein with protein-rich legumes would therefore reduce the need for synthetic nitrogenous fertilisers.

There would be no negative trade-offs from a well-managed transition away from animal-based agriculture and towards a plant-based food system. Instead, it would result in a multitude of co-benefits for our health, economy and environment. People in the UK are estimated to eat approximately 50% more protein than is recommended by WHO guidelines, and 60% of this is consumed as animal products, namely meat, dairy, fish and eggs.¹⁸ The British Dietetic Association affirms that well-planned vegan diets can support healthy living at every age and life stage¹⁹ and there is now compelling evidence that healthy plant-based diets are associated with decreased relative risk for many diseases including cancer, cardiovascular disease, type 2 diabetes and obesity.²⁰ A 100% adoption of plant-based diets in England could reduce NHS expenditure by an estimated £6.7 billion per year due to 2.1 million fewer cases of disease and a gain of more than 170,000 quality-adjusted life years across the population.²¹

Considering the above factors, policy must change to coherently and consistently support the urgent transition to intrinsically low nitrate pollution agricultural methods. We have outlined some key practical policy proposals needed to achieve this in the 'Government policy and regulation' section below.

4. What future developments could further increase nitrogen pollution, and how could those risks be reduced?

Further intensification of livestock farming, as is happening in the UK, will drive increased and more harmful nitrogen pollution.²²

Because of the concentration of animals in these production units, the nitrogen and phosphorus-rich waste produced is also concentrated in small areas,²³ exceeding the land's

capacity to absorb nitrogen. If this is not managed or disposed correctly, it will find its way into the natural environment through ammonia emissions, and nitrate leaching into surface water bodies from runoff.²⁴ In addition, the total dependence of confined animals on “high growth, high-yield” feed crops drives demand for feed and the associated fertiliser use. Reducing the amount of animal protein we consume will positively impact nitrogen levels in the environment because direct consumption of plant protein abolishes the 85% conversion losses from plant to animal protein.²⁵

Evidence from Compassion in World Farming indicates that there was a 12% increase in the number of intensive farms and a 20% increase of intensive pig and poultry units in the UK between 2016 and 2023.²⁶ Subsequent research on manure production in intensive farming by CIWF, Sustain and Friends of the Earth has calculated that “if intensive livestock farming were to continue to expand at its current rate, annual nitrate production could be up by 32% on 2016 levels by 2028”.²⁷

Intensive farming is driven by demand for artificially inexpensive (in terms of monetary cost at point of sale) meat and dairy. Dietary shift towards a significantly higher proportion of healthy plant-based foods will cut demand for foods derived from this method of farming and avert further intensification and its consequent nitrogen pollution.

Transitioning from animal agriculture to plant-based and more sustainable forms will also reduce future increases in nitrogen pollution. This goes beyond simply removing animals from the food chain and includes methods of farming which use no animal inputs, such as manure, at all. Stock-free organic farming is now certified by the Soil Association and derives fertilizer entirely from plant sources.

Government policy and regulation

1. How effective is existing policy at regulating and reducing nitrogen pollution? How could they be improved? Are there gaps?

Policy needs to change to coherently and consistently support the urgent transition to intrinsically low nitrate pollution agricultural methods. At present, no policy exists to encourage, foster or manage dietary transition towards a greater intake of plant-based foods, or to secure a reduction in livestock numbers in the UK. Given the abundant evidence and widespread expert consensus that such a transition is required to help meet health and sustainability goals – including from the Climate Change Committee²⁸, EAT-Lancet Commission²⁹ and the 2021 Food Strategy³⁰ – this longstanding policy gap appears increasingly inexplicable and, indeed, perverse.

Countries elsewhere are already taking advantage of the opportunity presented by plant-based food and diets. Canada has successfully scaled-up legume farming, including for

plant-protein food, increasing their legume harvest by a factor of five since 1991 and now sustaining over five million ha of land harvested for grain pulses.³¹ Denmark has also published a national 'Action Plan for Plant-based Foods'³² to begin the transition, whilst South Korea has released plans to boost its growing plant-based food industry³³ and Portugal has revised its climate plans to include a national strategy to promote consumption of plant protein alternatives as part of a low carbon diet, specifically highlighting legumes as a nutritious, cost-effective and sustainable plant protein.³⁴ The EU Strategic Dialogue on the Future of Farming recommended that the EU develop a plant-based action plan by 2026.³⁵

As a center of technological innovation with large vegan, vegetarian and flexitarian populations, the United Kingdom is well placed to lead the world in the growth of the plant-based food and drink sector. The Vegan Society proposes the below practical policies needed to facilitate this shift and ultimately reduce nitrate pollution in England, whilst simultaneously supporting other environmental and public health policy targets.

1. Set a target to reduce meat and dairy consumption

To promote plant-based foods and a sustainable food system transition, ambitious targets are essential. In the immediate term, policy must be guided by the evidence, in which context, the lower-level reductions proposed by the Climate Change Committee represent the bare minimum required, while reducing meat and dairy consumption by 70% by 2030, as proposed by Greenpeace Europe in 2020,³⁶ would represent an ambitious but achievable goal.

2. Support farmers for a just transition to more sustainable food systems

Supporting farmers in the transition away from nitrogen polluting forms of agriculture is crucial to long-term success. Firstly, a realistic land use plan is needed to support the growth in demand for plant-based crops, grow more fruit, veg and legumes in the UK and manage a reduction in livestock numbers.

Secondly, providing education and practical support on organic and nature-based forms of stock-free farming would empower farmers with the knowledge and skills to confidently transition away from harmful nitrogen-polluting methods of agriculture. This could include providing advice and support on vegan organic growing, conversion planning, essential machinery and equipment, useful supply names and suggested cropping plans.

Lastly, providing financial resources to help all farmers to play a role in this transition is essential for moving to more sustainable practices such as rewilding, or plant-based crop production. The UK must exceed Canada's investment in legume farming, as farmers are more likely to decide to grow legumes when they get the higher financial returns from pulse-based foods, than from feed for farmed animals. This could include subsidies such as a Protein Aid Scheme, as used in Ireland, or making protein crops a focus of a new farm entry

scheme. (Further information is available in Section 6 of our *Solutions for the Farm of the Future* report.³⁷)

3. Capitalise on the economic opportunity presented by plant-based foods

The UK market for meat substitutes is worth over one billion euros - making it the largest in Europe - with 40% of consumers calling for plant-based options.³⁸ However, for England to capitalise on the economic growth of the plant-based sector and strive to be a world leader in alternative proteins, there must be more investment and set regulations to level the playing field.

Developing and manufacturing plant-based foods and alternative proteins in the UK means high productivity jobs in research, manufacturing and production, as well as farming jobs, estimated by the Green Alliance in 2023 to potentially bring £6.8bn and create 25,000 jobs by 2035.³⁹ Mechanisms such as increased UKRI support and funding would also help to drive innovative growth in the UK plant-based market, improving taste, flavour and nutrition. With regards to plant-based food products, reviewing restrictions around terminology and encouraging price parity in retail and out-of-home sectors, will be essential for success.

Coupled with the above, the private sector should be encouraged to promote plant-based foods, and a statutory duty should be created for all food companies with more than 250 employees – including retailers, restaurant and quick service companies, contract caterers, wholesalers, manufacturers and online ordering platforms – to publish an annual report on metrics including sales of protein by type, sales of fruit and vegetables.

Finally, the Food Standards Agency should develop a harmonised and consistent mandatory food labelling system to describe the environmental impacts of food products. This, combined with the above actions, would help facilitate a just transition for farmers away from harmful nitrate polluting forms of agriculture.

4. Prioritise healthy and sustainable plant-based foods in public procurement

The government should use the procurement process as a lever to prioritise health and sustainability by having tasty and balanced plant-based dishes as the default on public sector menus, maintaining consumer choice with a guarantee of at least one nutritious vegan option on every public sector menu. Increasing the accessibility and availability of plant-based food is crucial, and redesigning the Government Buying Standards for Food (GBSF) is key to ensuring taxpayer money is spent on food that is both healthy and sustainable.

The public sector should also make it easy for people to choose a vegan lifestyle, by supporting vegans and promoting veganism as a positive choice for the benefit of people, animals and the planet.

5. Capitalise on the health benefits offered by plant-based diets

Public health campaigns must actively promote well-planned plant-based diets as a healthy and sustainable option. Promoting plant-based diets should also be included in strategies for prevention of diabetes, cardiovascular disease and obesity. With regards to the UK's Eatwell Guide, this should be aligned with environmental guidelines, as Germany has done,⁴⁰ ensuring the refreshed Guide gives plant-based, vegan-relevant advice. To support this, training on the benefits of whole food plant based and vegan diets should be provided for all health care professionals.

Word count: c 2650 (excluding citations)

References

1. Department for Environment, Food & Rural Affairs (2024). Accredited official statistics Chapter 11: Agri-environment [online] Available at: [Chapter 11: Agri-environment - GOV.UK](#) [Accessed 04.03.2025]
2. Hicks W. K, McKendree, J., Sutton M.A., Cowan, N., German, R., Dore, C , Jones, L., Hawley, J., Eldridge, H. (2022). A comprehensive approach to nitrogen in the UK. *World Wide Fund for Nature*. [online] Available at: [WWF_Comprehensive_Approach_Nitrogen_Full_Technical_Report.pdf](#) [Accessed 04.03.2025].
3. Hicks W. K, McKendree, J., Sutton M.A., Cowan, N., German, R., Dore, C , Jones, L., Hawley, J., Eldridge, H. (2022). Nitrogen: Finding the balance. Towards a comprehensive approach to nitrogen in the UK. *World Wide Fund for Nature*. [online] Available at: [NITROGEN_REPORT_summary_final.pdf](#) [Accessed 04.03.2025].
4. Hicks W. K, McKendree, J., Sutton M.A., Cowan, N., German, R., Dore, C , Jones, L., Hawley, J., Eldridge, H. (2022). Nitrogen: Finding the balance. Towards a comprehensive approach to nitrogen in the UK. *World Wide Fund for Nature*. [online] Available at: [NITROGEN_REPORT_summary_final.pdf](#) [Accessed 04.03.2025].

5. Hicks W. K, McKendree, J., Sutton M.A., Cowan, N., German, R., Dore, C , Jones, L., Hawley, J., Eldridge, H. (2022). Nitrogen: Finding the balance. Towards a comprehensive approach to nitrogen in the UK. *World Wide Fund for Nature*. [online] Available at: [NITROGEN_REPORT_summary_final.pdf](#) [Accessed 04.03.2025].
6. Oenema, O., & Tamminga, S. (2005). Nitrogen in global animal production and management options for improving nitrogen use efficiency. *Science in China. Series C, Life sciences*, 48 Spec No, 871–887. [online] Available at: [Nitrogen in global animal production and management options for improving nitrogen use efficiency - PubMed](#) [Accessed 04.03.2025]
7. UK Progress on Reducing Nitrate Pollution: Introduction, Nitrogen Pollution, Air and Water Quality and its Regulation. (2018). *Environmental Audit Committee – House of Commons*. [online] Available at: [UK Progress on Reducing Nitrate Pollution - Environmental Audit Committee - House of Commons](#) [Accessed 04.03.2025]
8. World Wide Fund for Nature (WWF), The Rivers Trust, and The Angling Trusts. (2018). Saving the Earth – A sustainable future for soils and water. [online] Available at: [WWF_Saving_The_Earth_Report_HiRes_DPS_0.pdf](#) [Accessed 04.03.2025].
9. Alpro Foundation. (2021). Reversing the Nitrogen crisis - Role of plant-based diets and sustainable farming, *Research Gate* [online] Available at: https://www.researchgate.net/publication/357001714_Reversing_the_Nitrogen_crisis_Role_of_plant-based_diets_and_sustainable_farming [Accessed 04.03.2025]
10. Alexander, P., Brown, C., Arneth, A., Finnigan, J., Rounsevell, M. (2016). Human appropriation of land for food: The role of diet. *Global Environmental Change*, 41:88-98. [online] Available at: <https://doi.org/10.1016/j.gloenvcha.2016.09.005> [Accessed 05.03.2025].
11. World Wide Fund for Nature (WWF). *Transform UK Farmland to Boost Food Resilience and Tackle Nature Crisis – WWF*. [online] Available at: [Transform UK farmland to boost food resilience & tackle nature crisis | WWF](#) [Accessed 05.03.2025]
12. Scarborough, P., Clark, M., Cobiac, L. et al. (2023). Vegans, vegetarians, fish-eaters and meat-eaters in the UK show discrepant environmental impacts. *Nat Food* 4, 565–574. [online] Available at: <https://doi.org/10.1038/s43016-023-00795-w> [Accessed 05.03.2025].
13. Alpro Foundation. (2021). Reversing the Nitrogen crisis - Role of plant-based diets and sustainable farming, *Research Gate* [online] Available at: https://www.researchgate.net/publication/357001714_Reversing_the_Nitrogen_crisis_Role_of_plant-based_diets_and_sustainable_farming [Accessed 04.03.2025]
14. Appetite for Change: Food system options for nitrogen, environment & health, 2nd *European Nitrogen Assessment Special Report on Nitrogen & Food* [online] Available at: <https://zenodo.org/records/10406450> [Accessed 05.03.2025]
15. WWF. (2022). Transform UK farmland to boost food resilience and tackle nature crisis. [online] Available at: <https://www.wwf.org.uk/press-release/transform-uk-farmland-boost-food-resilience-tackle-nature-crisis> [Accessed 04.03.2025]

16. Climate Change Committee. (2025). The Seventh Carbon Budget. [online] Available at: <https://www.theccc.org.uk/publication/the-seventh-carbon-budget/> [Accessed 04.03.2025]
17. Kakraliya, S.K. et al (2018). Nitrogen and Legumes: A Meta-analysis, *Legumes for Soil Health and Sustainable Management*, pp. 277 – 314 [online] Available at: https://link.springer.com/chapter/10.1007/978-981-13-0253-4_9 [Accessed 04.03.2025]
18. Hicks W. K, McKendree, J., Sutton M.A., Cowan, N., German, R., Dore, C , Jones, L., Hawley, J., Eldridge, H. (2022). Nitrogen: Finding the balance. Towards a comprehensive approach to nitrogen in the UK. World Wide Fund for Nature. [online] Available at: https://www.wwf.org.uk/sites/default/files/2022-02/NITROGEN_REPORT_summary_final.pdf [Accessed 04.03.2025].
19. British Dietetic Association. (2025). Vegetarian, vegan and plant-based diet [online] Available at: <https://www.bda.uk.com/resource/vegetarian-vegan-plant-based-diet.html> [Accessed 04.03.2025]
20. Henderson, N. and Sampson, C. (2023). The impact of higher uptake of plant-based diets in England: model-based estimates of health care resource use and health-related quality of life, *MedRxiv* [online] Available at: <https://www.medrxiv.org/content/10.1101/2023.12.26.23300536v1.article-info> [Accessed 04.03.2025]
21. Henderson, N. and Sampson, C. (2023). The impact of higher uptake of plant-based diets in England: model-based estimates of health care resource use and health-related quality of life, *MedRxiv* [online] Available at: <https://www.medrxiv.org/content/10.1101/2023.12.26.23300536v1.article-info> [Accessed 04.03.2025]
22. Compassion in World Farming. *Environmental Damage*. [online] Available at: [Environmental damage | Compassion in World Farming](#) [Accessed 04.03.2025]
23. Compassion in World Farming. *Environmental Damage*. [online] Available at: [Environmental damage | Compassion in World Farming](#) [Accessed 04.03.2025]
24. Compassion in World Farming. *Environmental Damage*. [online] Available at: [Environmental damage | Compassion in World Farming](#) [Accessed 04.03.2025]
25. Alpro Foundation. (2021). Reversing the Nitrogen crisis - Role of plant-based diets and sustainable farming, *Research Gate* [online] Available at: https://www.researchgate.net/publication/357001714_Reversing_the_Nitrogen_crisis_Role_of_plant-based_diets_and_sustainable_farming [Accessed 04.03.2025]
26. Compassion in World Farming. *Factory Farming Map*. [online] Available at: [Factory Farming Map: Tracking the Rise of Intensive Animal Farming in the UK | Compassion in World Farming](#) [Accessed 04.03.2025]
27. Compassion in World Farming. (2024). 'Muck Map' Reveals Areas Most at Risk from Factory Farm Pollution. [online] Available at: ['Muck Map' reveals areas most at risk from factory farm pollution | Compassion in World Farming](#) [Accessed 05.03.2025]

28. Climate Change Committee. (2025). The Seventh Carbon Budget. [online] Available at: <https://www.theccc.org.uk/publication/the-seventh-carbon-budget/> [Accessed 04.03.2025]
29. The Lancet (2019a). Food in the Anthropocene: the EAT–Lancet Commission on healthy diets from sustainable food systems. [online] Available at: The 21st-century great food transformation - The Lancet [Accessed 04.03.2025]
30. National Food Strategy. (2021). The Plan [online] Available at: <https://www.nationalfoodstrategy.org/the-report/> [Accessed 05.03.2025]
31. Ministry of Food, Agriculture, and Fisheries of Denmark. (2023). Danish Action Plan for Plant-based Foods, pp. 5 - 38 [online] Available at: [Danish-Action-Plan-for-Plant-based-Foods.pdf](#) [Accessed 04.03.2025]
32. AgPulse Analytica. (2023). Canadian Pulses Estimate for 2023-24 [online] Available at: <https://agpulseanalytica.com/market-insights/canadian-pulses-estimate-for-2023-24> [Accessed 05.03.2025]
33. The Korea Bizwire. (2023). South Korea unveils ambitious plans to cultivate thriving plant-based food industry [online] Available at: <http://koreabizwire.com/south-korea-unveils-ambitious-plan-to-cultivate-thriving-plant-based-food-industry/262752> [Accessed 04.03.2025]
34. European Commission. (2024). Portugal: National Energy and Climate Plan 2021 – 2030. [online] Available at: [f12fd5f8-605b-481c-9690-6b86fe2d48e3_en](#) [Accessed 04.03.2025]
35. EVU. (2024). EVU welcomes proposal for an EU Action Plan for Plant-based Foods by 2026 [online] Available at: [EVU welcomes proposal for an EU Action Plan for Plant-based Foods by 2026 - European Vegetarian Union](#) [Accessed 05.03.2025]
36. Greenpeace. (2020). Eu climate diet : 71% less meat by 2030. [online] Available at: <https://www.greenpeace.org/eu-unit/issues/nature-food/2664/eu-climate-diet-71-less-meat-by-2030/> [Accessed 04.03.2025]
37. The Vegan Society. (2017). Solutions for the farm of the future, pp. 23-27 [online] Available at: https://www.vegansociety.com/sites/default/files/Grow%20Green%20%20Full%20Report_0.pdf [Accessed 04.03.2025]
38. Statista. (2024). Veganism and vegetarianism in the United Kingdom – statistics & facts. [online] Available at: <https://www.statista.com/topics/7297/veganism-in-the-united-kingdom/#t>
39. Green Alliance. (2023). Appetite for change [online] Available at: https://green-alliance.org.uk/wp-content/uploads/2023/08/Appetite_for_change.pdf [Accessed 04.03.2025]
40. DGE. (2024). DGE Nutrition Circle, [online] Available at : <https://www.dge.de/english/dge-nutrition-circle/> [Accessed 04.03.2025]

