Name: Temi Owolabi

Age: 16

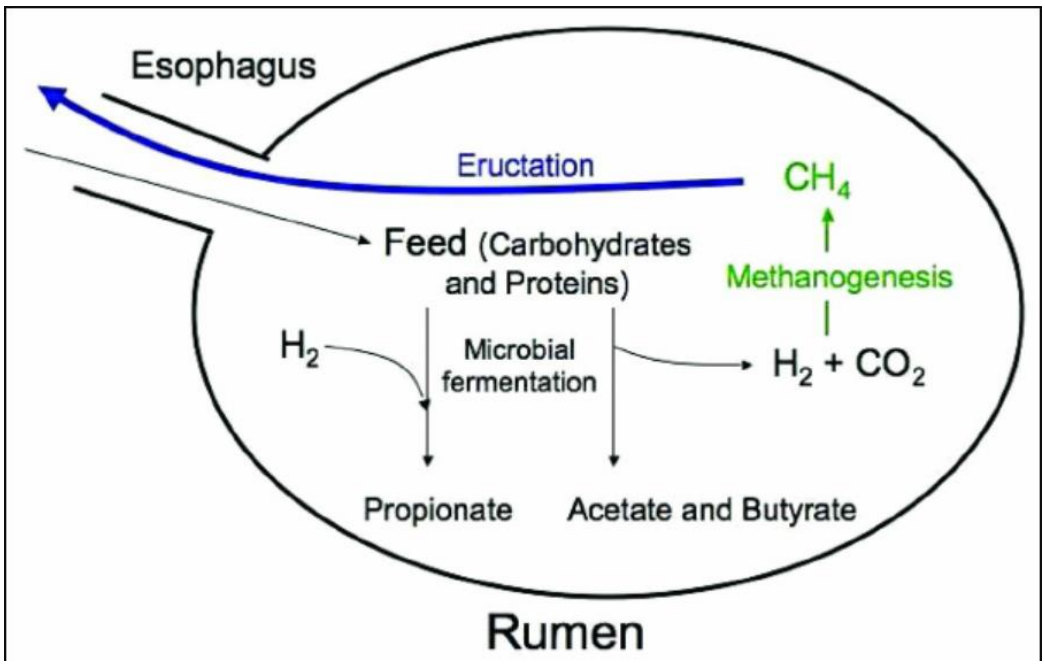
Email: Owolabi.T@etoncollege.org.uk

Institution: Eton College

Professor Richard Templer's Question: "Consider a small change that so many individuals could make that its collective impact would have a significant impact on reducing greenhouse gas emissions."

What if I told you the biggest climate polluter in your kitchen isn't Tupperware, but your Sunday roast? A surface-level glance would say otherwise. How could one's lunch cause more harm than something made from fossil fuels? Well, you'd be surprised how much it actually contributes. Agriculture is an underestimated source of emissions, and behind all the red meat we eat is an alarmingly large amount of methane, released by ruminant livestock. Unlike its more discussed counterpart, CO_2, methane is very potent, 28 times more to be exact, but it lasts for only a decade compared to centuries for CO_2. Therefore, slight changes will significantly affect methane emissions more than those of CO_2. If millions made slight changes in their diet, the collective impact could really be significant.

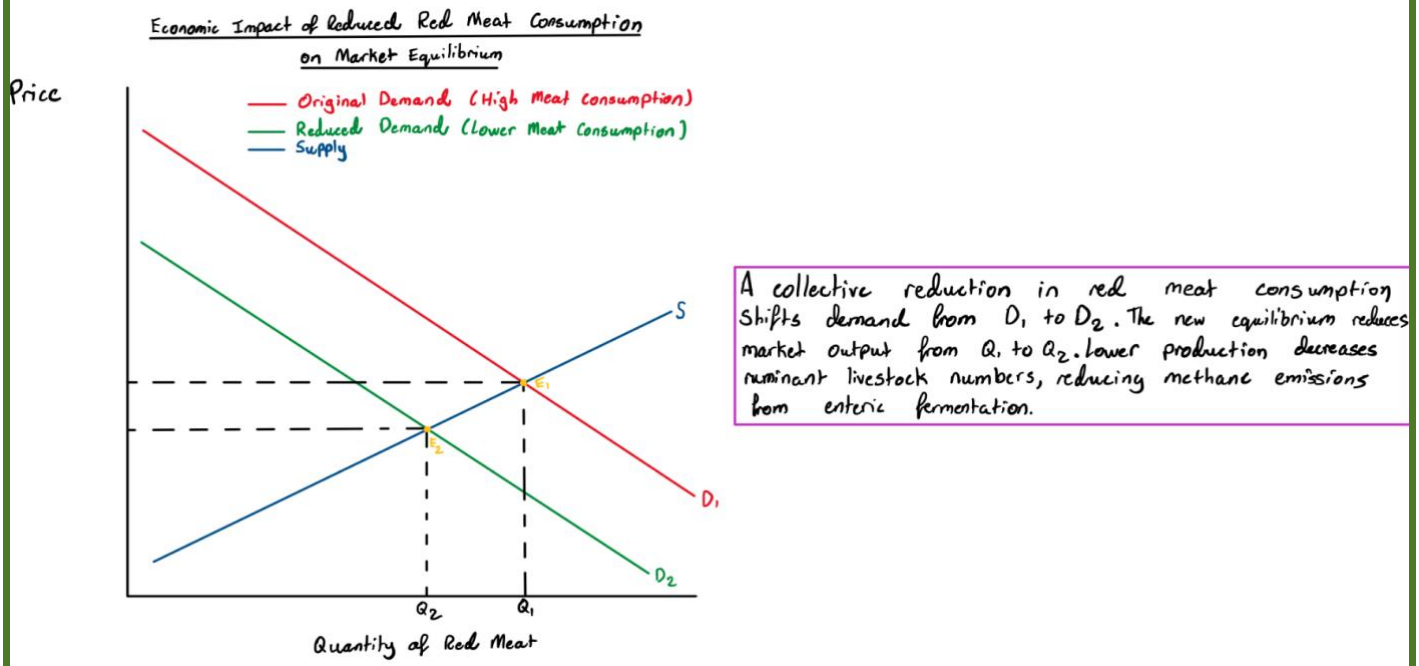
For a better understanding, we need to look at an unexpected source of emissions, a cow's rumen (stomach). Inside lies billions of tiny organisms called microbes. These microbes break down grass like factories, metabolising simple sugars into a biomolecule called Pyruvate. Pyruvate is fermented into three Volatile Fatty Acids (VFA's): acetate, propionate & butyrate, accounting for up to 70% of the animal's daily energy needs. VFA's are absorbed into the bloodstream to be used for maintenance, growth & reproduction, etc. Throughout the process, excess hydrogen is produced. Like when steam builds up in an engine, too much hydrogen can inhibit production as the microbes can't break down the feed anymore, so it must be removed. This happens through a process called methanogenesis. Archaea combine the excess hydrogen with CO_2 to form methane ($4H_2 + CO_2 \rightarrow CH_4 + 2H_2O$), which is then belched.



Altogether, the host loses around 2-12% of its gross energy intake. So, more feed, land & resources are required just to make up for the energy lost. When scaled across the 1.5 billion-strong cattle population on the planet, it represents a massive burden on the environment. In the same way, small dietary changes across large populations could significantly reduce the number of cattle and the emissions associated with raising them, cancelling them out.

Even with the focus on science, economics still has a part to play. When large numbers of people slightly reduce their red meat consumption, demands shift and signals are sent through the price mechanism. Farmers respond by reducing herd sizes, slowing expansion, or using resources for more sustainable practices. Furthermore, reduced demand will lower associated emissions, such as land use, feed production, and transport.

As the diagram shows, economic responses act as a multiplier, amplifying the benefits of reduced red meat consumption. Its effectiveness in reducing GHG emissions relies on how much effort we (as a population) put into it.

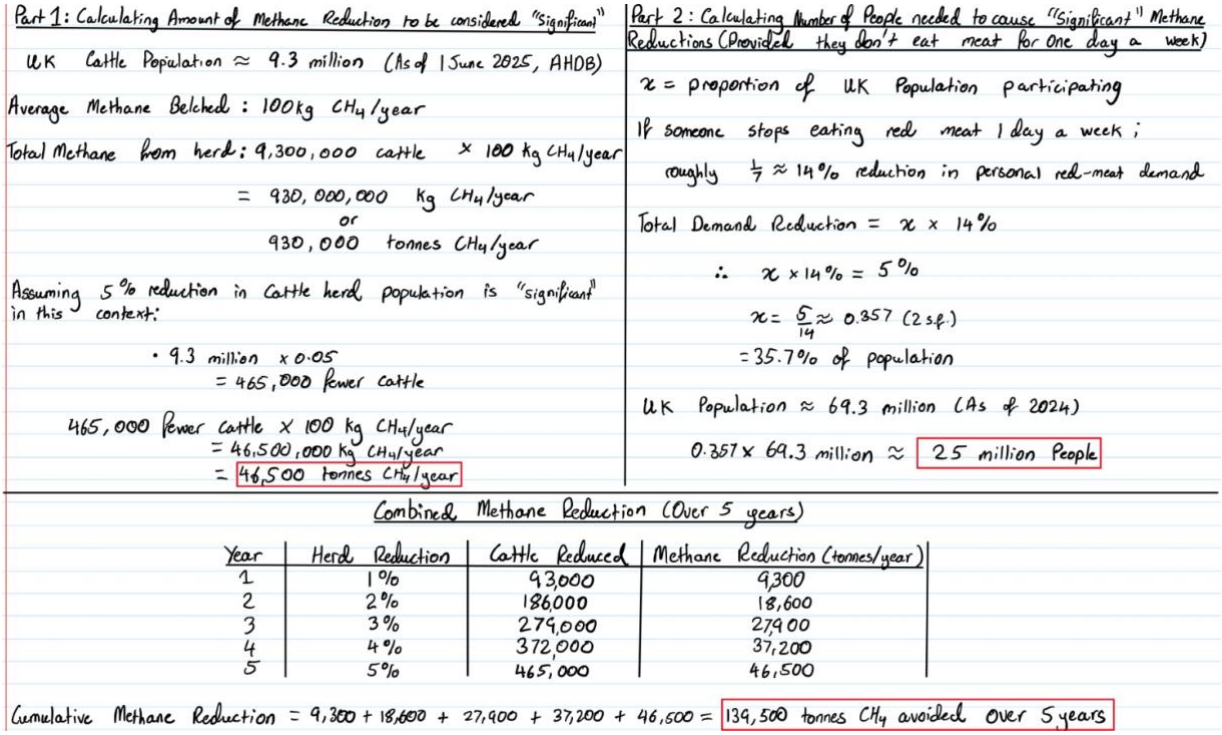


Moreover, reduced-meat diets are proven to benefit people as well as the planet. A 2024 study by the Conservative Animal Welfare Foundation observed that red meat contributes to several of our worst lifestyle diseases, such as cancer, diabetes (Type 2), cardiovascular disease & obesity, so much so that the WHO have classified it as Group 2A (probably carcinogenic). Another review found that eating less red meat can reduce weight gain by 12% and the risk of obesity by 9%. The NHS could save £2.2B annually, provided Britain ate meat-free lunches on weekdays. Even reducing British meat consumption by 10% (e.g. eating 2 fewer packs of sausages per family per month) could offset 16% of car emissions on UK roads. This suggests moderate reductions can contribute both to public health & emissions mitigation.

I wouldn't expect anyone to give up meat forever. Instead, I would propose that people choose one day a week when they can't eat red meat. Similar programs have already been put into place, such as Meatless Mondays, but the conceivable impact isn't felt as some don't know about it, or don't agree with the proposed day (50% of surveyed UK residents prefer Meat-free

Fridays over Monday). Based on my own calculations in the diagram below, around 25 million people in the UK would need to actively participate in the program to see a 5% reduction in the UK's methane emissions from ruminant livestock. The percentage would be even greater if I included the aforementioned factors like production, land use, and transport.

However, the changes won't be felt immediately. Cattle's gestation period is around 9 months, taking 18-24 months to reach slaughter weight. Assuming farmers reduce herd sizes through morally acceptable practices, such as breeding fewer calves & not replacing older cattle, it will take 3-5 years to see concrete results as farmers need to adjust breeding and production decisions. Therefore, methane reductions would increase progressively, from around 9,300 tonnes in year 1, to the anticipated 46,500 tonnes per year once equilibrium is reached. Cumulatively, this could prevent close to 140,000 tonnes of methane emissions within 5 years. While this calculation uses UK data, similar changes applied globally, across a cattle population exceeding 1.5 billion, could equate to millions of tonnes of methane reduced over the same period, which is significant.



Despite the overbearing facts, this is all easier said than done. Livestock farming is a massive global industry, involving millions of jobs, from farmers to processors. A sudden reduction could cause social, economic & even humanitarian problems. Even in the face of the underlying conditions, red meat does provide beneficial nutrients, such as iron, zinc & vitamin B12, so reductions should be paired with nutritionally adequate substitutes (legumes, soy products, etc.), which people may not be instantly drawn to. As well, people's diets are heavily influenced by culture, religion & tradition (e.g., asado and parrilla culture contribute heavily to Argentina consuming the most beef in the world) & not all populations have equal access to alternatives, so to put full responsibility on individuals seems quite insensitive.

A balanced approach should therefore combine voluntary consumer shifts with policy support & impartial transitions for agricultural communities, and when framed as moderate &

collective rather than absolute, dietary changes can represent a scientifically grounded way that everyone of us can contribute to reducing greenhouse gas emissions.

Word Count: 1000

Bibliography

1. Mitloehner, F.M. (n.d.). Simplified model of rumen fermentation.
2. Ahdb.org.uk. (2025). UK cattle and sheep populations continue to contract in Defra's June survey: Beef and lamb market update | AHDB. [online] Available at: https://ahdb.org.uk/news/uk-cattle-and-sheep-populations-continue-to-contract-in-defra-s-june-survey-beef-and-lamb-market-update.
3. CAFW (2026). [online] Google.com. Available at: https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&cad=rja&uact=8&ved=2ahUKEwiQ8frJx8SSAxXiQEEAHZ45OGoQFnoECBsQAQ&url=https%3A%2F%2Fwww.hopkinsmedicine.org%2Fhealth%2Fwellness-and-prevention%2F5-protein-packed-foods-for-healthy-meatless-meals&usg=AOvVaw3vgifUFC7Tqj7CgBgZqyul&opi=89978449 [Accessed 7 Feb. 2026].
4. EntericMethane. (n.d.). Home. [online] Available at: https://www.fao.org/in-action/enteric-methane/en.
5. Jhu.edu. (2020). The Benefits of Meatless Monday | Meatless Monday. [online] Available at: https://meatlessmonday.publichealth.jhu.edu/purpose/benefits-meatless-monday.
6. Morgavi, D.P., Forano, E., Martin, C., and Newbold, C.J. (2010). Microbial ecosystem and methanogenesis in ruminants. animal, 4(7), pp.1024–1036. doi: https://doi.org/10.1017/s1751731110000546.
7. National Health Service (2024). Meat in your diet. [online] nhs.uk. Available at: https://www.nhs.uk/live-well/eat-well/food-types/meat-nutrition/.
8. Rust, N.A., Ridding, L., Ward, C., Clark, B., Kehoe, L., Dora, M., Whittingham, M.J., McGowan, P., Chaudhary, A., Reynolds, C.J., Trivedy, C. and West, N. (2020). How to transition to reduced-meat diets that benefit people and the planet. Science of The Total Environment, [online] 718(718), p.137208. doi: https://doi.org/10.1016/j.scitotenv.2020.137208.

9. Smith, P.E., Kelly, A.K., Kenny, D.A., and Waters, S.M. (2022). Enteric methane research and mitigation strategies for pastoral-based beef cattle production systems. Frontiers in Veterinary Science, 9. doi: https://doi.org/10.3389/fvets.2022.958340. priority_highIssue numberclose

10. The £2 billion NHS windfall: Why meat reduction matters. (2024). Available at: https://bryantresearch.co.uk/wp-content/uploads/2024/02/2billion-NHS-Windfall-CAWF.pdf.priority_highReport authorclose

11. Umn.edu. (2018). The ruminant digestive system. [online] Available at: https://extension.umn.edu/dairy-nutrition/ruminant-digestive-system#fat-digestion-1001418.priority_highWebpage authorclose

12. Understanding methane emissions – Global Methane Tracker 2024 – Analysis - IEA (2024). Understanding methane emissions – Global Methane Tracker 2024 – Analysis - IEA. [online] IEA. Available at: https://www.iea.org/reports/global-methane-tracker-2024/understanding-methane-emissions#abstract.

13. United Nations Environment programme (2021). Methane emissions are driving climate change. Here's how to reduce them. [online] United Nations Environment Programme. Available at: https://www.unep.org/news-and-stories/story/methane-emissions-are-driving-climate-change-heres-how-reduce-them.

14. World Population Review (2024). Beef Consumption by Country 2023. [online] worldpopulationreview.com. Available at: https://worldpopulationreview.com/country-rankings/beef-consumption-by-country.

15. Youngman, A.B. (2023). Reducing Meat Consumption in the UK: Obstacles and Opportunities. [online] www.globalfood.cam.ac.uk. Available at: https://www.globalfood.cam.ac.uk/news/reducing-meat-consumption-uk-obstacles-and-opportunities.