

FoodBioSystems DTP - PhD Project Advertisement

Project title:

FBS2021-10-Cain: Minimising negative environmental impacts of beef consumption

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Project description:

Beef production causes larger greenhouse gas (GHG) emissions and occupies more land than poultry meat, or plant-based alternatives per kg of food or protein produced. J Sainsbury's has ambitious targets to achieve net-zero GHG emissions for their business and operations by 2040, and they have made incremental progress in the beef sector. This project will explore 'How low we can go?' towards this target for beef consumed through J Sainsbury's and its supply chains. This project will consider the full range of consequences of different potential emission reduction strategies, including how much global warming is avoided from different interventions arising over the full life cycle of beef production, as well as impacts to other environmental considerations, like air and water quality.

In this project, you will scrutinise and quantify a range of mitigation measures primarily aimed at reducing net GHG emissions to the atmosphere (e.g. additives to reduce methane emissions, genetic improvements, proactive health management, enhancing soil carbon sinks, agroforestry, biochar production from manure, and enhancing post-farm gate performance). These should also reduce negative impacts on, at least, water quality, air quality, meat quality and costs. Net-zero GHG emissions should not compromise these standards.

You will learn how to evaluate potential beneficial and adverse implications of interventions, and to derive optimal pathways, using a method called systems-based Consequential Life Cycle Assessment (CLCA). Narrow comparisons can be misleading when scaled up, and CLCA overcomes this, e.g. by addressing the alternatives for co-products from beef production, including pharmaceuticals and pet food. The assessment will include at least GHG emissions, water use, water and air quality, and toxicity potentials.

You will evaluate the impact on global warming of GHG emissions associated with different mitigation strategies for beef production using simplified climate modelling tools. You will not only use the classic global warming potential (GWP) that is used in emissions inventories, but also the alternative method of GWP*, which estimates the levels of global warming caused by short-lived methane as well as and longer-lived CO₂ and nitrous oxide emissions. This will deliver an explicit evaluation of how interventions contribute to global warming on defined timescales.

Part of the input data for the CLCA will be from *in vitro* experimental work. You will be funded to take annual 3-4 week research visits to at Queen's University Belfast (QUB), during which time you will be trained in the *in vitro* techniques required to test the GHG emissions associated with different cattle feed additives, which are designed to reduce emissions. Training will be provided in animal nutrition as well as the analytical techniques.

You will supplement the environmental analysis with a cost-benefit analysis initially for on-farm only, and then including external costs of the full life cycle emissions, e.g. 'the social cost of carbon', to consider the wider implications on society. You will be trained to use a social science approach to stakeholder engagement and analysis, You will apply this to farmers in the supply chain to understand what barriers limit their uptake of enlightened farm management, even if seemingly more profitable in theory. Through the understanding of factors like social capital, you will identify routes to wider uptake,

which you will then use in scenario modelling with the LCA to quantify realistic improvements.

At least three month's placement(s) with J Sainsbury's will enable you to understand the drivers of a very large retailer, and gain insight into how business and policy decisions are made. Detailed performance data from J Sainsbury's' beef breeding programme will be available for analysis. Engagement with supply chain stakeholders will start here.

In summary, the overall aim of the PhD is to combine industrial insight with the research outlined above to identify optimal pathways towards decarbonising J Sainsbury's beef activity, consistent with their stated net zero by 2040 goal. This research is necessary to underpin effective corporate action that reaches stated climate goals without compromising wider environmental or food-system priorities, and has wider implications for climate action across the entire food system.

Training opportunities:

At minimum, 3 months will be spent on placement(s) with the CASE partner J Sainsbury's, providing you with industry experience of farming operation and in the wider supply chain. The placement(s) will allow you to gain insight into the UK beef operations at J Sainsbury's, and to conduct stakeholder engagement to understand any potential barriers to uptake of proposed mitigation actions. It will provide ongoing opportunity for high-quality communication and exchange of ideas.

Student profile:

This project would be suitable for students with a degree in any of the environmental sciences, biology, chemistry, agriculture, food science or a closely related subject. Students with other numerate degrees will be considered, and prior study of this specific research area is not a pre-requisite. We encourage applications from under-represented and minoritised groups.

Funding particulars:

This is a CASE studentship with J Sainsbury's. The project is part of the FoodBioSystems BBSRC Doctoral Training Partnership (DTP), it will be funded subject to a competition to identify the strongest applicants.

The studentship is open to UK and international students (including EU countries) however due to funding rules, no more than 30% of the projects can be allocated to international students.

The funding will include a tax free stipend (minimum £15,285 per year), support for tuition fees at the standard UK rate (currently £4,407 per year) and a contribution towards research costs. **Please note** that the host universities have not yet confirmed the level of fees charged to international students funded by the DTP. Fee levels may vary across the institutions. This information will be shared on the FoodBioSystems DTP website as soon as it becomes available.

To apply

Please go to [FoodBioSystems DTP website](#) for information on how to apply for this studentship. The closing date for applications will be 8 February 2021.

References:

The following publications contain recent work on some of the techniques and models to be used in this PhD:

Smith, L. G., Kirk, G. J. D., Jones, P. J., & Williams, A. G. (2019). The greenhouse gas impacts of converting food production in England and Wales to organic methods. *Nature Communications*, 10(1), 4641. <https://doi.org/10.1038/s41467-019-12622-7>

Lynch, J., Cain, M., Pierrehumbert, R., & Allen, M. (2020). Demonstrating GWP*: a means of reporting warming-equivalent emissions that captures the contrasting impacts of short- and long-lived climate pollutants. *Environmental Research Letters*, 15(4), 044023. <https://doi.org/10.1088/1748-9326/ab6d7e>