FoodBioSystems DTP - PhD Project Advertisement Text

Project Title: FOODBIOSYSTEMS - Evaluating the sustainability and nutritional benefits of alternative production systems and foods

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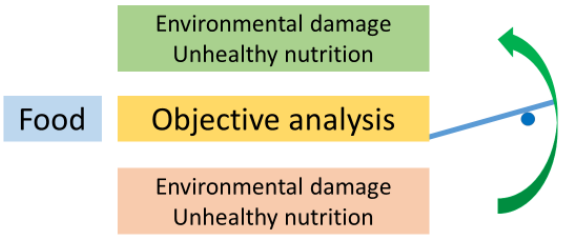
Research Group: FOODBIOSYSTEMS BBSRC DTP
Project ID: FBS2020-20

Application Deadline: 6 March 2020

Project Description: This is a great opportunity to tackle two major challenges to humanity: environmental degradation and poor nutrition.

The food system currently contributes to major negative environmental impacts including greenhouse gas (GHG) emissions, water degradation and major imbalances in human nutrition, e.g. surplus sugar leading to type 2 diabetes. Improving food qualities and reducing negative environmental impacts are both essential and of increasing urgency, e.g. the climate emergency (1). Both need to be addressed.

Novel production methods have the potential to benefit humanity with lower environmental impacts per unit output and to deliver more nutritious food. These need to be evaluated objectively and the limits to them assessed. Niche production may be apparently successful, but feeding nations well and with low impacts must be implemented at scale and this needs critical analysis, e.g. a 100% conversion to organic production in England and Wales would increase GHG emissions (2). Vertical farming exists in subterranean niches under cities, or on rooftops and balconies, but can these operate successfully at effective commercial scale? Understanding and quantifying the biophysical limits to supply is critical for the future to enable sustainable consumption with greatly reduced negative environmental impacts.



Environmental Life Cycle Assessment (LCA) has often been used to evaluate the environmental impacts individual foods and sometimes for whole diets. It is an objective approach that traces the flows of materials

and energy from natural resources in the ground to the final product (the Functional Unit). Potential environmental impacts are quantified all along the supply chain right up to the Functional Unit. However, the explicit inclusion of nutritional properties within analyses is still tentative. Further, the social acceptability and the environmental 'profile' of producing and consuming some novel foods could be a major obstacle to uptake.

Two major food areas will be considered: (a) meats and alternative high protein foods and (b) high value horticultural crops (mainly used for flavour and micronutrient supply). Examples are (but not limited to): plant and microbial proteins (as whole and processed foods), insects for human food and animal (including fish) feed, cultured meat, vertical farming and associated high technology horticultural production methods (hydro and aeroponic methods), both using natural and artificial lighting.

Primary production of meats (especially from ruminants) tend to create very high GHG emissions per unit product, while much high value horticultural produce is produced in high energy product systems, imported by air freight or imported from highly water stressed areas. Society needs lower impacting production systems as alternatives to meats and high value horticultural produce.

The hypothesis to be tested is that emerging alternative foods and production methods can make significant improvements in reducing negative environmental effects while promoting better nutrition.

These research questions will be addressed in the study.

(1) What are the more environmentally benign alternatives to meat?
(2) What are the more environmentally benign alternatives to current mainstream horticulture?
(3) How can nutritional properties be explicitly included in the LCA of foods and diets?
(4) What are the biophysical limits to production of the most favoured alternatives?
(5) What are the social obstacles to expanding production?
(6) What are the future prospects for novel foods and production for acceptable, healthy nutrient supplies?

The project is sponsored by J Sainsbury's, which will enable access to suppliers and to interact with scientists and policy-makers in a large business. This will enrich the student's experience and run alongside training in generic and project-specific skills from both Cranfield and Surrey Universities.

The project will run for four years in the UKRI-BBSRC FoodBioSystems Doctoral Training Partnership and will be based at Cranfield, near Bedford and Milton Keynes.

Funding Notes: This project is part of the FoodBioSystems BBSRC Doctoral Training Partnership (DTP), it will be funded subject to a competition to identify the strongest applicants. Due to restrictions on the funding, this studentship is only open to UK students and EU students who have lived in the UK for the past three years.

This project is a CASE studentship with Sainsbury's.

The FoodBioSystems DTP is a collaboration between the University of Reading, Cranfield University, Queen's University Belfast, Aberystwyth University, Surrey University and Brunel University London. Our vision is to develop the next generation of highly skilled UK Agri-Food bioscientists with expertise spanning the entire food value chain. We have over 60 Associate and Affiliate partners. To find out more about us and the training

programme we offer all our postgraduate researchers please visit https://research.reading.ac.uk/foodbiosystems/.

Training opportunities: The student will receive training in Life Cycle Assessment in both environmental and social forms along with the necessary modelling skills. The student will benefit from complementary skill sets in LCA from Surrey and Cranfield, complemented with in-depth consideration of human nutritional requirements and diets (via the 2017 Queen's Anniversary Prize winning Department of Nutritional Sciences at Surrey). Cranfield PhD students all receive core training in skills such as project management, data management and security, statistics, writing and presentation. A wide range of MSc modules is available to the student at both Universities.

Placements with Sainsbury's (and suppliers) will enable the student to understand commercial needs and collect primary data.

Student profile: he student must have a background in science, e.g. environmental, agricultural, physical or biological and be highly numerate. The student should also have familiarity with social science or a clearly evoked willingness to learn about it. The student must be confident with straightforward mathematical models. The student should be motivated towards improving environmental sustainability through science. The student should have good abilities to engage well with diverse stakeholders and should be outward facing.

Students without all the desired attributes will, of course, be considered if the weight of their current attributes and the student's potential seem likely to compensate.

References:

(1) https://www.un.org/en/climatechange

(2) 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. Nat Commun 10, 4641. https://doi.org/10.1038/s41467-019-12622-7