PhD Opportunity

Modelling sustainable dairy systems

Background

Agriculture is an important source of greenhouse gas (GHG) and ammonia (NH_3) emissions. The dairy sector in Ireland accounts for around 15% of national GHG emissions, and is a major contributor to Ireland's agri-food exports worth €13 billion annually. The dairy sector also contributes substantially to national NH_3 emissions which need to be reduced in line with EU Directives. Future growth of the sector is challenged by the need to meet national emissions reduction targets, and a policy ambition to achieve "carbon neutrality" in the agriculture, forestry & other land use sector by 2050. *Dr James Humphreys* in *Teagasc* has led the development of a milk production system with the potential to halve GHG and NH_3 emissions per kg milk solids; the *LoCAM-dairy* system. This system consists of efficient dairy cows selected for high yields of milk solids and low replacement rate, extended grazing on permanent grassland reliant on biological N fixation by white clover, and low concentrate input. This PhD is part of a larger project that will rigorously assess and benchmark the sustainability of the *LoCAM-dairy* system against existing systems of milk production.

In the first part of the four year PhD programme, the successful candidate will adapt an existing farm **life cycle assessment (LCA)** model used in sustainable dairy projects such as *CLEANER COWS*, *SusCoRiDa* and *SeQUEsTER*. The model will be applied to assess the efficiency of the *Lo-CAM* dairy system against conventional dairy systems, using national statistics and experimental data from the wider *LoCAM* project.

In the second part of the PhD programme, **consequential LCA** will be applied to model scenarios of future dairy production in Ireland, assuming (i) conventional production and (ii) maximum technical deployment of the *Lo-CAM* model (or components of it). An important aspect of the consequential LCA will be accounting for effects in the beef and forestry sectors connected via flows of dairy-beef and land occupation, respectively. Scenarios will integrate land availability for afforestation under baseline and *Lo-CAM* scenarios with emissions offsetting needed to achieve "carbon neutrality", providing a complete picture on the prospective contribution of *Lo-CAM* to Paris Agreement objectives. This work will dovetail with **economic and consequential LCA modelling** work being undertaken in the *SeQUEsTER* project (Scenarios Quantifying land Use & Emissions Transitions towards Equilibrium with Removals) led by *Dr. David Styles* and advanced **farm bio-economic modelling** research led by *Dr. James Gibbons* in Bangor University.

Essential Requirements

- Good primary degree (e.g. 2:1 or higher) or MSc. in a related discipline (Agricultural Science, Engineering, Environmental Science, Earth Sciences, Computer modelling, etc.)
- Excellent numerical skills
- Knowledge of LCA
- Knowledge of agricultural systems
- Knowledge of greenhouse gas and ammonia emission sources

Desirable requirements

- Coding skills (preferably python)
- Experience using Open LCA or SimaPro
- Knowledge of consequential LCA
- Skills in spatial analysis, e.g. GIS

Award

The PhD Fellowship is a joint research project between the School of Engineering in the University of Limerick and Teagasc. The student will be based at the School of Engineering, University of Limerick, working under the supervision of Dr. David Styles (UL), with co-supervision from Dr. James Humphreys (Teagasc) and Dr. James Gibbons (Bangor University). The Fellowship is available to commence in September 2020.

The fellowship provides a four year annual stipend of €22,000.

Further Information

Dr. David Styles, School of Engineering, University of Limerick.

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Application Procedure

Submit an electronic copy of Curriculum Vitae and a letter of interest to Dr David Styles at David.Styles@ul.ie. Closing date for applications: **Midnight, 28th June 2020.**