Sustainable intensification of UK dairy production: challenges and prospects

The need for sustainable intensification
Milk and beef production contributes 9% of global GHG emissions, alongside a large share of nutrient losses and ammonia emissions that reduce water and air quality, whilst causing soil degradation and depletion of finite phosphorus and fossil fuel reserves. Given growing global demand for meat and dairy products, there is an urgent need to identify management pathways and farm systems that deliver “sustainable intensification”, whereby higher levels of production can be supported at lower environmental cost whilst maintaining farmer income.

Changing patterns of dairy farming
Dairy farms in the UK are an excellent lens through which to study sustainable intensification owing to an ongoing trend of dairy consolidation and intensification, with implications for the efficiency of coupled beef systems and land use patterns at different geographical scales. The share of UK milk production on farms producing less than 500,000 litres declined from 45% to 11% between 1994 and 2012, while the share of milk produced on farms producing more than 2 million litres increased to 31% over the same period. This trend is expected to continue following the abolition of milk quotas in 2015. Highest financial margins per litre of milk are achieved by intensive grass-based systems, but highest margins per area of land are achieved by indoor housing and concentrate feed.

Integrated environmental and economic modelling
Large quantities of data are available from previous research studies on the environmental and economic effects of particular dairy management practices and land use change. Bangor and Aberystwyth Universities will collaborate to integrate these data into detailed farm models. In order to capture the upstream effects of e.g. fertiliser manufacture and feed production, and possible indirect effects via market signals, such as land use change in regions producing animal feed, farm models will be coupled with a macro-economic model from Cardiff University within a consequential life cycle assessment (LCA) framework. This novel framework will quantify the environmental efficiency of milk production in relation to multiple pressures on ecosystem services, including land use change.
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within and outside of the UK associated with changing dairy cow diets. Through a unique combination of detailed farm modelling and consequential LCA, the CLEANER COWS project will comprehensively quantify the environmental and economic efficiency of different pathways of dairy intensification, and compare ways of reducing emissions. This will provide clear guidance to farmers and policy makers on management practices and policies for an environmentally sustainable and economically viable UK dairy industry.

Above: Changes to dairy systems incur indirect environmental and economic effects via inter-linked beef and animal-feed-production systems

The CLEANER COWS research cluster

The NRN Sêr Cymru funded CLEANER COWS research cluster is a collaboration between Bangor, Aberystwyth, Cardiff and Nottingham Universities addressing sustainable intensification. The cluster will develop a model framework, coupling farm management, LCA and economics, for improving the sustainability of UK food production, accounting for regional/national socio-economic effects and international environmental burdens.

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