

# Seeking Sustainable Intensification in Dairy Systems



## The Challenge

Feeding our growing world population without further adverse environmental impacts remains one of agriculture's greatest challenges. In the dairy sector, increased milk yields in the past were achieved through agricultural intensification (e.g. draining fields and increasing stocking densities). With such practices typically resulting in environmental degradation, we need to explore innovative ways of enhancing milk yields.

## The Research

The Langhill herd's home-grown system provided a test system to explore the feasibility of achieving sustainable intensification in dairy systems. To maintain good milk yields, dairy cows need specific concentrations of carbohydrates, fats and proteins. In home-grown systems, these needs are met from a variety of crops grown on farm. Dietary modelling identified several different crop combinations that could support a high-yielding dairy herd. The land area to deliver these diets varied due to productivity and nutritional differences between crops with more efficient systems generating spare land. Production and biodiversity were investigated across scenarios with differing crop, land area, and potential surplus land (and its potential utilisation).

## The Results

We identified the potential to meet the dietary requirements of a high-yield dairy herd more efficiently (i.e. on less land) within home-grown dairy systems. Unsurprisingly, increasing system efficiency and allocating the resultant spare land to species-rich grassland benefited biodiversity. More excitingly, however, in some scenarios where spare land was used for additional production, models predicted increases in biodiversity indicating potential simultaneous increase in food production and biodiversity. The greatest biodiversity and production gains were predicted when spare land was targeted to a crop that supported distinct species to those already in the system.



## The Impact

The research was published in Journal of Applied Ecology and in 2018–2019 was amongst Wiley’s top 10% most downloaded papers. Altmetric scored the paper in the top 5% of all research outputs with strong uptake in social media (e.g. blogs, Twitter) and the national press. SEFARI funding was attained to further progress this research with a focus on identifying key performance indicators for intensive grassland systems (Developing practical guidelines and supporting policies for effective and robust sustainable grassland systems).

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## The Future

Future agricultural systems will have to deliver across the three pillars of sustainability, balancing environmental, social and economic outcomes. This work provides a framework that simultaneously explores different outcomes allowing us to identify synergies and trade-offs.

Agri-environmental policy should focus on optimising the potential benefits derived from both productive land and land taken out of production for biodiversity. Evaluating the impact of alternative practices such as multi-species swards, arable/livestock integration and diversified cropping systems on the three pillars of sustainability is crucial. Drawing from agroecological principles such practices have the potential to play a key role in ensuring Scotland’s agriculture is sustainable and resilient to future challenge

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## Additional Information:

### Publications:

White, P.J., Lee, M.A., Roberts, D.J. and Cole, L.J., 2019. Routes to achieving sustainable intensification in simulated dairy farms: The importance of production efficiency and complimentary land uses. Journal of Applied Ecology, 56(5), pp.1128–1139.

Links to website:

<https://besjournals.onlinelibrary.wiley.com/doi/full/10.1111/1365-2664.13347>

<https://appliedecologistsblog.com/2019/04/10/sustainable-intensification/>

Other:

<https://www.pressreader.com/uk/the-herald-1130/20200218/281904480194125>

Scottish Government Rural Affairs and Environment Strategic Research Programme 2016–2021, Theme 2: Productive and Sustainable Land Management and Rural Economies.

Edinburgh Napier University, Royal Botanic Gardens Kew.