PROJECT FACTSHEET

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SIMBA

Towards a better and sustainable dairy cattle management through a national decision support tool

Inspiration

Ensuring the environmental and economic sustainability of the farming sector is a complex task. The dairy cattle farms are facing important environmental challenges, such as the impact of methane emissions, which are closely linked to their management activities. The latter can greatly differ from one farmer to another when considering the whole decision-making process, partly driven by human behavior.

Several researches were conducted by LIST in order to simulate the evolution of farming systems in Luxembourg through a Life Cycle Assessment (LCA) approach. However, the Lucas project (2009) was only designed with an economically oriented model. The MUSA project (2016), which coupled LCA with Agent Based Models (ABM), enabled to consider the effects of farmers' choices, but reached some limitations due to a lack of individual based data on animal breeding.

Innovation

The SimBa project aims to develop an unprecedented decision support tool enabling the simulation of the evolution and the optimization of dairy farming systems in Luxembourg. This decision support tool will be based on an innovative LCA-ABM coupled simulator, which integrates a multi objective optimizer. The individual-based simulation model will not only consider economic and sustainability constraints, but also the behavioral components of farmer agents. In close collaboration with its partner, the Gembloux Agro-Bio Tech of the University of Liège, LIST will benefit from its phenomics approach and modelling of milk production traits, which will rely on more than 320 dairy farms in Wallonia and Luxembourg. These phenotypes (e.g. cow's characteristics and methane emissions, milk production/composition, feed intake/nutrients intake, etc.) will be implemented in the ABM by LIST researchers.

With a strong expertise in LCA, LIST will then be able to simulate and assess the economic and environmental impacts of different herd management strategies, possibly up to an individual cow scale (e.g. the methane emission per cow). As a results, these elements will improve the farm-level optimization model running inside the ABM. In parallel, the robustness of the assumptions made by the decision tool will be assessed using accurate data from a restricted sample of pilot farms, thus allowing a calibration of the model. In this last task, LIST and Gembloux Agro-Bio Tech will be assisted by the Institut fir biologesch Landwirtschaft an Agrarkultur Luxemburg, which will also provide support in the implementation of the farm business simulation model.

Impact

SimBa will enable the first integration of a multi-objective optimizer in this agent-based simulation tool, which incorporates, also for the first time, the equations derived from the proposed phenomics approach for the dairy sector. This novel approach will give information at cow scale, allowing an unprecedented level of precision (in a LCA framework) for the calculation of the environmental impacts from dairy herd managements.

As a result, this joined research project between LIST and its partner will provide an innovative decision support tool for a better management of the decision making process in agriculture and farming at regional and national level. With a view on a long term strategy, SimBa will open the path to further research projects aiming to develop public and customized decision support interfaces, which would be of high interest for agriculture and farming actors (e.g. governmental institutions, cooperatives) in Luxembourg and beyond.

Partners

Gembloux Agro-Bio Tech Faculty (BE) , Institut fir biologesch Landwirtschaft an Agrarkultur Luxemburg (LU)

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