FACCE MACSUR

L2.2-D2: Understanding the potential of existing models to characterize animal health conditions and estimate greenhouse gas emissions

Şeyda Özkan Gülzari[1,2,*] and Richard Kipling[3]
(with contributions from task partners)

[1] Norwegian Institute of Bioeconomy Research, Postbox 115, Ås 1431 Norway
[2] Department of Animal and Aquacultural Sciences, Faculty of Veterinary Medicine and Biosciences, Norwegian University of Life Sciences, Post box 5003, Ås 1430 Norway
[3] Aberystwyth University, King Street, Aberystwyth, Ceredigion, SY23 2BH, United Kingdom

*seyda.ozkan@nibio.no

Instrument:	Joint Programming Initiative
Topic:	Agriculture, Food Security, and Climate Change
Project:	Modelling European Agriculture with Climate Change for Food Security (FACCE-MACSUR)
Start date of project:	1 May 2015 (phase 2)
Duration:	24 months
Theme, Work Package:	LiveM WP2
Deliverable reference num.:	L2.2-D2
Deliverable lead partner:	NIBIO&NMBU
Due date of deliverable:	month 24
Submission date:	17-05-31
Confidential till:	**2018-06-01**

Revision	Changes	Date
1.0	First Release	2012-12-06
1.01	Section on model uncertainty updated	2013-01-28
1.1	Report (abstract) published	2017-06-13

Executive summary

The primary objective of this study was to assess the status and priorities for future development in modelling of the impacts of animal health on greenhouse gas (GHG) emissions. It also aimed to facilitate communication between experimental researchers and modellers by defining a list of parameters that are needed to model livestock health and disease, and the impact of health conditions on GHG emissions. The summary presented here provides a brief overview of ongoing work, which the L2.1/L2.2 partners, with support from the Global Research Alliance Animal Health Network (GRA AHN), is currently developing into a paper for publication in a peer reviewed journal.

An initial survey was developed and shared with modellers working with modelling livestock disease and health; with modellers working on the prediction of GHG emissions at farm level; and with those working specifically on characterising the impacts of health conditions on GHG emissions. The participants included MACSUR partners and GRA AHN members. Results from six models designed to model animal health were gathered. Following the collection of survey results, a workshop was organized at Norwegian University of Life Sciences in October 2016, where a typology of health conditions was defined. Diseases were grouped into four categories: metabolic; non-transmissable infective; reproductive; and transmissible infective. Fifty eight disease-related model parameters were defined, including parameters relating to: fertility rate, culling, genetics, replacement, manure management, water management, contagion, economics and management change. A second, more detailed survey of models, which investigated whether and how models incorporated the identified parameters, included inputs from four modelling groups working on modelling GHG emissions at the farm scale (i.e. models not specifically designed to incorporate animal health) as well as contributions from animal health modellers. Results revealed information both on the range of health conditions covered in current models, and on the nature of inclusion of (or potential to include) the health-related parameters.

Individual models used different approaches to characterise the health-related parameters identified in the workshop. At the simplest level, health conditions and their impacts can be incorporated into a model via the alteration of input parameters. At a second level, models can use empirical approaches to characterise changes in health and their impacts. At the highest level, models can characterise the mechanisms that underlie the statistical relationships that represent changes in health and their impacts (mechanistic modelling). Each of these three approaches have benefits and drawbacks; the extent to which they are fit-for-purpose depends on a number factors including the type of the health condition modelled, data availability, parameters accounted for, the complexity of interactions among different parameters and (crucially) the purpose of modelling (including the requirements of stakeholders). In relation to the range of health conditions addressed, it appeared that current models have a tendency to focus on parasitic infestations, with no or limited capacity to explore the relationships between different health conditions. Modelling interactions among diseases, pathogens, vectors and the environment should be a priority for future work, while the focus on specific health conditions should be reviewed with regard to the changing nature of health conditions under climate change (i.e. which health conditions are likely to worsen under climate change, and therefore require more attention). Current knowledge of some pathogens, their ecology and responses to changes in environmental conditions is incomplete, and presents a limitation to progress in modelling. Few models characterise the whole pathway from changes in health condition to changes in GHG emissions, and where this is attempted, the approach is usually via changes in input values to represent the effects of health conditions, or through empirical modelling of health conditions and impacts.

Full details of the survey and workshop results (still under analysis) are being developed into a peer-reviewed paper for submission in the coming months.

Acknowledgements

This paper is a contribution to the FACCE MACSUR knowledge hub.
MACSUR is significantly funded by the Norwegian Research Council.