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The formulation and analysis of a model framework for forecasting livestock demographics in Scotland

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The requirement to be able to accurately forecast the numbers, species and distribution of livestock on Scottish farms is vital for the management of rural economies, food security and predicting and managing the effects of disease introduction into a changed livestock demography. Furthermore, such a framework can be used for evaluating the effects of shocks such as CAP reform on the system. This paper describes the development of a stochastic simulation model framework for predicting the distribution of farms and numbers of cattle and sheep on the farms. The framework is based upon sampling from parameter and spatial distributions of changes to the sector. The model is parameterised through analysis of data from the Scottish agricultural census between 2006 and 2011 (inclusive). Between 2006 and 2011 there was a real fall of between 6 and 13% in the numbers of cattle, sheep and farms with either species. Using the model developed here a baseline scenario with 2006 as the starting point predicts the number of cattle, sheep and holdings in 2011 with either species to within 2% of the actual numbers. Furthermore, farm composition and distribution is accurately reflected in these predictions. The model was used to generate forecasts to evaluate the impact of shocks to the system, in particular the 2013 rounds of CAP reforms. The need to be able to forecast changes to the demographics of livestock are vital for agricultural management and to plan epidemic responses and these results will be used to populate epidemic models. Furthermore, the changes modelled here will be used to forecast changes in the pattern of movements within Scotland and between Scotland and its trading partners. This is a framework that could be readily applied to different countries and scenarios.