DTU Library

Predicting the structural development in Danish livestock and how it affects control strategies against FMD

Christiansen, Lasse Engbo; Hisham Beshara Halasa, Tariq; Boklund, Anette ; Enøe, Claes

[Link back to DTU Orbit](#)

Predicting the structural development in Danish livestock and how it affects control strategies against FMD

L.E. Christiansen[1], T. Halasa[2], A. Boklund[2], C. Enøe[2]

[1]Mathematical statistics, Department of Informatics and Mathematical Modelling, Technical University of Denmark
[2]Section for Epidemiology, National Veterinary Institute, Technical University of Denmark

The purpose of this study was to assess if the optimal control strategy against foot-and-mouth disease (FMD) spread is invariant to structural development in Danish livestock until 2030. The DTU-DADS model as presented by Halasa et al. uses demographic information of all farms including their location, size, and production type. The main challenge was to predict the demographic data.

Based on data for all herds with animals susceptible to FMD in the Central Husbandry Registry from 1999 to 2010 and supplementary data for swine herds from Danish Agriculture & Food Council (2002 to 2009), all farms were classified by production type and size each year. A total of 88 classes were used. For each species group (cattle, swine, and sheep and goat) a transition probability matrix (TPM) was estimated based on the ten year to year transitions.

It was hypothesized that there might be regional differences. This was assessed by dividing Denmark into 7 regions, counting all transitions per region, and comparing these counts to the country wide counts using a Chisq test. Due to the regionalization, some of the less populated size categories were merged to reduce noise. All regions were found to have significantly different TPMs. These TPMs were used in a Markov chain to predict the distribution of farms in year 2030. However, the predictions were unrealistic as far too many farms opened – since all closed farms were allowed to reopen. It was decided to make the closed state a terminal state and make an independent prediction of how many farms should open each year. The best model was a log-linear model for each region. The combined result is a reduction from 51,031 herds in 2007 to 14,126 farms in 2030 with larger average size.