Avian influenza

A strain of avian influenza is spreading among poultry farms. The virus has a near-100% fatality risk in birds, and has an R0 typically between 1.8 and 2.4 (among birds in a farm setting). Whether R0 is at the low end or the high end of this range seems to depend upon the farm, but the reasons for this variation are not fully understood. When birds are housed outdoors, there is around a 5% risk each year of any given farm having at least one case, but it has been observed that this risk goes up to around 20% if a neighbouring farm has had a substantial outbreak (with more than half of the flock affected). If birds are housed indoors, the risk of introduction is reduced 4-8 fold, because there is reduced contact with wild birds which may spread the virus. You have been asked to model different strategies for reducing the impact of avian influenza on poultry and poultry farms, based around establishing criteria for when birds should be housed inside and when a flock should be culled.

Design a model that could help you complete this task. For instance, you may wish to include the following:

- a compartment diagram of the disease including demographic states that you wish your model to track (showing arrows between your compartments denoting flows).
- Any further information on the model set-up (e.g. whether you wish to use a stochastic model and if so what type)
- A short list of information or parameters that you need to run your model
- Any values of these parameters needed (you may find googling helpful here - remember to state your source)
- A short list of where any uncertainty is in your assumptions, model structure or parameter values.