Assessing the consequences of bluetongue virus incursions to Scotland

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Introduction

- Since its arrival in northern Europe in summer 2006, bluetongue virus serotype 8 (BTV-8) has since caused thousands of livestock deaths and spread across much of the continent
- BTV-8 arrived in Great Britain (GB) in August 2007 and by the end of the year it had spread to 125 holdings in southern and eastern England
- Because of the risk posed to the valuable livestock industry, Scottish Government commissioned work to investigate:
  - feasible incursion scenarios for BTV in Scotland
  - epidemiological consequences of each incursion scenario under a range of control strategies
  - economic consequences under each incursion scenario and control strategy

Approaches

- **Incursion scenarios**
  Scenarios were identified by assessing the potential for incursion via:
  - wind-borne dispersal of infected vectors from affected areas of GB and mainland Europe
  - import of infected animals
  - northwards spread from affected areas in GB under the assumption that no vaccination was used
- **Epidemiological model**
  A stochastic, spatially explicit model was used to describe spread between farms and impact of vaccination
- **Economic analysis**
  An economic model used the results of the epidemiological model to compute the direct and indirect costs for each scenario

Incursion scenarios

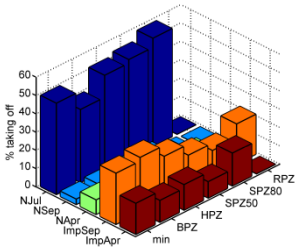
- Five incursion scenarios were identified for consideration in the epidemiological and economic analyses:
  - northwards spread with BTV arriving in July 2008 (NJul)
  - northwards spread with BTV arriving in September 2008 (NSep)
  - northwards spread with BTV arriving in April 2009 (NApr)
  - import of infected animals in September 2008 (ImpSep)
  - import of infected animals in April 2009 (ImpApr)
- The risk of direct incursion of BTV-infected midges from south-east England or mainland Europe was low to negligible
- If BTV were to become established in Northern Ireland, this would pose a distinct incursion risk to Scotland

Control scenarios

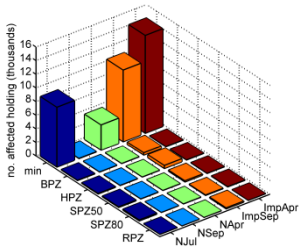
- Five (plus one) control strategies were considered:
  - minimal control measures (min)
  - vaccinate 100% farms in a border protection zone (BPZ)
  - vaccinate 80% of farms in a PZ to the Highland line (HPZ)
  - vaccinate 50% of farms in a PZ comprising the whole of Scotland (SPZ50)
  - vaccinate 80% of farms in a PZ comprising the whole of Scotland (SPZ80)
  - vaccinate 80% of farms in 100km PZ around first IP (RPZ)
- Vaccination:
  - reactive for July and September incursions; preventive for April incursions
  - additional reactive vaccination in 20km radius of infected holdings
  - assumed to be 100% effective

Results: epidemiological analysis

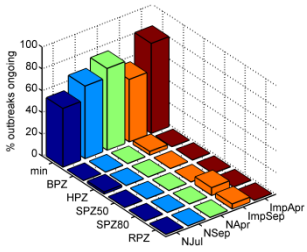
Do outbreaks take-off?



How many affected holdings?

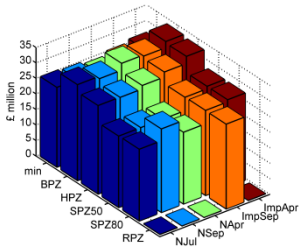


Do outbreaks die-out?

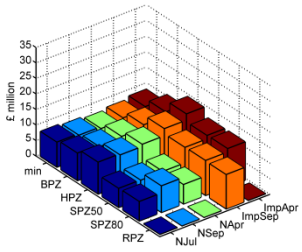


Results: economic analysis

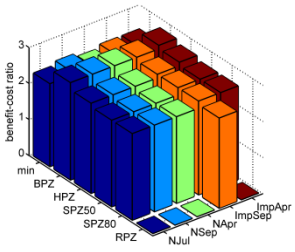
Direct cattle costs



Direct sheep costs



Benefit-cost ratio



Conclusions

- The most likely incursion scenarios are northwards spread form south-east England or import of infected animals
- Under most scenarios infection seldom spreads from the initial incursion; only if the incursion occurred in July did outbreaks become more widespread in a substantial number of replicates
- Vaccination is an effective means of controlling the spread of BTV
- Under most incursion scenarios, the best control strategy was to vaccinate 80% of farms in a protection zone comprising the whole of Scotland (SPZ80)
- The largest direct costs were borne by the cattle sector; furthermore, the indirect costs of an outbreak were much higher than the direct costs

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