RESEARCH BRIEF: Predicting the spread of ASF following introduction in Great Britain and its implication for Scotland.

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1. KEY MESSAGE

African swine fever (ASF) can spread rapidly across Great Britain if the disease is spreading without detection for a long period of time (e.g. 8 weeks). The incursion in Yorkshire poses a higher risk to Scotland compared to other higher-risk areas in England (East Anglia and Devon). Early detection of ASF and biosecurity measures to prevent between-farm spread via fomites would mitigate the risk of ASF spread.

2. MAJOR FINDINGS

- If African swine fever (ASF) virus is introduced in Aberdeenshire, East Anglia, Devon or Yorkshire (four previously defined as areas of higher risk of generating epidemics; EPIC_201819_RB_002v1) and left undetected for a long period of time (e.g. 8 weeks), ASF can spread rapidly to other farms and could cover a large geographical area in Great Britain (Figure).
- If an ASF incursion occurs first in a domestic pig farm in a higher-risk area in England (e.g. East Anglia, Devon or Yorkshire), the probability that a Scottish farm will subsequently become infected with ASF within 2 or 4 weeks of pre-detection spread via animal movements and local spread (disease spread between farms located in geographical proximity) is low (0.11% and 0.83%, respectively). Within 8 weeks of pre-detection spread, the probability of ASF introduction into Scotland increases to 4.4%.
- The probability of infection of a Scottish farm decreases tenfold if only animal movements are involved in disease spread – i.e. no local spread (2 weeks: <0.001%, 4 weeks: 0.09%, 8 weeks: 0.46%).
- Irrespective of the time to detect ASF (2, 4, or 8 weeks of "silent" or undetected spread), the probability that a Scottish farm will be infected with ASF will be lower if an incursion occurs in East Anglia (2 weeks: 0%, 4 weeks: <0.001%, 8 weeks: 0.005%) and Devon (2 weeks: <0.001%, 4 weeks: 0.006%, 8 weeks: 0.45%) compared to Yorkshire (2 weeks: 0.11%, 4 weeks: 0.83%, 8 weeks: 3.9%).

3. OBJECTIVES

(1) Predicting the pre-detection spread of ASF following hypothetical introduction events in GB and
(2) Assess the impact of early detection of incursions on the spread of ASF.

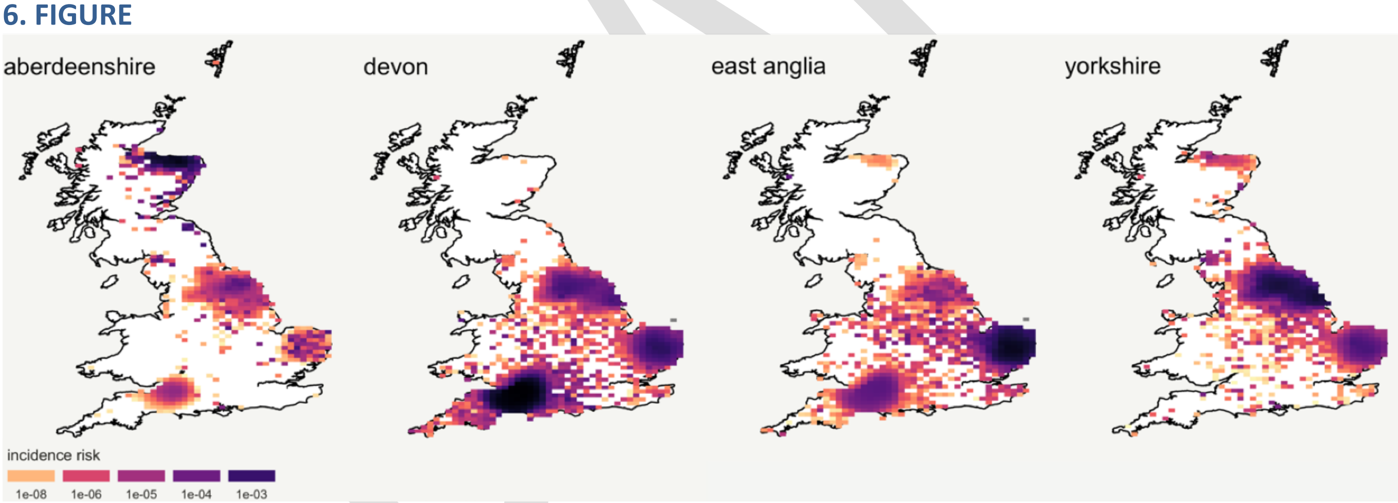
4. POLICY IMPLICATIONS

Early detection of ASF and mitigation of local spread of ASF is an important measure to prevent larger geographical disease spread. Increasing the awareness of clinical signs and disease transmission pathways amongst pig owners will promote early detection of ASF and investments in biosecurity practices.

5. IMPORTANT ASSUMPTIONS AND LIMITATIONS

- This study used the modelling framework previously developed in EPIC for Classical Swine Fever (EPIC_201819_RB_002v1; Porphyre *et al.*, 2017). This framework was modified to account for the impact of small size holdings on disease spread. This ASF model only considers the role of animal movement and local spread but does not include the role of other routes of transmission (e.g. wild boars, haulage vehicles or feeds). As such, its results may be an underestimation of disease spread in real outbreak situation.
- All movements reported between January 1st 2012 and December 31st 2013 in both the Scottish livestock electronic identification and traceability database (ScotEID) and the electronic animal movement licensing system (AMLS) were included in this study.
- Incursion events in four areas of higher risk of generating epidemics (i.e. Aberdeenshire, East Anglia, Devon and Yorkshire) were considered (EPIC_201819_RB_002v1; Porphyre *et al.*, 2017). The risk from other higher-risk areas was not assessed. In each of these four areas, 100 randomly-chosen farms (both commercial and non-commercial farms) were tested individually as a primary case (the first infected farm). ASF was introduced into the primary farm on the first Monday of every other month. In total, 5.4 million simulations were carried out for each area of introduction and for each scenario which explored pre-detection periods of different durations. Three pre-detection periods (i.e. when disease was silently spreading without detection) were explored: 2, 4 or 8 weeks.

6. FIGURE



Spatial distribution of the incidence risk of ASF infection in Great Britain if incursion is left undetected and freely spreading for 8 weeks. We individually tested 100 sites of incursion in four areas of higher risk of generating epidemics. Each map shows the incidence risk expressed as the cumulative number of farms affected by ASF among all farms within each 10 km grid square over all simulated outbreaks. Note that all sites of incursion tested were removed from the list of farms when computing risk values.

7. LINKS TO EXISTING PUBLICATIONS OR REPORTS

Scientific paper under development

Modelling framework and parameter values published in:

- C. Guinat, **T. Porphyre**, A. Gogin, L. Dixon, D.U.Pfeiffer, S. Gubbins (2018) Inferring the within-herd transmission parameters for African swine fever virus using mortality data from outbreaks in the Russian Federation. *Transboundary and Emerging Diseases* 65(2): e264-e271
- K. Gamado, G. Marion, **T. Porphyre** (2017) Data-driven risk assessment from small scale epidemics: Estimation and model choice for spatio-temporal data with application to a classical swine fever outbreak. *Frontiers in Veterinary Sciences* 4:16.
- **T. Porphyre**, C. Correia-Gomes, M. E. Chase-Topping, K. Gamado, H.K. Auty, I. Hutchinson, A. Reeves, G.J. Gunn, M.E.J. Woolhouse (2017) Vulnerability of the British swine industry to classical swine fever. *Scientific reports* 7:42992.