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Qualitative risk assessment of the role of the feral wild boar (*Sus scrofa*) in the likelihood of incursion and the impacts on effective disease control of selected exotic diseases in England

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Abstract A qualitative risk assessment was undertaken to analyse the likelihood of the incursion of selected exotic infectious disease into England's small populations of feral boar and the potential impacts these animals could have on effective disease control. In order to identify the exposure pathways, it was necessary to consider not only the epidemiology of the pathogens but also to understand how the ecology and behaviour of wild boar would affect disease transmission. It was concluded that the greatest risks of exotic disease incursion into the UK were associated with disease entering through the consumption of infected pork meat or meat products by either wild boar or domestic swine and thus the diseases of highest risk are classic swine fever, foot and mouth disease and *Trichinella* sp. It should be noted that much of the peer review publications used as the scientific evidence base for this assessment describes disease outbreaks in boar populations in countries which have the disease endemically or have been previously exposed to the disease. In the UK, disease may act differently as the UK population of boar will be naïve to the exotic notifiable diseases.

Keywords Feral wild boar · Transmissible diseases · Risk assessment · Wildlife

Introduction

The wild boar (*Sus scrofa*) became extinct in the UK in 1705 (Moore 2004). Since that time, escapes and deliberate release of captive animals has led to the re-establishment of four known populations totalling 750–1,000 animals.

Feral boar are susceptible to a wide range of pathogens which may impact on human health, livestock health and wildlife conservation (Ruiz-Fons et al. 2008). Free-ranging boar may act as incidental 'spill-over' hosts, disease vectors or a true reservoir of infection and therefore influence the epidemiology of the disease and the effectiveness of disease control measures (Gortazar et al. 2007).

Some of these diseases such as *Mycobacterium bovis* and postweaning multi-systemic wasting syndrome are considered to be endemic in UK livestock. These diseases can have significant impact on livestock health and economics; however, whilst they remain widespread and uncontrolled in domestic livestock, the small populations of feral boar in England are unlikely to impact on effective disease control.

Of more significance are those diseases which the UK is considered to be free of infection in both domestic and wild animals. A single confirmed case of these diseases would result in an official outbreak response, disease control measures and trade restrictions resulting in negative social and economic impacts. Several of these diseases are also zoonotic therefore prevention and control is important for human health protection and food security. The presence of feral boar may impact on the effectiveness of disease control and the likelihood of disease eradication or time taken to regain disease freedom.

This qualitative risk assessment examines the likelihood of incursion and the potential impacts of selected infectious diseases in England's feral boar population. The diseases

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are all considered to be exotic to Great Britain and many are notifiable under European and domestic legislation.

Materials and methods

This qualitative risk assessment was conducted using a methodology developed for the specific requirements of the policy-making process with the Department of Environment, Food and Rural Affairs. This process has been endorsed through a process of peer review. Further examples can be seen at www.defra.gov.uk/animalh/diseases/monitoring/riskassess.htm.

Hazard identification

This analysis considers two key scenarios in which wild boar may influence exotic infectious disease incursion and subsequent control and eradication:

- Incursion of exotic diseases directly into the free-ranging feral boar population.
- Incursion of exotic disease into domestic livestock and subsequent transmission to feral boar.

Situation assessment

The situation assessment considers the factors which are likely to influence the risk analysis and allows construction of an exposure pathway, this leads to assessment of the risks associated with each step in the pathway.

The methods of disease transmission are fundamental to incursion and epidemiology of the disease. The potential methods were categorised into *direct contact* and *indirect contact* with the later being further categorised into airborne, faeco-oral, food borne and vector borne. Each disease was then reviewed to identify potential routes of transmission into feral boar. Incursion could occur directly into feral boar from outside England or into domestic livestock and then into feral boar (Fig. 1).

The feral boar population in England contributes to the risk of incursion and maintenance of exotic notifiable diseases. The risk of exotic disease incursion is reduced by a series of measures enforced by European or national legislation. These include a requirement for animal owners and veterinarians to report suspicion of disease to official veterinarians for further investigation. There are restrictions on the import of live swine, including wild boar or pork meat and meat products from infected areas which are enforced by veterinary certification and border inspections. Swill feeding of pigs is banned, and pigs are subject to a 20-day stand-still period after sale either from farms or livestock markets. Disposal of pig carcasses is also strictly controlled. These measures, in conjunction with farm biosecurity, especially on the increasing number of outdoor pig units, protect the UK livestock and wildlife population from exotic diseases.

There are around five million pigs in the UK. It is estimated that 18–25% of England's pigs are managed in outdoor husbandry systems however this is increasing. The majority of outdoor pigs are located in the areas shown in Fig. 2. Although Kent and East Sussex is not a major area

Exposure Pathway

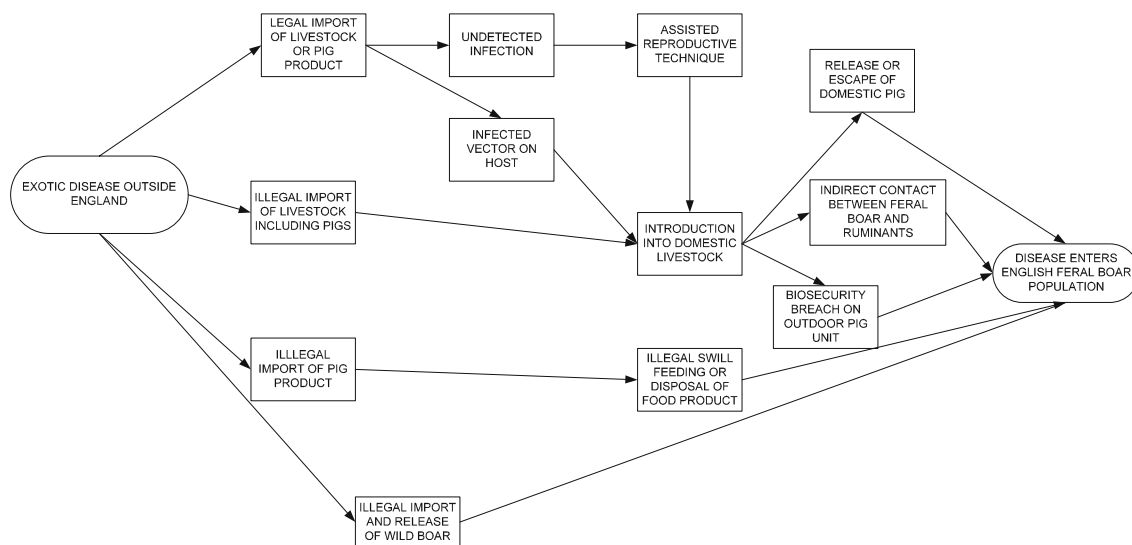


Fig. 1 Exposure pathways of wild boar in England to selected exotic diseases

for commercial pig production, there are 23,000 pigs in this area, most of which are in outdoor pig production systems. This overlaps with the most significant wild boar population.

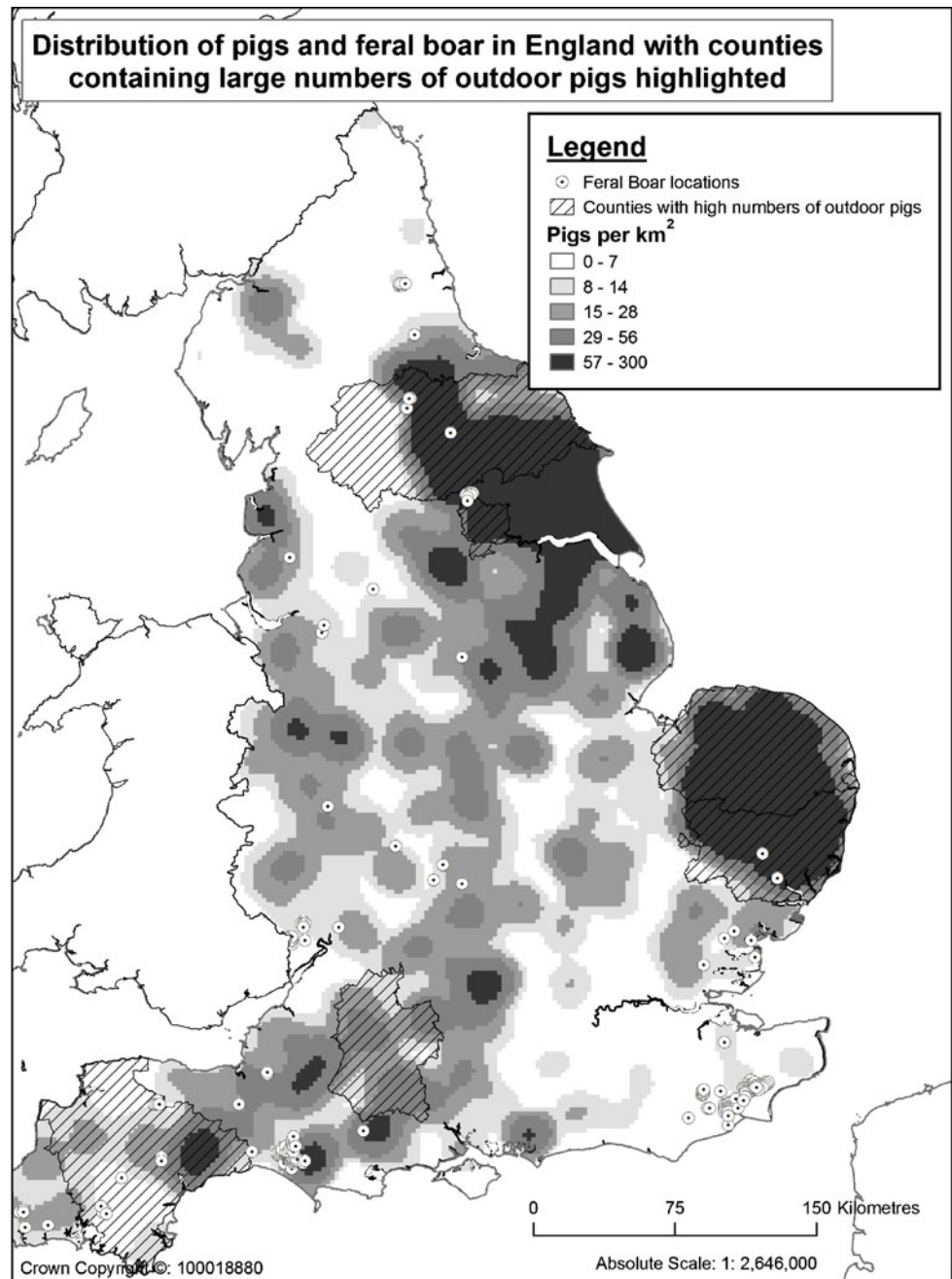
The location of the feral boar in relation to the domestic pig population in the UK is shown in Fig. 2.

There are four known established populations of feral boar in England however sporadic reports are

more widespread. The largest population of feral boar is found in Kent/East Sussex and is estimated at 200 animals. The overall range is estimated at 164 km² with a population density of 5 boars/km² (Wilson 2006, unpublished).

The West Dorset population is estimated to be fewer than 50 animals at a density of 1.1 boars/km² (Wilson

Fig. 2 Distribution of pigs and feral boar in England with counties containing large numbers of outdoor pigs highlighted



CREATOR: RADAR Team, Defra
 DATE CREATED: 11 November 2008
 SOURCES: June Agricultural Survey and Natural England

QUALITY: Pig populations are for June 2007 and 2/3 of data will be imputed based on previous returns and yearly trends.



2003). There are unconfirmed reports that this population is being supplemented by continuing occasional escapes from a nearby boar farm.

A population in Ross-on-Wye/Forest of Dean appears to fluctuate widely ranging from fewer than 30 to over 50 animals. This is influenced by heavy shooting activity and resulting compensatory reproduction in remaining animals (Wilson 2006, unpublished).

A more recent escape in Dartmoor has resulted in the establishment of a population of 30 animals (Wilson, personal communication).

It is assumed that free-ranging feral boar would not have direct contact with domestic pigs managed in indoor systems. Indirect disease transmission methods should be addressed by a farm biosecurity plan which should include measures such as boot and vehicle washing, use of protective clothing, food hygiene precautions, pest control and effective cleansing and disinfection protocols. The OIE Working Group on Wildlife Diseases stated that 'appropriate compartmentalisation can efficiently avoid cross-contamination of domestic swine, provided that effective measures are used to avoid introduction of contaminated material in pig housing (Artois et al. 2002). Boars are known to break into both domestic pig and farmed wild boar enclosures in order to mate with sows. Outdoor pig enclosures also provide an accessible source of food. Outdoor pig production uses 12-volt electric fencing to contain the livestock, this is unlikely to deter a determined wild boar.

Commercial farming of wild boar began in the 1980s. The 2004 Agricultural Census indicates that there are around 100 holdings with 2,800 breeding sows including boar/domestic pig hybrids. Farmed boar herd sizes range from fewer than ten to over 130 breeding sows. Wild boar farms are distributed throughout England but with bias towards the south-west where there is already free-ranging feral boar and the north-west where there are currently no reports of free-ranging boar.

As all feral boar in England originated from wild boar farms, the location of such farms should be considered significant; however, there are a number of other factors which will influence the likelihood of new feral boar populations becoming established, the most significant being suitable habitat. Although there are a number of wild boar farms and significant farming industry in the north-west of England, the landscape is primarily rolling pasture or moorland rather than deciduous woodland required by boar. In terms of legislation and governance, wild boar farms are subject to the same controls as domestic pigs so all meat produced from these farms is subject to the same meat hygiene practises as domestic pigs and wild boar are subject to the same import controls as domestic pigs. Release or escape of farmed boar should be

considered a risk for the introduction of disease into the feral population.

Boars are naturally shy and reclusive; however, recently, escaped animals and boar/domestic pig hybrids are less timid around man and livestock than truly wild boar or escaped boar which have been established. Use of open habitats such as pasture is mainly limited to night time. Contact with cattle appears to be rare, although there is little evidence available. There is one anecdotal report describing a large male boar disturbing cattle in the forest of Dean and tracks have been found within 5 m of farm buildings in the same area (Wilson, personal communication). There have been no reports in England of free-ranging feral boar scavenging within farm buildings, or from livestock feed troughs but boar are likely to be attracted to easily available feedstuffs, recently escaped boar are likely to be less wary than other boar.

The omnivorous, opportunistic, scavenging behaviour of free-ranging wild boar increases the likelihood of them becoming infected where infected carrion, other wildlife or livestock may be present within their range. The boars' characteristic rooting behaviour makes them susceptible to infection from faeces and possibly other secretions on pasture e.g. urine and saliva from other animals including livestock and wildlife. Feeding on pasture will increase potential direct and indirect contact with livestock, particularly sheep and cattle; therefore, in scenarios where boar spends increased time feeding on pasture, the disease transmission risks would be higher.

Factors influencing incursion of exotic diseases into feral boar from outside England

Due to the stringent controls and well-developed contingency plans in place, exotic disease incursion into Great Britain would be quickly identified and controlled. The risk pathway shows that incursion of these diseases is likely to occur into the domestic pig population and be transmitted to feral boar rather than entering feral boar directly. The exception to this would be food-borne infections which could be introduced into wild boar by illegal feeding of infected meat.

This could be in the form of illegal import of swill to feed domestic pigs which feral boar gained access to, inappropriate disposal of international catering waste from ships and aircraft or through inappropriate disposal of illegal personal food imports. These risks are mitigated by these processes being legally prohibited and having vigilant enforcement agencies. In addition, it is unlikely that boar would be present or gain access to where these products may be disposed of.

In Europe, the import or translocation of boar and subsequent release into the wild for sports hunting is

considered a significant risk and is thought to be the cause of disease outbreaks (Gortazar, personal communication). However, sports hunting is not established in England with culling by land owners in order to manage the deleterious effects of boar being the motivation for feral boar hunting. In addition, much of the range of the feral boar in England is owned by the Forestry Commission where hunting is not permitted. This exposure pathway is therefore considered as of low likelihood.

Factors influencing the impact of exotic diseases on effective disease control following incursion into England's feral boar

The risk pathway analysis demonstrates that exotic disease incursion is more likely to enter via the domestic pig population.

The UK's contingency plan for exotic diseases describes the measures taken to control an outbreak of notifiable diseases <http://www.defra.gov.uk/animalh/diseases/control/contingency/index.htm>.

Based on reports from other countries, if the preventative measures against exotic disease incursion failed and disease entered England and was not controlled, feral boar populations could play a role in the epidemiology and transmission of some diseases. It is possible that additional measures would be required or that controls and mitigating actions would be necessary over a wider area. The boar could directly transmit the disease to uninfected animals thereby increasing the size or duration of an outbreak.

Once disease has been transmitted to the feral boar, it has been confirmed that they can maintain some pathogens in their populations without the intervention of domestic or other wild animals. Although both the domestic pig and wild/feral boar are considered as the same species and basic features of the infection could be identical, risk factors differ widely (Ruiz-Fons et al. 2008). In addition, the literature available often describes disease outbreaks in boar populations in countries which have the disease endemically or have been previously exposed to the disease. In the UK, disease may act differently as the UK population of boar will be naïve to the exotic notifiable diseases.

Wild boar population dynamics have significant effect on the likelihood of the establishment of a disease epidemic or a disease reservoir being established.

An increasing boar population would mean a larger number of hosts available for the transmission of disease and also a higher contact rate between hosts. Although population size is important, high population density and the associated high opportunity of transmission from infected or carrier animals to uninfected or naïve animals is more influential. An increase in the feral boar population in the UK would increase the likelihood of a significant

impact on effective disease control. The key determinants to the extent of this effect would be the nature and extent of the population increase (e.g. increase of numbers within the same range and hence increase in density or increase in numbers over expanded range and thus no change or decrease in population density), and if the population increase occurred in an area where outdoor pig production was common.

A minimum absolute number of individuals sharing the same habitat is necessary for disease persistence. This has been estimated as several hundred individuals. None of the populations in England have currently reached this size. Piglets of less than 1 year are more likely to persistently shed virus and therefore play a major role in disease epidemiology (Laddomada 2000). However, in naïve populations such as those found in England, there is likely to be high mortality in young boar and significant reduction in fertility in sows which might lead to infection being self-limiting. Population density is also significant as contact between susceptible animals is reduced below a level at which the disease can be maintained.

Boar generally live in small social groups consisting of two or three mature females with their most recent litters and the sub-adults from previous litters. Maximum group sizes of 42 individuals have been recorded in Europe with a maximum group size of 28 recorded in England (Moore and Wilson 2005). The size of the group would influence the ability of a disease reservoir to become established. The social structure of feral boar populations may favour the spread of disease as contact rates can be very high in herds, especially when aggregated around food and water sources (Kramer-Scadt et al. 2007).

Home ranges for feral boar vary widely (males, 2.8–25.7 km²; females, 1.4–54.1 km²). Home ranges of social groups overlap and therefore provide potential for mixing of animals and any diseases being carried. Home range size influences potential disease transmission as it indicates the likely movement of infected animals. This is also true of juvenile dispersal which has been recorded as a maximum of 250 km. Radio tracking of 18 juvenile and sub-adult animals in Kent and Ross-on-Wye gave range sizes of 1–9.6 km² and maximum distance tracked from site of capture was 20 km (Moore 2004).

The practicalities of managing free-ranging wild boar through live capture or culling need to be considered and significantly affects the risk assessment. Locating and then effectively managing a feral boar population would be technically challenging, resource intensive and during a disease outbreak may cause further dissemination of susceptible animals. Any interventions may not be effective as the success rates of capture or culling would not be 100% due to the illusive behaviour of the boar and limitations of management techniques used.

Risk analysis

The terminology described in Tables 1, 2 and 3 will apply:

Risk estimation

The overall risk estimation is based on the likelihood of wild boar becoming infected with the specified disease and the consequences for effective disease control resulting from the wild boar becoming infected. These two assessments are combined according to the following method to produce an assessment of overall risk.

The risk estimation was undertaken by reviewing the current disease control policy, legislation and preventative measures in place for each of the diseases and reviewing the scientific literature concerning epidemiology of the selected diseases in free-ranging feral boar and wild pigs and finally considering the information collated in the situation assessment. The impact of disease in feral boar on effective disease control was assessed by identifying the key factors from the situation assessment and assessing likelihood of them occurring. This is summarised in Table 4.

Results and discussion

The complete risk assessment is summarised in Table 5.

Classical swine fever virus (CSF) is of increasing concern in Europe where wild boar plays an important epidemiological role (Artois et al. 2002). Outbreaks of disease in wild boar are generally self-limiting but in some circumstances, the virus circulates for several years (Pol et al. 2008). Epidemiological links between disease outbreaks in wild boar and domestic pigs have been reported. The main sources of CSF outbreaks in Europe have been contact with wild boar, illegal swill feeding and contaminated livestock trucks (Boklund et al. 2008). The disease can be transmitted through consumption of infected meat and meat products and therefore this route of infection must

Table 1 Risk terminology used in this assessment

Term	Definition
Likelihood	Probability; the state or fact of being likely
Likely	Probable; such as well might happen or be true; to be reasonably expected
Negligible	So rare that it does not merit to be considered
Very low	Very rare but cannot be excluded
Low	Rare but does occur
Medium	Occurs regularly
High	Occurs very often

Table 2 Uncertainty categories used in this assessment

Low	Solid and complete data available; strong evidence provided in multiple references; authors report similar conclusions
Medium	Some but no complete data available; evidence provided in small number of references; authors report conclusions that vary from one another
High	Scarce or no data available; evidence not provided in references but rather in unpublished reports or based on observations, or personal communication; authors report conclusions that vary considerably between them

be considered (Laddomada 2000). Indeed the last outbreaks of this disease in England are likely to have originated through this route.

All CSF strains isolated from wild boar in Germany were isolated in the domestic pig populations in the same area and 92% of outbreaks of CSF in pigs were in regions where CSF was endemic in the wild boar populations and 60% of outbreaks were due to direct or indirect contact with wild boar (Artois et al. 2002). This suggests that should disease control measures fail and CSF became established in a population of feral boar in England, it is possible a reservoir would be established that could re-infect domestic pigs.

Boklund et al. (2008) predicted that CSF would be transmitted from domestic pigs to wild boar if the infected pig herd is located less than 5 km away from the wild boar location. In the UK, all the feral boar populations are within 5 km of domestic pig herds. In countries, like England, where the feral boar are free of CSF infection, if an outbreak occurs in domestic pigs and all infected pigs are culled immediately, the feral boar are unlikely to become infected (Klinkenberg et al. 2005).

Information on the epidemiology of foot and mouth disease virus (FMDV) in wild boar is scarce (Ruiz-Fons et al. 2008). It is accepted that wild boar are susceptible to the disease and are capable of transmitting it to livestock (Elbers et al. 2003); however, there is only one field report of an epidemiological link between FMDV infection in wild boar and an outbreak of the disease in livestock (Elbers et al. 2003). In Western Europe, there has been no reports of spill-over of FMDV from domestic livestock to boar in the past 80 years therefore it can be concluded that transmission between livestock and feral boar is very unlikely. However, Peche and Hone (1988) considered that feral pigs were a significant risk to disease control should the disease enter Australia. This suggests that although the establishment of a reservoir is possible, it is less likely than for CSF. FMDV outbreaks have occurred in England in 2001 and 2007, and there have been no evidence of infection in feral boar populations.

Wildlife contributes to FMDV epidemiology by acting as an additional population of susceptible hosts. It has already

Table 3 Risk estimation categories used in this assessment

Likelihood assessment	Impact assessment				
	Negligible	Very low	Low	Medium	High
Negligible	Negligible	Negligible	Very low	Low	Low
Very low	Negligible	Very low	Low	Low	Medium
Low	Very low	Low	Low	Medium	Medium
Medium	Low	Low	Medium	Medium	High
High	Low	Medium	Medium	High	High

been proposed that feral boar in England have limited contact with livestock but contact with wild deer species is likely to be higher and feral boar could contribute to establishment of a wildlife reservoir through transmission to deer species especially as pig species are considered virus amplifiers and secrete significant amounts of virus via aerosol. However, surveillance in deer during and after FMDV outbreaks has demonstrated that infection in deer is very rare and there is little evidence to suggest that deer are likely to be a reservoir of FMDV either (Gibbs et al. 1975; Simpson 2002; Wilesmith 2001).

Information on density of wild boar required to maintain infection is only available for two diseases, classical swine fever and foot and mouth disease. For the former, a density of three boars per square kilometre (Moore 2004; Zanardi et al. 2003) and for the latter, a density of 2.3–14 boars per square kilometre (Peché and Hone 1988) is required to maintain the disease in wild boar and therefore act as a reservoir of disease for domestic pigs.

At current population size and density, it is unlikely that even if CSF or FMDV did enter feral boar populations, it would be perpetuated in order for these boars to become a

reservoir of infection. However, if populations did increase if an outbreak of disease was not contained and entered wild boar populations in southern England, there would be potential for a reservoir of disease to be established for CSF and FMDV.

African swine fever virus (ASFV) is able to infect both domestic pigs and feral boar and can also replicate in soft ticks of the genus *Ornithodoros* (Laddomada et al. 1994). This virus spread from domestic pigs to wild boar in Spain and Sardinia resulting in both peracute and acute disease progressing to sub-acute infection (Perez et al. 1998). The onset of an ASFV outbreak in wild boars would be likely to result in high mortality. No seropositive boar has been reported in areas where the domestic pig is free of disease (Laddomada et al. 1994; Perez et al. 1998). In the naive feral boar populations in England, clinical disease and high mortality is likely and it is possible that the boar could contribute to disease spread and persistence as seen in a current outbreak in Azerbaijan. Tick species capable of transmitting ASFV are not found in the UK. This disease can also be transmitted through pig products and therefore these routes should be considered.

Table 4 Impact assessment

Disease	Likelihood of transmission from boar to boar	Likelihood feral boar become a reservoir of disease	Likelihood that infected feral boar would transmit disease to livestock	Likelihood confirmation of disease in feral boar would cause additional disease control measures to be required	Likelihood confirmation of disease in feral boar would require disease control measures to overcome an increase geographical area	Likelihood that confirmation of disease in feral boar in England would negatively impact trade of pig products	Overall assessment of impact
Classical swine fever	Medium	Low	High	High	High	High	High
African swine fever	Medium	Low	Low	High	High	High	Medium
Foot and mouth disease	Low	Low	Low	Medium	Medium	High	Medium
Swine vesicular disease	Low	Low	Very low	Low	Low	High	Low
Vesicular stomatitis	Low	Low	Low	Low	Low	Medium	Low
Aujeszky's disease	Medium	Medium	Medium	Low	Low	Medium	Medium
<i>Trichinella</i> sp.	Medium	High	Very low	Low	Low	High	Medium
<i>Brucella suis</i>	Medium	High	Medium	Low	Low	Medium	Medium

Table 5 Summary of risk assessment

Disease	Likelihood of incursion of exotic diseases directly into the free-ranging wild boar population	Impact on effective disease control and eradication following exotic disease incursion into domestic livestock and subsequent transmission to feral boar	Overall risk assessment	Uncertainty
Classical swine fever	Low	High	Medium	Medium
African swine fever	Low	Medium	Medium	Medium
Foot and mouth disease	Low	Medium	Medium	Medium
Swine vesicular disease	Low	Low	Low	High
Vesicular stomatitis	Low	Low	Low	Medium
Aujeszky's disease	Low	Medium	Medium	High
<i>Trichinella</i> sp.	Medium	Medium	Medium	Low
<i>Brucella suis</i>	Low	Medium	Medium	Medium

Swine vesicular disease has only been identified rarely on serological surveys of wild boar in Europe and boar are therefore not considered an important reservoir of this disease (Elbers et al. 2000). A serological survey of 362 wild boars in the Czech Republic found no evidence of infection (Sedlak et al. 2008). However, little work has been undertaken on this disease in wild boar and therefore the role of feral boar in the epidemiology of an outbreak in a naive population is unknown (Ruiz-Fons et al. 2008).

Vesicular stomatitis virus is endemic in some populations of feral pigs in North America with sporadic transmission to domestic pigs. In a comprehensive review of viral infections in European wild boar, no specific references to this disease were included (Ruiz-Fons et al. 2008) and therefore it is likely that this disease is not a significant risk.

Aujeszky's disease virus infects both domestic pigs and wild boar as natural hosts (Ruiz-Fons et al. 2008). The disease has been identified in boar serologically (Ruiz-Fons et al. 2007; Sedlak et al. 2008; Vincente et al. 2005) and clinically (Gortazar et al. 2002; Muller et al. 2000). Disease transmission from domestic pigs to feral boar and vice versa has been demonstrated in experimental infections (Tozzini et al. 1982; Muller et al. 2001) and transmission from boar has been suggested as the cause of outbreaks in domestic pigs (Sedlak et al. 2008). However, others rejected transmission from boar as the source of infection (Muller et al. 2000). There is general consensus though that free-ranging boar have the potential to act as a reservoir of infection, that the disease can establish in populations as a latent infection which can lead to consequent virus excretion and transmission by the oral/nasal and venereal routes of infection are important (Gortazar et al. 2002; Lari et al. 2006; Ruiz-Fons et al. 2008). Despite the conflicting evidence, it appears that in areas where the domestic pig

population is free from disease, it is uncommon for feral boar to be infected and reports of transmission from feral boar to domestic pigs are far rarer than vice versa and the strain of virus in feral boar are sometimes of low virulence or attenuated (Leuenberger et al. 2007; Ruiz-Fons et al. 2007). An association between increasing densities of wild boar and prevalence of Aujeszky's disease was identified in Spain (Vincente et al. 2005).

Aujeszky's disease was eradicated from Great Britain in 1991 (last case in 1989) and despite continuing imports of pigs for breeding, production and slaughter, including some pigs from countries with endemic disease, Aujeszky's diseases has not been re-introduced. Serological surveillance is carried out on boars at slaughter houses as an additional measure, and those pigs that enter Great Britain for breeding or production are randomly tested. No such tests conducted during 2008 detected any positive cases. This suggests that there is a low risk of incursion into the boar population and an uncertain impact on the country's ability to regain disease freedom following re-introduction but that resources and effort would be needed to establish if disease was present in the feral boar population.

Domestic pigs and feral boar could become infected by *Trichinella* species through consumption of infected meat. The UK has undertaken a surveillance programme in the intermediate host *Vulpes vulpes* with negative results since 1979. The disease is however widespread in Europe (De Bruyne et al. 2006). However, illegal imports of infected meat products inadvertently fed to feral boar could occur particularly through non-commercial importations. Introduction of this parasite into the UK would have significant impact on public confidence in pork products and additional carcass testing and surveillance costs would cause increase in costs to the pig farming industry.

Brucella suis prevalence in European domestic pigs is low but is widespread in wild boar (Godfroid 2002). A seroprevalence of 12% has been reported in wild boar in Germany (Melzer et al. 2007) and 30% in Switzerland (Leuenberger et al. 2007). Wild boars are often subclinically infected. The disease has re-emerged in outdoor-reared pigs as a result of spill-over from wild boars in France (Leuenberger et al. 2007). The disease is principally transmitted through contact with foetal membranes and post-parturient discharges (Godfroid 2002). *B. suis* could be transmitted between domestic pigs and wild boar; however, the UK domestic pig population has been free of the disease for many years and the feral boar population originates from wild boar farms which are subject to the same testing and disease control measures the likelihood of infection is low. In addition, there are national surveillance schemes in domestic pigs for *B. suis*.

Conclusions

The overall likelihood of exotic disease occurring in feral boar in England is *low*. This is primarily influenced by the low risk of incursion of exotic disease generally into the UK. Risk assessments supporting this position can be found at www.defra.gov.uk/animalh/diseases/monitoring/riskassess.htm.

The risk of most concern was considered to be through oral consumption of illegally imported pig products. The risks of incursion are mitigated by a suite of legally enforced measures such as import restrictions, veterinary certifications and inspections.

If exotic disease did enter the feral boar population the impact on effective disease control is dependent on if disease reservoirs in boar are established, the control measures necessary, the practicality of achieving these measures and the extent of the impact on the trade of livestock and livestock products.

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