Feral wild boar in England:

An action plan

Forestry Commission England

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Published by the Department for Environment, Food and Rural Affairs

Contents

Executive summary

1. This document explains Defra's policy on the management of feral wild boar populations and outlines who will have responsibility for its delivery. It follows on from the Defra public consultation 'Feral Wild Boar in England' held between 2 September 2005 and 6 January 2006 and draws on two risk assessments on the likely impacts of feral wild boar.

2. Defra's underlying strategy for managing wildlife starts from the basis of no government intervention, with intervention only where there is a sound reason and evidence for doing so. Where conflicting priorities occur they need to be balanced to ensure the most appropriate outcome which reflects Defra's key aims.

3. On the basis of the risk assessments, Defra considers regional management to be the most appropriate approach given the current numbers of feral wild boar.

Defra policy is that primary responsibility for feral wild boar management lies with local communities and individual landowners. However, Government will help facilitate this regional management through the provision of advice and guidance.

4. We have secured the agreement of our delivery partners to implement the attached action plan. The plan includes some monitoring of the population to help highlight increases in the number and spread of local populations which may impact on Defra's intermediate outcomes. Defra will review the effectiveness of this action plan after 3 years taking into account any further available evidence.

Introduction

5. Wild boar became extinct in England at least 300 years ago. However, over recent years a small number of feral wild boar populations have become established as a result of escapes and deliberate releases from wild boar farms.

Image courtesy of C. J. Wilson

6. There are three established feral breeding populations; the largest, in Kent/Sussex was estimated in 2004 at approximately 200 animals in the core distribution area, the second largest in the Forest of Dean/Ross on Wye area, where there may be in excess of 50 animals, and the smallest, in west Dorset, where there are still believed to be fewer than 50 animals. Since winter 2005/6 significant escapes/releases have resulted in animals colonising areas around the fringes of Dartmoor and evidence of breeding in the wild has been recorded (Natural England data). These are considered as an additional single new breeding population and it is currently estimated (Natural England estimate, based on reports and records) that there are up to around 50 animals in this population. There have also been further release incidents in Devon in 2007, potentially resulting in many 10s of animals being left in the wild. The English feral wild boar population is estimated at probably no more than around 500 in the established populations, and almost certainly fewer than 1000 in total.

7. Wild boar are capable of rapid population increases due to the early onset of sexual maturity, their ability to have large litters and potential to breed more than once a year. They are also able to disperse widely and with the exception of young piglets, have no natural predators in England. Although some people enjoy seeing boar in the countryside the species has the potential to have significant negative impacts on agriculture and conservation. Nevertheless around 20 years after the release of the wild boar that led to the first known established population in England, total numbers of feral wild boar in England remain relatively small.

8. This document outlines the Government's approach for the management of feral wild boar in England. The policy covers both feral wild boar and wild boar hybrids as it is often not possible to distinguish between them in the field. The strategy takes account of the potential positive benefits of this species and the need to mitigate the negative impacts they may have on the environment.

The impact of feral wild boar in England

9. The English countryside and our way of life have changed substantially since wild boar became extinct and there is therefore a degree of uncertainty concerning the impacts the re-established boar population may have. Due to the limited information available on the impacts of feral wild boar, Defra commissioned two risk assessments, (one on livestock disease and the other on risks to biodiversity, agricultural damage, human health & safety etc) (see annexes Hartley, 2007; Wilson, 2007).

10. The risk assessments concluded that it was likely that the species will become more widely established in England. In time, unless positive efforts are made to prevent it, the species is likely to become established in suitable habitat throughout much of England, however, this could take 20-30+ years. The most significant impact is likely to be on disease control if wild boar become involved in the transmission of an exotic disease such as Classical Swine Fever or Foot and Mouth disease. However, the risk assessment considered the likelihood of this occurring to be low.

11. At moderate densities, environmental impact is likely to be minor or beneficial. Whereas economic impacts, such as agricultural damage, are likely to become significant at the local scale in the longer term if the population spreads and increases substantially. However, this is likely to be small in comparison to agricultural damage from more common wildlife such as rabbits (estimated at £115M pa[1]).

Possible policy options

12. We considered three main possible policy approaches to the management of feral wild boar; 1) no management, 2) a proactive government led national eradication and 3) regional management to address local concerns.

13. On the basis of the risk assessments, Defra considers regional management to be the most appropriate approach given the current numbers of feral wild boar. Therefore, **Defra policy is that primary responsibility for feral wild boar management lies with local communities and individual landowners. However, Government will help facilitate this regional management through the provision of advice and guidance.**

[1] Smith GC, Garthwaite DG, Prickett AJ (2006) Rabbit Control on Great Britain. In: Feare CJ, Cowan DP ed. Advances in vertebrate pest management IV, Vol IV. Furth, Germany:Filander Verlag pp 165–174.

Action plan: Roles and responsibilities

14. Currently, Government and its agencies fulfil a number of roles regarding the management of wild mammals in England:

- **Provision of appropriate regulations (including legislation);**
- **Disease control**
- **Co-ordinating and supporting the provision of advice;**
- **Commitment to conserving and enhancing native biodiversity;**
- **Setting food standards;**
- **Carrying out research and monitoring; and**
- **Practising exemplary management on public estates.**

15. These roles are reflected in the action plan.

Ensuring high quality advice

16. The Defra family in partnership with the Deer Initiative[2] (DI) will coordinate a range of authoritative advice regarding feral wild boar which will include:

- Guidance for land managers on the impacts of wild boar and their management. (DI & Natural England)
- Guidance on welfare such as minimum recommended firearm calibres. (DI & Natural England)
- Guidance on best practice and safe shooting. (DI)
- Guidance on carcass handling including meat for human consumption and waste disposal. (DI & Food Standards Agency (FSA))
- Advice to aid hunters, gamekeepers and stalkers in disease identification. (DI, FSA & Defra)
- Public awareness of wild boar including safety advice. (DI & Natural England)
- Advice on dealing with wounded wild boar. (DI)
- Advice for keepers of wild boar and Local Authorities to minimise the risk of further escapes. (DI, Local Authorities Coordinators Of Regulatory Services (LACORS) & Natural England)

Regulation and Legislation

17. Aside from general protection afforded to mammals in the wild, feral wild boar do not have any specific legal protection in England.

[2] The Deer Initiative is a broad partnership of statutory, voluntary and private interests dedicated to ensuring the delivery of a sustainable, well-managed wild deer population in England and Wales.

Welfare

18. There is some concern over the appropriateness of certain firearms/ ammunition being used to shoot feral wild boar. Certain firearms (e.g. low calibre rifles and shotguns) pose a potential risk to animal welfare and to public health and safety from injured animals. Currently there is no legislative vehicle under which specific welfare protection for feral wild boar can be introduced.

Keeping of Wild boar

- **The Deer Initiative in collaboration with Natural England will provide guidance on appropriate firearms/ ammunition. Should voluntary regulation not prove effective, Defra will consider introducing mandatory regulation.**

19. The keeping of wild boar is covered by the Dangerous Wild Animals Act 1976 which contains provision for Local Authorities (District Councils/ Unitary Authorities) to licence their keeping and specify conditions in the licence such as minimum fencing requirements. The Act requires that the conditions of a licence are written in such a way as to ensure that the animal is held in secure accommodation from which it will not escape. Failure to meet the licence conditions is an offence under the Act. We do not propose to change this licensing regime at this time.

Release into the Wild

20. Defra does not condone the illegal release of wild boar into the English countryside. We also expect farmers and other individuals, who keep wild boar, to continue to minimise the risk of accidental release into the wild by ensuring enclosures are adequate to prevent escapes.

21. Defra is currently consulting[3] on whether wild boar should be added to schedule 9 of the Wildlife and Countryside Act, 1981. This would make it an offence to release or allow wild boar to escape into the wild. We will make appropriate changes following the outcome of the consultation.

Disease control

22. Although wild boar are susceptible to and can transmit endemic diseases, the low likelihood of contact between feral wild boar and domestic pigs means that feral wild boar will not significantly impact on the ability to control endemic diseases nationally. Endemic disease control on a local basis may be influenced by wild boar but with the use of biosecurity measures and feral wild boar population control individual farmers can act to mitigate these risks on their holding.

Image courtesty of C. J. Wilson

23. The most significant impact of the feral wild boar population in England on disease risks is likely to be associated with the incursion and maintenance of exotic notifiable diseases. Should an exotic notifiable disease become established in the feral wild boar population the impact could be high. **However the likelihood of this occurring is considered low.**

[3] Copy to come????

24. The primary tool to protect against exotic notifiable disease risks is through the maintenance of the existing and extremely effective mechanisms currently in place (import controls). These measures, in conjunction with farm biosecurity, especially on the increasing number of outdoor pig units, protect the UK livestock population from exotic diseases.

- **Defra is committed to the maintenance and improvement of the current import controls**

25. Regardless of the low risk of disease incursion into the feral wild boar populations it is still important that hunters, stalkers and land mangers remain vigilant for notifiable diseases.

- **Defra in conjunction with the Deer Initiative will produce guidance on the identification of important diseases in feral wild boar.**

26. Co-ordinating and supporting the provision of advice

27. Defra will ensure appropriate advice on the management of feral wild boar is available. This will be delivered mainly through the Defra partners such as the Deer Initiative, Natural England, the Food Standards Agency and LACORS. As well as the provision of specific advice mentioned under the specific headings in this document:

- **Natural England will continue to provide technical advice on wild boar management.**
- **The Deer Initiative in collaboration with LACORS and Natural England will provide advice on secure fencing specifications for use at wild boar farms.**
- **The Deer Initiative will play a coordinating role in the provision of advice.**

Commitment to conserving and enhancing native biodiversity

28. Defra's Biodiversity strategy 'Working with the Grain of Nature' outlines the Governments partnership approach to English biodiversity which comprises a combination of:

- Protecting the best wildlife sites
- Promoting the recovery of declining species and habitats
- Embedding biodiversity in all sectors of policy and decision-making.
- Enthusing people
- Developing the evidence base

- **Natural England will advise the Government on any threats feral wild boar pose to native biodiversity and aim to minimise any such threats on land managed by them.**

Setting food standards

29. When shot, feral wild boar are generally kept for personal consumption or enter the human food chain. As with any quarry species it is important to ensure that the best food and hygiene standards are met. The Food Standards Agency will lead with respect to food hygiene issues regarding feral wild boar shot for human consumption:

- The FSA will provide advice on public health & hygiene issues, including EU hygiene regulations.
- The FSA will supply Trichinella testing kits for sampling feral wild boar entering the human food chain.

Research, evaluation and monitoring

30. Due to a paucity of information about the impacts of wild boar in England there is a continued need to monitor feral wild boar populations and the impacts they have.

- Natural England will continue to monitor current wild boar populations, the incidence of new releases and the impacts of wild boar reported to them.
- Defra will investigate the potential for enhanced monitoring of the impacts of wild boar if Natural England advise this is appropriate.
- The Deer Initiative in collaboration with DfT's Highways Agency will widen the current monitoring project looking at road traffic accidents involving deer to include data on wild boar.
- Defra will continue to fund research on the development of fertility control for use in managing wild mammal populations: Wild boar being one such mammal to which this technique may be applicable.

Management of public estates land

31. The Government is a significant landowner, especially of forestry and linear woodland such as the highways estate which can provide good habitat for feral wild boar.

- The Defra family will therefore continue to manage feral wild boar on its land ensuring best practice at all times, including cooperative management with adjacent landowners where appropriate and practical.

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SURVEILLANCE, ZOONOSIS, EPIDEMIOLOGY & RISK UNIT

Food and Farming Group

Qualitative Risk Assessments

DISEASE RISKS FROM WILD BOAR:

LIKELIHOOD AND IMPACTS OF TRANSMISSION OF SELECTED INFECTIOUS DISEASES BETWEEN FREE-RANGING WILD BOAR, HUMANS AND DOMESTIC LIVESTOCK IN ENGLAND.

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Contents

1. Executive Summary

DISEASE RISKS FROM WILD BOAR: Likelihood and impacts of transmission of selected infectious diseases between free-ranging wild boar, humans and domestic livestock in England.

This Qualitative Veterinary Risk Assessment considers four potential scenarios in which free-ranging wild boar may impact on the transmission and control of infectious diseases. A risk assessment for each is reached by considering the likelihood of the scenario occurring and the impact associated with this event. The four scenarios are described below:

- Incursion of exotic diseases directly into the free-ranging wild boar population. (Assessment A)
- Impact on effective diseases control following transmission of exotic disease to wild boar following incursion into domestic livestock. (Assessment B)
- Impact on disease management of endemic diseases common to wild boar and domestic livestock. (Assessment C)
- Zoonotic disease risk. (Risk of disease transmission to humans from infected wild boar or wild boar products) (Assessment D)

In addition the impact of an increase in the population size, density or distribution on each of these scenarios was investigated.

Three categories of diseases were considered; exotic notifiable diseases (which may also be zoonotic), endemic zoonotic diseases and endemic livestock diseases. It was concluded that the most significant risks associated with wild boar came from the potential impact on an exotic notifiable disease incursion.

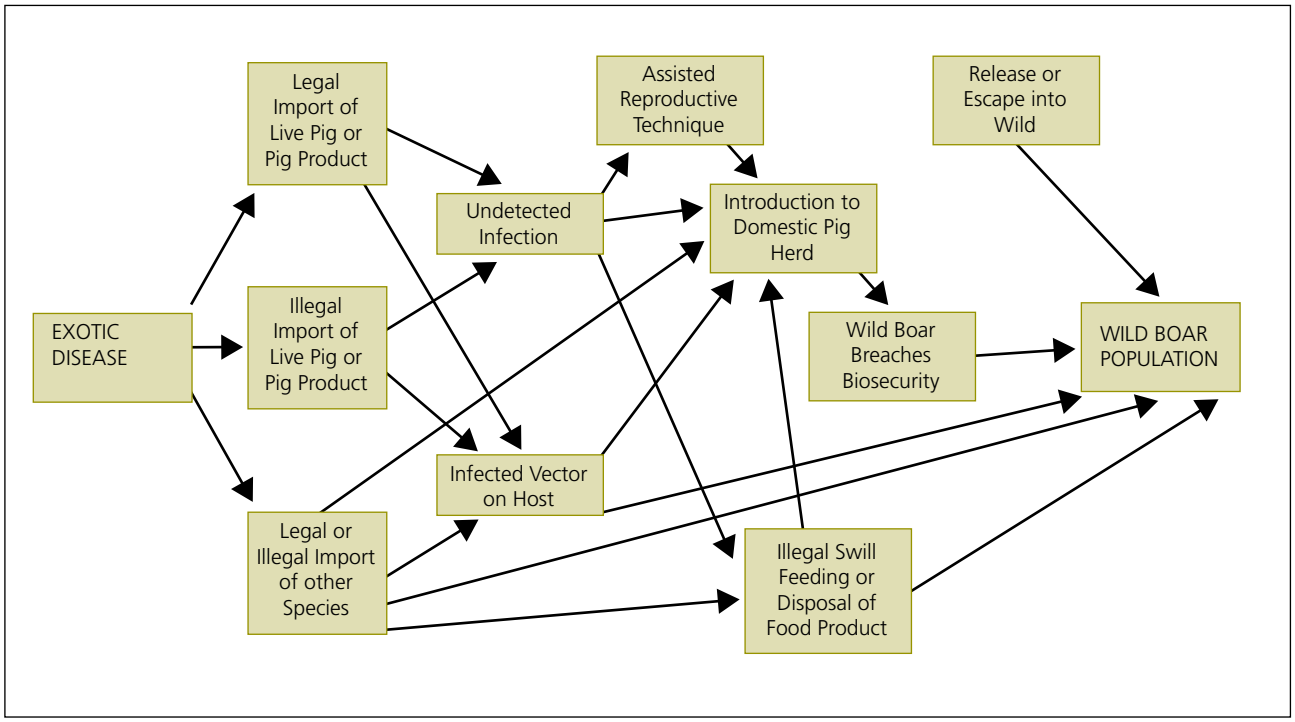
In order to determine potential risk pathways for disease incursion it is necessary to consider the method of transmission for each of the diseases included. It was concluded that the greatest risks of exotic disease incursion into the UK were associated with disease entering through the consumption 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*.

The ecology of the wild boar has considerable relevance to disease transmission and disease control. The salient points identified were that boar social structure may favour spread of disease as contact rates can be very high especially when localised around food and water sources. In addition home ranges can be very large and can overlap with other populations providing potential for mixing of animals. In addition juveniles can disperse over considerable distances. Habitat preference is woodland and woodland edge with 92% of time spent in these areas. This preference will influence current and future distribution of wild boar. The boars' omnivorous, opportunistic, scavenging behaviour increases the likelihood of boar becoming infected where there is infected wildlife or livestock in their range. This behaviour also increases risk from faeces and other secretions deposited on pasture. Boar are naturally shy and reclusive and contact between boar and livestock, humans and pet dogs are rare. There have been no confirmed reports of boar scavenging in farm buildings or feed troughs although boar will be attracted by easily available food.

Free-ranging boar will be attracted into outdoor domestic pig holdings by the available food, social interaction and reproductive behaviour. Current pig fencing is unlikely to deter a determined wild boar. This interaction is of particular concern as diseases may be transmitted in either direction. Biosecurity measures and effective exclusion are essential. This will be increasingly important as the number of outdoor pig herds increase.

The following diagram demonstrates disease incursion pathways into the wild boar population and the current control points in these pathways. This is a summary of Figures 5 and 6.

Simplified risk pathway for incursion of exotic diseases into the free-ranging wild boar population in England.



Disease incursion into the UK is likely to enter the domestic pig population and then be transmitted to boar. This risk can be mitigated by maintaining and enforcing current disease control procedures and maximising biosecurity on domestic pig holdings. Should exotic disease incursion occur it is likely that it would be identified and rapidly controlled in domestic livestock before transmission to wildlife such as boar.

Based on reports from other countries, if the preventative measures against exotic disease incursion failed and disease entered GB and was not controlled, wild boar populations could play a role in the epidemiology and transmission of some diseases. In these cases wild boar would need to be considered in the disease control plans. This is dependent on the susceptibility of wild boar to the specific disease and the transmission rates between boar populations and boar and domestic pigs. In addition the information 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. The likelihood of exotic disease incursion has been summarised as being generally **LOW**.

The impact should incursion occur has been summarised as generally being **MEDIUM**. This reasons for this include the ecology and behaviour of the boar and the practicalities of restricting boar movements, locating infected animals and managing infected boar populations effectively.

Due to the natural behaviour of wild boar interaction with the general public and therefore risk of zoonotic diseases would be low. However hunters would be exposed to higher risk especially if consuming the meat. The likelihood of zoonotic disease transmission is considered **VERY LOW**. The impact assessment should this occur would be **HIGH** due to the morbidity or mortality to human populations and impacts on the pig industry through loss of public confidence and increased disease control requirements.

An increase in population of feral wild boar would affect disease risk if exotic diseases entered the wild boar population. The key determinates 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. Thus very localised differences in these factors will affect disease risk.

Further assessment can be made by assuming a population increase and distribution predicted by Moore and Wilson (2005) of 3.5-5boar/km2 and a population of between 6,300 and 9,000 boar. This population size and density would be reached in 2025. This presumes that the population is not subjected to culling. 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.

There is insufficient data to predict the impact of population increases on the control of other diseases.

The likelihood of exotic disease outbreaks occurring in wild boar **remains LOW** despite increases in population size, density and distribution. However the impact resulting from disease incursion and transmission from domestic stock would be **HIGH**.

2. Introduction

Wild boar are susceptible to the same diseases as domestic pigs and therefore have the potential to impact on infectious disease epidemiology and control. Diseases in wild boar have been studied across the world but with focus on the economically important diseases such as Classical Swine Fever (CSF), Foot and Mouth Disease Virus (FMDV) and Aujesky's Disease. However there are still significant gaps in our knowledge of the epidemiology of disease in wild boar.

3. Hazard Identification

This analysis considers four key scenarios in which wild boar may influence infectious disease epidemiology.

- Incursion of exotic diseases directly into the free-ranging wild boar population. (Assessment A)
- Impact on effective diseases control following transmission of exotic disease to wild boar following incursion into domestic livestock. (Assessment B)
- Impact on disease management of endemic diseases common to wild boar and domestic livestock. (Assessment C)
- Zoonotic disease risk. (Risk of disease transmission to humans from infected wild boar or wild boar products.) (Assessment D)

In addition it is necessary to consider how the risk may be changed by an increase in the wild boar population. However this is highly variable depending on the extent of any population increases, the population densities reached and the geographical spread of this increase. For example the English boar population could increase but remain in the current locations thus increasing population densities or the English boar population could increase whilst at the same time increasing its distribution thus leading to a decreased population density. These two scenarios are likely to have very different consequences on disease epidemiology.

4. Risk Assessment

4.1 Situation Assessment

4.1.1 The Diseases

The diseases selected for this VRA have a peer-reviewed scientific evidence base on which to ground this work. Other diseases may be found in wild boar but little or no information is available and therefore cannot be assessed.

4.1.1.1 Classification of diseases

Exotic Notifiable Diseases: A notifiable disease is a disease named in section 88 of the Animal Health Act 1981 or an Order made under that Act. Any person having in their possession or under their charge an animal affected or suspected of having one of these diseases must, with all practicable speed, notify that fact to Animal Health (formerly The State Veterinary Service). Government is responsible for management of exotic notifiable disease outbreaks.

Zoonotic Disease: Diseases which are "naturally transmitted between vertebrate animals and man". A zoonotic agent may be a bacterium, virus, fungus, parasite, or other communicable agent. Government has responsibility for protection of public health and therefore is responsible for the control of many of these diseases.

Non-Zoonotic Endemic Livestock Diseases: These are diseases which are not naturally transmitted between vertebrate animals and man, and are recognised as being present in British livestock. The diseases are not under statutory control. These diseases can have significant economic consequences. Government policy is that the control programmes for these diseases should be largely managed by the individual farmer or industry.

4.1.1.2 Disease Transmission

Disease transmissions methods as used in this analysis are described below.

Direct Contact: Direct contact transmission requires physical contact between an infected animal and a susceptible animal, and the physical transfer of micro organisms. Direct contact includes bodily contact, sexual contact or contact with bodily secretions including blood, saliva and other discharges.

Indirect Contact: Indirect contact transmission refers to situations where the transmission of the disease does not involve direct contact between animals. Indirect contact transmission occurs when a susceptible animal is infected from contact with a contaminated inanimate object such as tools, vehicles or bedding material or contaminated biological material such as urine, blood, saliva and other discharges not on the infected animal at the time of contact. Some organisms are capable of surviving outside a host for an extended period of time. Diseases are also capable of surviving in the environment; this may be in a specific lifestyle stage such as parasitic larvae, bacterial spore or a resistant virus particle.

Indirect contact can be further described as below.

- **Airborne:** Airborne transmission refers to situations where disease is passed from one animal to another through the air without direct contact between the animals. Droplet or dust particles containing microorganisms can remain suspended in air for long periods of time. Airborne transmission allows organisms to enter the upper and lower respiratory tracts.

- **Faeco-oral:** Faecal-oral transmission is usually associated with organisms that infect the digestive system. Micro organisms enter the body through ingestion of contaminated food and water. Inside the digestive system (usually within the intestines) these micro organisms multiply and are shed from the body in faeces.
- **Food-borne:** The disease is transmitted by consumption of infected meat. This is an important method of disease in wild boar as they are opportunistic scavengers. This also includes consumption of infected water.
- **Vector:** Vectors are animals that are capable of transmitting diseases but which do not themselves suffer from the disease. This may be by becoming infected but not becoming ill or by mechanical transmission. Examples of vectors are flies, mites, fleas and ticks, rats, and dogs. It is important to study the behaviour of the vector as well as the disease-causing micro organism in order to establish a proper method of disease prevention.

Figure 1: Disease Transmission Table

Disease	Notifiable	Zoonotic	Endemic	Methods of Transmission to Boar	Methods of Trans-mission from Boar to Humans	Methods of Transmission from Boar to Livestock including domestic pigs
Classical Swine Fever	Yes	No	No	Direct Contact Indirect Contact Food-borne	N/A	Direct Contact Indirect Contact Food-borne
African Swine Fever	Yes	No	No	Direct Contact Indirect Contact Food-borne Vectors (ticks)	N/A	Direct Contact Indirect Contact Food-borne Vectors (ticks)
Foot and Mouth Disease	Yes	No	No	Direct Contact Indirect Contact Airborne Food-borne	N/A	Direct Contact Indirect Contact Airborne Food-borne
Swine Vesicular Disease	Yes	No	No	Direct Contact Indirect Contact	N/A	Direct Contact Indirect Contact
Vesicular Stomatitis	Yes	Yes	No	Direct Contact Indirect Contact	N/A	Direct Contact Indirect Contact
Aujeszky's Disease	Yes	No	No	Airborne Direct Contact Indirect Contact	N/A	Airborne Direct Contact Indirect Contact
Bovine Tuberculosis	Yes	Yes (Rare)	Yes	Direct Contact Food-borne	Direct Contact Food-borne	Direct Contact Food-borne

Figure 1: Disease Transmission Table *(continued)*

Disease	Notifiable	Zoonotic	Endemic	Methods of Transmission to Boar	Methods of Trans-mission from Boar to Humans	Methods of Transmission from Boar to Livestock including domestic pigs
Anthrax	Yes	Yes	Yes	Direct Contact Indirect Contact Food-borne	Direct Contact Indirect Contact Food-borne	Direct Contact Indirect Contact Food-borne
Rabies	Yes	Yes	No	Direct – Saliva of infected animal	Direct – Saliva of infected animal	Direct – Saliva of infected animal
Rinderpest	Yes	No	No	Airborne Direct Contact	N/A	Airborne Direct Contact
Trichinella sp.	No	Yes	No	Food-borne	Food-borne	Food-borne
Taenia solium	No	Yes	No	Faeco-oral	Food-borne	N/A
Echinococcus granulosus	No	Yes	Yes	Faeco-oral (from infected canine host)	Food-borne	Food-borne
Brucella suis	No	Yes	No	Direct Contact Food-borne	Direct Contact Food-borne	Direct Contact Food-borne
Post–weaning Multisystemic Wasting Syndrome and Porcine Dermatitis and Nephropathy Syndrome	No	No	Yes	Unknown	N/A	Unknown
Salmonellosis	No	Yes	Yes	Faeco-oral	Faeco-oral	Faeco –oral

4.12 The Hosts

4.1.2.1 Wild Boar

Definition

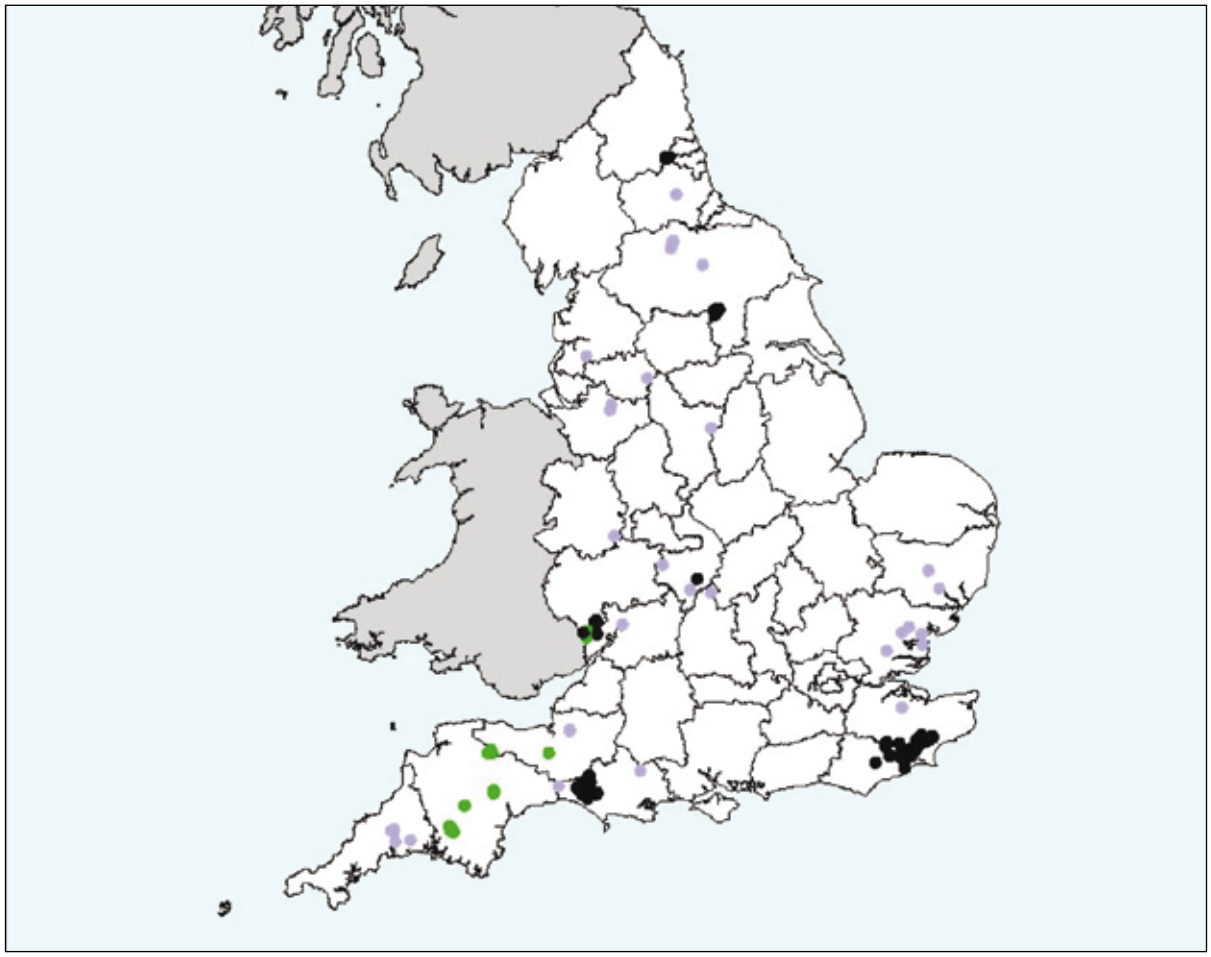
It is assumed that farmed wild boar will have the same disease risk profile as pigs in outdoor managed units, and are therefore considered as 'farmed pigs' in this document. This assessment refers to free-ranging wild boar but is relevant to feral domestic pigs or hybrids however it should be noted that feral pigs have been demonstrated to have reduced avoidance behaviour and higher fecundity than true wild boar and thus this should be considered when reviewing this assessment.

Geographical location

Free-ranging populations of wild boar have become established in areas of England as demonstrated in figure 2.

Figure 2: Distribution of reports of feral pigs/free-ranging wild boar in England from 1980 to June 2006

(Reproduced from Update Report on Distribution and Status of Feral Wild Boar in England, C J Wilson, National Wildlife Management Team, Rural Development Service. August 2006)



Note: Black dots indicate animals possibly still present at the end of each reporting period (there is some doubt about those in Yorkshire and Tyne & Wear still being present; green dots show records where animals believed possibly still present but associated with new releases/escapes since the beginning of 2003; pale blue dots show areas where animals believed no longer present.

There is no published information on the distribution of wild boar in Wales and Scotland however there has been reported sighting in Wales thought to originate from the Wye Valley population.

Behaviour and Ecology

Abundance and distribution: as discussed above. The risk is the opportunity for disease spread in high density populations. Due to their social nature, high reproductive rate and generalist food requirements, wild boar can readily reach high densities if uncontrolled.

Currently there are three significant wild boar populations:

The largest population of wild boar is found in Kent/East Sussex and is estimated at 200 animals. The overall range is estimated at 164km^2 with a population density of 5 boar/km^2 (Wilson, 2006).

The West Dorset population is estimated to be fewer than 50 animals at a density of 1.1boar/km^2 (Wilson 2006). 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).

Social groups: Wild 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. The size of the group would influence the ability of a disease reservoir to become established. The social structure of wild 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. Wild boar also show responses to food availability by increasing reproduction. Young pigs are numerous and are also most vulnerable to disease being naive and having less well developed immune systems (Kramer-Scadt et al, 2007).

Home range and dispersal: Home ranges for wild boar vary widely (Males 2.8-25.7km^2, Females 1.4-54.1km^2). Some individuals have an annual home range of 154km^2. 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 250km. Radio-tracking of 18 juvenile and sub-adult animals in Kent and Ross-on-Wye gave range sizes of 1-9.6km^2 and maximum distance tracked from site of capture was 20km (Moore, 2004).

Habitat: Free-ranging wild boar show a preference for woodland and woodland edge however boar feed on pasture on a regular basis, though this will be reduced when sufficient food can be found in woodland e.g. autumn beechmast/acorns and increased during the summer months when there is increased undergrowth. Sufficient undergrowth is especially important during daytime and for sows with young. Moore (2004) reported that 65% of the boars' time is spent in woodland and 92% of time is spent in woodland and within 50m of woodland edge.

Feeding behaviour: 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 spend increased time feeding on pasture the disease transmission risks would be higher.

Interaction with outdoor pigs or farmed wild boar: Free-ranging wild boar 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.

Interaction with other livestock: Wild boar 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 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 5m of farm buildings in the same area (Wilson – personnel communication). Feral pigs are known to predate on lambs – this has not been reported in England but a common problem Australia – but this behaviour has not been recorded in wild boar. There have been no reports of free-ranging wild boar scavenging within farm buildings, or from livestock feed troughs but boar are likely to be attracted to easily available feedstuffs and again, recently escaped boar and hybrids are likely to be less wary than other boar.

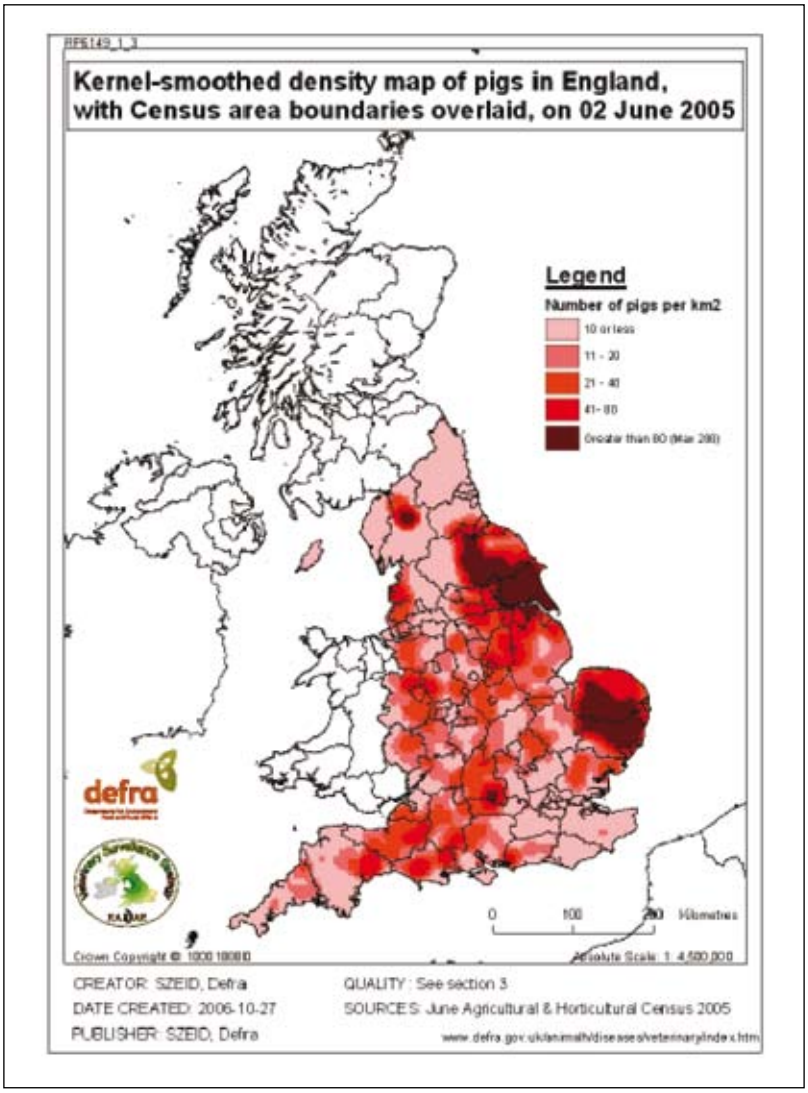
Interaction with companion animals: Due to their shy nature the likelihood of wild boar interacting with pet dogs is low although this becomes much more likely when the boar are recent escapes and in areas with high public access. In the Forest of Dean and West Dartmoor area Forestry commission rangers have reported problems with boar interacting with dogs being walked. In some cases there has been physical contact between boar and dogs. The use of dogs during hunting would pose a higher risk as dogs are likely to have direct contact with boar. When threatened boar will attack potential predators, this is particularly likely when sows have young. All dogs being exercised in areas with wild boar populations could be exposed to boar faeces.

Interaction with humans: So far in England, interaction between live wild boar and the general public is rare but has been recorded when a boar is threatened or has piglets. Hunters have direct contact with boar. In the UK and hunting of wild boar is allowed. There is no information available on the extent of hunting in the UK. Food-borne disease transmission could be possible through the handling and preparation of infected boar meat as skinning and butchering may take place in an unregulated environment. Consumption of infected meat, particularly if not properly cooked is also a risk. Wild boar meat sold for human consumption on a commercial basis would be subject to Food Hygiene Regulations **((EC) 853/2004)** and thus would pose minimal risk to the public. The general public could be exposed to boar faeces in areas with a boar population.

4.1.2.2 Domestic Pigs

Pigs in the UK are used for producing pork, ham and bacon. Most of the pig farms are down the Eastern side of Scotland and England, mainly because that is where most of the cereals for feeding the pigs are grown. There are also some concentrations of pigs in North West and South West England. Altogether there are about 5 million pigs in the UK. There are around 500,000 breeding pigs and the remainder are for finishing.

Figure 3: Distribution of England Pig Population.



Indoor Pig Production

It is assumed that free-ranging wild 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). Indeed in Hungary and Slovakia the wild boar population is known to be infected with Classical Swine Fever however there has been no outbreaks in domestic pigs for three years. European Commission, (2003). Animal Disease Notification System. Primary disease notification, 12 August 2004.

Therefore, due to the potentially higher opportunity for disease transmission, this risk assessment is based on the risks of disease transmission between wild boar and outdoor pig husbandry systems.

Outdoor Pig Production

It is estimated that 18-25% of England's pigs (including farmed boar) are managed in outdoor husbandry systems. Outdoor pig production requires chalky or sandy soil and so the majority of the industry is based in East Anglia and Wiltshire.

Wild Boar Farming

Commercial farming of wild boar began in the 1980's. 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 10 to over 130 breeding sows. All meat produced from these farms is subject to the same meat hygiene practices as domestic pigs.

Figure 4: The distribution of wild boar farms registered as members of the British Wild Boar Association in 2004.

Pig industry in areas with wild boar populations: Although Kent and East Sussex is not a major area 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.

4.1.3 Exotic Notifiable Disease Control.

A range of legislation protects the UK from incursion of exotic notifiable diseases. This includes import restrictions on live animals and animal products, legislation banning swill feeding practices, food hygiene and food safety legislation and statutory reporting of suspected diseases. In addition UK monitoring disease outbreaks around the world and assesses the risk that these outbreaks pose to disease incursion into the UK and if necessary action is taken to mitigate this risk, for example imports from the infected country may be restricted until the disease is controlled. Surveillance is undertaken in domestic livestock and wildlife species in the UK in order to detect these exotic diseases. We also have well developed contingency plans and emergency procedures which would be put in place should a disease incursion occur to rapidly control the disease and eradicate it. Further information is available on the Defra website.

International Disease Monitoring and Risk Assessments
http://defraweb/animalh/diseases/monitoring/index.htm
http://defraweb/animalh/diseases/monitoring/pdf/csf-europe200307.pdf

Illegal Imports
http://defraweb/animalh/illegali/default.htm

Disease Control
http://defraweb/animalh/diseases/control/index.htm

Contingency Plans
http://defraweb/animalh/diseases/control/contingency/index.htm

4.2 Release Assessment

4.2.1 Terms and definitions

For the purpose of the release assessment (Section 4.1) the following terminology* will apply:

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.

Uncertainty categories

Term	Definition
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.

Risk Estimation

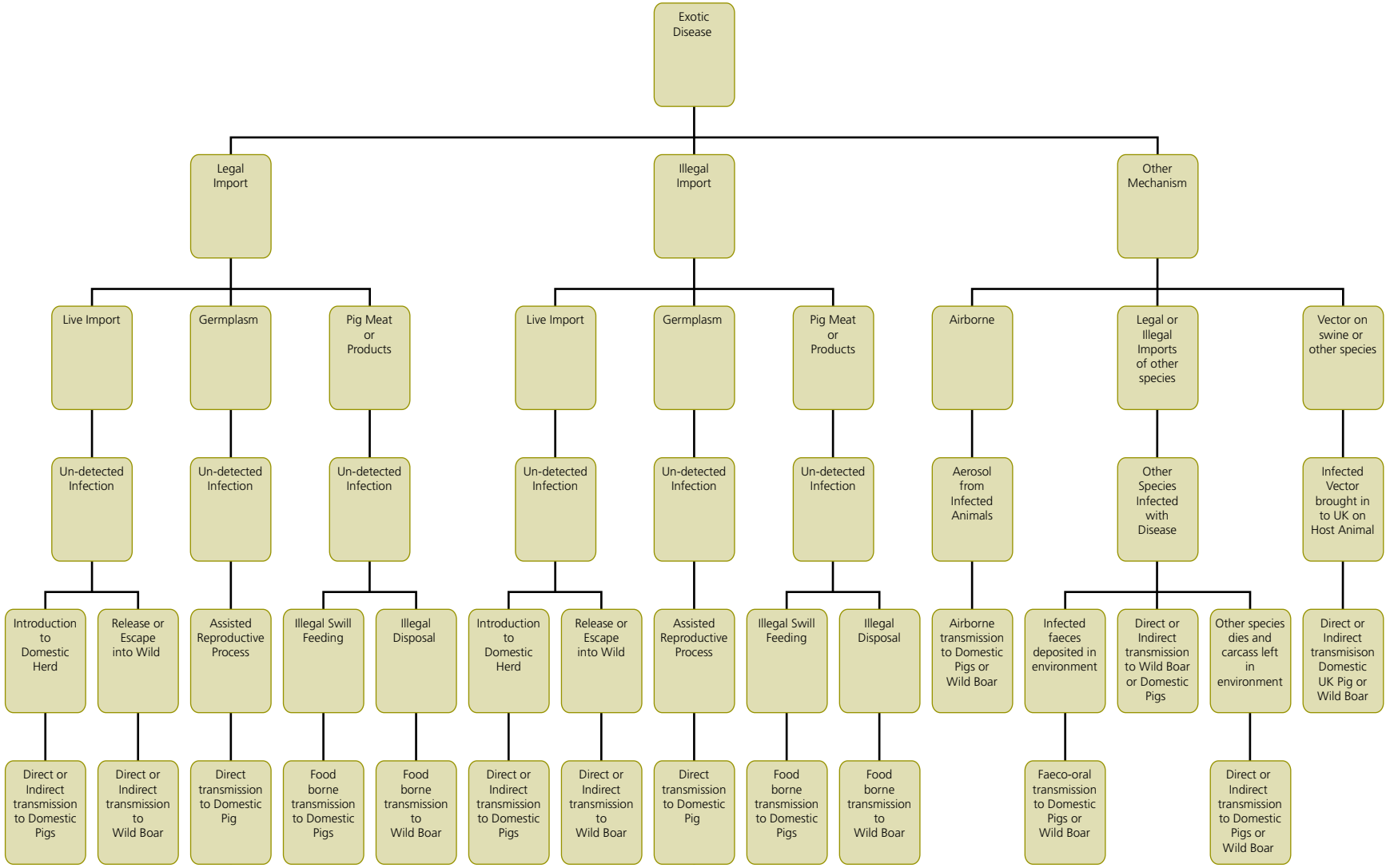
The overall risk estimation is based on the likelihood of wild boar becoming infected with the specified disease and the consequences resulting from the wild boar becoming infected. These two assessments are combined according to the following method to produce an assessment of overall risk.

	Consequence Assessment				
Likelihood Assessment	**Negligible**	**Very Low**	**Low**	**Medium**	**High**
Negligible	Negligible	Negligible	Very Low	Low	Low
Very Low	Negligible	Very Low	Very Low	Low	Medium
Low	Very Low	Low	Low	Medium	Medium
Medium	Low	Low	Medium	Medium	High
High	Low	Medium	Medium	High	High

4.2.2 Pathways

4.2.2.1 Incursion of exotic diseases into the GB free-ranging wild boar population – Conceptual pathways

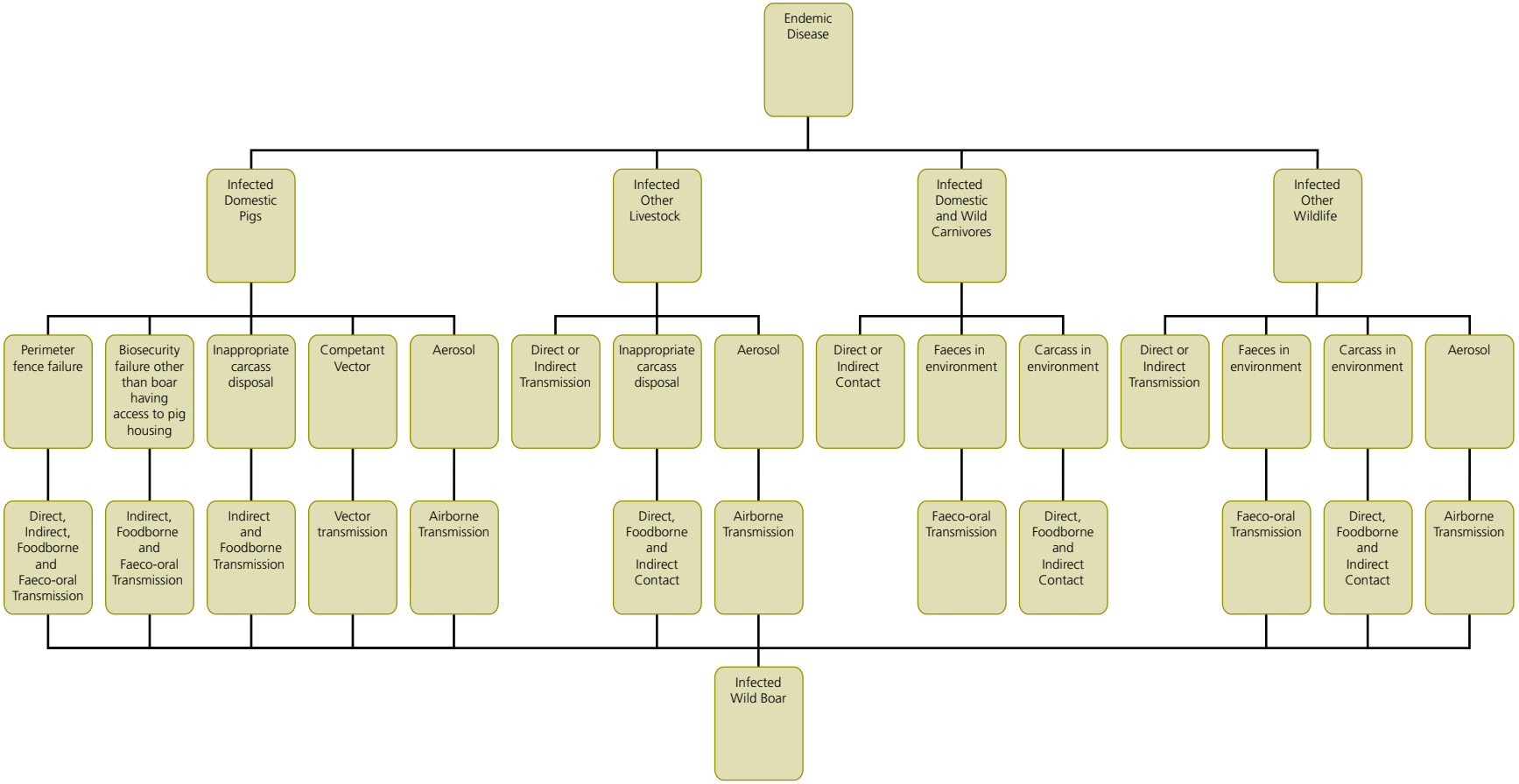
Figure 5 – Flow chart showing potential routes. (Start at top and work down). NB: Once disease has entered the GB domestic pig population Figure 5 should be used to show disease transmission from the domestic pig population to wild boar.



4.3 Exposure Assessment

4.3.1 Transmission of endemic diseases or exotic disease following incursion into GB, into free-ranging wild boar populations in GB

Figure 6 – Flow chart showing transmission of endemic diseases or exotic disease following incursion into GB, into free-ranging wild boar populations in GB



4.4 Consequence Assessment

The impacts of disease on the pig industry and the taxpayer can be considerable. During outbreaks of exotic notifiable diseases, trade in pigs and pig products would be banned from infected areas, with EU exports temporarily disrupted and a complete loss of third country exports (non EU countries). Disease control programmes may be paid for by the government or by the farmer. Increased disease transmission or disease outbreak would have financial implications to both the pig industry and government

Domestic pig farming: In the UK in 2004 approximately 1,500,000 tons of pig meat was consumed. There are about 5 million pigs in the UK. The export market is worth approximately £190 million per annum, should an exotic disease outbreak occur this would be severely affected. The domestic market would be much less affected. The impact would be related to the disease of concern and the extent of the outbreak. This makes assessment of losses unpredictable.

Wild boar farming: In 2004 the wild boar meat market was estimated at 500,000kg in volume and £2 million. The market for stock is estimated at £100,000 annually.

Costs of disease outbreaks: A Classical Swine Fever outbreak in GB in 2000 cost more than £20 million. Outbreaks of notifiable diseases can result in the banning of export of pig products and disruption to the home pig industry. An outbreak of Aujeszky's disease, on a single farm would cost at least £500K in relation to tracings and patrols, plus compensation for depopulation of the infected premises. If spread occurs this figure could possibly reach £1 million. The 2001 outbreak of Foot and Mouth Disease cost the UK over £8 billion.

4.5 Risk Estimation

4.5.1 Risk Estimation – Notifiable Exotic Diseases.

Figure 7

Disease	Current Preventive Measures	Supporting Evidence	A) Risk of incursion of exotic diseases directly into the free-ranging wild boar population	B) Impact on effective diseases control following transmission of exotic disease to wild boar following incursion into domestic livestock.	D) Zoonotic disease risk. (Risk of disease transmission to humans from infected wild boar or wild boar products.)
Classical Swine Fever	Statutory requirement to report on suspicion Banning of fresh pork meat and meat products from infected and surveillance zones within the EU. 3rd country importations form selected approved countries and subject to strict veterinary controls. Banning of live pigs and germplasm from infected zones. Ban on swill feeding pigs. Legislation requires a 20 day stand-still on movements between farms, markets etc.	Aubert et al (1994) proposed three reasons why wild boar should NOT be considered as CSF reservoirs and a risk to domestic pigs. Firstly, when the disease is eradicated in domestic pigs the disease is not maintained in the wild boar. Secondly when CSF has been intentionally introduced into feral pig populations the disease is not self maintained and thirdly when information about the origin of a CSF outbreak in wild boars has been collected human interference was apparent. However, epidemiological links between CSF virus infection in wild boar and domestic pigs have been repeatedly reported in Germany. (Laddomada et al, 1994)	Medium CSF is endemic in some trading partners within the EU	High Dependent on population size and density	N/A

Figure 7 (continued)

Disease	Current Preventive Measures	Supporting Evidence	A) Risk of incursion of exotic diseases directly into the free-ranging wild boar population	B) Impact on effective diseases control following transmission of exotic disease to wild boar following incursion into domestic livestock.	D) Zoonotic disease risk. (Risk of disease transmission to humans from infected wild boar or wild boar products.)
Classical Swine Fever (continued)		92% of outbreaks in domestic pigs are located in areas where CSF is endemic in wild boar and 60% of outbreaks were due to direct or indirect contact with wild boar. (Moennig et al. 1999) CSF is not sustainable in a population of below 400 individuals or 3 boar/km2 (Moore, 2004) Infection in wild boar on the Italian/Swiss border is managed by hunting young boar and preserving older immune boar. This strategy reduced infection from 42.2% to 8.8% in 2 years. (Zanardi et al, 2003)			

Figure 7 (continued)

Disease	Current Preventive Measures	Supporting Evidence	A) Risk of incursion of exotic diseases directly into the free-ranging wild boar population	B) Impact on effective diseases control following transmission of exotic disease to wild boar following incursion into domestic livestock.	D) Zoonotic disease risk. (Risk of disease transmission to humans from infected wild boar or wild boar products.)
African Swine Fever	Reporting on suspicion Banning of fresh pork meat and meat products from infected and surveillance zones. Banning of live pigs and germplasm from infected zones. Ban on swill feeding pigs.	Wild boar are considered to be much less important in the epidemiology of ASF. They are susceptible to the disease and can be infected without showing clinical signs. They do not appear to spread or support persistent outbreaks of the disease. (Perez et al, 1998, Laddomada et al, 1994) No seropositive wild boars have been reported in areas where the domestic pig is free of the disease. (Perez et al, 1998))	Very Low ASF is not endemic in any EU countries or any UK trading partners.	Low Wild boar dead end host	N/A

Figure 7 (continued)

Disease	Current Preventive Measures	Supporting Evidence	A) Risk of incursion of exotic diseases directly into the free-ranging wild boar population	B) Impact on effective diseases control following transmission of exotic disease to wild boar following incursion into domestic livestock.	D) Zoonotic disease risk. (Risk of disease transmission to humans from infected wild boar or wild boar products.)
Foot and Mouth Disease	Reporting on suspicion Banning of fresh meat and meat products from infected and surveillance zones. Banning of live animals and germplasm from infected zones. Ban on swill feeding pigs.	There have been no reports of spill-over from infected livestock to wild boar in over 80 years, suggesting that infection is very rare. Following an outbreak in the Netherlands in 2001 208 boar from the infected area were tested. All were negative. (Elbars et al, 2003) A population density of 2.3-14 boar/km 2 is needed for the disease to persist. (Peche & Hone, 1998)	Low Low susceptibility and low risk of incursion.	Medium Have not impacted on disease epidemiology in other countries but would affect ability to declare disease freedom.	N/A Only 1 reported case.

Figure 7 (continued)

Disease	Current Preventive Measures	Supporting Evidence	A) Risk of incursion of exotic diseases directly into the free-ranging wild boar population	B) Impact on effective diseases control following transmission of exotic disease to wild boar following incursion into domestic livestock.	D) Zoonotic disease risk. (Risk of disease transmission to humans from infected wild boar or wild boar products.)
Swine Vesicular Disease	Reporting on suspicion Banning of fresh meat and meat products from infected and surveillance zones. Banning of live animals and germplasm from infected zones.	All published reports identified seropostive boar only and do not describe clinical infection or transmission to other boar or livestock. The disease is uncommon in European wild boar populations and so they are not considered an important reservoir of diseases. (Elbers et al, 2000)	Low	Medium	N/A
Vesicular Stomatitis	Reporting on suspicion Banning of fresh meat and meat products from infected and surveillance zones. Banning of live animals and germplasm from infected zones.	No specific peer reviewed information found. Disease is endemic in some populations of feral pigs in USA with transmission to domestic pigs occurring sporadically.	Low	Low	Low

Figure 7 (continued)

Disease	Current Preventive Measures	Supporting Evidence	A) Risk of incursion of exotic diseases directly into the free-ranging wild boar population	B) Impact on effective diseases control following transmission of exotic disease to wild boar following incursion into domestic livestock.	D) Zoonotic disease risk. (Risk of disease transmission to humans from infected wild boar or wild boar products.)
Aujeszky's Disease	The Aujeszky's Disease Order 1983 requires the notification of suspected disease in animals and slaughter of pigs on infected premises. It also provides for movement controls on all animals and products onto and off an infected premises and movement control of pigs within an infected area	Only one natural outbreak of clinical disease has been reported. (Gortazar et al, 2002) In a recent study carried out in Spain concluded there was no evidence of ADV interaction between domestic pigs and wild boar. (Ruiz-Fons et al, 2007) However in areas where ADV is endemic in domestic pigs up to 35% of wild boar are infected. (Muller et al, 2000) Some studies suggest strains in wild boar are different to domestic pig strains. The long term presence of disease in wild boar in regions were the disease has been eradicated in pigs suggests that risk of transmission is very small. (Mueller at al, 2000)	Low	Medium	N/A One suspected case reported.

Figure 7 (continued)

Disease	Current Preventive Measures	Supporting Evidence	A) Risk of incursion of exotic diseases directly into the free-ranging wild boar population	B) Impact on effective diseases control following transmission of exotic disease to wild boar following incursion into domestic livestock.	D) Zoonotic disease risk. (Risk of disease transmission to humans from infected wild boar or wild boar products.)
Rabies	Reportable on suspicion. Rabies Quarantine and PET Travel Scheme	Pigs limited susceptible. Rabies has been confirmed in 1 warthog *(Phacochoerus aethiops)* and not uncommonly in domestic pigs.	Very Low	Medium	Very Low
Rinderpest	Reporting on suspicion Banning of fresh meat and meat products from infected and surveillance zones. Banning of live animals and germplasm from infected zones. Movement restriction of live animals and fomites.	The primary host is cattle and pigs are rarely infected.	Negligible	Low	N/A

Figure 7 (continued)

Disease	Current Preventive Measures	Supporting Evidence	A) Risk of incursion of exotic diseases directly into the free-ranging wild boar population	B) Impact on effective diseases control following transmission of exotic disease to wild boar following incursion into domestic livestock.	D) Zoonotic disease risk. (Risk of disease transmission to humans from infected wild boar or wild boar products.)
Trichinella sp.	Meat inspection required by legislation. Movement restriction on infected premises Carcass disposal regulations.	Trichinella surveillance programmes in operation under contract to VLA/CSL. & the results for the UK have been negative since 1979. Wild boar related infection is typically associated with hunters and their families. (De Bruyne et al. 2006)	High Food borne transmission	High If Trichinella became endemic each pig carcase would require testing causing a large increase in costs to the industry. Likely to be a decrease in public confidence on the safety of pork.	Low Providing recommended precautions taken.
Brucella suis	Movement of pigs from other disease free regions only.	Widespread in boar in western Europe (Godfroid 2002). Seroprevalence of 22% in wild boar in Germany.	Low Due to direct contact transmission.	Medium	Low

4.5.2 Risk Estimation – Endemic Diseases

Disease	Current Preventive Measures	Supporting Evidence	C) Impact on disease management of endemic diseases common to wild boar and domestic livestock.	D) Zoonotic disease risk. (Risk of disease transmission to humans from infected wild boar or wild boar products.)
Bovine Tuberculosis	Reporting on suspicion/ detection. Biosecurity	See separate VRA. Reported widely in boar populations in Europe.	Low	Low.
Anthrax	Removal and appropriate disposal of infected carcasses.		Low	Very Low
Salmonellosis	Biosecurity Zoonoses Action Plans	Surveys have demonstrated a maximum of 7% infection in wild boar in western Europe. (Decastelli et al, 1995) Endemic in domestic pig population.	Low	Low
Post–weaning Multisystemic Wasting Syndrome and Porcine Dermatitis and Nephropathy Syndrome.	Biosecurity	PMWS has been identified in free-ranging wild boar in Europe. (Schulze et al, 2003) PCV2 isolates from wild boars have been found to be identical to those from domestic pigs in the same or distant regions. It is likely that the origin of PCV2 infection in wild boar population is through contacts with domestic pigs not least because of a close to 100% infection rate in pig herds. (Ruiz-Fons et al, 2007)	Low	N/A

Assessment A and B – Incursion of exotic diseases directly into the free-ranging wild boar population and impact on effective disease control: Due to the stringent controls and well developed contingency plans in place, exotic disease incursion into GB would be quickly identified and controlled. Due to the pathways of incursion these diseases are likely to enter the domestic pig population and be transmitted to wild boar rather than entering wild boar directly. (see below) The exception to this would be foodborne infections which could be introduced into wild boar by illegal feeding of infected meat.

Based on reports from other countries, if the preventative measures against exotic disease incursion failed and disease entered GB and was not controlled, wild boar populations could play a role in the epidemiology and transmission of some diseases. In these cases wild boar would need to be considered in the disease control plans. This is dependent on the susceptibility of wild boar to the specific disease and the transmission rates between boar populations and boar and domestic pigs. In addition the information 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.

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 wild 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. In addition, during previous research projects and management procedures involving boar populations in Kent have been sabotaged by animal rights activists despite interventions by police to prevent disruption

Summary of Overall Risk

Disease	Likelihood of Incursion	Consequence of Incursion	Overall risk assessment
Classical Swine Fever	Medium	High	High
African Swine Fever	Very Low	Low	Very Low
Foot and Mouth Disease	Low	Medium	Medium
Swine Vesicular Disease	Low	Medium	Medium
Vesicular Stomatitis	Low	Low	Low
Aujesky's Disease	Low	Medium	Medium
Rabies	Very Low	Medium	Low
Rinderpest	Negligible	Low	Very Low
Trichinella sp.	High	High	High
Brucella Suis	Low	Medium	Medium

Assessment C – Impact on disease management of endemic diseases common to wild boar and domestic livestock: These diseases are already present in the domestic livestock population. Due to the small, low density populations, the risk of wild boar influencing control of these endemic diseases, if all recommended precautions such as secure fencing and biosecurity are in place has been assessed as **VERY LOW**.

Assessment D – Zoonotic disease risk. (Risk of humans becoming infected from wild boar or wild boar products: Due to the natural behaviour of wild boar interaction with the general public and therefore risk of zoonotic diseases would be low. However hunters would be exposed to higher risk especially if consuming the meat. The risk can be managed by ensuring good hygiene practices (hand washing), butchering and meat hygiene precautions and ensuring meat is properly cooked before consumption. The likelihood of zoonotic disease transmission is considered VERY LOW. The impact assessment should this occur would be HIGH due to the morbidity or mortality to human populations and impacts on the pig industry through loss of public confidence and increased disease control requirements. Therefore the overall risk is assessed as **MEDIUM**.

4.5.3 Impact of Increase in Wild Boar Numbers and Density on Disease Risk

Wild boar have a high reproductive potential and, in the absence of control can increase rapidly in numbers. Since the 1950's wild boar populations have increased both in numbers and distribution throughout Europe, apparently due to lack of predators, extreme adaptability, artificial feeding and mild winters. Present populations in EU member states are estimated at between 800,000 and 1 million (Kramer-Scadt et al, 2007). A relatively small number of founder animals can give rise to viable populations. These populations are also supplemented by immigration of occasional escapees from captivity.

To date, however, there has not been a great increase in numbers in any of the existing English populations though the number of breeding populations has grown.

Several modelling exercises have been conducted to try and predict the likely future trends in English wild boar populations. This gave a wide range of potential population sizes after 15 years assuming a starting population of 100 animals. The range of annual growth rates estimated a potential population after 15 years of between 130 and 3,500 animals (Moore and Wilson, 2005).

In practice, it appears that the Kent/Sussex population (the largest in England) has remained nearer the lowest growth estimate with relatively little growth and spread, probably due to the high rate of culling experiences. The slow pattern of population growth in Sussex is mirrored in the Dorset and Ross on Wye populations. In all cases, culling by landowners and others seems to be keeping the populations from increasing rapidly.

In addition to culling the other key factor in determining the future spread and increase in wild boar populations in England is the availability of suitable habitat, in particular woodland. Wild boar are highly dependant on woodland or other cover throughout their range and most European countries with substantial and increasing boar populations have over 25% woodland cover. Woodland cover in England at 8.5% is amongst the lowest in Europe but this varies substantially between counties. Individual extensive woodland areas such as the Forest of Dean should also be considered. It must also be noted that woodland cover is currently increasing

in lowland England aided by schemes such as the Farm Woodland Protection Scheme and initiatives like the National Forest.

If it is presumed that >12.5% woodland cover by county is required to maintain a viable population of boar all of the suitable habitat is found in the south of England (except for Northumberland where there is no boar currently). If all woodlands in the high risk counties of the south of England were colonised, and a population density of 3.5-5boar/km^2 is assumed the area could hold between 6,300 and 9,000 boar. This size of population could be reached within 20 years if no culling was carried out given a founder population of 100 animals (Moore and Wilson, 2005).

In summary, though wild boar have the potential for rapid population expansion, this has not occurred to date in England due to heavy culling by land-owners and others. Woodland cover is also far lower than in most of the rest of Europe and this is likely to restrict spread. Existing boar populations will probably slowly increase in size and continue to spread. Other populations may become established following escapes or releases particularly in areas with good woodland cover. In the long-term boar are likely to become established over large areas of England but will mainly be restricted to areas where woodland cover is high and where shooting pressure is low.

An increasing boar population would mean a larger number of hosts available for the transmission of disease and also a higher contract rate between hosts. Although population size is important, a continuous population of 400 animals (Moore, 2004) would be required to maintain CSF infection, high population density and the associated high opportunity of transmission from infected or carrier animals to uninfected or naïve animals is more influential.

The influences on dispersal rate and distance would also be key to determining the potential increase in distribution of boar in GB.

Due to the specific characteristics of each disease and the distribution of the domestic pig population it is not possible to determine the overall disease risk to GB should the wild boar population increase.

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 population of 400 animals at a density of 3 boar/km^2 is required and for the latter a density of 2.3 -14 boar/km^2 (Peche & Hone, 1998) is required to maintain the disease in wild boar and therefore act as a reservoir of disease for domestic pigs.

The role of wild boar density in the persistence of CSF virus among wild populations after the onset of an epizootic outbreak may have an influence together with age structure and the size of the affected population (Artois et al, 2002). CSF could persist in dense wild boar populations where there are no barrier restrictions, due to high recruitment rate and an increased availability of young animals. This would impede disease control and eradication schemes due to increased risk of transmission from wild boar to domestic pigs.

The same would be true of Foot and Mouth Disease.

The likelihood of incursion of exotic diseases into the UK is assessed above and this is **NOT CHANGED** should the wild boar population increase. Exotic disease incursion, should it occur is likely to enter the domestic pig population and be controlled at this point, as was seen in the Classical Swine Fever outbreak in 2000 and Foot and Mouth Disease outbreak in 2001.

An increase in population of feral wild boar would affect disease risk if exotic diseases entered the wild boar population. The key determinates 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. Thus very localised differences in these factors will affect disease risk.

Further assessment can be made by assuming a population increase and distribution predicted by Moore and Wilson (2005) of 3.5-5boar/km^2 and a population of between 6,300 and 9,000 boar. This population size and density would be reached in 2025. This presumes that the population is not subjected to culling. 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.

The growing population in the Forest of Dean does not yet consist of 100 animals, which is the starting population required for this model. However should it reach this threshold and increase according to the model, this population also has the potential to reach a size where CSF and FMDV could be maintained. This is primarily due to the good habitat in this area.

There is insufficient data to predict the impact of population increases on the control of other diseases.

The likelihood of exotic disease outbreaks occurring in wild boar **remains LOW** despite increases in population size, density and distribution. However the impact resulting from disease incursion and transmission from domestic stock would be **HIGH**.

5. Risk Management

There is EU legislation that determines that the UK must prevent and control notifiable diseases of swine. Part of this requirement is to undertake surveillance for specific diseases in order to claim 'disease freedom'. It is therefore necessary to maintain and enforce legislation currently in place to protect Great Britain from the incursion of exotic porcine diseases. Current disease control measures and targeted surveillance projects for both notifiable diseases and diseases for which GB claims freedom from should be maintained. There is no requirement for disease surveillance specifically in wild boar if the pig population is free from disease This is only required when disease becomes endemic in either the domestic pig or wild boar populations.

Scanning surveillance detects new and emerging diseases or changes in current disease status. It is dependant on the submission of appropriate carcasses for post-mortem examination. Defra funds the Veterinary Laboratories Agency, through its network of 16 regional laboratories to perform this work. Carcasses from feral boar are not currently submitted because hunted boar enter the human food chain and thus are not available for post-mortem examination.

Awareness of the potential disease risks and the associated signs of disease in free-ranging wild boar and appropriate preventive measures, especially from zoonotic diseases should be heightened amongst farmers, hunters and the general public. Educating people who may come into contact with wild boar is a feasible objective for government.

Although there is a growing scientific research output investigating disease in wild boar this is largely undertaken overseas. The evidence base for the role of free-ranging wild boar in the epidemiology of disease in Britain is limited. As Britain has a different disease status and thus a wild boar population which is naïve to many of the diseases of concern and different land management practices and natural environments to other countries, the existing research may not always be directly relevant or appropriate. To improve understanding, it is important to review available data thoroughly in order to identify whether there are critical gaps in knowledge, which would constitute research priorities.

The difficulty of excluding free-ranging wild boar from farm land is considerable and exclusion measures expensive. In addition there is limited experience on the effectiveness of there exclusion measures. The main disease risks are to outdoor swine and farmed boar rather than other livestock and companion animals. There are reports that pigs and particularly farmed wild boar routinely escape and subsequently re-enter outdoor pig facilities increasing the risks of disease transmission considerably. (Personal Communication – Central Science Laboratory). Biosecurity should be maximised on all outdoor pig units.

Farmers could be made responsible for control, capture or elimination and associated costs of escaped animals. However this may not be feasible as on occasions farmed boar has been released deliberately by third parties.

In some countries wild boar and feral pigs have been vaccinated against specific diseases in order to control outbreaks. These diseases include Classical Swine Fever and Foot and Mouth Disease. This measure is currently not necessary in Great Britain, and would be inconsistent with the 'stamping-out' policy which would be adopted in the UK in the event of incursion of one of these diseases. Consideration of authorisation of vaccination programmes would only be given if notifiable diseases became endemic in the UK. Every effort should be taken to prevent this by implementing the other measures described.

6. Conclusions

It has been confirmed that free-ranging wild boar populations can maintain some pathogens in their populations without the intervention of domestic or other wild animals. There is a lack of information on pathogenesis, clinical manifestation, epidemiology and prevention and control methods of diseases in wild boar. Although both the domestic pig and wild boar are considered as the same species and basic features of the infection could be identical, risk factors widely differ between domestic and wild species (Ruiz-Fons et al, 2007)

Although boar are susceptible to and can transmit endemic diseases, the low likelihood of contact between boar and domestic pigs means that boar will not significantly impact on the ability to control endemic diseases nationally. Endemic disease control on a local basis may be influenced by boar but with the use of biosecurity measures and boar population control individual farmers can act to mitigate these risks on their holding.

The most significant role that the feral boar population in the UK has on disease risks is associated with the incursion and maintenance of exotic notifiable diseases. The primary tool to protect against exotic notifiable disease risks are by maintenance of the existing and extremely effective mechanisms currently in place. These measures, in conjunction with farm biosecurity, especially on the increasing number of outdoor pig units, protect the UK livestock population from exotic diseases.

It is not clear what size of population and density of boar is required for a true reservoir of disease to be established. It is still difficult to predict if and by how much the existing wild boar populations will grow. Indeed some studies suggest that, due to the high culling rates, the existing population may become extinct (Moore and Wilson, 2005). However should the populations grow then the impact on our ability to undertake effective disease control would increase.

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Appendix II: Summary of Findings

Summary of findings of Risk Assessment carried out using UK Non-Native Species Project Board Risk Assessment template

C J Wilson, WMLS, Exeter, November 2007

This summary is drawn from a risk assessment carried out by Natural England Wildlife Management and Licensing Service (WMLS), on behalf of Defra, using the risk assessment template and methodology prepared for the UK Non-native Species Project Board by CABI Bioscience, Centre for Environment, Fisheries and Aquaculture Science, Centre for Ecology and Hydrology, Central Science Laboratory, Imperial College London and the University of Greenwich under Defra Contract CR0293, February 2005.

Although the wild boar is a former native species in England, the risk assessment framework provided by the Non-native Species project Board's risk assessment template was considered a useful process by which to assess the species' potential impact in the event of its re-establishment in this country. As far as practicable the assessment of risk and uncertainty levels follows the guidance in the risk assessment User Manual (anon., 2005). For most aspects of the risk assessment this requires allocation of risks in a range of scored categories, such as 'very unlikely' (0), 'unlikely' (1), 'moderately likely' (2), 'likely' (3) and 'very likely' (4). In most instances this is accompanied by an uncertainty score of 'low' (0), 'medium' (1) or 'high' (2), depending on the level of uncertainty the assessor places on the scoring of that particular risk. For example, assessment scores based on a substantial supporting evidence base would normally have a 'low' uncertainty score, whilst those based on relatively little evidence, or if some evidence is contradictory, would have a 'high' uncertainty score. The Manual also provides guidance on allocation of some other score types, such as those for economic impacts, which are scored as 'minimal' (0), 'minor' (1), 'moderate' (2), 'major' (3) and 'massive' (4).

The purpose of the risk assessment was to assess the risks to biodiversity and socioeconomic interests posed by increase, expansion, and possible establishment of new populations of feral wild boar (*Sus scrofa*) in the risk assessment (RA) area. Although the focus of the risk assessment is England, in practical terms the RA area is the whole of mainland UK.

1. Probability of Entry:

The species is already established in several small feral populations (Wilson, 2005) and has the potential for spread and dispersal from these. It is also kept in a significant, but unknown, number of premises as a farmed animal (perhaps 100 holdings in England with ~2,800 breeding sows; Wilson, 2005). As the species is already present in the wild in some localised areas 'entry' here is taken to mean entry into additional new areas within the RA area. There are, therefore two main potential pathways for further entry to the risk assessment area; expansion and dispersal from existing feral populations, and establishment of new colonies or populations as a result of new escapes/releases. For the purposes of the risk assessment the primary pathway considered is expansion and dispersal from the existing populations as this source is already in place and would require positive action to remove.

There are three established feral breeding populations; the largest, in Kent/Sussex was estimated in 2004 at ~200 animals in the core distribution area (Moore, 2004), the second largest in the Forest of Dean/Ross on Wye area, where there may be in excess of 50 animals,

and the smallest, in west Dorset, where there are still believed to be fewer than 50 animals (Wilson, 2003, 2006). Since winter 2005/6 significant escapes/releases have resulted in animals colonising areas around the fringes of Dartmoor and evidence of breeding in the wild has been recorded (Wilson, 2007; WMLS data). For the purposes of this assessment, these are considered as an additional single new breeding population and it is currently estimated (WMLS estimate, based on reports and records) that there are up to around 50 animals in this population. There have also been further 'release' incidents in Devon in 2007, potentially resulting in many 10s of animals being left in the wild.

Wild boar show significant preference for woodland, or other natural or semi-natural habitats, which provide cover (Boitani et al, 1994; Gerard et al, 1991; Spitz & Janeau, 1990). Suitable woodland, or similar cover, is present throughout much of the RA area but there are significant regional differences in the amount of suitable woodland habitat available (Forestry Commission, 2003; Moore & Wilson, 2005).

If uncontrolled the species could become established throughout the RA area, wherever adequate semi-natural cover exists (e.g. woodland, scrub, reedbeds, marshes etc). If subject to informal control (by farmers, gamekeepers etc) it is likely that it would establish in areas where sufficient cover exists to provide secure refuge, but would be kept at low density or not become established in more open or developed areas (based on published data on habitat selection – various refs and reviewed in Wilson, 2005).

Probability of Entry: 'Very likely'; uncertainty in this assessment: 'Low'.

2. Probability of Establishment:

For the purpose of the risk assessment 'establishment' here is taken to mean further establishment beyond the existing core areas.

The species' natural range includes the temperate forest regions of western Europe and it is a former native species in Great Britain (Spitz, 1999). Native and well established populations are found in neighbouring western European countries with similar environmental conditions to the RA area.

High culling pressure appears to have limited spread from the oldest established populations (Moore, 2004; Wilson, 2003). However, increasing reports from outside these areas (WMLS unpublished data) suggest that some dispersal is taking place. Where this enables colonies to establish in favourable habitat these may found new population cores.

The existing feral populations have resulted from escapes of farmed boar and deliberate releases. There has been an average rate of at least 1.5 escape/release incidents per year over the last 20 years, with several involving >20 animals (WMLS data). Assuming no changes to current legislation, and continuation of the current circumstances in which wild boar may be kept or traded, there will continue to be the potential for further escapes or for persons intent on illegal release to obtain animals. Some of these may result in 'permanent'/long-term populations, but it is also highly likely that some would result, at least, in transient populations. It is also possible that animals dispersing from the established populations may establish transient satellite populations.

Probability of Establishment: 'Very likely'; uncertainty in this assessment: 'Medium'.

3. Spread in Risk Assessment area:

The likely spread of feral wild boar in the RA area is difficult to estimate. The four existing populations have occurred as a result of 'human assistance' and represent a mean rate of establishment of one new population core every 5 years. Two of the most recent significant incidents are reported to have been the result of deliberate release as a result of human action (in 2004 and 2005/6; Wilson, 2006; plus further reported incidents in 2007). Unpredictable human intervention could create new foci of establishment in a very short period, as demonstrated by the apparent establishment of the most recent population, in Devon.

Experience so far suggests that isolated populations can be contained, at least in the medium term, by ad-hoc, but high, culling pressure. Core distribution areas for these populations have consisted of well-wooded areas. Where animals occur in sparsely wooded areas it is likely that they could be prevented from establishing significant populations. Modelling work developed by Holland et al (2007) could help identify areas where populations are most likely to establish and areas where they would probably go extinct or could be eradicated.

Potentially, wild boar could spread throughout suitable habitats across the whole UK mainland. However, extensive areas of the country where optimum habitat is limited or absent may restrict/prevent spread in some regions (Moore & Wilson, 2005).

Likely rate of spread: 'Intermediate'; uncertainty in this assessment: 'Medium'.

4. Likely Impacts in RA area:

Impacts on Agriculture:

Wild boar consume a wide range of crops (Schley & Roper, 2003) but most damage recorded in the RA area so far is rooting of grassland (Goulding et al, 1998; Moore, 2004; Wilson, 2004). This mainly occurs within 100m of woodland and of incidents of rooting damage reported in Kent/Sussex and in west Dorset, 3% and 7%, respectively, were classed as 'severe' (Moore, 2004; Wilson, 2004). Given the small numbers of animals currently present, and the highly localised nature of the damage, the level of damage at present is insignificant. However, this would be expected to increase if the population increases. Moore & Wilson (2005) used a range of population density of 3.5-5/km^2 to estimate potential future population levels. This range of densities is typical for wild boar in non-pristine environments (Ickes, 2001; Jedrzejewska et al, 1994; Smiet et al, 1979). Fernandez et al (2006), studying potential reintroduction and associated risks in Denmark, used % deciduous and mixed forest to estimate potential boar density. In poor habitat, such as monoculture conifer plantations, they suggested that population density was likely to be <1/km^2 and may not enable long-term occupation by significant numbers of wild boar. Given the amount of woodland in mainland Britain (about 27,500km2, of which 57% and 43% is coniferous and broadleaf woodland, respectively; Forestry Commission, 2007), these figures suggest a potential future population of wild boar in Britain of around 57,000-75,000, or 30,000-41,500 in England alone. In England, the greatest concentration of broadleaf and mixed woodlands is in the central southern counties, with outlying concentrations elsewhere (Forestry Commission, 2003) and this area is likely to hold the bulk of any future English wild boar population (see Moore & Wilson, 2005). A population of this size would be expected to have a significant economic impact, however, it would take many years for this population level to be reached, if at all, given the likely levels of culling that

establishing populations are likely to be subject to. Moore & Wilson (2005) suggested that a population of 6,300 to 9,000 could be reached, from a starting population of 100, within 20 years, if no culling was carried out. Longer-term population growth has not been modelled, however, assuming a similar growth rate, the numbers and distribution discussed above (pop ~30,000-41,500 in England) is unlikely to be reached for more than 30 years.

In addition to crop damage there is a potential impact associated with possible exotic disease incursion and impact on disease control. The impact on these was assessed as 'low' and 'medium', respectively, in the Defra Qualitative Veterinary Risk Assessment, but potentially a 'high' impact on exotic disease control if wild boar numbers and population density were to increase significantly (Hartley, 2007). Overall, this is not considered to affect the score allocated. The score appropriate for economic (primarily agricultural) impact at present, and for the medium-term is 'moderate', but in the long term, based on the above crude population estimates, this could become 'major', as defined in the RA User Manual.

Environmental Impacts:

As wild boar are a former native species in the RA area it may be expected that their environmental impact will be more comparable to that where they occur as native species rather than where they occur as invasive non-natives. Nevertheless, as they have been absent for several hundred years they could have an impact on some semi-natural ecosystems which now have conservation value. Preliminary evidence and reports concerning the feral populations suggest that their impact is likely to be minor, as long as the populations do not reach significantly higher densities than those currently present (Wilson, 2005). Anecdotal reports from these areas suggest that rooting at moderate levels should have a beneficial effect.

One of the main concerns has been for potential impact on woodland flowers such as bluebells (Goulding et al, 1998) and species-rich grassland (Wilson, 2005). Studies with the feral population in Sussex have shown that rooting increases species richness but may reduce bluebell numbers, though these appear to recover well over relatively few growing seasons (Sims, 2005). Unimproved grassland in west Dorset was found to recover within three years of rooting (Cox, unpublished). However, some concerns remain about other possible impacts, such as damage to wild daffodils (J. Spencer, pers comm).

Other Economic and Social Impacts:

Other economic costs might include impact on tourism/access to the countryside, although this could have positive as well as negative impacts, and increase in wildlife related road traffic accidents (RTAs). RTAs are likely to be the most significant of these. Deer-vehicle collisions in England are estimated at about 60,000 per year, with material damage costs of ~£13.5 million and an average of at least 4 human fatalities and 27 serious injuries every year (Langbein, undated). These occur with an estimated total deer population in England of ~700,000 (Langbein, undated). Based on the crude population projection given above, accidents involving wild boar in England might be expected to be of the order of ~4-6% of the number involving deer (i.e. 2,400-3,600 per year). Compared with evidence from mainland Europe (Groot Bruinderink & Hazebroek, 1996), the number of RTAs involving the projected population would be expected to be somewhat smaller, between ~150-2,000 per year. The current number of accidents is believed to be fewer than 20 per year (Wilson, 2005). Costs at present are likely to be 'minor' but with limited further population growth these are likely to

become 'moderate' and the costs in terms of human injury or fatality could be high, even if the total number of incidents is small.

The main social harm, excluding road accidents, is likely to be perceived safety risk to the public. Reports of wild boar in some European cities, and posing a risk to the inhabitants, are occasionally reported in the popular press and media (e.g. Jacoby, 2003; Mollers, 2004; Paterson, 2003). However, despite a wild boar population in Europe estimated at around 1.25 million (European Commission, 1999), Wilson (2005) did not find any reports of attacks or serious injuries caused by wild boar in Europe in the literature. Only three reports of attacks by wild boar in their natural range were found; one on a vehicle, one on a tourist, resulting in injury, and one suspected attack where an elderly woman in Japan was found dead. More recently, further wild boar attacks have been recorded; one in India, resulting in the victim being killed (Manipady et al, 2006), three in Turkey, resulting in injury (Gunduz et al, 2007) and one fatality and two injuries from attacks by a wild boar, which had been shot and wounded, in Sri Lanka (anon, 2006). Nevertheless, given their wide distribution and substantial populations throughout much of their range the risk of attack and injury is very small.

Likely impact in RA area: 'Moderate'; uncertainty in this assessment: 'Medium'.

Conclusion of Risk Assessment:

It is very likely that the species will make further 'entry' into the RA area and become more widely established. Although spread from existing populations has been slow to manifest itself, there are now some indications that this is occurring. Further entry could also happen at any time as a result of new escapes/releases, such as have recently occurred in Devon. Key factors potentially limiting entry, spread and establishment will be the culling effort on existing feral populations, and new colonies, and security of premises where captive animals are kept. In time, unless positive efforts are made to prevent it, the species is likely to become established in suitable habitat throughout much of the RA area, however, this could take 20-30+ years. Areas vulnerable to damage will be those adjoining suitable habitats, principally mixed/broadleaf woodland. The most significant impacts are likely to be effect on disease control, should wild boar be associated with areas where exotic disease incursion has occurred, and increased risk of wildlife RTAs. At moderate densities, environmental impact is likely to be minor or beneficial, whilst economic impacts, such as agricultural damage, are likely to become significant in the longer term, if the population spreads and increases substantially.

Despite quite extensive literature on wild boar and feral pigs there is a shortage of studies on some of the issues considered in the risk assessment. There is also relatively little data available on the feral populations, and relatively little published specifically on environmental impacts. Combined with the unpredictability of future events – e.g. new population cores may become established very quickly as a result of new escapes/ releases; conversely small establishing populations can be eradicated by heavy culling pressure – a relatively high level of uncertainty in the assessment is unavoidable.

In view of the potential impacts, the existing feral populations should continue to be monitored and new escapes/ releases recorded. Further detailed assessment of regional habitat availability and modelling of potential spread and establishment would also help to reduce the uncertainty around potential future impacts and management priorities. Assessment of actual population levels and approximate culling effort could be used to help gauge the degree to which

informal control is containing the populations and improve predictive ability. This would also help to provide 'early warning' if control is failing and give early notice if a review of control/ management effort or approaches is needed.

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Published by the Department for the Environment, Food and Rural Affairs,

Printed on material that contains a minimum of 100% recycled fibre for uncoated paper and 75% recycled fibre for coated paper.

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