www.defra.gov.uk

Feral wild boar in England

Status, impact and management

A report on behalf of Defra European Wildlife Division

defra
Department for Environment
Food and Rural Affairs

Department for Environment, Food and Rural Affairs
Nobel House
17 Smith Square
London SW1P 3JR
Telephone 020 7238 6000
Website: www.defra.gov.uk

Further copies of this publication are available from:

Defra Publications
Admail 6000
London
SW1A 2XX
Tel: 08459 556000

This document is also available on the Defra website.

Published by the Department for Environment, Food and Rural Affairs. Printed in the UK, August 2005, on material containing 80% post-consumer waste and 20% Elemental Chlorine Free pulp.

PB11232C

Feral Wild Boar in England

Status, impact and management

A Report on behalf of Defra European Wildlife Division

Charles J. Wilson
Senior Wildlife Management Adviser
Defra, RDS National Wildlife Management Team, Exeter.

July 2005

Contents

Contents

Acknowledgements: I thank all those who took part in discussions for this review, in particular N. Sims, University of Sussex, J. Cox, EN, and N. Moore, CSL, for providing unpublished data, and colleagues in the Forestry Commission, Forest Research, Forest Enterprise and Defra Veterinary Divisions for helpful discussion and advice. I also thank colleagues in the NWMT for information on escapes and in European Wildlife Division for helpful comments on the draft report.

Summary

Feral wild boar populations have recently become established in England. The largest of these is located in Kent/East Sussex, and there are others in west Dorset and Herefordshire. The total current population is estimated at fewer than 500 animals and eradication of the existing populations is still considered feasible. Other escapes have occurred and in some cases may have led to animals breeding in the wild.

Wild boar farming is increasingly popular and there are currently estimated to be up to 100 wild boar farms in England, with *c.* 3000 breeding sows. Wild boar farms in England are widely dispersed across the country and demand still exceeds supply. The feral populations are all believed to have originated from farmed stock.

In the wild, wild boar are closely associated with cover, in particular woodland habitats. They also use open habitats, including farmland, particularly at night, for feeding and travelling between different parts of their range.

Wild boar can damage a wide range of agricultural crops and are important pests of agriculture in Europe. To date, most damage reported in England has been rooting of grassland but damage may also be caused to arable crops and to fencing, and there have been occasional unconfirmed reports of lamb predation.

Wild boar can potentially act as a reservoir for Classical Swine Fever (CSF) and Aujeszky's Disease (AD), and as a vector for Foot & Mouth Disease (FMD) and Bovine Tuberculosis (bTB). A threshold population size of over 200 animals and density over 1/km^2 are considered necessary for CSF to persist. FMD infected wild boar are capable of excreting large quantities of virus and spreading the disease but evidence suggests that the risk of infection of livestock from infected wild boar is very low. In the case of AD, it is not clear if the strain found in wild boar in Europe is the same as that found in domestic pigs.

Wild boar may also impact on native fauna and flora and there has been concern about the effect they may have on bluebell woods or as opportunistic predators of small mammals and birds nests. At moderate density their impact on woodland habitats is probably beneficial.

Authenticated attacks by wild boar on humans are very rare; only two reports of attacks were found in the scientific literature. A total of 12 incidents have been recorded in the UK over *c.* eight years but physical contact was only made in two cases. A total of 14 road traffic accidents were recorded over nine years and in one of these minor human injuries were reported.

The presence of feral boar could be seen as the return of a former native species and, as a keystone woodland species, their impact could make them a valuable component in semi-natural woodlands. They may also reduce

Summary

populations of harmful invertebrates and rodents in commercial woodland and will feed on the roots of bracken, an invasive species. In addition, their return may be seen by some as presenting an opportunity for hunting a quarry not previously available in England.

Methods used for reducing potential wild boar damage, include fencing, supplementary feeding and culling. The main techniques for population control likely to be used in British conditions are live-trapping or shooting. Alternative means of management include the use of oral immunisation against CSF or the use of immuno-contraception. These techniques are currently under study.

There is no specific legislation governing methods of controlling feral pigs/wild boar in this country. Restriction of permitted firearms is currently effected by local Police firearms licensing officers and the keeping of farmed wild boar is currently regulated under the Dangerous Wild Animals Act 1976. The Destructive Imported Animals Act 1932 could provide a more adaptable means of regulating both their keeping and the control of escapes.

Due to their large potential impact, there is clearly a need to consider the likely costs and benefits if wild boar were allowed to become more widely established, to determine how best to manage the feral populations, if legal controls are necessary, and if the problems they may cause justify a programme of reduction or eradication.

Part 1: Introduction

1.1 Wild boar *Sus scrofa* were once native to Britain but were probably driven to extinction by man around the end of the 13th century (Rackham, 1986; Yalden, 1999). However, the development of wild boar farming, which started in the 1980s (Booth *et al.*, 1988), has been accompanied by occasional escapes from farms and abattoirs and led to the establishment of a small number of feral breeding populations. Because wild boar have a high reproductive capacity and good dispersal abilities, such escapes have the potential to spread and become widely established if they are not controlled.

1.2 The established feral populations now present a number of problems. On the one hand, they might be considered a successful, albeit unplanned, re-introduction of an extinct species and a valuable addition to our biodiversity. On the other, they are a potential reservoir for livestock diseases, a destructive pest of agriculture or native biodiversity and a potential danger to people or pets. There are also no specific legal controls on the ways, or the times of year, in which they may be killed, to ensure that it is done humanely.

1.3 This review draws on discussions with key parties with interests in or knowledge of wild boar in Britain (see Appendix 1), a review of relevant scientific literature and other authoritative published material, and on experience to date with the existing feral populations. It aims to assess their present status, the potential problems they may cause, management options and the legislative framework for their control in the wild and the prevention of further escapes. The review includes proposals on policy and possible legislative changes, where appropriate, and it is intended that it should act as a stimulus for further discussion and help to inform public debate on the future of feral wild boar in England.

Part 2: Biology and Ecology

Description

2.1 The wild boar is the ancestor of and can freely inter-breed with domestic pigs. Animals with the general appearance of wild boar may be pure wild boar, feral pigs, or hybrids. Some feral pig populations, such as those in Australia and parts of North America, are descended entirely from domestic stock (Lever, 1985; Long, 2003) but the animals present in England, with a wild boar-like appearance, are likely to be pure wild boar or wild boar hybrids. However, since some of the farmed stock is cross-bred with domestic pigs, the true genetic status of the feral populations is uncertain.

2.2 Adult wild boar are large animals and can weigh up to 300kg but more typical weights are around 100kg for males and 75kg for females (Pepin *et al.,* 1987). They are usually dark in colour but can vary from pale grey-buff through red-brown to black (Macdonal & Frädrich, 1991). The piglets at birth measure about 25cm long and weigh less than 1kg. They have a red-brown coat, with longitudinal stripes, which they moult to uniform red-brown at four to five months of age then to the adult coat at about ten to 12 months (Massei & Genov, 2000; Vassant, 1995).

World Distribution & Status

2.3 Wild boar naturally occur from western Europe to south-east Asia (Corbet, 1966; Spitz, 1999). They formerly occurred in Britain and southern Scandinavia and have been reintroduced in the latter (Lever, 1985). They have been widely translocated in Europe to stock hunting areas (Corbet, 1966; Genov, 1999) and have increased significantly in numbers across Europe in recent decades (Sáez-Royuela & Telleria, 1986; Spitz, 1999).

2.4 Outside their natural distribution wild boar or feral pigs have become widely established, including in parts of the USA, Africa and most of the major oceanic island groups (Lever, 1985; Long, 2003).

2.5 The taxonomy of wild boar in Europe is complex due to animals having been moved and interbreeding between animals of different geographical origin or with domestic pigs (Genov, 1999). However, it has recently been concluded that all European boar belong to one sub-species *Sus scrofa scrofa* (Genov, 1999).

Social Organisation & Reproduction

2.6 The typical social structure of wild boar is of related females living in groups, along with sub-adults and juveniles, whilst the mature males lead a largely solitary existence for most of the year (Fernandez-Llario *et al*., 1996; Gabor *et al.,* 1999; Leaper *et al.,* 1999). The males join the female groups for the rut, which mainly takes place from November to January (Groot Bruinderink *et al*., 1994; Mauget, 1991), and the main farrowing period is in spring (Fernandez-Llario *et al.,* 1996; Mauget, 1991).

2.7 In favourable conditions sows can reach breeding condition in their first year (Coblentz & Baber, 1987; Gaillard *et al.*,1993; Moore, 2004). True wild boar normally only have one litter per year but, again in favourable conditions, they can have a second litter (Boitani *et al.,* 1995; Fernandez-Llario & Mateos-Queseda, 1998; Groot Bruinderink *et al.*, 1994; Pépin *et al.,* 1987). Typically they have smaller litters than domestic or feral pigs with usually 3-5 young per litter (Boitani *et al.,* 1995; Coblentz & Baber, 1987; Fernandez-Llario & Mateos-Queseda, 1998; Gabor *et al.,* 1999; Massei *et al*., 1996).

2.8 Wild boar can live up to 10 years in the wild (Jezierski, 1977) but in hunted populations there may be few animals more than 5-6 years old (Boitani *et al.,*1995). Sex ratio is usually about 1:1 and overall mortality rates appear to be similar for both sexes (Boitani *et al.,* 1995; Focardi *et al*., 1996; Massei *et al.,* 1997).

Habitat Selection & Diet

2.9 Wild boar show a preference for woodland or other habitats which provide suitable cover (Boitani *et al.*, 1994; Gerard *et al.*, 1991; Spitz & Janeau, 1990). This is especially important during daytime and sows are particularly associated with dense cover (Boitani *et al.*, 1994; Gerard *et al.*, 1991; Spitz & Janeau, 1995). Use of open habitats is mainly limited to night time, for feeding, travelling between different parts of the home range, or for longer distance movements (Boitani *et al.*, 1994; Spitz & Janeau, 1990).

2.10 Wild boar are omnivorous but around 90% of their diet is made up of a wide variety of vegetable matter (Fournier-Chambrillon *et al.,* 1996; Genov, 1981a; Groot Bruinderink *et al.*, 1994; Hahn & Eisfeld, 1998; Massei *et al.,* 1996; Schley & Roper, 2003). Acorns, beech nuts and chestnuts are particularly significant dietary components (Fournier-Chambrillon *et al.,* 1996; Groot Bruinderink *et al.*, 1994; Singer *et al.,* 1981; Valet *et al.,* 1994).

2.11 Animal food makes up only *c*. 10% of the diet (Genov, 1981a; Groot Bruinderink *et al.*, 1994; Massei *et al.,* 1996), but is consumed frequently (Fournier-Chambrillon *et al.*, 1996; Genov, 1981a). Species taken include insect larvae, earthworms and snails (Massei *et al.,* 1996; Schley, 2000) and carrion is consumed opportunistically (Dardaillon, 1987).

2.12 Wild boar also exploit a wide range of cultivated plants and these can make up a large proportion of their diet (e.g. Genov, 1981a). Preferred plants include potatoes, maize and vines (Fournier-Chambrillon *et al.*, 1996; Mackin, 1970). Deliberate supplementary feeding, often with maize, is important in some parts of Europe in winter, making up as much as 50% of the diet (Fournier-Chambrillon *et al.*, 1996; Hahn & Eisfeld, 1998).

Home Range, Movements & Population Density

2.13 Wild boar home ranges vary considerably in size. *Annual* home ranges of 120-150km² for males, and 40-60km² for females, have been recorded in

Europe (Janeau & Spitz, 1984, cited in Dardaillon & Beugnon, 1987). Mean *seasonal* or *monthly* home ranges have been recorded from 1.1km² (Boitani *et al.,* 1994) to over 50km² (Maillard & Fournier, 1994). Radio-tracking of 18 juvenile/sub-adult animals by Central Science Laboratory (CSL) in the Weald and Ross-on-Wye areas gave range sizes of 1.0-9.6km² for animals tracked for between one and 12 months (Moore, 2004).

2.14 Long distance dispersal movements of up to 300km for males and 100km for females have been reported and even large rivers present little obstacle to dispersal (Andrzejewski & Jezierski, 1978; Dietrich, 1984, cited in Spitz & Janeau, 1990). However, normal dispersal distances are less than 20km (Dardaillon & Beugnon,1987; Truvé & Lemel, 2003) and in England the maximum distance moved by a radio-tracked animal was a male which moved 20km from the site where it was trapped (Moore, 2004).

2.15 Population densities for boar and feral pigs vary widely (0.3-26/km²; Coblentz & Baber, 1987; Kanzaki *et al*., 1998) with feral pigs tending to live at higher densities than true wild boar. Typical densities for wild boar in continental Europe range from 2-5/km² (Smiet *et al*., 1979; Ickes, 2001).

Part 3: Wild Boar in England

Potential Reintroduction to Great Britain

3.1 The wild boar is popularly believed to have survived in Britain until the 17th century (e.g. Corbet, 1966; Harting, 1880; Spitz, 1999). However, it is likely that its numbers were supplemented by introductions for a long time prior to this and true native wild boar may have become extinct around the end of the 13th century (Rackham, 1986; Yalden, 1999).

3.2 Article 22 of the European Community Habitats Directive 1992 (92/43/EEC) requires that member states study the desirability of reintroducing *Species of Community Interest* (listed in Annex IV of the Directive) to parts of their former range from which they have been lost. Although the wild boar is not listed in Annex IV it has been suggested as a potential candidate for reintroduction (Howells & Edwards-Jones, 1997; Leaper *et al.,* 1999; Yalden, 1986; 1999).

Wild Boar Farming

3.3 Small numbers of wild boar have been kept in zoos and wildlife collections in Britain for many years but commercial farming of the species for meat production only became established in the 1980s (Booth *et al.*, 1988). In 1989 the British Wild Boar Association (BWBA) was formed to promote wild boar farming (Booth, 1995). By the mid 1990s there were around 40 wild boar farms, with about 400 breeding sows (Kyle, 1995) and by 2001 the BWBA had a register of about 2,000 breeding sows (Defra, 2002). The BWBA estimate that their membership accounts for about 80% of British farmed wild boar. A survey carried out by Defra in 2002 identified only 38 licensed wild boar farms in England (J. Leach, Defra) but the 2004 June Census suggests that there may now be as many as 100 holdings in England with about 2,800 breeding sows, including hybrids (S. Langton, Defra). The distribution of BWBA members farming wild boar in England is shown in Figure 1.

3.4 The keeping of farmed wild boar is controlled under the Dangerous Wild Animals Act 1976 (DWA Act) (see Legislation, Part 7). Following a review of the DWA Act it has been proposed that farmed wild boar be removed from its provisions.

Part 3: Wild Boar in England

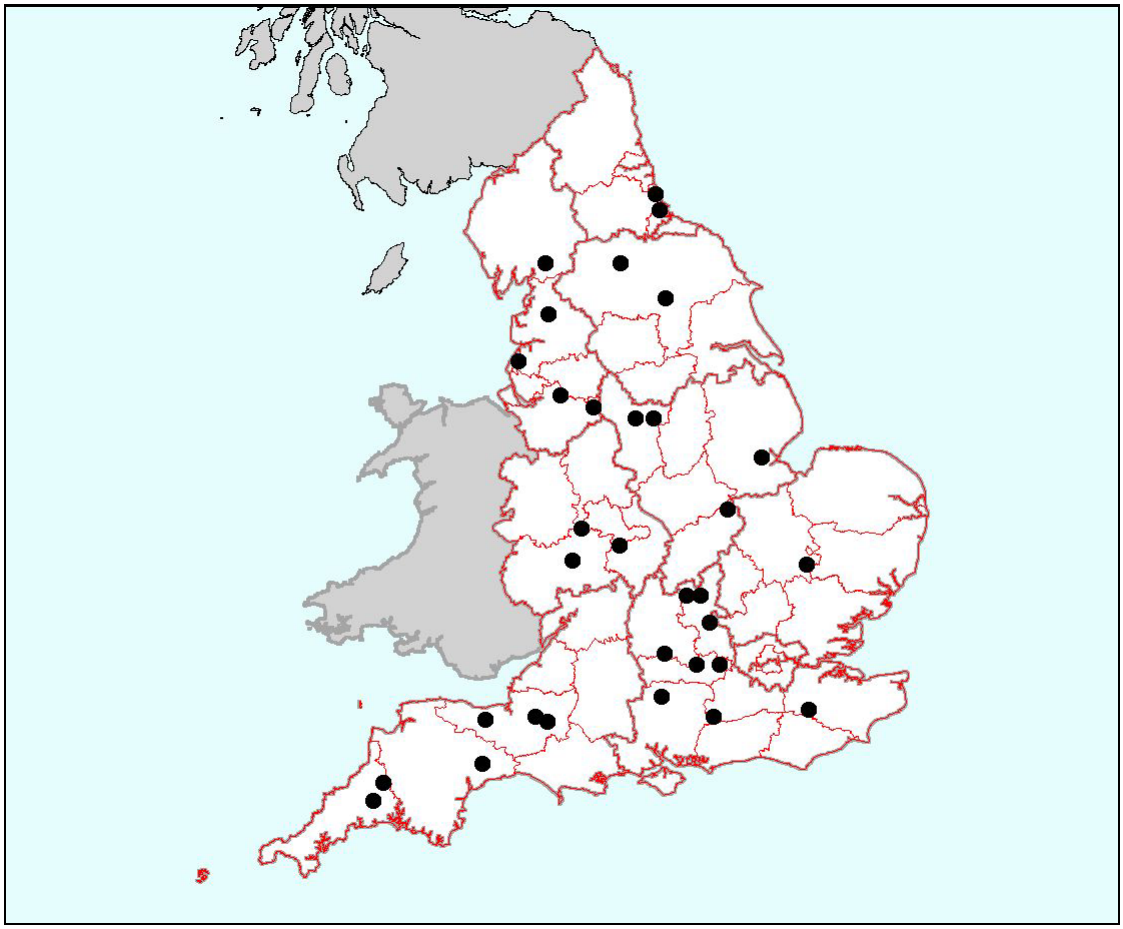


Figure 1: Locations of BWBA members' boar farms in England. There may be at least as many farms again, which are not members of the BWBA.

3.5 The original wild boar farms used surplus wild boar from zoo stock and some cross-bred stock (Booth *et al.*, 1988; Booth, 1995). Cross-breeding with domestic sows achieves more frequent farrowing and larger litter size (Booth, 1995; Kyle, 1995). However, the BWBA promotes the use of pure stock. Purity of stock is usually judged on the basis of phenotypic characteristics (Booth, 1995) but the BWBA is currently developing a quality assurance scheme that also employs DNA testing (I. Horrell, BWBA). Wild boar meat labelled and sold as such must now be derived from animals of at least 93% wild boar ancestry (Defra, 2002).

3.6 Farmed herd sizes range from fewer than 10 to over 130 breeding sows (S. Langton, Defra). The total annual UK market for wild boar meat is estimated at 500,000kg or £2m and the market for stock is estimated at £100,000 (BWBA). Demand for wild boar meat currently exceeds supply (BWBA; Defra, 2002).

Current Feral Pig/Wild Boar Populations

3.7 Over the last two decades there have been a number of escapes of wild boar or wild boar crosses from captivity and the current feral populations

undoubtedly derive from such escapes. The Rural Development Service (RDS) National Wildlife Management Team (NWMT) has received anecdotal reports of animals having escaped from farms, abattoirs and private wildlife collections. The majority of reports has been investigated by the NWMT or CSL (Wilson, 2003b) (Figure 2).

3.8 Breeding in the wild has been confirmed in the three longest established populations (Goulding *et al*., 1998 & 2003; Moore, 2004; Wilson, 2003a). In addition, there are another two areas where breeding may have taken place and other reports of escapes or animals possibly living in the wild. The reports recorded probably cover most cases of significant escapes or free-living feral boar, but sightings elsewhere have been reported in the press and some escapes may have occurred and gone unreported.

Kent/East Sussex

3.9 The largest current population of feral wild boar is that in The Weald in Kent/East Sussex. This population has probably been present since the late 1980s/early 1990s and may have originated from escapes when fences were damaged during the great storm of 1987. The animals appear, phenotypically, to be wild boar, but up to 20% of the population are light-coloured individuals (Moore, 2004). The distribution shown in Figure 2 has been estimated using data from Goulding *et al*. (1998), Moore (2004) and NWMT Wildlife Advisers. The number of 1 km squares where boar have been recorded has increased since 1998, but using 5 x 5km squares, which may give a more accurate indication of range, the overall range appears to have remained the same at 175km² (Moore, 2004).

3.10 The 1998 CSL report estimated that the number of boar in the Kent/Sussex population was between 49 and 160 animals and confirmed that breeding had taken place. Unconfirmed reports suggest that more than 300 animals have been shot to date. Assuming a population density of about 5/km^2 CSL now estimate the population in their main study area to be around 200 animals (Moore, 2004) suggesting that the population has been heavily culled. Density is believed to be lower in the periphery of the range and higher in some woodland areas, where the boar are concentrated.

West Dorset

3.11 The population in west Dorset has been monitored by the NWMT since 1997 (Wilson, 1999 & 2003a). The animals here also appear, phenotypically, to be wild boar. This population is believed to have originated from escapes from a farm in winter 1994/5 and reports of sightings or damage have been recorded from 47 km squares and the presence of boar confirmed in 21 of these (Wilson, 2003a).

3.12 The original escapes are believed to have involved fewer than 10 animals but more than 70 are reported to have been killed since 1994. Breeding has been confirmed by sightings of sows with piglets, including a litter of very young striped piglets seen by the NWMT (Wilson, 2003a).

Part 3: Wild Boar in England

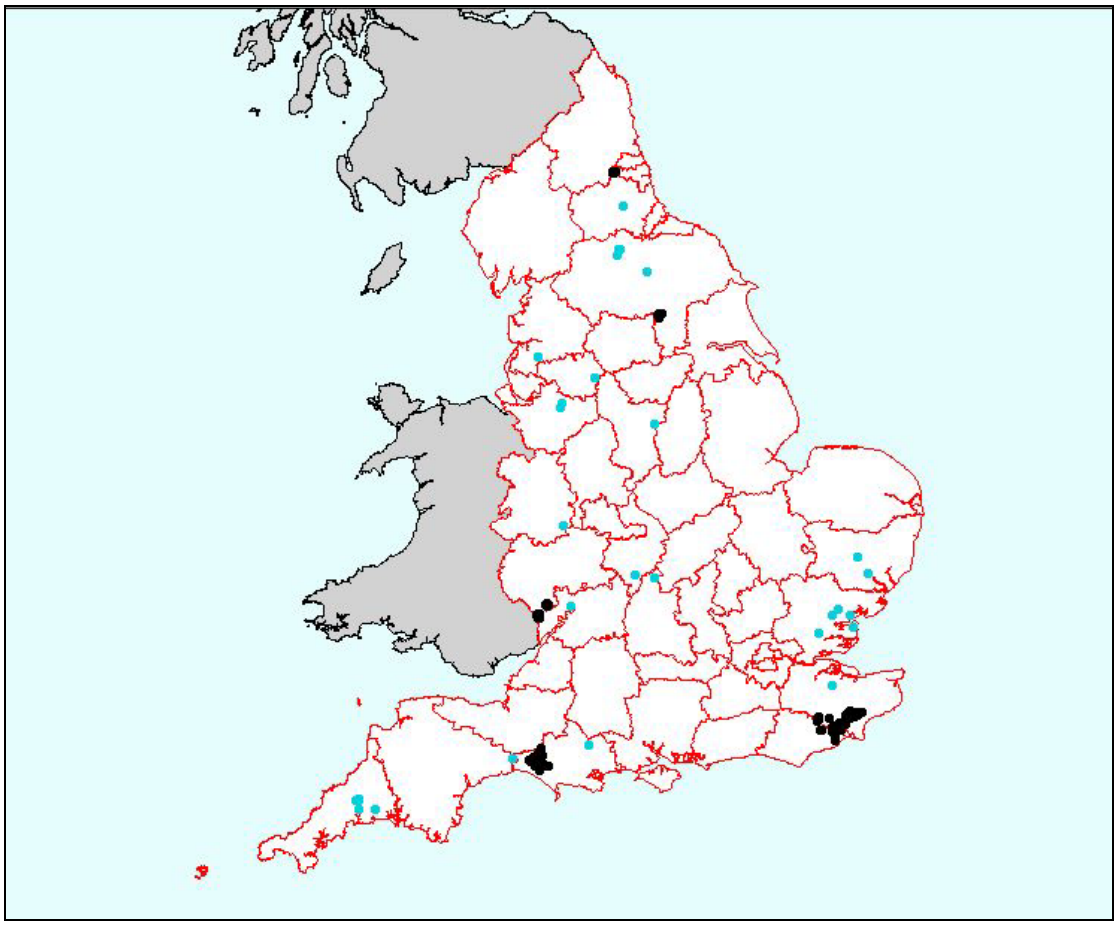


Figure 2: Distribution of reports of feral pigs/wild boar in England since 1990. Black dots show populations extant in 2004; pale dots show areas where animals are believed no longer present.

3.13 A retrospective census of the Dorset population suggested that the minimum over-winter population had remained at fewer than 20 animals and that the post breeding population may have peaked at about 30 in 1998 (Wilson, 2003a). This population appears to have been contained at a low level as a result of heavy culling. A recent escape of 29 animals threatened to add significantly to the population in this area but virtually all of these have been recaptured (Table 1). Assuming a population of 30 animals occupying about 27km² (the number of km squares with at least two records; Wilson, 2003a) this gives an overall population density of 1.1 boar per km².

Ross-on-Wye/Forest of Dean

3.14 Reports were first received from this area in 2000 and these animals also have the appearance of wild boar. This population probably originated from escapes from a farm in the late 1990s (P. Herritty, NWMT). Most of the reports are from six km squares south of Ross-on Wye but they may also have crossed the River Wye into Wales (R. Chaffer, CSL). Reports have also

been received of two male boar killed in road accidents: 15km to the east in 2002 and 10km to the south, in 2004.

3.15 Up to the end of 2003 at least three were known to have been killed in this area but significantly more than this are believed to have been killed since then. Reliable reports suggest that breeding has occurred each year since 2001 but the size of the colony is still believed to be small and there is no evidence yet of significant growth in numbers.

3.16 In 2004 a boar, or possible hybrid, was reported to have escaped from an abattoir 10km south of Ross-on-Wye (N. Sollis, FC), and in November 2004 an illegal release of wild boar, thought to involve at least 25-30 animals, is suspected to have occurred in the Staunton area, 10km to the south-west (Table 1). Several animals have since been shot in this area but, at the time of writing, a significant number is believed to be still at large.

Other colonies and reported escapes

3.17 Several other substantial escapes have been reported and some of these may have resulted in animals breeding in the wild. The most significant of these have been near Gateshead (Tyne & Wear) in 2001, near York (2003-04) and the Bodmin area in Cornwall in 2002.

3.18 The remaining reports, summarised in Table 1, mainly concern escapes or records of single or small numbers of animals, which are believed to have been recaptured or killed. Exceptions are the incident at Catterick, North Yorkshire, which occurred in 1993 and involved up to 27 boar, and the Dorset and Forest of Dean incidents already referred to. All but two of the Catterick boar are thought to have been recaptured.

Part 3: Wild Boar in England

Table 1: Reported escapes of wild boar in England: 1990 to February 2004.

Location	Number of animals	Time in wild	Last reported
Bishop Aukland, Co Durham	1	< 1 year	January 1993
Catterick, N. Yorks (several reports)	Initially up to 27	Possibly > 8 years	October 2001
Thirsk, N. Yorks	3	< 1 year	February 1993
Charnock Richard, Lancs	1	Unknown	January 1995
Stalybridge, Gt Manchester	Unknown	< 1 year?	1996
Knutsford, Cheshire (several reports)	1?	< 1 year	January 2001
Mansfield, Notts	Unknown	< 1 year	October 1999
Highley, Shropshire	7+	3 months	January 1999
Shipston-on-Stour, Warks	< 5 (same as below?)	< 1 year	March 1998
Banbury, Oxfordshire	< 5 (same as above?)	< 1 year	March 1998
Stowmarket, Suffolk	8	1 month	January 1991
Ipswich, Suffolk	1	Unknown	February 1993
Tiptree area, Essex (several reports)	6 to 8	> 1 year?	April 1996
West Hanningfield, Essex	1	Unknown	1997
Hucking, Maidstone, Kent	1	Unknown	October 1997
Bridport, Dorset	29	Most < 2 weeks	February 2004
Near York, N. Yorks	<10	>6 months	Still present
Liskeard, Cornwall	Possibly only 1 on each occasion	Normally <1 day	November 2004
Staunton, Forest of Dean	25-30	>3 months	Still present

Part 4: Problems caused by Wild Boar

Damage to Agricultural Crops

4.1 Over 400 species of plants, animals and fungi have been recorded in the wild boar's diet, including over 40 crop plant species (Schley & Roper, 2003). Cultivated crops represent an important dietary component throughout western Europe and the main crops taken include maize, potatoes, oats, sugar beet, wheat and grasses. Maize appears to be the most preferred crop but this may be due to its frequent use as a supplementary feed by hunters.

4.2 Consumption of crops does not necessarily equate to economic damage but wild boar are considered an important pest of agriculture in much of Europe e.g. in Poland about 70% of agricultural damage due to wildlife is caused by wild boar (Mackin, 1970). Vegetables appear not to suffer significant damage but vineyards do (Fournier-Chambrillon *et al*., 1995 &1996; Onida *et al*., 1995). Damage has been reported in a vineyard in Kent but this concerned rooting on grassland between the vines (Butt, 1994).

4.3 The most evident form of damage so far with the English feral populations is rooting of grassland (Goulding *et al.*, 1998; Wilson, 2004). Similar rooting is recorded wherever wild boar occur on mainland Europe (e.g. Dardaillon, 1987; Gallo Orsi *et al.*, 1995; Geisser, 1998; Genov, 1981b; Mackin, 1970; Onida *et al.*, 1995). This tends to be seasonal (Dardaillon, 1987; Gallo Orsi *et al.*, 1995; Genov 1981b; Moore, 2004; Welander, 2000; Wilson, 2004) occurring when the soil is relatively damp and soft.

4.4 Damage levels may be related to boar density (Geisser, 1998) but other factors, such as proximity to cover (Genov, 1981a; Mackin, 1970; Onida *et al.*, 1995) and the length of the field/wood boundary (Genov, 1981a) are also likely to be important. Most rooting damage in both Dorset and Kent/East Sussex has been recorded within 100m of woodland cover (Goulding *et al.*, 1998; Moore, 2004; Wilson, 2004). A key factor affecting the level of damage to agricultural land appears to be the availability of preferred natural foods within the woodland; in particular the availability of mast (Andrzejewski & Jezierski, 1978; Fournier-Chambrillon *et al.*, 1996).

4.5 Other crop damage recorded for the feral populations in England includes rooting in recently sown cereal fields, damage to ripening maize, trampling in wheat crops and rooting and trampling in turnip fields (Butt, 1996; Goulding *et al.*, 1998; Moore, 2004; own unpublished data). Potential soil contamination of silage may also be a problem (R. Sheasby, NFU). In Kent/ East Sussex, out of 92 damage incidents, only three were considered 'severe' (Moore, 2004), whilst in Dorset, out of 58 reports of rooting damage recorded, four were considered 'severe', with 30% or more of the affected area rooted up (Wilson, 2004).

Predation of Livestock

4.6 Several reports of suspected lamb predation by feral wild boar in the Kent/Sussex area have been received by the NWMT and CSL (Bennett, 1995; Goulding *et al.*, 1998). Goulding *et al.* (1998) followed up reports of alleged

lamb predation on five separate farms. These claimed losses of 2-30 lambs per farm, all in fields close to woodland and mostly involving 1-2 day old lambs, but it was not possible to show conclusively that wild boar were responsible. Only one report of lamb predation has been received from Dorset, where it was claimed that a boar was seen attacking lambs, but again it was not possible to verify this. There are no accounts in the scientific literature of wild boar predating lambs (Goulding *et al.*, 1998) but it is a recognised problem with feral pigs in Australia (Tisdell, 1982). There has also been one unconfirmed report of a wild boar injuring cattle in the Hereford population.

Other Agricultural Damage

4.7 A number of other potential damage issues has been raised. For example, cross-breeding as a result of wild boar breaking into outdoor pig units may have an adverse impact on profitability (R. Sheasby, NFU). Wild boar are also capable of causing significant damage to stock-proof fencing and other types of fences. Normal agricultural fencing or hedging are not effective barriers against wild boar and the animals may cause damage, both by necessitating repairs to fences/hedges, and by allowing stock to escape. Similarly, damage to fencing at game rearing facilities, such as pheasant release-pens, or to rabbit- or deer-proof fencing could also be significant.

Disease

4.8 A range of diseases has been recorded in wild boar (Table 2) and the potential for feral populations to act as a reservoir or means of spread of livestock disease is one of the main concerns for farming organisations in England. Some of the diseases involved can affect other livestock species as well as pigs. Those of most concern are Classical Swine Fever (CSF), African Swine Fever (ASF), Foot & Mouth Disease (FMD), Aujeszky's Disease (AD) and Trichinosis. None of these are endemic to the UK although current VLA/CSL projects involve screening wildlife, including feral pigs/wild boar, for Trichinosis, as well as Bovine Tuberculosis (bTB) (P. Duff, VLA). The exotic diseases are discussed in more detail below, however, there are a number of endemic diseases in the UK which wild boar could potentially transmit from pig unit to pig unit. These include bTB and Salmonellosis, and possibly also Postweaning Multisystemic Wasting Syndrome (PMWS) and Porcine Dermatitis Nephropathy Syndrome (PDNS), although the means by which the latter two are spread is not yet known (A. Simmons, Defra).

4.9 PMWS is considered the most important disease affecting the UK national pig herd and, along with PDNS, it may predispose pigs to other infections (VLA, 2003). It may be caused by a porcine circovirus and is now distributed worldwide (Segales & Domingo, 2002). PMWS has recently been identified in wild boar raised under free-range conditions (Ellis *et al.*, 2003) and in a free-living juvenile wild boar found dead in Germany (Schulze *et al.*, 2003). It is therefore possible that the disease could be endemic in some European wild boar populations. However, results of an investigation of the spread of the disease in domestic pigs in Bavaria (Ritzmann *et al.,* 2002)

suggest that domestic stock density and movements were the primary factors in its spread.

Table 2: Diseases recorded in wild boar by the Office International des Epizooties (Collated by P. Duff, VLA from OIE reports 1997-2002).

Disease	**Countries Recorded**
Salmonellosis*	Austria, Hungary
Leptospirosis*	Austria, Italy, Latvia
Pasteurellosis*	Widespread
Q Fever*	Austria
Echinococcosis	Austria, France
Chlamydiosis**	Italy
African Swine Fever	Italy
Classical Swine Fever	Italy, France
Sarcoptic Mange*	Widespread
Aujeszky's Disease	France, Germany
Tuberculosis (unspecified)	Spain
Bovine Tuberculosis*	Spain, France
Avian Tuberculosis*	Italy
Trichinosis	France, Italy, Latvia, Netherlands, Slovakia
Brucellosis (unspecified)	Italy
Porcine Brucellosis	France
Rabies	Slovakia

**Endemic in livestock in UK; **Possibly endemic in UK.*

4.10 Salmonellosis is one of the most common causes of food borne disease in humans worldwide and infection is most commonly transmitted to people through contaminated food (Wegener *et al.*, 2003). Several recent European surveys found *Salmonella* strains in up to 7% of wild boar carcasses (Decastelli *et al.*, 1995; Vicente *et al.*, 2002; Wisniewski, 2001). This compares with a prevalence of 23% in caecal samples and 5.3% in carcass swabs from 2509 domestic pigs at slaughter in a UK survey in 1999/2000 (Davies, 2000).

4.11 The badger is currently considered the only significant self-sustaining wildlife reservoir of bTB in the UK (Delahay *et al.*, 2002). However, bTB is known to occur in wild boar populations in a number of European countries (Machackova *et al.*, 2003), e.g. 4.3% of 395 boar examined in Italy were found to have tuberculous lesions (Mignone *et al.*, 1995). Of ten identified to type, six were *Mycobacterium bovis* and four *M. tuberculosis.* In Central Europe *M. bovis* was identified in 22 boar (5.1% of those examined) between 1983 and 2001 (Machackova *et al.*, 2003). Thus, in high density populations such as those found in Central Europe, the wild boar may have the potential to act as a vector of bTB (Machackova *et al.*, 2003).

4.12 At the time of writing bovine TB is not a notifiable disease in feral pigs/wild boar in the UK. A small number of feral wild boar have been tested for TB and no evidence was found (Central Science Laboratory, 2004) but a

bTB incident was confirmed in *farmed* wild boar in the West Country in 2000 in an area with a history of bTB breakdowns in cattle herds (R. De La Rua, Defra).

Classical and African Swine Fever

4.13 CSF, sometimes called 'Hog Cholera', and ASF, are classified by the Office International des Epizooties (OIE) as List A diseases, requiring that any suspected case be investigated and that confirmed outbreaks be notified. The reporting and control of CSF and ASF in England is now governed by The Classical Swine Fever (England) Order 2003 and The African Swine Fever (England) Order 2003, respectively (see Legislation section). CSF is caused by a pestivirus and is probably the most important viral disease of domestic pigs (Moennig, 2000). Mortality amongst young animals, in particular, can be very high, reaching as much as 90% (Moennig, 2000).

4.14 Outbreaks of CSF in domestic stock have often been linked to swill feeding and the risk of disease spread is greatest in areas with high pig and pig farm density (Fritzemeier *et al.*, 2000; Moennig, 2000). Wild boar are also fully susceptible and epidemics in wild boar populations have also been reported to be initiated by swill feeding, for example by hunters (Laddomada, 2000). In Germany in the 1990s, 59% of primary outbreaks in domestic pigs were found to be due to direct or indirect contact with infected wild boar (Fritzemeier *et al.*, 2000). Indirect transfer, for example, through contaminated equipment being used by farmers who were also hunters, feed contaminated by wild boar excretions or carcasses, or illegal swill feeding, appear to have been more important than direct, animal to animal contact (Moennig, 2000).

4.15 However, most wild boar populations in western Europe have remained free from CSF and the disease is prevalent only in a few limited foci. It appears that the disease in wild boar normally proceeds to spontaneous extinction within a few years (Artois *et al.*, 2002). Exceptions to this general rule have occurred in France, Germany and Italy, where disease outbreaks have been prolonged, with a slow progressive reduction in infection following an initial peak (Artois *et al.*, 2002). The most persistent problems have occurred in Sardinia, where CSF has been recorded in the wild boar population in two areas for more than 15 years (Laddomada, 2000). Despite "relatively high" wild boar densities outside these areas (~2-3 wild boar/km²) the disease has remained largely confined within the established infected areas (Laddomada, 2000).

4.16 Surveys in France and the Netherlands suggest that wild boar are not a significant threat with respect to CSF in these countries (Albina *et al.*, 2000; Elbers *et al*., 2000). Some studies suggest that their role is dependent on a threshold density and/or population size of about 200 susceptible animals in an area of approximately 220km² (Artois *et al.*, 2002), about 3 animals/km² (Zanardi *et al.*, 2003) or "a few hundred individuals" (Laddomada, 2000). If the density of the population falls below the critical threshold the reproductive rate of the disease (R_0; mean number of susceptible animals infected by each

infectious individual) is <1 and the infection naturally dies out. EU guidance suggests a threshold level of about 1 wild boar/km² (EU, 1999). Modelling by CSL suggests that a limited epizootic might occur in a population of 400 animals but would not be sustained if the population were only 200 (Moore, 2004).

4.17 Wild boar appear to be much less important in the epidemiology of ASF. They are susceptible to the disease and can be infected without showing clinical signs. However, they do not appear to spread or support persistent outbreaks of the disease (Pérez *et al.*, 1998). Even in Sardinia ASF did not spread amongst wild boar outside the endemically infected areas and appeared only to persist where the animals lived alongside infected free-ranging pigs (Laddomada *et al.*, 1994).

Foot and Mouth Disease

4.18 FMD is a viral disease which primarily affects wild and domestic ungulates. Infected wild boar/feral pigs are capable of excreting large quantities of virus, and have the potential to spread infection, but immune animals are not considered to be carriers of the disease (Callis & Shahan, 1970 cited in Pech & Hone, 1988). Nevertheless, feral pigs are seen as potentially important vectors of FMD in Australia and much work has been done to examine their possible role in the spread of the disease in that country (e.g. Pech & Hone, 1988; Pech & McIlroy, 1990). There it has been estimated that a feral pig density of 2.3-14 per km² is needed for the disease to persist (Pech & Hone, 1988).

4.19 During the 2001 FMD outbreak in the UK concerns were expressed about the potential role of wild boar in harbouring and spreading FMD virus. However, no incidents of the disease were recorded in the areas where feral wild boar were present so no wild boar samples were examined. When the epidemic spread to the Netherlands, the areas covered by the outbreak did adjoin areas where wild boar were present (Elbers *et al*., 2003). Following the outbreak of the disease, serosurveillance of wild boar from the region continued for 10 months. During this time 208 wild boar were tested for antibodies but all proved negative (Elbers *et al.*, 2003). In western Europe there have been no reports of spill-over of virus from domestic stock to wild boar over the last 80 years, suggesting that it is rare and that the risk of infection of livestock by infected wild boar is very low. The Veterinary Risk Assessment at the time of the UK epidemic (Defra, 2001) recommended that emphasis is placed on rapid diagnosis and destruction of infected stock and exclusion of feral boar, rather than on control of the boar population.

Aujeszky's Disease

4.20 AD or "Pseudorabies", is caused by a herpesvirus and although most mammal species can be affected pigs are the main host. Experimental infection of wild boar in the 1980s did not cause clinical signs (Tozzini *et al.*, 1982 cited in Müller *et al.*, 1998) but clinical disease has recently been described in a very high density (15-17/km²) fenced-in wild boar population in

Spain (Gortázar *et al.*, 2002).

4.21 Infection in wild boar has been shown to be endemic in a number of areas in the world with overall rates of seropositive animals ranging from 2.1% to more than 35% of animals sampled (Albina *et al.*, 2000; Gortázar *et al.*, 2002; Müller *et al.*, 2000). Some studies suggest that the strains found in wild boar are genetically distinct from those found in domestic pigs, being mainly attenuated and adapted to free-living hosts (Müller *et al.*, 2000). Nevertheless, the high rate of infection in some areas has led some authors to suggest that wild boar could be a source of infection for domestic pigs (Müller *et al.*, 2000; Szweda *et al.*, 1998). Conversely, the long-term presence of AD in wild boar in some regions where the disease has been successfully eradicated from domestic pigs has led others to suggest that the risk of transmission from the wild is very small (Albina *et al.*, 2000; Lutz *et al.*, 2003). In the Netherlands, where infection in wild boar has been recorded (Müller *et al.*, 2000), a survey from 1996-1999 found no infection in wild boar and the authors concluded that the risk of infection of domestic pigs was “negligible” (Elbers *et al.*, 2000).

4.22 However, because of the attenuated nature of AD virus in some wild boar populations, it has been suggested that infection of domestic pigs could be “silent” and go undetected for some time (Müller *et al.*, 2000). It is therefore recognised that surveillance for the disease needs to be maintained even if the risks are considered low.

Other Exotic Diseases

4.23 Trichinellosis is one of the most widespread parasitic helminthic zoonoses and is contracted by consumption of raw or partly cooked infected meat. It appears to have been increasing in Europe in recent years and outbreaks have been recorded in France, Germany, Italy, Spain and parts of Eastern Europe during the 1990s (Dupouy-Camet, 1999). Increased incidence in France may be linked to increased consumption of ‘rare’ wild boar meat which is insufficiently cooked to destroy the infectious larvae in the meat (Dupouy-Camet, 1999). Wild boar related infection is typically associated with hunters or their families. A joint CSL/VLA project is currently examining the incidence of *Trichinella* in some British wildlife species. A small number of feral wild boar have been tested but, to date, no infection has been reported (A. Barlow, VLA).

4.24 Other potentially important diseases which may occur in wild boar include Brucellosis and Tularaemia. Both of these have been identified in wild boar in the Czech Republic (Hubalek *et al*., 2002).

4.25 The greatest potential for transmission of disease from feral wild boar to domestic pigs is likely to occur where feral animals break into outdoor pig units. Four such incidents, associated with the current feral populations, are known to have occurred in recent years (plus a further unconfirmed incident recently reported in the press).

Part 4: Problems caused by Wild Boar

Impact on Conservation

4.26 One of the strongest arguments in favour of the return of the wild boar is the restoration of a natural component of woodland ecosystems. However, after 600 years absence many of the species and habitats that we now value for their conservation interest might be adversely affected by the activities of feral boar. In addition, areas of remaining ancient/semi-natural woodland are typically scattered and small, so may not be able to sustain otherwise potentially beneficial effects of wild boar rooting. A recent English Nature report on the condition of SSSIs does not list feral pigs/wild boar as a factor having an adverse effect on SSSI condition (English Nature, 2004), but this is not surprising since the feral populations are still small and localised.

4.27 Where they are an introduced exotic species feral pigs and wild boar generally have a negative impact on native flora and fauna (Bratton, 1975; Singer *et al*., 1984). In the UK, concerns have been raised that their rooting may destroy woodland vegetation, especially bluebells *Hyacinthoides non-scripta* (Goulding *et al.*, 1998), and cause damage to species-rich grassland. Swathes of bluebells are a characteristic feature of many English woods (Tansley, 1949). It is feared that wild boar could threaten these communities and the relative absence of comparable woodlands on the Continent is sometimes taken as support for these fears. Preliminary results from a University of Sussex study suggest, however, that, although boar root up and eat bluebell bulbs, the impact on plant density is localised and short-lived, (N. Sims pers comm.).

4.28 Rooting in unimproved grassland in a nature reserve in Dorset raised the concern that such sites could be adversely affected. Grassland on this reserve has been rooted by boar in most years since they first appeared in the area and some severe rooting has occurred (own observations). Botanical monitoring by English Nature has shown that within three years bare rooted patches were largely re-vegetated (Cox, in prep.). In all cases grass cover recovered rapidly but marsh thistle *Cirsium palustre* also colonised many of the rooted patches.

4.29 Published studies from the Continent show that localised disturbance, such as boar rooting, can break up the dominant species matrix and increase botanical diversity (Lavorel *et al.*, 1998; Milton *et al*., 1997; Welander, 2000). This may favour “disturbance specialists” such as common bent *Agrostis capillaris*, creeping thistle *C. arvense* and white clover *Trifolium repens* (Lavorel *et al.*, 1998) and small ephemeral field weeds (e.g. knotgrass *Polygonum aviculare*) (Milton *et al.*, 1997). Welander (1995) concluded that reintroduced wild boar in Sweden re-established a natural disturbance regime and caused an increase in plant species richness. Preliminary results from the University of Sussex study suggest a similar impact in Sussex (N. Sims, pers comm.).

4.30 Rooting by wild boar in woodland might also help control weeds and insect pests, improve soil aeration, fertility and structure, and create

favourable germination sites for tree seedlings (Brownlow, 1994; Genov, 1981b).

4.31 Wild boar have the potential to impact directly on other vertebrate species (Singer *et al.*, 1984). They may compete with small mammals by digging up caches of buried mast (Focardi *et al*., 2000) and may predate the young opportunistically. There is also some concern that they may predate over-wintering dormice *Muscardinus avellanarius* (A. Whitbread pers comm.). In some parts of Europe, wild boar predation is thought to have had an impact on woodcock *Scolopax rusticola,* capercaillie *Tetrao urogallus* and hazel grouse *Bonasa bonasia* (Nyenhuis, 1991; Saniga, 2002).

4.32 Views on the impact of feral wild boar in the two areas where the longest established populations currently occur were sought from local English Nature staff and staff of the Kent, Sussex and Dorset Wildlife Trusts. The overall view of these conservation organisations was that moderate disturbance by boar in woodland was having a beneficial effect. However, experience from woodland in Kent suggests that wild daffodils *Narcissus pseudonarcissus* may be susceptible to damage by boar rooting (J. Spencer, FE).

4.33 English Nature do not currently have a formal policy in relation to feral wild boar but, at the time of writing, a draft position statement has been prepared. This supports the eradication of feral populations if they are predominantly *feral domestic pigs* and states that they (EN) will take a decision on eradication on their own reserves on the basis of whether or not the animals are causing damage to the conservation interest of the site. However, if the animals are, “to all intents and purposes, wild boar” they recognise these as a native species with conservation value. They take the view that further information is needed on their possible impact and, at present, would not support their complete removal. If they are to be retained as a reintroduced species they recognise that the population will need to be managed to reduce damage and maintain “a positive conservation benefit, particularly in woodland” (A. Mitchell-Jones, EN).

Public Safety & Road Traffic Accidents

4.34 Public safety is the issue which gains most attention in press coverage of feral wild boar. Goulding and Roper (2002) found that fear of attacks on people was the issue most frequently mentioned (60%) in 107 press articles dealing with feral wild boar in England. They thought this was unfounded as they were unable to find any confirmed reports in the literature of wild boar making unprovoked attacks on people. A series of science and internet searches carried out for the present review found only three records of attacks. One involved an elderly woman thought to have died following an attack by wild boar in Japan (Hatake *et al.*, 1995) and another, a tourist who suffered a bite wound and tibial fracture following attack by a wild boar in India (Gubler, 1992). The third case involved a news report of a wild boar attacking a car in Primorye, Russia in 2001.

Part 4: Problems caused by Wild Boar

4.35 A search of UK press cuttings and queries in the areas of the boar's range (October 1998 to February 2005) uncovered 12 reported incidents involving wild boar. However, the only incidents where actual physical contact appears to have been made involved two people knocked over by an animal which had just escaped from an abattoir. The other incidents included six where people were charged by boar (mostly sows with piglets), one where a dog was chased, two where the boar stood its ground but did not attack and one where a boar was disrupting traffic in a Kent village and was considered a danger to residents.

4.36 The Defra website gives general guidance on what members of the public should do to avoid dangerous incidents if they encounter wild boar whilst out in the countryside. This includes keeping dogs on leads, avoiding walking through dense undergrowth and detouring around any animals that are encountered. People concerned that wild boar present a safety hazard in an area should inform local Police.

4.37 As large, heavy animals, wild boar are a significant cause of wildlife-related road traffic accidents (RTAs) in Europe. Groot Bruinderink & Hazebroek (1996) estimated that 0.5-5% (mean of 2%) of the spring population of wild boar in each country is involved in RTAs each year. A similar percentage for England would result in a mean of about six RTAs annually. The actual number of accidents known to Defra is 14 reports concerning at least 16 incidents over nine years. Though lower than would be expected, given the estimated size of the current populations, it is within the range recorded in other European countries. Vehicle damage was reported in at least six of these incidents but is likely to occur in most wild boar RTAs. In one case, minor injuries were reported to have been sustained by the driver of the vehicle involved.

Part 5: Potential Benefits of Wild Boar

5.1 The wild boar was once a member of the British mammal fauna and its re-establishment could be seen as restoration of a native species previously driven to extinction (Yalden, 1999). Its intrinsic value as an addition to native biodiversity, however, depends on the feral animals being true wild boar, rather than feral pigs (A. Mitchell-Jones, EN), and preferably being of a similar genotype to the animals which historically occurred in the UK. Recent analysis suggests that all native European boar belong to the subspecies *Sus scrofa scrofa* (Genov, 1999) so it seems likely that the British animals would also have belonged to this subspecies. In addition, genetic analysis by CSL on animals from Sussex has shown that DNA from the feral animals is within the range of variation found in continental Europe (Moore, 2004). These preliminary findings suggest that the feral English animals may be at least as 'pure' as their continental counterparts.

5.2 The presence of a large and novel wild animal may provide opportunities for areas with feral wild boar to benefit from 'wildlife tourism', although any local advantage might be lost if the animals become more widespread. At least one company already appears to be offering wild boar tours (Barkham, 2003).

5.3 Rooting and feeding behaviour by wild boar in commercial woodland might also have some beneficial effects. Genov (1981b) found that wild boar reduced populations of three harmful moth species including pine beauty *Panolis flammea*, as well as the pine saw fly *Diprion pini.* They may also reduce populations of rodents which can be damaging to planted trees (Brownlow, 1994; Genov, 1981b) and will feed on bracken *Pteridium aquilinum* roots (Schley & Roper, 2003). Forest Enterprise have conducted trials to assess the effectiveness of boar in removing invasive rhododendron *Rhododendron ponticum*. Whilst this did not appear to be successful in the trials, it is reported to be being used effectively by a private contractor in north west England.

5.4 Driven shooting of large game species, is not generally practiced in this country (Lecocq, 2003). This contrasts with many European countries where hunting tradition includes driving game, such as deer and wild boar, to a number of standing hunters. Most wild boar in this country are likely to be shot from high seats or by stalking. Nevertheless, the establishment of feral wild boar is seen by some as presenting an opportunity for a highly valued form of hunting not previously available in this country. Commercial stalking of wild boar is already being offered in at least one of the three existing boar populations.

Part 6: Management, Control and Damage Prevention

6.1 Worldwide, a range of methods are used to manage feral pigs and wild boar, or to reduce their impact. Techniques include fencing, supplementary feeding, population control by poisoning, trapping and shooting, and payment of compensation for damage (Choquenot et al., 1999; Coblentz & Baber, 1987; Mazzoni della Stella *et al*., 1995; McIlroy, 1995; Tisdell, 1982). The use of vaccination for disease control has also been studied (e.g. Kaden *et al.*, 2000).

Fencing

6.2 Where specific high value crops are at risk, exclusion fencing may be a cost-effective means of damage prevention. Standard stock fencing is inadequate for excluding wild boar and materials and labour costs for the construction of effective wild boar-proof wire netting fencing are likely to be in excess of £3.00 per metre.

6.3 Electric fencing is likely to be cheaper and several designs are given in the literature (Tisdell, 1982; Vassant, 1995) but none has been tested in the UK. The costs of some of the simpler fence designs are likely to be approximately £1.00 per metre and most use fencing materials that are readily available. The effectiveness of electric fencing merits further investigation.

Supplementary Feeding

6.4 Supplementary or diversionary feeding has been widely used in Europe to maintain wild boar populations for hunting, to bait them for shooting and to attempt to divert them from damaging agricultural crops. A number of early studies advocated this method for reducing damage (Andrzejewski & Jezierski, 1978; Genov, 1981b; Mackin, 1970) but more recent studies, suggest that supplementary feeding does not reduce damage (Geisser, 1998; Hahn & Eisfeld, 1998) and may even increase it (Groot Bruinderink *et al.*, 1994). Providing supplementary feed may improve survival of the animals, resulting in more damage in the future. However, carefully targeted supplementary feeding during periods of crop vulnerability may be appropriate in some circumstances (Fournier-Chambrillon *et al.*, 1996; Mackin, 1970).

Population Control

6.5 Poisoning (using '1080' or warfarin) is the most efficient method of reducing feral pig/wild boar populations and has been used on non-native feral populations overseas (e.g. Coblentz & Baber, 1987; McIlroy, 1995; Tisdell, 1982). However, there are no pesticides currently approved for use against feral pigs/wild boar in the UK under the Control of Pesticides Regulations 1986 and the laying of poisoned bait in the open is prohibited under the Protection of Animals Acts 1911-27. In addition, because of the potential risks to non-target species, the likelihood that poisoning would be considered acceptable in this country is remote.

6.6 The main alternative methods of control are shooting and trapping. Snares have been used in the Galapagos, with little success (Coblentz &

Baber, 1987), and have been used illegally in south east England (Sussex Police). The use of snares on an animal as robust as a wild boar, is unlikely to be humane and would potentially create unacceptable non-target risks, particularly for deer.

6.7 Large pen-type traps, constructed from a number of wire mesh fence panels, have been used effectively in Australia (Tisdell, 1982). Baited drop-door traps have been used successfully by CSL to trap animals for research purposes but, as in other studies, there is a tendency for these traps to catch subadults (Debernardi *et al*., 1995; N. Moore, CSL). However, as young animals appear to play an important role in the spread of CSF (Laddomada, 2000) this could be advantageous in disease control operations.

6.8 Shooting is labour intensive and in Australia it is generally only considered effective on small accessible populations (Tisdell 1982). It may also be limited by the density of cover at control sites (Coblentz & Baber, 1987). However, none of the areas where feral populations occur in this country present any significant physical access difficulties. Shooting tends to selectively remove adults and could therefore be complementary to trapping (Debernardi *et al.*, 1995).

6.9 Several techniques are used to increase the efficiency of shooting as a control method. These include baiting or other means of attracting or locating groups of animals. The use of radio-tagged so-called 'Judas pigs' has proven successful in some trials (McIlroy,1995). Current radio-tracking work by CSL on the feral populations may indicate the potential efficacy of this technique in this country.

6.10 In the event of a disease outbreak, avoiding causing animals to disperse may be equally, or more important, than reducing population size. In Europe hunting boar (with beaters and dogs) generally causes them to increase their range (Maillard & Fournier, 1994 & 1995; Sodeikat & Pohlmeyer, 2002). It is unclear whether shooting at bait stations or from a high seat would cause similar disturbance but this is thought unlikely.

Level of Control

6.11 Although wild boar are intensively hunted throughout Europe their numbers have continued to increase. Because of their high reproductive rate the level of cull required to maintain a stable wild boar population is 70-160% of the previous spring population (Csány, 1995; McIlroy, 1995; Vassant, 1995). Thus, if the English feral wild boar population were to grow to several thousand, a roughly equivalent number would need to be culled every year to maintain a stable population.

6.12 The principal concern regarding disease risk is that wild boar may harbour or spread CSF. Current EU guidance on CSF suggests that the critical threshold population level below which the disease dies out, is about 1 animal/km² (EU, 1999). Thus maintenance of a population close to, or below,

this level, rather than complete eradication, may be adequate to significantly reduce any disease risk. Furthermore, wild boar populations of less than 1/km² are unlikely to persist without constant immigration (Andrzejewski & Jezierski, 1978). This may therefore be a suitable target density in areas where the option to eradicate may be reserved for the future.

Alternative Methods

6.13 Trials of oral immunisation of wild boar against CSF have shown some promise as a means of preventing the spread of infection (Laddomada, 2000). Immunisation could provide an alternative or additive means of bringing the reproductive rate of the disease to <1, rather than relying solely on population reduction. However, young animals are less likely to be immunised because the older animals dominate the baiting points (Kaden *et al.*, 2000; Laddomada, 2000). This is particularly problematic as the young animals are most susceptible to the virus. An effective strategy for control of CSF spread is therefore most likely to involve a combination of vaccination and population reduction. Further development of vaccination strategies should be monitored.

6.14 Immuno-contraception is a non-lethal alternative to culling which has potential as a means of controlling population size (Fagerstone *et al.*, 2002). Any method which interferes with the wild boar's high reproductive rate could have a critical role in population control. The main candidate material suitable for pigs is Gonadotropin Releasing Hormone (GNRH). A single dose appears to be effective for 2+ years, and its effects are reversible (Fagerstone *et al.*, 2002). Defra is currently funding a project to examine the potential of GNRH in controlling the reproduction of feral pigs/wild boar (R. Brand-Hardy, Defra).

Part 7: Legislation

Note that certain extracts of Acts have been paraphrased in this section and the original legislation should be consulted for the exact wording. Where exact wording is given it is enclosed in double quotation marks.

Control of Animals in the Wild

7.1 There is currently no specific legislation governing the culling or management of feral pigs/wild boar in this country. The **Protection of Animals Acts 1911-1927** provide general protection for all domestic or captive animals and make it an offence to wantonly or unreasonably do anything, or omit to do anything, as a result of which unnecessary suffering is caused. The scope of these Acts is considered to include wild or feral animals held in captivity, for example, in a cage-trap. The **Wild Mammals (Protection) Act 1996** protects all wild mammals against specific acts of cruelty intended to cause unnecessary suffering. As this Act makes "impaling" or "stabbing" a wild mammal an offence it is likely that this would prohibit feral pig/wild boar hunting by so called 'pig-sticking'. However, there is no legal control over the types of firearms that may be used or the times of year when feral pigs/wild boar may be culled. Unconfirmed reports suggest that feral boar have been shot in south east England with centre-fire .22 rifles, or even rim-fire rifles. The use of such small calibres is likely to result in wounding and unnecessary suffering, and could leave an animal more dangerous than if unmolested.

7.2 Current guidance from the Association of Chief Police Officers (ACPO) specifies that a variation to include 'wild boar' on a Firearms Certificate (FAC) is required before the FAC holder can use the firearm specified on the certificate to shoot wild boar. Such a variation will only be given if the FAC holder has authority to shoot on land where feral pigs/wild boar are believed to occur and 'liberal conditions' (i.e. allowing the FAC holder to shoot on any other land he/she deems suitable) will not be given for this purpose (R. Ash, Kent Police). The term 'other vermin' used on some FACs is *not* considered to include wild boar. Home Office guidance recommends a minimum calibre for wild boar of .270 Winchester, or equivalent, (Home Office, 2002) and this is the minimum calibre the Police will normally approve. Approval may also be given for a solid non-spherical projectile (e.g. Brenneke 'slug') for use with a shotgun, but this also requires a FAC.

Keeping or Release

7.3 The release of non-native species into the wild is controlled by the **Wildlife & Countryside Act 1981**. Part I section 14 of the Act makes it an offence to release, or allow to escape into the wild, any animal of a kind which is "not ordinarily resident in and is not a regular visitor to Great Britain in a wild state". Section 27 provides definitions for a number of terms used in Part I of the Act but does not define "ordinarily resident". Guidance may therefore be required on whether a species which has been present in a feral state for a number of years could be defined as "ordinarily resident". A number of naturalised exotic species (e.g. muntjac deer *Muntiacus reevesi*) are specifically listed in Part I of Schedule 9 to the Act prohibiting further releases

even though they are already present in the wild.

7.4 The keeping of wild animals in zoos for exhibition to the public is governed by the **Zoo Licensing Act 1981** (as amended). This Act covers all species which are not normally domesticated in Great Britain. However, none of the existing feral populations, or recent escapes, are thought to have originated from zoo collections and it seems most likely that any further significant escapes would be associated with farmed animals.

7.5 The keeping of farmed wild boar is currently licensed under the **Dangerous Wild Animals Act 1976** (DWA Act). The main purpose of the Act is to ensure that dangerous wild animals kept by individuals are properly cared for and kept securely in a manner that does not present a risk to the public. The species covered by the Act are listed in a Schedule to the Act. This was amended by **The Dangerous Wild Animals Act 1976 (Modification) Order 1984**, which added to the Schedule, amongst other species, all Old-world pigs (*Suidae:* including wild boar but excepting the domestic pig). In addition, hybrids of the species listed, where one or both parents are of a kind listed, are also covered by the Act. The DWA Act is administered by local authorities and it is an offence to keep an animal covered by the Act without an appropriate licence issued by the relevant local authority. The Act is currently under review and one of the proposed changes to the Act is the removal of farmed wild boar from the Act (Greenwood *et al*., 2001).

7.6 Under section 1(3) of the DWA Act a local authority must not issue a licence unless it is satisfied, amongst other things, that:

- It is “not contrary to the public interest on the grounds of safety, nuisance or otherwise”,
- Any animal kept under the licence will be “held in accommodation which ensures that the animal will not escape”, and
- “All reasonable precautions will be taken at all such times to prevent and control the spread of infectious disease”.

Furthermore, it shall not grant a licence unless a veterinary surgeon or veterinary practitioner authorised by it has inspected the premises where the animal(s) will normally be kept.

7.7 There is no specific provision in the Act requiring action from a licensee to recover escaped animals. However, section 4 of the Act gives local authorities power to seize an animal(s), and retain or destroy it, if the animal is “being kept contrary to section 1” of the Act or any condition of the licence under which it is held. No compensation is payable if an animal is seized and the local authority is entitled to recover from the licensee any expense incurred in exercising its powers of seizure.

7.8 The Local Authorities Coordination Of Regulatory Services (LACORS) does not give detailed guidance on security requirements under the DWA Act (G. Beddoe, LACORS). Licensing under the Act is mainly carried out by

District Councils or Unitary Authorities. Concern has been expressed by the BWBA about lack of consistency in the standards required by different local authorities and in the thoroughness of inspections. The BWBA consider that wild boar should be removed from the Schedule to the Act (K. Taylor, BWBA).

Disease Control

7.9 Under section 21 of the **Animal Health Act 1981** the Minister has power, in relation to any disease (excluding rabies for which similar provisions are made in section 19) specified by order under section 1 of the Act, to make an order providing for the destruction of wild species in an area, provided that the Minister is satisfied:
That the disease "exists" among the members of that species in the area and "has been or is being transmitted from" that species to any kind of animal in the area, and
That destruction of members of the wild species is "necessary in order to eliminate, or substantially reduce the incidence of, that disease in animals of any kind in the area".
An order made under this section of the Act may authorise "methods of destruction that would otherwise be unlawful" and wild species, for the purposes of the Act, means members of a species which is "neither domesticated nor held in captivity". Despite the fact that feral pigs/wild boar are descended from escapes of farm stock it is likely that this definition would include these animals.

7.10 Under section 22 of the Act, where an authorised officer has reasonable grounds for suspecting that a disease to which section 21 applies exists in a wild species in any area, he may enter land in the area to take samples of the animals concerned and to determine if an order under section 21 should be made. Under section 22 he may also enter any land in an area covered by an order made under section 21 to destroy members of that species, or to ascertain if destruction has been effectively carried out. However, an order cannot be made under section 21 on a precautionary basis; i.e. if the disease is not suspected to already exist in the species and present a risk of transmission to other animals.

7.11 A number of orders have been made under the Animal Health Act that are potentially relevant to disease in feral pigs/wild boar. These include the Foot-and-Mouth Disease Order 1983, the Aujeszky's Disease Order 1983, The Classical Swine Fever (England) Order 2003 and The African Swine Fever (England) Order 2003. Each of these orders requires suspicion that an animal or carcase has the disease to be notified to the Divisional Veterinary Manager (DVM; or veterinary inspector or police constable, in the case of the earlier orders).

7.12 The **Foot-and-Mouth Disease Order 1983** requires notification of the disease by any "person who has in his possession or under his charge an affected or a suspected animal, or the carcase of such an animal". The Order includes "swine" but it is unclear if the requirement for notification would

extend to feral pigs/wild boar. However, at the time of writing the FMD Order is under review and it seems likely that more specific requirements for notification in wild animals will be made in the new Order. The **Aujeszky's Disease Order 1983** requires notification by the "owner of an affected or suspected animal or carcase" or "any veterinary surgeon or other person who, in the course of his duties, examines or inspects such an animal or carcase". This Order also applies to "swine" but as feral animals are not owned the requirement for notification in such animals, again, is not clear cut. Neither of these Orders deals specifically with the control of wild or feral species for disease control. The issue of additional specific orders for this purpose under section 21 of the 1981 Act would appear to be necessary.

7.13 **The Classical Swine Fever (England) Order 2003** requires notification by "any person who suspects the disease in any pig or carcase" which is in his possession, under his charge, or examined or inspected by him. Section 13 of the Order also makes provision for the Secretary of State to declare a "Feral pig investigation zone" if there is "reason to suspect that the disease exists in feral pigs". Within this zone "any person who shoots, or finds the carcase of, a feral pig" must notify the DVM. If he shot the animal he must also keep the carcase "for at least 24 hours after informing the DVM" and make it available for sampling and testing. If the disease is confirmed in feral pigs the Secretary of State may establish an "infected area" of "sufficient size to cover the area where the disease is suspected to be present". Further restrictions and requirements may be applied within the infected area, including the suspension of hunting and banning the feeding of feral pigs. In the context of the Order "feral pig" would also mean wild boar. A separate order would appear to be required to instigate control measures against feral pigs.

7.14 **The African Swine Fever (England) Order 2003** makes similar provisions with respect to ASF as The Classical Swine Fever (England) Order 2003 does with respect to CSF.

7.15 Unlike in wild deer, tuberculosis is not at present a notifiable disease in feral pigs/wild boar. However, at the time of writing there are proposals to widen the scope of the **Tuberculosis (England & Wales) Order 1984** to make the disease notifiable in all mammal species, except humans (R. de la Rua, Defra).

Part 8: Discussion and Proposals

8.1 The findings of this review are discussed below with reference to the potential for feral pigs/wild boar to cause problems in this country and the options for their future control. Where appropriate, specific proposals are made, including suggestions for changes to the legislation. Proposals are given in bold type after the relevant paragraph(s).

8.2 Experience with the existing feral populations suggests that, if necessary, they could be eradicated or contained at low population levels. This supports the view that the claim that it is "already too late" to eradicate feral boar in England, is not correct. Where wild boar occur in more extensive or heavily wooded areas, however, eradication could prove difficult. In these areas it would still be desirable to contain the populations within limits to ensure that numbers and cull requirements remain manageable.

8.3 This review does not attempt to provide an answer to the question; "should the present feral wild boar populations be eradicated?". This can only be answered on the basis of weighing the costs and benefits to different sectors. However, the evidence suggests that the choice is not necessarily as stark as between being over-run with them or getting rid of them completely.

Monitoring Escapes & Feral Populations

8.4 One of the main difficulties in assessing the potential future risks associated with further escapes or feral populations is lack of knowledge of the numbers, whereabouts, and trend in numbers of farms rearing wild boar and wild boar hybrids. Until recently, the only ready source of data on this was the BWBA but their information only covers their own members. Following discussions with Defra Statistics Division, a question on the number of farmed wild boar/hybrid breeding sows was included in the 2004 Census. Although limited by the size of the sample used, over a period of years this should provide useful data on farm locations and trends.

8.5 Early reporting of new incidents of escaped/feral wild boar is needed. This will enable up-to-date assessment of trends in the status of feral populations and provide essential information in the event of disease outbreaks. A requirement to report escapes and records of the species in new areas would be beneficial in this respect but ad-hoc recording of new reports and monitoring of existing populations by Defra should continue.

- ***Defra NWMT should continue to record, collate and, where appropriate, investigate reports of escapes and feral populations of wild boar.***
- ***Existing feral populations should be monitored by Defra NWMT or by CSL, where the latter have a significant fieldwork involvement, in cooperation with the NWMT.***
- ***A standard repeatable protocol should be developed in order to provide an index for monitoring the feral populations.***

Part 8: Discussion and Proposals

Managing Agricultural Damage

8.6 Advice should be available to farmers and others on crop vulnerability to wild boar damage, damage recognition, options for damage reduction and legal aspects of control. The RDS NWMT, with the help of CSL research findings, has been developing expertise in this area in recent years. The Team has Wildlife Advisers based throughout the country and is well-placed to provide such advice. However, some training is likely to be required for staff in parts of the country where the problem is rarely encountered or has not yet arisen. This should be backed up by suitable advisory literature and by assessment of potential fencing specifications.

- ***The RDS NWMT should continue to develop expertise in managing wild boar problems and ensure that Wildlife Advisers are adequately trained and have access to appropriate advisory materials.***
- ***As a priority, the efficacy of low-cost electric fence designs, which will give an adequate level of protection to vulnerable crops, should be assessed.***
- ***Advice should be made available to farmers and others on wild boar, the problems they may cause, and their management.***

(An advisory leaflet on wild boar is currently in preparation by the NWMT and some guidance is already available on the NWMT internet site).

8.7 The assessment and development of new techniques such as immuno-contraception, which is seen as a humane alternative method of control, could prove decisive if the eradication of local populations were considered necessary.

- ***Development of novel non-lethal methods of control, such as immuno-contraception, should be kept under review.***

(A preliminary assessment of immuno-contraception is being funded by Defra)

Minimising Disease Risk

8.8 The risk of disease transmission is likely to be heightened where wild boar are attracted into pig farms. However, the parts of the country most suited to colonisation by wild boar are separated from the main pig-rearing counties (Appendix 2) by a broad swathe of sparsely wooded land. This is likely to be relatively inhospitable to wild boar and could potentially be treated as a wild boar-free zone. It seems feasible that much of this area could be maintained as wild boar-free.

8.9 Because of the risk of further escapes from wild boar farms and the particular disease risks in areas with high numbers of domestic pig farms there may be grounds for considering stricter control of wild boar farming in these areas. There also needs to be minimum standards for the fencing required at wild boar farms. The BWBA has developed its own recommended fencing specifications but a recognised, approved minimum standard is needed. In addition, advice and guidance should be available to pig farmers wishing to improve the security of their premises against ingress by feral wild

boar.

- ***The possibility of a regionalised approach to management of feral wild boar should be considered, where they may be accepted and managed in some areas, but eradicated or kept at minimum population density in others.***
- ***The need for stricter controls on wild boar farming in 'wild boar-free zones' should be considered.***
- ***Fencing standards for keeping farmed wild boar in, and feral wild boar out, should be developed and guidance made available through access to advice and advisory literature.***

8.10 The main diseases of concern are notifiable under a series of Orders made under the Animal Health Act 1981 but in some cases there is ambiguity as to whether their notification is required in wild or feral species. Whilst the requirement appears to apply to wild/feral animals in relation to CSF and ASF, it is less clear that it applies to FMD, at least under the current Order, or to Aujeszky's Disease, nor does it apply, at the time of writing, in relation to feral pigs/wild boar and TB. In addition, hunters, gamekeepers and deer stalkers, who may be most likely to find/cull a suspect animal, may not recognise signs of the diseases in this species. Relevant training could be linked to that provided for deer stalkers and others likely to be involved in culling wild boar. The St Hubert Club of Great Britain already includes a chapter on wild boar management in their training manual for deer stalkers although specific information on diseases relevant to wild boar is not included (St Hubert Club, 2002).

- ***The requirement for notification of the relevant diseases in feral pigs/ wild boar should be clarified, including in any widening of the provisions proposed under the Tuberculosis (England & Wales) Order 1984.***
- ***Where necessary, modification of existing orders, such as the Aujeszky's Disease Order 1983, to make a clear requirement for notification in feral animals, should be considered.***
- ***Illustrated advisory material should be produced to aid hunters, gamekeepers, deer stalkers and others in disease identification.***
- ***Consideration should be given, by those involved in providing training in deer management, to include disease identification in wild boar and to stress the obligations for notifying suspected cases.***

8.11 Evidence from Europe suggests that the greatest risk of CSF infection entering a wild boar population is through swill feeding with material containing infected pig meat. In some circumstances, deliberate feeding of wild boar could have a legitimate purpose as part of a control operation or as diversionary feeding to protect vulnerable crops. It is also unlikely that the risk of wild boar having access to discarded food could be completely eliminated. However, the deliberate feeding of feral pigs/wild boar with food which could be infected should be prevented.

- ***Deliberate feeding of feral pigs/wild boar with meat or meat-based***

products or waste should be prohibited.

8.12 In the event of a CSF outbreak in an area with feral wild boar, if it is suspected that the disease is present in the feral population, an effective strategy for halting the spread of disease might involve a combination of culling and vaccination. The potential use of vaccination is likely to be the subject of debate and could only go ahead with the authorisation of the Secretary of State (The Classical Swine Fever (England) Order 2003, section 15). However, developments in vaccination on mainland Europe should continue to be monitored. In the meantime there may be merit in developing baiting strategies which could be used in the event of an oral vaccination programme.

- ***Developments in CSF vaccination should be monitored and consideration given to developing a baiting strategy which could be used in the event of an oral vaccination programme.***

Balancing Conservation Issues

8.13 The balance of evidence from Europe and initial experience in this country do not show a clear negative or positive impact of wild boar on semi-natural habitats. As yet there does not appear to have been an adverse effect on bluebell woods and the view of the conservation bodies in the current feral population areas is that they have a beneficial effect at moderate to low population density. Further data are needed before firm conclusions can be drawn about the impact of feral wild boar on conservation.

- ***Longer term studies of the effects of wild boar rooting on woodland and grassland flora should be undertaken to supplement the preliminary data so far available.***

8.14 Because of their omnivorous diet, wild boar may be opportunistic predators of small mammals or birds' eggs or nestlings. Where uncommon, rare or endangered species are at risk it may be necessary to keep wild boar numbers at low density. There are insufficient data to provide guidance on 'safe' population levels and, in practice, in some circumstances it may be prudent to aim for as low a population as practicable.

- ***Conservation managers should monitor signs of wild boar on vulnerable sites and initiate control action where appropriate.***
- ***Advice should be made available to land managers and others on wild boar, the problems they may cause, and their management.***

(An advisory leaflet on wild boar is currently in preparation by the NWMT)

8.15 The status of feral wild boar in England as a former native species remains in doubt as long as their genetic status is uncertain. From a conservation viewpoint there are grounds for treating the feral animals differently, depending on whether or not they are considered true wild boar or feral pigs. For the time-being, this distinction may have to be made on the basis of the animals' appearance.

- ***Consideration should be given to adopting a different strategy towards the control of feral pigs and feral wild boar.***

- ***Guidance on identification features to distinguish 'true' wild boar and feral pigs should be included in advisory literature.***

Safety Risks

8.16 Wild boar have an intimidating appearance and a fearsome reputation which probably stems mainly from accounts in the hunting literature. However, injuries resulting from RTAs are likely to be a much greater threat to human safety than direct attacks. A range of possible mitigation measures was discussed in a report accompanying the recent Defra consultation on deer management (Wilson, 2003c). Deer cause between an estimated 12,500 - 54,000 RTAs in England every year (Wilson, 2003d) and there is already a need for improved measures to reduce RTAs caused by deer and other wildlife. The same mitigation measures should help to address the RTA risks posed by wild boar.

- ***Advisory guidelines should be made available to the public on how to minimise the risk of potentially dangerous encounters with feral wild boar.***
- ***Highways authorities should be encouraged to consider wildlife under- over-passes or combination of roadside fencing and 'cross walks' as a long term solution in wildlife RTA 'black spots'.***
- ***Roadside vegetation management criteria for minimising RTA risks should be developed.***
- ***Advisory guidelines/literature should be produced to provide guidance to Local Authorities etc. based on the above.***

(Guidance on avoiding encounters with wild boar is already available on the Defra NWMT internet site and will be included in the advisory leaflet currently in preparation.)

Adapting the Legislation

8.17 Although there is some level of control exercised on culling methods through the firearms licensing role of the Police, in the interests of humane treatment of the feral animals, there is a strong argument for introducing limited legal restrictions. The calibres of firearms permitted for shooting free-running wild boar should be restricted to those which can reliably give a 'clean kill'. This is justified, not only to avoid unnecessary suffering in the animal shot, but also because wounded animals are potentially more dangerous. There are also clear welfare grounds for restricting the culling of sows during the main farrowing period.

8.18 There appears to be broad consensus that the minimum calibres permitted for deer in England (.240 inches and 1700ft/lbs muzzle energy; Deer Act 1991) are not powerful enough to be reliably effective for wild boar. A suitable *minimum* might therefore be .270 Winchester, or equivalent, with a bullet weight of at least 130 grains, which is capable of delivering a muzzle energy in excess of 2600ft/lbs. The use of shotguns could also be permitted for damage prevention, in exceptional circumstances, under similar provisions to those in section 7 of the Deer Act 1991.

- ***Consideration should be given to introducing a legal minimum firearms requirement for culling feral pigs/wild boar; a suggested minimum is .270 Winchester, 130 grain bullet and 2600ft/lbs muzzle energy.***
- ***The use of a 12 bore shotgun loaded with a cartridge containing a single non-spherical projectile weighing not less than 22.68 grammes (350 grains) should be permitted where the animals are believed to be causing serious damage.***

8.19 Wild boar sows normally produce one litter per year, with the peak of births in spring, and the young are normally weaned by three months old (roughly the end of August) (Massei & Genov, 2000; Vassant, 1995). A limited 'close season' finishing at the end of August would protect sows and young during the main period of dependency. Any such close season should have provision for exceptions where action is necessary to prevent serious damage; e.g. a 'farmers' defence' comparable with that in section 7 of the Deer Act 1991

- ***Consideration should be given to introducing a close season for sows from 1 March to 31 August.***

8.20 It has been proposed elsewhere that farmed wild boar be removed from the provisions of the Dangerous Wild Animals Act 1976. However, because of the potentially destructive impact of escapee and feral wild boar/hybrids discussed in this review, it is not considered appropriate to remove all controls on the keeping of these animals. The farming of other destructive non-indigenous wild species, for example coypu *Myocastor coypus* and mink *Mustela vison*, has been controlled by orders made under the **Destructive Imported Animals Act 1932** (DIA Act). There are a number of significant potential benefits of this legislation over the DWA Act; provisions relating to individual species are created by statutory order and can thus be more easily adapted to changing circumstances; under an order the nature of the premises on which the animals are kept and the precautions that must be taken against their escape may be regulated; the appropriate department (Defra) may issue licences to keep the species in accordance with the regulations and conditions attached to the licence, and an officer authorised by the department may inspect the premises at any reasonable time. Unlike the DWA Act, there are also provisions for actions to be taken when animals of a type covered by an order are found "at large". This normally includes a requirement for any occupier discovering the animals at large to give notice of this to the appropriate department and powers for action to be taken by the department for the destruction of those animals. As wild boar fall within the definition of "non-indigenous animals" in the Act an order could be made with respect to this species, although the position with regard to hybrids may be less clear. In addition, mink keeping orders have been used to make different provisions with respect to different parts of the country. Thus, bringing wild boar/hybrids under the DIA Act would allow a flexible but consistent national approach to controlling their keeping for farming purposes, provide scope for different levels of control between regions depending on the risk posed, for

example creating ‘wild boar-free zones’ as discussed above, and could make provision for regulation of action to be taken to deal with escapes and for the reporting of escapes and feral animals. It may also be appropriate to consider adding wild boar to Schedule 9 of the Wildlife and Countryside Act 1981 to prohibit their deliberate release into the wild. Further legal guidance would be required on how controls on permitted firearms and close seasons might be implemented, if considered appropriate.

- ***The possibility of removing farmed wild boar and their hybrids from the DWA Act and making an order for the control of their keeping under the DIA Act 1932 should be examined.***
- ***Avenues for implementing the suggested firearms, close season and other controls relevant to escaped/feral animals should be explored.***
- ***Consideration should be given to adding wild boar/wild boar hybrids to Schedule 9 of the Wildlife and Countryside Act 1981 to prohibit their deliberate release into the wild.***

References

Albina, E., Mesplède, A., Chenut, G., Le Potier, M. F., Bourbao, G., Le Gal, S. & Leforban, Y. (2000) A serological survey on classical swine fever (CSF), Aujesky's disease (AD) and porcine reproductive and respiratory syndrome (PRRS) virus infections in French wild boars from 1991 to 1998. *Veterinary Microbiology*, **77**, 43-57.

Andrzejewski, R. & Jezierski, W. (1978) Management of a wild boar population and its effects on commercial land. *Acta Theriologica*, **23**, 309-339.

Artois, M., Depner, K. R., Guberti, V., Hars, J., Rossi, S. & Rutili, D. (2002) Classical swine fever (hog cholera) in wild boar in Europe. *Revue Scientifique et Technique de l' Office International des Epizooties.* **21**, 287-303.

Barkham, P. (2003) We're going on a wild boar hunt....we're not scared. *The Times*, October 6, 2003, p. 3.

Bennett, A. (1995) *Investigation into a report that wild boar have been attacking lambs.* Unpublished ADAS Report.

Boitani, L., Mattei, L., Nonis, D. & Corsi, F. (1994) Spatial and activity patterns of wild boars in Tuscany, Italy. *Journal of Mammalogy*, **75**, 600-612.

Boitani, L., Trapanese, P., Mattei, L. & Nonis, D. (1995) Demography of a wild boar population in Tuscany, Italy. *Gibier Faune Sauvage*, **12**, 109-132.

Booth, W. D. (1995) Wild boar farming in the United Kingdom. *Ibex, JME*, **3**, 245-248.

Booth, W. D., Hughes-Parry, R. & Jackson, S. R. K. (1988) Wild boar farming. *State Veterinary Journal*, **42**, 167-175.

Bratton, S. P. (1975) The effect of the European wild boar on gray beech forest in the Great Smoky Mountains. *Ecology*, **56**, 1356-1366.

Brownlow, M. J. C. (1994) Towards a framework of understanding for the integration of forestry with domestic pig and European wild boar husbandry in the United Kingdom. *Forestry*, **67**, 189-218.

Butt, P. (1994) *Exotic mammals in the wild; escapes of wild boar – South Kent*. Unpublished ADAS Report.

Butt, P. (1996) *A report on the presence of wild boar in the Aldington area of Kent.* Unpublished ADAS Report.

Central Science Laboratory (2004) *The risk to cattle from wildlife species other than badgers in areas of high herd breakdown risk.* Defra Final Project Report, SE3010.

References

Choquenot, D., Hone, J. & Saunders, G. (1999) Using aspects of predator-prey theory to evaluate helicopter shooting for feral pig control. *Wildlife Research*, **26**, 251-261.

Coblentz, B. E. & Baber, D. W. (1987) Biology and control of feral pigs on Isla Santiago, Galapagos, Ecuador. *Journal of Applied Ecology*, **24**, 403-418.

Corbet, G. B. (1966) *The Terrestrial Mammals of Europe.* Foulis, London.

Cox, J. H. S. (in prep.) *Wild Boar excavations in unimproved grassland in West Dorset – Botanical Monitoring.* English Nature Report.

Csányi, S. (1995) Wild boar population dynamics and management in Hungary. *Ibex, JME*, **3**, 222-225.

Dardaillon, M. (1987) Seasonal feeding habits of the wild boar in a Mediterranean wetland, the Camargue (Southern France). *Acta Theriologica*, **32**, 389-401.

Dardaillon, M. & Beugnon, G. (1987) The influence of some environmental characteristics on the movements of wild boar. *Biology of Behaviour*, **12**, 82-92.

Davies, R. (2000) *Salmonella* monitoring and control in pigs. *Abstract Book of the Second Conference on Zoonotic Infections in Livestock and the Risk to Human Health.* London, December 2000, pp. 20-22.

Debernardi, P., Patriarca, E. & Sabidussi, R. (1995) Wild boar control in Regional Park “La Mandria” (Piedmont, NW Italy). *Ibex, JME*, **3**, 237-240.

Decastelli, L., Giaccone, V. & Mignone, W. (1995) Bacteriological examination of meat of wild boars shot down in Piedmont and Liguria, Italy. *Ibex, JME*, **3**, 88-89.

Defra (2001) Veterinary Risk Assessment No. 7: What is the risk of feral wild boar becoming infected with FMD and subsequently causing new incidents of FMD in domestic livestock? *Defra website*.

Defra (2002) *UK Country Report on Farm Animal Genetic Resources 2002.* Department for Environment, Food and Rural Affairs, London.

Delahay, R. J., De Leeuw, A. N. S., Barlow, A. M., Clifton-Hadley, R. S. & Cheeseman, C. L. (2002) The status of *Mycobacterium bovis* infection in UK Wild Mammals: A review. *The Veterinary Journal*, **164**, 90-105.

Dupouy-Camet, J. (1999) Is trichinellosis an emerging zoonosis in the European Community? *Helminthologica*, **36**, 201-204.

References

Elbers, A. R. W., Dekker, A. & Dekkers, L. J. M. (2003) Serosurveillance of wild deer and wild boar after the epidemic of foot-and-mouth disease in the Netherlands in 2001. *Veterinary Record*, **153**, 678-681.

Elbers, A. R. W., Dekkers, L. J. M. & van der Giessen, J. W. B. (2000) Sero-surveillance of wild boar in the Netherlands, 1996-1999. *Revue Scientifique et Technique de l' Office International des Epizooties*, **19**, 848-854.

Ellis, J., Spinato, M., West, K., McNeilly, F., Meehan, B., Kennedy, S., Clark, E., Krakowka, S. & Allan, G. (2003) Porcine circovirus 2-associated disease in Eurasian wild boar. *Journal of Veterinary Diagnostic Investigation*, **15**, 364-368.

English Nature (2004) *SSSI Condition Summary 2004*. On-line version: www.english-nature.org.uk

EU (1999) *Classical Swine Fever in Wild Boar*. Scientific Committee on Animal Health and Animal Welfare, European Commission.

Fagerstone, K. A., Coffey, M. A., Curtis, P. D., Dolbeer, R. A., Killian, G. J., Miller, L. A. & Wilmot, L. M. (2002) *Wildlife Fertility Control* (R. Kirkpatrick, Ed.). The Wildlife Society, Bethesda, Maryland. Technical Review 02-2.

Fernandez-Llario, P., Carranza, J. & Hidalgo De Trucios, S. J. (1996) Social organisation of the wild boar in Doñana National Park. *Miscellania Zoologica*, **19**, 9-18.

Fernandez-Llario, P. & Mateos-Quedesa, P. (1998) Body size and reproductive parameters in the wild boar. *Acta Theriologica*, **43**, 439-444.

Focardi, S., Capizzi, D. & Monetti, D. (2000) Competition for acorns among wild boar and small mammals in a Mediterranean woodland. *Journal of Zoology, London*, **250**, 329-334.

Focardi, S., Toso, S. & Pecchioli, E. (1996) The population modelling of fallow deer and wild boar in a Mediterranean ecosystem. *Forest Ecology and Management*, **88**, 7-14.

Fournier-Chambrillon, C., Maillard, D. & Fournier, P. (1995) Diet of the wild boar inhabiting the Montpellier garrigue. *Ibex, JME*, **3**, 174-179.

Fournier-Chambrillon, C., Maillard, D. & Fournier, P. (1996) Variability of the diet of wild boars in the Montpellier garrigue. *Gibier Faune Sauvage*, **13**, 1457-1476.

Fritzemeier, J., Teuffert, J., Greiser-Wilke, I., Staubach, Ch., Schlüter, H. & Moennig, V. (2000) Epidemiology of classical swine fever in Germany in the 1990s. *Veterinary Microbiology*, **77**, 29-41.

References

Gabor, T. M., Hellgren, E. C., Van Den Bussche, R. A. & Silvy, N. J. (1999) Demography, sociospatial behaviour and genetics of feral pigs in a semi-arid environment. *Journal of Zoology London*, **247**, 311-322.

Gaillard, J-M., Brandt, S. & Jullien, J-M. (1993) Body weight effect on reproduction of young wild boar females. *Folia Zoologica*, **42**, 204-212.

Gallo Orsi, U., Sicuro, B., Durio, P., Canalis, L., Mazzoni, G., Serzotti, E. & Chiariglione, D. (1995) Where and when: the ecological parameters affecting wild boars choice while rooting in grassland in an Alpine valley. *Ibex, JME*, **3**, 160-164.

Geisser, H. (1998) The wild boar in the Thurgau (northeastern Switzerland): population status, damages and the influence of supplementary feeding on damage frequency. *Gibier Faune Sauvage*, **15**, 547-554.

Genov, P. (1981a) Food composition of wild boar in north-eastern and western Poland. *Acta Theriologica*, **26**, 185-205.

Genov, P. (1981b) Significance of natural biocenoses and agrocenoses as the source of food for wild boar. *Ekologia Polska*, **29**, 117-136.

Genov, P. V. (1999) A review of the cranial characteristics of the Wild Boar with systematic conclusions. *Mammal Review*, **29**, 205-238.

Gerard, J-F., Cargnelutti, B., Spitz, F., Valet, G. & Sardin, T. (1991) Habitat use of wild boar in a French agroecosystem from late winter to early summer. *Acta Theriologica*, **36**, 119-129.

Gortázar, C., Vicente, J., Fierro, Y., León, L., Cubero, M. J. & González, M. (2002) Natural Aujeszky's disease in a Spanish wild boar population. *Annals of the New York Academy of Science*, **969**, 210-212.

Goulding, M. J. & Roper, T. J. (2002) Press responses to the presence of free-living wild boar in southern England. *Mammal Review*, **32**, 272-282.

Goulding, M. J., Roper, T. J., Smith, G. C. & Baker, S. J. (2003) Presence of free-living wild boar in southern England. *Wildlife Biology*, **9** (Suppl. 1), 15-20.

Goulding, M.J., Smith G. & Baker S. J. (1998) *Current status and potential impact of wild boar (Sus scrofa) in the English countryside: a risk assessment*. Central Science Laboratory Report to the Ministry of Agriculture Fisheries and Food.

Greenwood, A. G., Cusdin, P. A. & Radford, M. (2001) *Effectiveness Study of the Dangerous Wild Animals Act 1976*. Defra Research Report.

References

Groot Bruinderink, G. W. T. A., Hazebroek, E. & Van Der Voot, H. (1994) Diet and condition of wild boar without supplementary feeding. *Journal of Zoology London*, **233**, 631-648.

Groot Bruinderink, G. W. T. A. & Hazebroek, E. (1996) Ungulate traffic collisions in Europe. *Conservation Biology*, **10**, 1059-1067.

Gubler, J. G. H. (1992) Septic arthritis of the knee induced by *Pasteurella multocida* and *Bacteroides fragilis* following an attack by a wild boar. *Journal of Wilderness Medicine*, **3**, 288-291 (abstract only).

Hahn, N. & Eisfeld, D. (1998) Diet and habitat use of wild boar in SW Germany. *Gibier Faune Sauvage*, **15**, 595-606.

Harting, J. E. (1880) *British Animals Extinct within Historic Times.* Trübner, London.

Hatake, K., Taniguchi, T., Negoro, M., Ouchi, H., Minami, T. & Hishida, S. (1995) A case of death of a woman attacked by a wild boar. *Research and Practice in Forensic Medicine,* **38**, 275-277 (abstract only).

Home Office (2002) *Firearms Law: Guidance to the Police.* HMSO, London.

Howells, O. & Edwards-Jones, G. (1997) A feasibility study of reintroducing wild boar to Scotland: are existing woodlands large enough to support minimum viable populations? *Biological Conservation*, **81**, 77-89.

Hubalek, Z., Treml, F., Juricova, Z., Hunady, M., Halouzka, J., Janik, V. & Bill, D. (2002) Serological survey of the wild boar for tularaemia and brucellosis in South Moravia, Czech Republic. *Veterinarni Medicina*, **47**, 60-66.

Ickes K. (2001). Hyper-abundance of native wild pigs (*Sus scrofa*) in a lowland dipterocarp rain forest of peninsular Malaysia. *Biotropica* 33: 682-690.

Jezierski, W. (1977) Longevity and mortality rate in a population of wild boar. *Acta Theriologica*, **22**, 337-348.

Kaden, V., Lange, E., Fischer, U. & Strebelow, G. (2000) Oral immunisation of wild boar against classical swine fever: evaluation of the first field study in Germany. *Veterinary Microbiology*, **73**, 239-252.

Kanzaki, N., Perzanowski, K. & Nowosad, M. (1998) Factors affecting wild boar population dynamics in Bieszczady, Poland. *Gibier Faune Sauvage*, **15** (3), 1171-1178.

Kyle, R. (1995) Wild boar in Britain: a new farming enterprise. *State Veterinary Journal*, **5**, 10-12.

References

Laddomada, A. (2000) Incidence and control of CSF in wild boar in Europe. *Veterinary Microbiology*, **73**, 121-130.

Laddomada, A., Patta, C., Oggiano, A., Caccia, A., Ruiu, A., Cossu, P. & Firinu, A. (1994) Epidemiology of classical swine fever in Sardinia: a serological survey of wild boar and comparison with African swine fever. *Veterinary Record*, **134**, 183-187.

Lavorel, S., Touzard, B., Lebreton, J-D. & Clément, B. (1998) Identifying functional groups for response to disturbance in an abandoned pasture. *Acta Oecologica*, **19**, 227-240.

Leaper, R., Massei, G. Gorman, M. L. & Aspinall, R. (1999) The feasibility of reintroducing wild boar to Scotland. *Mammal Review*, **29**, 239-259.

Lecocq, Y. (2003) A European perspective on wild deer management. *Proceedings of the Future for Deer Conference 28 & 29 March 2003.* English Nature Research Report 548, pp. 51-57.

Lever, C. (1985) *Naturalized Mammals of the World*. Longman, Harlow, Essex.

Long, J. L. (2003) *Introduced Mammals of the World; their History, Distribution and Influence*. CABI Publishing, Oxford.

Lutz, W., Junghans, D., Schmitz, D. & Müller, T. (2003) A long-term survey of pseudorabies virus infections in European wild boar of western Germany. *Zeitschrift fur Jagdwissenschaft*, **49**, 130-140.

Macdonal, A. A. & Frädrich, H. (1991) Pigs and peccaries: what are they? In R. H. Barrett & F. Spitz (Eds.) *Biology of Suidae.* IRGM, Briançon, France, pp. 7-19.

Machackova, M., Matlova, L., Lamka, J., Smolik, J., Melicharek, I., Hanzlikova, M., Docekal, J., Cvetnic, Z., Nagy, G., Lipiec, M., Ocepek, M. & Pavlik, I. (2003) Wild boar as a possible vector of mycobacterial infections: a review of literature and critical analysis of data from Central Europe between 1983 to 2001. *Veterinari Medicina*, **48**, 51-65.

Mackin, R. (1970) Dynamics of damage caused by wild boar to different agricultural crops. *Acta Theriologica*, **27**, 447-458.

Maillard, D. & Fournier, P. (1994) Le sanglier en milieu méditerranéen: Occupation de l'espace, unité de gestion. *Office National de la Chasse Bulletin Mensuel*, *Numéro Spécial: Gestion du Sanglier*, **191**, 26-35.

References

Maillard, D. & Fournier, P. (1995) Effects of shooting with hounds on size of resting range of wild boar groups in Mediterranean habitat. *Ibex, JME*, **3**, 102-107.

Massei, G., Genov, P. V. & Staines, B. W. (1996) Diet, food availability and reproduction of wild boar in a Mediterranean coastal area. *Acta Theriologica*, **41**, 307-320.

Massei, G., Genov, P. V., Staines, B. W. & Gorman, M. L. (1997) Mortality of wild boar in a Mediterranean area in relation to sex and age. *Journal of Zoology London*, **242**, 394-400.

Massei, G. & Genov, P. (2000) *Il Cinghiale.* Calderini Edagricole, Bologna.

Mauget, R. (1991) Reproductive biology of the wild Suidae. In R. H. Barrett & F. Spitz (Eds.) *Biology of Suidae.* IRGM, Briançon, France, pp. 49-64.

Mazzoni della Stella, R., Calovi, F. & Burrini, L. (1995) The wild boar management in a province of the Central Italy. *Ibex, JME*, **3**, 213-216.

McIlroy, J. C. (1995) New techniques for an old problem – recent advances in feral pig control in Australia. *Ibex, JME*, **3**, 241-244.

Mignone, W., Poggi, M., Pistone, G. C., Caramelli, M., Bollo, E. & Biolatti, B. (1995) Pathology of wild boar in Liguria, Italy, between 1989 and 1992. *Ibex, JME*, **3**, 85-87.

Milton, S. J., Dean, W. R. J. & Klotz, S. (1997) Effects of small-scale disturbances on plant assemblages of set-aside land in Central Germany. *Journal of Vegetation Science*, **8**, 45-54.

Moennig, V. (2000) Introduction to classical swine fever: virus, disease and control policy. *Veterinary Microbiology*, **73**, 93-102.

Moore, N. (2004) *The Ecology and Management of Wild Boar in Southern England.* Defra Final Project Report, VC0325.

Müller, T., Coranths, F. J. & Hahn, E. C. (2000) Pseudorabies infection (Aujeszky's disease) in wild swine. *Infectious Diseases Review*, **2**, 27-34.

Müller, T., Teuffert, J., Ziedler, K., Possardt, C., Kramer, M., Staubach, C. & Conraths, F. J. (1998) Pseudorabies in the European wild boar from Eastern Germany. *Journal of Wildlife Diseases*, **34**, 251-258.

Nyenhuis, H. (1991) Predation between woodcock game of prey and wild boar. *Allgemeine Forst und Jagdzeitung*, **162**, 174-180. (abstract only).

References

Onida, P., Garau, F. & Cossu, S. (1995) Damages caused to crops by wild boars in Sardinia (Italy). *Ibex, JME*, **3**, 230-235.

Pech, R. P. & Hone, J. (1988). A model of the dynamics and control of an outbreak of Foot and Mouth Disease in feral pigs in Australia. *Journal of Applied Ecology,* **25**, 63-78.

Pech, R. P. & McIlroy, J. C. (1990). A model of the velocity of advance of Foot and Mouth Disease in feral pigs. *Journal of Applied Ecology,* **27**, 635-650.

Pépin, D., Spitz, F., Janeau, G. & Valet, G. (1987) Dynamics of reproduction and development of weight in the wild boar in south-west France. *Zeitschrift für Saugetierkunde*, **52**, 21-30.

Pérez, J., Fernández, A. I., Sierra, M. A., Herráez, P., Fernández, A. & Martín de las Mulas, J. (1998) Serological and immunohistochemical study of African swine fever in wild boar in Spain. *Veterinary Record*, **143**, 136-139.

Rackham, O. (1986) *The History of the Countryside.* (2000 edition) Phoenix Press, London.

Ritzmann, M., Vorbuchner, K., Majzoub, M., Hermanns, W., Heinritzi, K., Geissler, K. & Truyen, U. (2002) Investigation of spreading of porcine circovirus type 2 in Bavaria. *Tierarztliche Praxis Ausgabe Grosstiere Nutztiere*, **30**, 386-391. (abstract only).

Sáez-Royuela, C. & Telleria, J. L. (1986) The increased population of the wild boar in Europe. *Mammal Review*, **16**, 97-101.

Saniga, M. (2002) Nest loss and chick mortality in capercaillie and hazel grouse in West Carpathians. *Folia Zoologica*, **51**, 205-214. (abstract only).

Segales, J. & Domingo, M. (2002) Postweaning multisystemic wasting syndrome (PMWS) in pigs. A review. *Veterinary Quarterly*, **24**, 109-124.

Schley, L. (2000) *The Badger and the Wild Boar: Distribution and Damage to Agricultural Crops in Luxembourg.* Unpublished D. Phil. Thesis, University of Sussex.

Schley, L. & Roper, T. J. (2003) Diet of the wild boar in Western Europe, with particular reference to consumption of agricultural crops. *Mammal Review*, **33**, 43-56.

Schulze, C., Neumann, G., Grutze, I., Engelhardt, A., Mirle, C., Ehlert, F. & Hlinak, A. (2003). Porcine circovirus type 2-infection in an European wild boar in the state of Brandenburg, Germany. *Deutsche Tierarztliche Wochenschrift*, **110**, 426-428. (abstract only).

References

Singer, F. J., Otto, D. K., Tipton, A. R. & Hable, C. P. (1981) Home ranges, movements, and habitat use of European wild boar in Tennessee. *Journal of Wildlife Management*, **45**, 343-353.

Singer, F. J., Swank, W. T. & Clebsch, E. E. C. (1984) Effects of wild pig rooting in a deciduous forest. *Journal of Wildlife Management*, **48**, 464-473.

Smiet A.C., Fulk G.W. and Lathiya S.B. (1979) Wild Boar Ecology in Thatta District: A Preliminary Study. *Pakistan Journal of Zoology* 11 (2): 295-302.

Sodeikat, G. & Pohlmeyer, K. (2002) Temporary home range modifications of wild boar family groups caused by drive hunts in Lower Saxony (Germany). *Zeitschrift für Jagdwissenschaft*, **48,** 161-166.

Spitz, F. (1999) *Sus scrofa* in A. J. Mitchell-Jones *et al.* (Eds.) *The Atlas of European Mammals.* Poyser/Academic Press, London, pp. 380-381.

Spitz, F. & Janeau, G. (1990) Spatial strategies; an attempt to classify daily movement of wild boar. *Acta Theriologica*, **35**, 129-149.

Spitz, F. & Janeau, G. (1995) Daily selection of habitat in wild boar. *Journal of Zoology London*, **237**, 423-434.

St Hubert Club (2002) *Stalker Training Manual.* (D. M. Thomas, Ed.). St Hubert Club of Great Britain.

Szweda, W., Lipowski, A., Ciecierski, H., Zalewski, K. & Pirus, T. (1998) European wild boar as a reservoir of *Herpesvirus suis* 1. *Medycyna Weterynaryjna*, **54**, 541-544. (abstract only).

Tansley, A. G. (1949) *The British Islands and their Vegetation.* Volume I, Cambridge University Press, Cambridge.

Tisdell, C. A. (1982) *Wild Pigs: Environmental Pest or Economic Resource?* Pergamon Press, Sydney.

Truvé, J. & Lemel, J. (2003) Timing and distance of natal dispersal for wild boar in Sweden. *Wildlife Biology*, **9** (Suppl. 1), 51-57.

Valet, G., Rosell, C., Chayron, L., Fosty, P. & Spitz, F. (1994) Autumn diet of the wild boar in Ariege, France, and in Catalonia, Spain. *Gibier Faune Sauvage*, **11**, 316-326.

Vassant, J. (1995) *Le Sanglier.* Office National de la Chasse, Auffargis.

Vicente, J., Leon-Vizcaino, L., Gortazar, C., Cubero, M. J., Gonzalez, M. & Martin-Atance, P. (2002) Antibodies to selected viral and bacterial pathogens

in European wild boars from southcentral Spain. *Journal of Wildlife Diseases*, **38**, 649-652.

VLA (2003) *Veterinary Investigation Diagnosis Analysis 2001.* Veterinary Laboratories Agency, Defra.

Wegener, H. C., Hald, T., Lo Fo Wong, D., Madsen, M., Korsgaard, H., Bager, F., Gerner-Smidt, P. & Mølbak, K. (2003) Salmonella control programs in Denmark. *Emerging Infectious Diseases,* **9**, 774-780.

Welander, J. (1995) Are wild boars a future threat to the Swedish flora? *Ibex, JME*, **3**, 165-167.

Welander, J. (2000) Spatial and temporal dynamics of wild boar rooting in a mosaic landscape. *Journal of Zoology, London*, **252**, 263-271.

Wilson, C. J. (1999) Wild boar in south west England. *Proceedings of the International Union of Game Biologists XXIVth Congress, Thessaloniki, Greece, September 1999* (C. Thomaidis & N. Kypridemos, Eds.), pp. 490-492.

Wilson, C. J. (2003a) Distribution and status of feral wild boar in Dorset, southern England. *Mammal Review*, **33**, 302-307.

Wilson, C. J. (2003b) *Preliminary Report on Distribution and Status of Feral Wild Boar in England*. Unpublished report to Defra European Wildlife Division.

Wilson, C. J. (2003c) *Current and Future Deer Management Options*. Report on behalf of Defra European Wildlife Division.

Wilson, C. J. (2003d) *Estimating the Cost of Road Traffic Accidents Caused by Deer in England.* Supplementary Report on behalf of Defra European Wildlife Division.

Wilson, C. J. (2004) Rooting damage to farmland in Dorset, southern England, caused by feral wild boar. *Mammal Review,* **34**, 331-335.

Wisniewski, J. (2001) The incidence of *Salmonella* spp. in wild boars in Poland. *Medycyna Weterynaryjna*, **57**, 399-401. (abstract only).

Yalden, D. W. (1986) Opportunities for reintroducing British mammals. *Mammal Review*, **16**, 53-63.

Yalden, D. (1999) *The History of British Mammals.* Poyser/Academic Press, London.

Zanardi, G., Macchi, C., Sacchi, C. & Rutili, D. (2003) Clasiical swine fever in wild boar in the Lombardy region of Italy from 1997 to 2002. *Veterinary Record*, **152**, 461-465.

Appendix

Appendix 1: Individuals and Organisations Consulted

Ash, R., Police Firearms Licensing Officer, Sussex Police.
Barlow, A., Veterinary Investigation Officer, Defra, Veterinary Laboratories Agency.
Beddoe, G., Policy Officer, Trading Standards & Registration, Local Authorities Coordination of Regulatory Services.
Brand-Hardy, R., Head of Wildlife Management Branch, Defra, Land Use & Rural Affairs Science Unit.
Campbell, I., Regions Manager, National Pig Association.
Clarke, A., Policy Officer, National Farmers Union.
Cordrey, L., Nature Conservation Officer, National Trust.
Cox, J., Botanical Manager, English Nature, Dorset.
Critchley, C., Chief Wildlife Ranger, Forest Enterprise, England.
Currie, F., Forestry Commission.
Davenport, I., Head of Conservation, Dorset Wildlife Trust.
De La Rua, R., Veterinary Adviser, Defra, Veterinary Endemic Diseases & Zoonoses Division.
Dell, A., Defra, Pigs & Pigmeat Policy Unit.
Dorset Police.
Duff, P., Veterinary Investigation Officer, Defra, Veterinary Laboratories Agency.
Ferguson, I., Head Ranger, Forestry Commission, Dumfries & Galloway.
Gill, R., Forest Research.
Harvey, P., Conservation Officer, English Nature, Kent.
Highways Authority.
Horrell, I., Kernow Wild Boar/Committee Chairman, British Wild Boar Association.
Izzard, M., Senior Project Officer, Defra, South West Agri-Environment Team.
Kent Police.
Landeg, F., Head of Defra Veterinary Exotic Diseases Division.
McCormick, A., Deer Officer, British Association for Shooting & Conservation.
Mitchell-Jones, A., Senior Vertebrate Ecologist, Terrestrial Wildlife Team, English Nature, Headquarters.
Moore, N., Head of Conservation Management Team, Defra, Central Science Laboratory.
Moyse, R., Senior Conservation Officer, Kent Wildlife Trust.
Nixon, R., Chairman, St Hubert Club of Great Britain.
Rose, H. R., Scottish Secretary, British Deer Society.
Sheasby, R., Rural Surveyor/Policy Officer, National Farmers Union.
Simmons, A., Head of Defra Veterinary Endemic Diseases & Zoonoses Division.
Sims, N., PhD researcher, University of Sussex.
Spencer, J., Ecology Adviser, Forest Enterprise, England.
Sussex Police.
Tapper, S., Department of Public Affairs, Game Conservancy Trust.
Taylor, K., former Director, British Wild Boar Association.
Trout, R. C., Forest Research.

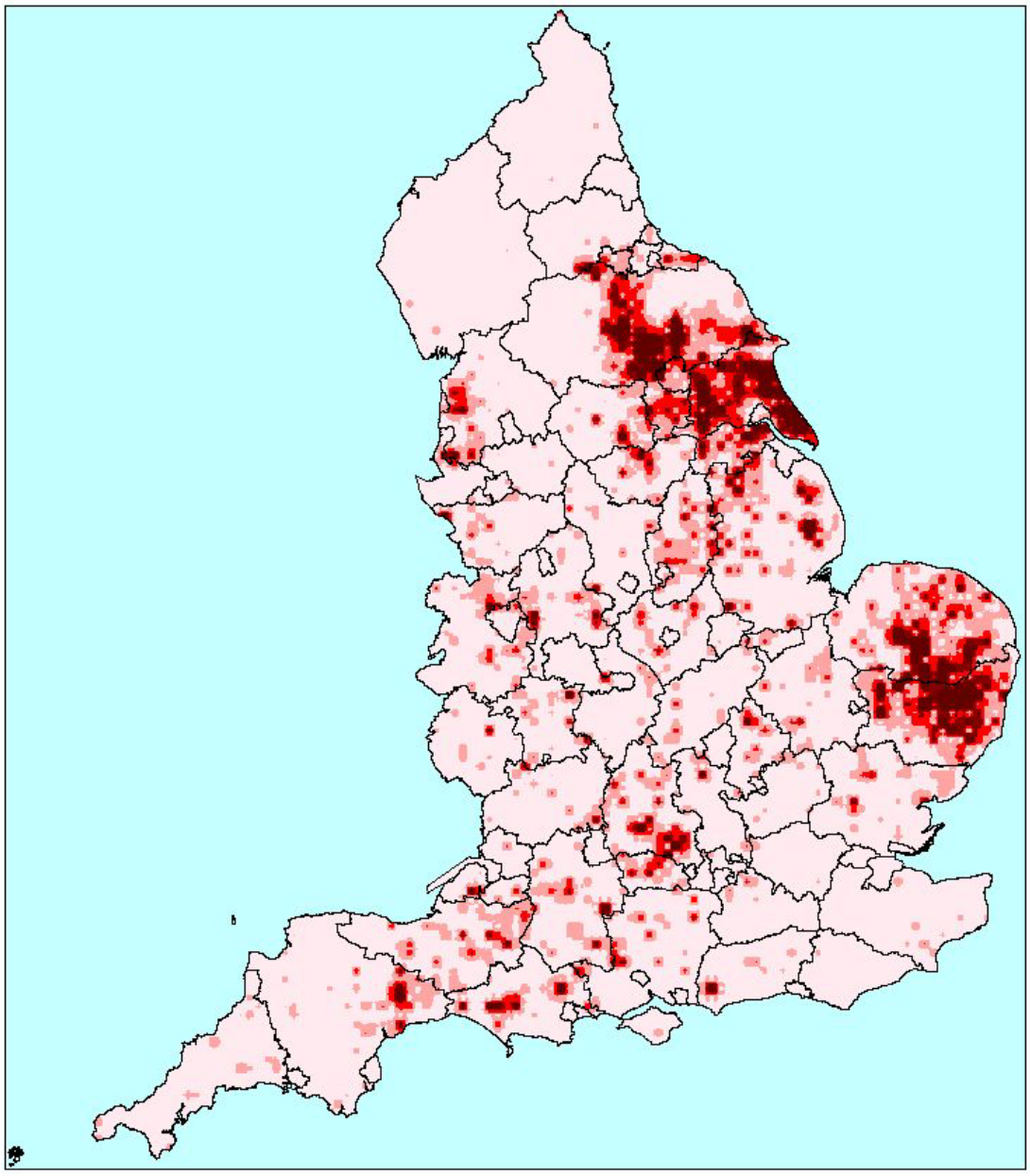
Appendix

Webb, J., Woodlands & Forestry Adviser, Country Landowners & Business Association.
Webb, J., Forest Timber Growers Association.
Whitbread, A., Head of Conservation, Sussex Wildlife Trust.
Whitmore, G., Veterinary Adviser, Defra, Veterinary Exotic Diseases Division.
Yalden, D. W., Mammal Society/Reader in Vertebrate Zoology, University of Manchester

Appendix 2: Relative Density of Pig Farms in England

June 2001 Agricultural Census
ENGLAND

Distribution of Total Pigs



This map is a representation of the statistical data.
The graduations of colour from light to dark indicate the increase in distribution density.
The actual statistical data is available from the Farming Statistics web site.
For an explanation of the methodology used to produce this map
please refer to: http://farmstats.defra.gov.uk/cs/agricultural atlas/method.htm

PB 11232C

Nobel House
17 Smith Square
London SW1P 3JR

www.defra.gov.uk