# Current Status and Potential Impact of Wild Boar (*Sus scrofa*) in the English Countryside: A Risk Assessment

Report to Conservation Management Division C, MAFF.

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I declare that this work was done under my supervision according to the procedures described herein and that this report represents a true and accurate record of the results obtained.

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## Executive Summary

1. A comprehensive literature review has been carried out on wild boar and feral pigs. No published material can be found on the biology or ecology of free-living wild boar or feral pigs in the United Kingdom, and the literature refers primarily to studies on the animals present in Europe, America and Australia.

2. The presence of populations of free-living wild boar living in the counties of Kent, East Sussex and Dorset has been confirmed, evidenced by tracks, rooting in agricultural fields and woodland, and from the inspection of animals shot by hunters or killed by road traffic.

3. The free-living wild boar in Kent and East Sussex are almost certainly breeding as a farrowing nest has been found and piglet tracks located. The possibility that an escaped domestic sow constructed the farrowing nest is unlikely. There have been a number of eye witness sightings of wild boar sows with young but no domestic pigs have been seen. However, the possibility that the free-living wild boar sows were pregnant prior to their escape can not be disproved. The free-living wild boar in Dorset may also be breeding due to eye-witness accounts of sows with piglets.

4. Establishing where the free-living wild boar originally escaped from is not possible. The animals carry no identifying marks and ownership cannot be determined. In England wild boar are kept in captivity in wild boar farms, wildlife parks and private animal collections.

5. Wild boar farming is a relatively new enterprise in England. Approximately 40 farms, situated in counties throughout the country, are registered with the British Wild Boar Association (BWBA). The Association was founded to promote wild boar farming in this country and membership is voluntary. Currently an unknown number of wild boar farms also exist that are not members of the BWBA. Wild boar currently escape from their farm enclosures and, where suitable habitat can be found, the potential exists for future escapees to establish free-living populations in other areas of the country.

6. The phenotypic appearance of carcasses examined from the Kent and East Sussex animals indicate the animals to be wild boar, as opposed to feral pigs (free-living domestic pigs that have reverted to the appearance of the wild type) or hybrid animals (wild boar and domestic pig crosses). However, the exact genetic make-up of the free-living animals in Kent, East Sussex and Dorset is unknown.

7. Free-living wild boar have no natural predators in the UK and their high breeding and dispersal rates, combined with the presence of suitable habitat, indicates that the population will spread and increase. Computer modelling predicts a positive growth rate for the population in south-east England. From a suggested initial population of one hundred animals, a five year projection shows an average population size of 169 animals, with a minimum of 108 animals and a maximum of 326. A fifteen year projection, with more probability of error, gives an average population size of 485.

8. Damage to agriculture by free-living wild boar has been confirmed in Kent and East Sussex on pasture land and cereal crops. In Dorset, pasture land has been damaged. Farmers in Kent and East Sussex have reported predation on lambs by wild boar. However, no evidence of lamb predation by free-living wild boar was found during the 1997 lambing season in Kent and East Sussex.

9. In Kent and Dorset, free-living male wild boar have come into contact with domestic pigs by breaking into outdoor pig units. Mating with domestic sows has occurred and hybrid

piglets produced. This contact between free-living wild boar and domestic pigs could provide a transmission route for the spread of disease. A transmissible disease becoming endemic in the wild boar population could continually re-infect the domestic pig stock, with considerable economic consequences.

10. Rooting amongst woodland bluebells has occurred in woodlands harbouring free-living wild boar. It is not known if the rooting is detrimental to the plant or to the general ecology of the woodlands.

11. It has been confirmed that the free-living wild boar in Kent, East Sussex and Dorset have been involved in road traffic accidents and confrontations between wild boar, the public and farmers have occurred.

12. Wild boar are a former native species of the British Isles up to the 17th century. The possibility of re-introduction, particularly into woodland in Scotland, has been considered. The species could be either regarded as a native species with a biodiversity value or conversely as an invasive pest.

13. The free-living wild boar impact on many areas, particularly to agriculture, animal health, conservation and public safety. It is therefore recommended that the Ministry formulate a policy with regard to wild boar and their management. Research into the ecology, population dynamics, feeding behaviour and genetic make up of the wild boar in the UK is recommended to help formulate cost-effective management procedures. It is further recommended that legislation covering wild boar farming is reviewed with the aim of reducing the likelihood of further escapes.

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# 1. Introduction

1. Wild boar (Figure 1) were once a native species of the British Isles before their extinction in the 17th century from hunting and loss of habitat. In the last decade, however, a number of wild boar have escaped from captivity in wildlife parks or farms throughout Britain (Baker 1990), and a breeding population is thought to have established itself in wooded areas of Kent and East Sussex. Where the animals originate from is unclear, although they may have escaped from a wild boar farm and abattoir. On the European continent, wild boar still range freely in substantial numbers and are known to cause serious agricultural damage to crops (Mackin 1970, Schmidt 1986, Jezierski and Myrcha 1975, Genov 1981, Wollenhaupt 1991). They are an adaptable species and can occupy a diverse range of habitats, including coastal swamps, fresh or brackish marshland, riparian environments, woodlands and forested areas. With the reduction of woodland areas in Western and Central Europe wild boar have also adapted to feeding on agricultural land and this has inevitably brought them into conflict with man. They are a favoured hunting quarry, particularly in European countries, where wild boar hunting is a well regulated, prestigious and expensive sport. In France, emphasis is also placed on farming the animals for their meat.

**Figure 1.** Male wild boar of East European origin, photographed in captivity.

2. Phenotypically, wild boar possess a brindled bristly coat with a thick underlying brown pelage. The head and shoulders are large and the body weight lies forward of the small hind quarters. The snout is narrow, long and straight and the ears are small and erect, the tail is straight with long hairs at the end. Wild boar are distinct from the animals referred to as feral pigs. Feral pigs are pigs living wild (through accidental or deliberate release) which, at some stage, were domesticated pig stock. From generations of breeding in the wild, they have lost the appearance of a domestic pig and have reverted back to the wild form resembling a wild boar (from which they were originally

domesticated), rather than a domestic pig. However, unlike a true wild boar, feral pigs have shorter snouts, smaller shoulders and larger hind quarters, larger ears, a more curly tail and a lack of the underlying thick brown pelage. Wild boar can freely mate with both feral pigs and domestic pigs producing fertile hybrids. Wild boar farmers often cross a male wild boar with a domestic pig sow in order to produce a hybrid with increased productivity. Hybrid sows farrow more frequently and have larger litter sizes. Phenotypically, a hybrid animal can resemble either a domestic pig or a wild boar, depending on the amount of domestic pig blood in the animal.

3. Thus, for the purpose of this risk assessment, three forms of *Sus scrofa* are recognised, all of which possess a brown coat colouration and share certain phenotypical similarities. They are;

   Wild boar - Pure breeding wild boar

   Feral pig - Pigs living wild with domestic ancestry

   Hybrids - Wild boar/domestic pig crossbreed

4. Wild boar escaping from captivity and establishing a wild breeding population is not a unique occurrence and has been documented in one other country. Animals imported into Sweden in the 1940s for use as quarry in hunting enclosures, for meat production and as zoo exhibits escaped and established a scattered wild population (Tisdell 1982). The animals continue to provoke controversy, agriculturists class them as pests and call for their eradication whilst the hunting lobby argue for keeping the animals as a hunting asset. Sweden, in common with Britain, previously possessed a wild boar population which became extinct a few hundred years earlier.

5. Following initial reports in 1991, concern has been raised by several farmers in Kent and East Sussex with MAFF about the damage caused to agricultural crops and lamb predation, allegedly by a free-living wild boar population. Several road traffic accidents are also said to have occurred involving vehicles hitting wild boar.

6. This risk assessment was initiated as part of the policy of the Ministry of Agriculture, Fisheries and Foods continually to review vertebrate management issues and procedures. The main objective of the assessment was to determine the current status of free-living wild boar in England and to evaluate the future potential for conflict between agricultural, conservation and recreation interests. The future policy then can be determined.

## 2. Literature Review

7. There has been no scientific research published on the activities of the free-living wild boar currently present in England. The only English literature available is concerned with the farming of wild boar for meat (Booth 1988, Kyle 1995, NFU 1989), the integration of wild boar with forestry (Brownlow 1992, Brownlow 1994) and their possible re-introduction into the British Isles (Yalden 1986, Howells and Edwards-Jones 1997). However, European wild boar populations, particularly in Italy, France and Poland, have been studied in some depth as have feral pig populations in Australia and America. This literature has been reviewed to determine the current state of knowledge on wild boar and feral pig populations.

8. The origin and genetic purity of the many wild boar populations throughout the animal's native range is unclear. Wild boar are a favoured animal for hunting and have been introduced into numerous localities and countries for this reason (Singer 1981, Tisdell 1982, Boitani *et al.* 1994). Some localities may have already supported a wild boar population of their own, thus populations are often genetically mixed. For example, the genetic polymorphism seen in many wild boar from interbreeding with feral pigs is believed to effect the phenotypic and ecological characteristics of certain Italian wild boar populations (Apollonio *et al*. 1988, Boitani *et al.* 1995, Paolo and Marina 1988).

**Distribution**

9. Wild boar are indigenous to Western Europe and Northern Africa, ranging eastwards across the Mediterranean basin through India and South-East Asia to Japan, Sri Lanka, Java, Taiwan, Korea and Malaya (Spitz 1986, Mayer and Lehr Brisbin 1991). Non-indigenous populations of wild boar and feral pigs have, as a result of activities by man, become established in Norway, southern Sweden, South Africa, Sudan, the USA, the West Indies, Central and South America, Australia, New Zealand, many Indonesian, Hawaiian and Galápagos Islands, Fiji, Mauritius and numerous other oceanic islands (Lever 1994).

10. Twenty three subspecies of wild boar have been described (Mayer and Lehr Brisbin 1991) all of which can interbreed. Western European wild boar are smaller than the Eastern European animals and the trend towards a larger body size also runs from South to North; wild boar in northern Europe are larger than animals in southern Europe. Typically, Western European wild boar are described as small with a light coat and dark tips to the ears, limbs, snouts and tail. East European animals are larger and more uniformly black in colour. Both sexes are of similar appearance though only males above two years old grow tusks (Figure 2), and boars are generally larger than sows.

11. Genetically, chromosome numbers also differ, the majority of wild boar in Spain and France posses 36, whilst most of the animals in the rest of Europe possess 38 (Porter 1993); domestic pigs have 38. Animals possessing 36 chromosomes have mated with animals possessing 38 and produced fertile offspring with 37 chromosomes (McFee *et al.* 1966). Chromosome number does not affect interbreeding (Kyle 1995).

12. Population numbers of wild boar have increased in recent decades throughout their range in continental Europe (Saez-Royuela and Telleria 1986, Apollonio *et al*. 1988, Boitani *et al.* 1995) and in Russia (Telishevskiy 1990) and Pakistan (Shafi and Khokar 1986). The increase in wild boar numbers may be due to lack of predation from

decreasing numbers of their natural predators such as brown bears, tigers, wolves and leopards (Bratton 1975). Supplementary feeding, re-introduction, agricultural crop changes, wide ecological flexibility and high fecundity have also been suggested as relevant factors in the increase (Saez-Royuela and Telleria 1986, Genov 1981).

**Figure 2.** Tusk development in a male wild boar shot by a hunter in south-east England.

**Social groups and behaviour**

13. Wild boar and feral pigs prefer to live in small social groups. The groups are referred to as 'sounders' and are described by Spitz (1986) as being organised around a core of two or three mature reproductive females and their last litters. On the edge of the group are the surviving young and sub-adults from previous litters and group size varies between 6 and 30 animals. Mature males tend to be found in the vicinity of the group only during the breeding season. Outside the breeding season, the mainly solitary males will tolerate the presence of each other but aggression increases in winter with competition for females. Different female groups will co-exist in the same areas but retain their social identity. Group structure changes with the coming and going of farrowing females, the migration of sub-adults and the arrival of sexually active males and mature females who have not had a first litter. Feral pigs in South Carolina, USA, observed by Kurz and Marchinton (1972), existed in groups of up to eight animals with more than three adults per group uncommon. Occasionally a single male would be seen with a non-breeding group of females, otherwise these groups were entirely female.

14. Wild boar are primarily nocturnal animals irrespective of sex, age, or season (Boitani *et al*. 1994). The feral pig population in South Carolina, USA, studied by Kurz and Marchinton (1972) was predominantly diurnal in winter but became more nocturnal in the summer months, a behaviour thought to be thermoregulatory as the animals have no sweat glands and need to cool their body temperature using other methods. Nocturnal

activity was also found to increase on moonlit nights. Wild boar in Tuscany, Italy, were most active in open areas during darkness (Boitani *et al.* 1994), as were feral pigs on Santa Catalina Island, California (Baber and Coblentz 1986). In the Maremma Natural Park, Italy, wild boar usually became active before sunset and activity ceased shortly after sunrise, however the animals were not completely nocturnal and became active again for a short time during the day. With the exception of the month of July, activity was more synchronised to sunrise than sunset (Massei 1995). Mauget (1980) radio-tracked wild boar in a French forest and found the night activity began around sunset in autumn and winter and before sunset in spring and summer, possibly explained by the light decreasing well before sunset in the dense cover prevalent in spring and summer where the boar rest during the day. Wild boar are described by Spitz (1986) as having one long rest period in dense cover during the day that can last more than 12 hours, and a short period of grooming on awakening was followed by four to eight hours feeding during the night. Nocturnal feeding may be interspersed with a short rest phase and the wild boar's daily cycle of activity is related to the time of sunset.

15. The density of wild boar in Europe is usually below five individuals per $km^2$ (Spitz 1986) and three animals per $km^2$ were recorded by Spitz *et al.* (1984) in a forested area of France. In Thatta, South Pakistan, 3.7 animals per $km^2$ were recorded in a riparian forest environment (Smiet *et al.* 1979), and higher densities of 7.6 - 9.2 animals per $km^2$ have been recorded in Great Smoky Mountain National Park, USA (Singer 1981). Still higher densities of wild boar can occur when supplementary feed is given: 10 animals per $km^2$ have been recorded in a Polish forest (Andrzejewski and Jezierski 1978). Feral pigs, without supplementary feeding, can live at even higher densities: 28 feral pigs per $km^2$ were recorded on a Californian Island (Baber and Coblentz 1986).

**Breeding and Development**

16. Wild boar are seasonal breeders and generally have a more restricted breeding season than feral pigs. In European male wild boar, sexual activity and testosterone production are triggered by decreasing day length, reaching a peak in October and November when the rut occurs. During the peak of testosterone production, one wild boar under study refused food for a six week period and lost approximately 25% of body weight (Weiler *et al.* 1996). A dominant male wild boar sires the most offspring, as will a dominant male in a feral pig population. Male wild boar are capable of breeding all the year round but are least sexually active in the longest days of the year. Unlike wild boar, feral pigs may breed all year round with no distinct rutting season (Peine and Farmer 1990). It has been suggested that feral pigs are less well adapted to a life outside of captivity than wild boar, and will try to breed in unsuitable seasonal and food conditions (Barrett 1978).

17. In the breeding season the normally solitary males move into the female groups. Rival males will fight for dominance and the maturing young males from the previous year's litter are driven away from the sows. Kurz and Marchinton (1972) describe the males fight for dominance in a feral pig population as a constant circling and pushing with attempts made to slash each other with the tusks. Smaller skirmishes periodically occurred as dominance was maintained over subordinates.

18. A wild boar sow is in oestrus with a 21 day cycle from autumn until June/July at which time she becomes anoestrus until the next autumn, either because she is lactating or occasionally pregnant with a second litter. The start of the autumn oestrus in European wild boar is not clearly understood but may be triggered by nutritional status or day length (Spitz 1986, Delcroix *et al.* 1990, Porter 1993), although endocrine mechanisms

may also play a role (Booth 1988). The odour from steroidal pheromones present in the male wild boars' saliva stimulates receptivity in sows.

19. Although other species of ungulate give birth over a relatively short period, wild boar sows can farrow anytime throughout a six month period, although synchronised farrowing has been observed within female wild boar groups kept experimentally in a large forested enclosure (Delcroix *et al.* 1990). Pregnancy lasts 115 - 120 days and piglets in European populations are most frequently born between February and May.

20. Stolba and Wood-Gush (1989) observed free-ranging domestic pigs in a semi-natural environment in Scotland and considered their breeding behaviour similar to that shown by wild boars. Nest sites typically chosen possessed an open view as well as providing some shelter; fully enclosed or very sheltered sites were rarely chosen. The farrowing nest consisted of a hollow scrape in the ground lined with twigs and grasses. Piglets followed the sow out of the nest after the second week and in the fourth and fifth weeks daughter sows from a previous litter brought their own litter to the nest that they then shared. Boars became interested in the sows again three to five weeks post-partum and mating could occur while a sow was still lactating. Within 3 to 30 metres (10 to 100 feet) of the nest the pigs rub their heads and bodies on certain trees suggesting scent marking.

21. Feral pig sows in Australia have bred at an age of six to eight months (Hone and Robards 1980) whereas wild boar less than one year old will only breed in favourable conditions (Boitani *et al.* 1995). Feral pig litter sizes are typically 5 - 7 piglets but more can be born in good conditions. Wild boar litter sizes average 4 - 6 piglets. Boitani *et al.* (1995) recorded a mean litter size of 4.95 in Italian wild boar and Peine and Farmer (1990) recorded a mean of 4.36 in an American population. Boitani *et al.* (1995) found that in Italian wild boar, litter size was positively correlated with sow weight but not age. Parturition peaked in March - July with a smaller peak in November and December, probably second litters from the same females. The nutritional status of the sow is important for breeding success. Bruindesink (1995) found that for wild boar in a forest/heathland ecosystem an absence of oak and beech mast resulted in complete reproductive failure unless broad leaf grasses were available. A large natural harvest of acorns and olives for a wild boar population in a Mediterranean coastal habitat produced animals with higher body weights and a corresponding increase in litter size, when compared to a poor acorn and olive year (Massei *et al.* 1996).

22. The natural regulatory processes of wild boar populations are not fully understood. Boitani *et al.* (1995) suggest that the Italian wild boar populations studied were density-dependent, the birth rate being controlled by a feedback to the fertilisation process (ova and sperm viability, mating success and embryo implantation) when population numbers have increased to a certain level.

23. Unlike domestic pigs, wild boar piglets are born with a characteristic striped coat (Figure 3). Rooting behaviour develops in the piglets as early as the first few days of life and thermoregulatory control develops within approximately one month. Wild boar piglets are fully weaned after three - four months and lose their striped appearance at about five months old. Wild boar reach puberty at 8 to 24 months old depending on environmental factors.

24. Weight gain in wild boar differs between the males and females as the animals age. Gallo Orsi *et al.* (1992) found in an Italian alpine population that weight gain between the sexes differs after 18 months. Female weight gain stopped after 18 months at

around 50 kg (110 lbs.) whilst the males continued to grow, reaching 90 kg (198 lbs.) in later years. Similarly, for a wild boar population in a wooded area of Italy studied by Boitani *et al.* (1995), both sexes reached a weight of approximately 45 kg (99 lbs.) in their first two years. Males then increased quickly up to 60 kg (132 lbs.) with the females reaching the weight more slowly. Most animals over 80 kg (176 lbs.) were males with some males reaching the 120 - 140 kg (264 - 308 lbs.) range.

25. Wild boar dispersal strategy is unusual for an ungulate as they may disperse from an area prior to the depletion of the local food resources, a strategy more usually associated with small mammals (Saez-Royuela and Telleria 1986). Wild boar thus disperse when physically in good condition and as a consequence mortality rates will be low (Saez-Royuela and Telleria 1986). Dispersal can be through individuals or as a group; animals dispersing are usually adult males or males and females in their second year. Invasions into new habitat are sporadic and the furthest distances are often traveled in times of food shortage. Dardaillon and Beugnon (1987) note that wild boar in the Carmargue region of France move preferentially through natural land rather than cultivated areas, and will skirt around water. However, wild boar are good swimmers and one individual wild boar has been reported as having swum across a 700m (765 yards) wide river (Andrzejewski and Jezierski 1978). Wild boar can range long distances and one animal has been known in Kampinos National Park, Poland to move over 250 km (155 miles) (Andrzejewski and Jezierski 1978). Long distance dispersal may be related to the type of landscape, population density and hunting pressures. Cargnelutti *et al.* (1992) compared dispersal movements in six areas of southern France, results indicated that although long distance movement occurs more often in wild boar than for any other ungulate, a majority of individuals were sedentary.

**Figure 3.** Captivity bred wild boar piglets with attendant sows.

26. Jezierski (1977) looked at mortality rates in a wild boar population in Poland. Very high mortality was seen with 84% of animals dying during their first two years. The

hardest time for survival was the first three months of life and in the autumn months of October and November. The average mortality rate for new born piglets over a ten year period was 15%. Several possible reasons for the mortality were suggested: early mortality may be due to thermoregulatory mechanisms not being fully formed, therefore an April ground frost could be fatal. Autumn deaths may be the result of metabolic stress from acquiring a first winter coat, the first seasonally cold weather or development of parasitic loads. December mortality may result from fighting injuries in the rutting season. Emigration accounted for disappearance of 12 - 32 % of the two - five year olds. The oldest male wild boar recorded was nine years old and the oldest female was eight years old. In a Sri Lankan population, annual mortality in young and juvenile wild boar was found to be approximately 75% (Santiapillai and Chambers 1980), the high mortality amongst the young was attributed to their vulnerability to attack from leopards and crocodiles. The annual mortality in a French population for all age classes was found by Spitz *et al.* (1984) to be approximately 60%, of which hunting accounted for 40%. Similarly, in an Italian population studied by Boitani *et al.* (1995), 40% of the total population was lost through hunting. Neo-natal mortality varied considerably, 9% was recorded for one and 71% for another population. Boitani *et al.* suggest this may be related to a population regulation mechanism.

**Home Range**

27. Home range size for wild boar and feral pigs is dependent upon the availability and distribution of food, water, and secure shelter. Group size, habitat disturbance and predation will also influence home range size. As a consequence home range sizes vary considerably, for example, Boitani *et al.* (1994) recorded mean monthly home ranges of 1.1 - 3.9 $km^2$ (0.4 - 1.5 square miles) for a population of wild boar in a forested area of Italy. Singer *et al.* (1981) determined the mean seasonal home range of male boar in Tennessee, USA to be 3.5 $km^2$ (1.3 square miles) and 3.1 $km^2$ (1.2 square miles) for the females, and during a year of poor beech mast production, the home range of certain animals increased to 10.7 $km^2$ (4.1 square miles). Feral pigs on Santa Catalina Island, California, USA possessed smaller mean home ranges of 1.4 $km^2$ (0.6 square miles) for the males and 0.7 $km^2$ (0.3 square miles) for the females. Feral pig boars in a tropical Australian habitat possessed a mean aggregate home range of 33.5 $km^2$ (12.9 square miles) and the sows 24.1 $km^2$ (9.3 square miles) (Caley 1997). In a National Park in New South Wales, Australia, feral pig boars had a mean home range of 35.0 $km^2$ (13.5 square miles) and the sows 11.1 $km^2$ (4.3 square miles) (Saunders and Kay 1996).

28. Spitz and Janeau (1990) described two types of wild boar movement occurring within the animals' home range in a forested area in southern France. Movements slower than 1 km per hour corresponded to feeding, wallowing, exploring and marking. Faster than 2 km per hour were escaping, excursion or connective movements, when for example, a boar or sow with piglets abandoned the feeding area and moved to a distant resting place. Boitani *et al.* (1994) refer to these deliberately sought after sites as core areas typically containing preferred nesting areas and increased security whilst resting. One family group repeatedly returned to a small core area after feeding searches at night. Utilising resting sites away from the feeding areas may be interpreted as anti-predator behaviour (Spitz and Janeau 1990). Solitary males used several larger core areas that were fragmented throughout the home range. The ranges of different family groups overlapped and the overlap increased in winter, though none of the individual animal's core areas overlapped, suggesting exclusive use. Male ranges were found to overlap female core areas, inferring males were most interested in the areas frequently occupied by females (Boitani *et al.* 1994). Seasonal ranges in Tuscany, Italy were smallest when

food abounded. Singer *et al.* (1981) noted the wild boar in Great Smoky Mountains National Park, USA, often moved in circular or elliptical patterns during a 24 hour period returning to bed on, or near, the same hillside to the previous day. Wild boar sows and feral pig sows use a smaller than usual home range immediately before and after farrowing. Movement centres around the farrowing nest and this farrowing range can be maintained until the piglets are three weeks old (Kurz and Marchinton 1972).

29. Wild boar movements in an Italian Natural Park indicated that the animals, if undisturbed, made use of the same areas for several weeks at a time and returned to these areas one year later (Massei and Tonini 1992). Wild boar sows have been shown to rest in areas close to the area used on a previous night considerably more often than did the males; 80% of the sows versus 11.5% of the boars (Janeau and Spitz 1984). When Spitz and Janeau (1995) looked at sexual differences in daily habitat selection for wild boar, females showed a preference for more dense, and therefore more safe, habitats than did the males, who spent more time in open habitats.

**Diet**

30. Wild boar are omnivorous and will consume a large variety of food items; plant food typically constitutes around 90% of the diet, with animal matter constituting around 10%, although a tendency for concentrating on a few preferred foods, such as forest fruits and grain plants can be shown where these items occur in abundance. For example, wild boar diet in the southern Appalachians contained 89% vegetative material of mainly acorns and hickory nuts and 6% invertebrate material (Henry and Conley 1972). Genov (1981) found that in Poland plant material constituted 91% of the diet and animal matter 9%. Of the plant material 71% was cultivated plants, with potatoes the favoured food and where acorns were available, less damage to cultivated fields occurred. Animal material taken included frogs, nestlings and mice. It has been suggested by Sjarmidi *et al.* (1992) that where natural foods occur in abundance, wild boar will not use additional foods such as agricultural crops.

31. The diet of a wild boar changes to include food that is seasonally abundant. In the Camargue, southern France, wild boar ate mainly forest fruits, seeds and grain in the early autumn and in late autumn roots and bulbs became more prominent in the diet as forest fruits were not as abundant (Dardaillon 1987). In summer the animals moved to agricultural areas where crops then became the main food source. Feral pigs in South Carolina, USA, fed mainly on acorns and hickory nuts when in season and as the supply of nuts dwindled, roots and herbage became more important. Vertebrates taken included mice, birds, snakes and lizards and invertebrates included worms, beetles and centipedes. When considering sex and age differences to diet, no difference was determined for feral pigs in South Carolina (Wood and Nick Roark 1980), although Dardaillon (1989) found juvenile wild boar in the Camargue to have sampled a greater variety of foods than yearlings and adults. Early experience of many different food items may be advantageous when coping with fluctuations in food availability. Wild boar inhabiting an Italian Mediterranean coastal area without any agricultural crops and not given supplementary feed, consumed mainly acorns, olives, grain plants (stems, leaves and rhizomes), pine seeds and juniper berries. 97.9% of their diet was vegetarian and 2.1% animal matter. Animal matter consisted mainly of invertebrates, including cicada, beetle, butterfly larvae, earthworms and snails. The small amount of vertebrates consumed included reptiles, birds, small rodents and porcupines (Massei *et al.* 1996).

32. Genov (1981) highlighted the diversity of diet in a Polish wild boar population by isolating 131 different kinds of food items consumed, including 12 species of

vertebrates and carrion, 45 species or higher taxons of invertebrates, 14 species of cultivated plants, 18 species of bushes and shrubs and 41 species of higher taxons of woodland and meadow plants.

**Economic Status**

33. The prevailing attitude to a wild boar or feral pig population differs from one country to another. In certain countries the animals are viewed as a pest to be controlled or eradicated, while others regard the animals as an economic resource generating considerable revenue from hunting fees or from the sale of meat. For example, Germany, Poland, Russia, France and Spain all suffer agricultural damage from wild boar but on balance consider the animals to be an economic asset (Tisdell 1982). The cost of any agricultural damage (to the country or individual farmer) can in theory be offset by the large revenue generated by the hunting or farming of the animals and systems to compensate farmers for wild boar damage are in operation in several countries. For example, in France, hunting authorities indemnify farmers for severe agricultural losses resulting from wild boar damage. Polish state forest authorities compensate the owners of wild boar damaged crops and Italian local governments also compensate for wild boar damaged crops.

34. Religious beliefs also have a bearing on how a wild boar or feral pig population is tolerated. Islamic religious beliefs in countries, such as Pakistan, regards pigs as unclean and therefore no commercial use of wild boar is allowed. Moslem beliefs in Indonesia prevent the consumption of pig meat, however, killed animals can be sold to non-Muslim neighbours.

35. Different areas within a country can also have conflicting views on the status of the animals. For example, as Williamson (1996 p124) states; 'Pigs on Hawaii are a conservation disaster, yet there are hunters who want to keep them'. In Australia, Choquenot *et al.* (1996) state that 'the feral pig is no longer simply regarded as an agricultural threat, but also as a contributor of significant income to rural communities through recreational and commercial hunting'.

**Economic Advantage**

*Wild Boar Farming*

36. High production rates and fast growth make wild boar economically feasible to farm and the meat is considered a great delicacy commanding a higher price than domestic pig meat. Optimum flavour is dependent on the animal's age, diet, speed of maturation and farming practice - free range or intensive. Wild boar farming on the continent is often based around woodland as the wood provides food, shelter and hunting sport. France has the most developed wild boar farming industry in Europe for meat production whereas in Germany, wild boar farming places more emphasis on breeding animals for release into managed hunting forests.

37. Wild boar farming in Britain is in its infancy. Wild boar are covered under the Dangerous Wild Animals Act 1976, as amended in 1984 and certain legal requirements have to be met prior to commencing a farming operation. A licence to keep the animals has to be obtained from the local District Council who will appoint a veterinarian to inspect the premises and report on the suitability for housing the animals. Requirements include secure accommodation and fencing, correct drainage, temperature, lighting,

hygiene, ventilation and liability insurance. Crossing a pure bred male wild boar with a domestic pig sow is practised by many wild boar farmers in this country for economic reasons. The resulting hybrid sows can, unlike pure bred wild boar sows, farrow twice yearly with larger litters and earlier maturity. Hybrid piglets also possess the striped coats of the wild type. However, too much domestic blood in the wild boars blood line will result in a loss of the desired meat flavour. Hybrid animals, providing one of the parents is a wild boar, are also covered by the Dangerous Wild Animals Act 1976, as amended in 1984.

38. In 1989 the British Wild Boar Association was formed to promote wild boar farming in the UK. The association promotes the commercial development, welfare and husbandry of wild boar and endeavours to maintain a breeding register of pure bred stock, thus reducing the practice of farmers selling inferior hybrid meat as pure bred wild boar meat. The BWBA currently has a membership of 40 wild boar farmers in the UK, 16 of whom have pure bred wild boar registered. The remaining 24 farms generally keep hybrid stock from crossing wild boar with domestic pigs. Membership of the BWBA is voluntary and an unknown number of wild boar farms exist in Britain which are not members of the BWBA. Farms containing pure bred wild boar or hybrid animals should be registered with their local District Council, however as no central register is compiled listing all the wild boar farms in the UK, the total number of wild boar farms is currently unknown. Wild boar farms are spread throughout Britain, although the majority occur in southern England (Figure 4).


**Figure 4.** Distribution of wild boar farms which are members of the British Wild Boar Association.

39. To minimise the risk of escape some wild boar farm enterprises advocate the practice of nose ringing of their stock. Alleged advantages of nose ringing are a reduction in the animals rooting and ploughing of the paddock field providing a 'cleaner' environment for the animal to live in, and a reduction in the risk of escape from rooting under perimeter fencing and from shorting out electric fences from pushing earth across the wires.

*Wild Boar Hunting*

40. In many countries, wild boar are favoured hunting quarry by groups of amateur hunters or by well organised and regulated shoots. In Germany, for example, wild boar hunting is an expensive and prestigious sport with hunters killing over 200,000 animals each year in managed hunting forests (Kyle 1995). Feral pigs also provide popular sport and are considered in Australia to be the most important game animal (Tisdell 1982). Wild boar and feral pigs can be stalked on foot, shot at feeding stations, driven towards waiting guns or located with tracker dogs. The animals popularity as a sporting quarry is due to its large size, aggressive nature and valued meat.

*Agriculture*

41. Thought has been given to integrating wild boar husbandry with forestry in this country (Brownlow 1994). Wild boar were once a part of our natural forest ecosystem; their rooting activities can benefit a forest by improving soil aeration and permeability to water, accelerating the decay of leaf litter and reducing insect pests by eating the larval grubs of, for example, cockchafers, click beetles and sawflies (Telishevskiy 1990). The targeted use of wild boar has been shown to reduce May bug (*Melolontha hippocastani F.)* density and thus reduce the damage that May bugs caused to underplanting in Pine forests. In one enclosed area, grub density was shown to be reduced by 80% (Schmid-Vielgut *et al.* 1991).

42. Recently wild boar have been reported as being used in a Scottish country park management programme to control long grass and unwanted weeds. The wild boar are credited with breaking up vegetation, thus allowing pine seedlings to grow unhindered without the use of pesticides and herbicides (Anon 1987).

*Economic Disadvantage*

43. The economic and environmental damage attributed to wild boar and feral pigs can be summarised as:

    damage to agricultural crops and fences from rooting, trampling and breaching.

    predation of domestic livestock and interbreeding with domestic pigs.

    Vectors of disease to domestic livestock, domestic pets and humans.

    damage to native flora and fauna.

*Damage to Agriculture*

44. Mackin (1970) looked at agricultural damage in three areas of Poland where 70% of crop damage is attributed to wild boar. Oats and potatoes were the preferred crops although rye, wheat, barley and mixed grain crops were also taken. Damage occurred at specific times of the year. In north-east Poland, damage occurred over a three month period, while in south-west Poland the period of damage was longer, lasting for five months. Mackin found that the amount of damage caused by wild boar depended not on the density of the population but on the availability of beech and acorn mast; the less mast available, the more agricultural damage occurred. Dardaillon (1987) also found that wild boar in the Camargue region of France made use of other foods, including cultivated plants, when forest mast was scarce and Genov (1981), in western Poland, found a good natural harvest of acorns or beech mast reduced wild boar damage to

cultivated fields, although the damage increased the following year from the resulting higher boar population.

45. Examples of wild boar damaging agricultural crops can be found throughout their range. In Pakistan, government encouragement of large scale sugar cane cultivation has led to a corresponding increase in damage to the sugar cane from wild boar. Damage is regarded as 'considerable' in the Faisalabad district alone (Shafi and Khokhar 1986). In Indonesia, young coconut plantations often fall victim to wild boar damage (Schmidt 1986). Crops of oil palm, banana, cassava, sweet potato and yams which were planted in an Indian research institute and deliberately left unprotected were completely destroyed by wild boar within 50 days (Jacob 1993). Macchi *et al.* (1992) studied wild boar damage in the Cuneo province of Italy, and although they found the percentage of damage to the total study area to be very low, the hardest hit areas were the small diversified mountainous ones where the local economy can be heavily affected by damage from the animals. The most damaged crops were meadows of fodder crops, followed by maize, cereals, vegetables and orchards.

46. An increase in serious damage to agricultural crops from an increasing wild boar population has been reported in the Turin district of Italy (Paolo and Marina 1988). Table 1 shows how the amount of compensation that was paid out to agricultural farmers and forestry in the Turin area increased more than fivefold during the period 1981 - 1988.

**Table 1.** Compensation for damage due to wild boar in Turin, Italy.

Data from Paolo and Marina 1988

| Year | Number of wild boar shot | Damages paid in Lira (millions) | Damages paid in £ Sterling * |
|---|---|---|---|
| 1981-2 | 169 | 71 | 25,204 |
| 1982-3 | 191 | 80 | 28,399 |
| 1983-4 | 201 | 75 | 26,624 |
| 1984-5 | 382 | 120 | 42,599 |
| 1985-6 | 439 | 225 | 79,872 |
| 1986-7 | 558 | 343 | 121,760 |
| 1987-8 | 1024 | 477 | 169,329 |

* at an exchange rate of 2,817 lira: £1.00 (13/12/97).

47. In Australia, where feral pigs are responsible for a considerable amount of agricultural damage, no accurate estimates of the economic cost to agriculture exists. However, Choquenot *et al.* (1996) estimate the damage '...is at least of the order of [Australian] $100 million annually and it may be considerably more.'

48. Meriggi and Sacchi (1992) investigated the factors that affect damage to cereal fields in northern Italy. They found that out of a total of 61 fields, 31 fields were damaged by wild boar, the damaged fields were those further from human settlements, closer to wallowing and resting sites and had a greater amount of surrounding hedgerow and fruit bearing trees. Cultivated fields alongside woodland were found to be the most favoured for feeding activity in a Polish study (Genov 1981). Although beyond the scope of this

work, an investigation of the factors associated with damage should enable vulnerable fields to be identified in the southern England situation.

*Damage to Livestock*

49. Feral pigs are known to include lambs in their diet and this has inevitably brought them into conflict with sheep farmers, particularly in Australia and New Zealand, where sheep are farmed extensively. Pavlov and Hone (1982) described feral pigs attacking lambs in New South Wales, Australia. The lambs attacked were all healthy, with the pigs running down their prey with a short run usually in an open habitat. Opportunist scavenging of after-birth and dead lambs was suggested as initiating killing behaviour and male feral pigs ate more lambs than the sows. One male feral pig was noted as becoming a habitual lamb killer. Pavlov and Hone (1982) suggested the feral pigs consumed the lambs in a distinctive manner, thus the remains of a carcass consisting of only lower leg bones and some skin could implicate pigs when the predator was unseen.

50. In Australia, feral pigs can be notable lamb killers (Choquenot *et al.* 1997, O'Brien 1985, Plant *et al.* 1978). On a property in north-west New South Wales, an investigation into lamb losses estimated that in 1975 over 600 lambs from 1,422 ewes were killed by feral pigs (Plant *et al.* 1978). At its worst, lamb predation by feral pigs has been a consideration in substituting sheep production with cattle production in the Macquarie Marsh area of New South Wales (O'Brien 1985). To observe a feral pig actually taking a lamb is a rare occurrence; predation usually occurs under the cover of darkness and all of the lamb may be consumed. Direct evidence of a kill can therefore be difficult to obtain and as a consequence the numbers of lambs killed are likely to be underestimated. Lamb production can also be decreased as a result of harassment by the wild pigs. Choquenot *et al.* (1997) assessed lamb predation by different densities (range 0.7 - 6.4 feral pigs per $km^2$) of feral pig populations in the western area of New South Wales. The rate of predation was found to increase significantly with an increase in feral pig density and on average twin lambs were predated 5 - 6 times more frequently than were single lambs. The twin lamb's vulnerability to predation was probably a result of parental attention being divided and the lack of strength in a twin lamb compared to a single lamb. It was also suggested that the predation rate of the feral pigs on the lambs was not influenced by the availability of alternative foods.

51. When reviewing the literature no examples could be found of wild boar, as opposed to feral pigs, predating lambs. The reason is unclear as wild boar, like feral pigs, are omnivorous and will consume a diverse range of food items. It may simply be that wild boar do not live in areas where large numbers of sheep are farmed. For example, the countries reporting most lamb predation; Australia and New Zealand, do not have populations of wild boar, only feral pigs (Lever 1994). It is possible that wild boar do predate lambs but, perhaps due to the small number of reported incidents, this has gone unrecorded in the literature.

*Damage to Flora and Fauna*

52. Singer *et al.* (1984) looked at the effects the non-indigenous wild boar population had in Great Smoky National Park, USA. They found ground vegetation cover and leaf litter reduced to such an extent that two small mammals, the red-backed vole (*Clethrionomys gapperi*) and short-tailed shrew (*Blarina brevicauda*) were nearly eliminated from intensely rooted areas. Accelerated leaching from the leaf litter and soil of various elements also occurred. In the same National Park, Bratton (1975) found that in

severely rooted areas the forest understorey had been reduced from 80% - 100% to as little as 2% - 15% with a significant reduction in plant species number.

53. Damage to the flora of recreational ground was caused by a group of feral pigs inhabiting an ecological preserve in an urban area of Florida, USA. The feral pigs were eradicated by shooting when considerable damage occurred to the preserve's natural understorey combined with increased rooting damage to the fairways and greens of the local golf course (Brown 1985).

54. A study carried out in a region of Germany used as a hunting area for woodcock *(Scolopax rusticola* L.), implicated wild boar as the cause of the decline of the ground nesting woodcock by disturbing and predating the nests (Nyenhuis 1991).

*Vectors of Disease*

55. The danger of feral wild boar in England spreading disease to domestic pig stock is a cause for concern. Wild boar and feral pigs can carry diseases fatal to domestic stock. These include Foot and Mouth, Rinderpest, African and Classic Swine Fever and Aujeszky's disease. Classic Swine Fever virus has spread in the wild boar populations of Germany and France, and in Italy domestic swine in contact with wild boar have been infected with Classic Swine Fever (Rutili *et al.* 1992). Concern has been raised in, for example Australia, that the feral pigs will act as a reservoir and vector for an outbreak of an exotic disease such as Foot and Mouth (Caley 1993) with drastic economic consequences from loss of exports. Numerous studies have been commissioned to determine how to control such an outbreak should one occur (Choquenot *et al.* 1993, McIlroy 1983, McIlroy and Saillard 1989, McIlroy *et al.* 1989, O'Brien and Lukins 1990). The uncontrolled movement of wild boar and feral pigs for stocking hunting grounds, which has for example, occurred in the USA and Italy, may also aid the spread of various diseases.

56. As well as carrying infectious diseases from micro-organisms, wild boar also play host to a number of parasites transmissible to both humans and animals. Eslami and Farsad-Hamdi (1992) looked at helminth parasites in Iranian wild boar. From 57 wild boar examined 74% had a least one species of helminth present. In total, ten species of helminth were isolated, nine of which also occur in domestic pigs and three that occur in humans. Humans have caught helminth infections from wild boar or feral pigs. Twenty four cases of trichinosis in humans were contracted from the consumption of feral pig meat in the USA between 1974 and 1978 (Wood and Barrett 1979) and in an outbreak of trichinosis in Ontario, Canada, several patients required treatment following consumption of infected farmed wild boar meat (Greenbloom *et al.* 1997). Domestic cats and dogs have also been documented as having died after being fed wild boar meat that was infected with the Aujeszky's disease virus (Capua *et al.* 1997).

**Control and Management Measures**

57. In areas where wild boar and feral pigs are considered an agricultural menace, various control techniques have been implemented to reduce or eradicate local populations. Control programmes have not always been successful and in certain Australian states where eradication is mandatory, feral pig populations have still increased over the last 40 years (Izac and O'Brien, 1991). Lack of success has been attributed to insufficient basic biological information, lack of a completely effective removal technique and the inability to detect efficiently the reduced number of remaining feral pigs after a control operation has been carried out. Problems encountered by control techniques include

difficult physical environments (e.g. swampland) and the high cost of eradication programmes compared to agricultural losses. Hone and Robards (1980) also emphasize the need for accurate data regarding population numbers, breeding rates, mortality and movement for a control operation to be successful. Peine and Farmer (1990) looked at the management of a feral pig control programme being carried out in Great Smoky National Park, USA and highlighted the importance for control measures to be sustained as any progress made on reducing pig numbers can be lost if efforts are relaxed for as little as two years. Adequate staffing levels were necessary as was knowledge of where the animals actually were in the park. Continuous data collection was important to assess and improve the effectiveness of the programme.

*Poisoning*

58. Successful reductions of feral pig numbers have been achieved by poisoning, particularly in areas of Australia (Hart 1979, McIlroy 1983). Poisoning is particularly suitable to the extensive Australian agricultural systems as it is low in cost and can be implemented over a large area. Sodium monofluoroacetate (1080) is commonly used and considered to be the most effective poison. However, a problem with 1080 is that a poisoned feral pig will vomit repeatedly prior to death and the vomit contains enough poison to kill any non-target species that ingest it (O'Brien and Lukins 1990). When considering alternative poisons which avoid the vomiting problem, McIlroy *et al.* (1989) suggested warfarin to be equally as effective as 1080 although unsuitable for controlling pigs in a disease outbreak as warfarin kills in five - ten days, as opposed to three to 80 hours using 1080. Poisoning with 1080 was also considered the best method, as compared to trapping and shooting, in terms of cost and efficiency for a feral pig control programme on Isla Santiago in the Galápagos Islands, Ecuador (Coblentz and Baber 1987).

*Shooting*

59. In situations where poisoning was unacceptable, shooting has on occasion proved an effective method of control. Brown (1985) describes the successful removal of an urban feral pig population over a period of time in Florida, USA, by shooting the animals feeding at bait stations. Problems encountered with shooting as a form of control include animals dispersing at the sound of the shot, the difficulty of shooting in wooded, wet or marshy terrain and the inherent danger of using high-powered, large calibre weapons. In open Australian terrain, where pig numbers are high, shooting from helicopters has proved effective (Hone 1990). Shooting from the ground has also been used in combination with hunting dogs; the dogs track and hold the feral pig which can then be shot. Hunting with dogs has proved to be an effective way of removing residual pigs surviving other forms of control (Caley and Ottley 1995). Pregnant and nursing females are particularly vulnerable to capture by dogs.

60. Amateur shooting as a sport has helped reduce feral pig numbers in Australia. Tisdell (1982 p125) states "amateur hunters not only place a high value on the opportunity of hunting wild pigs, but make a significant contribution towards controlling their population". In Europe, wild boar hunting for sport has also served as a control method. Hunting took 40% of wild boar numbers in south-west France (Spitz *et al.* 1984), although Boitani *et al.* (1995) note that recent population increases of wild boar in Italy can no longer be controlled effectively by traditional seasonal hunting methods.

*Trapping*

61. Wild boar and feral pigs will enter baited traps and this method has been employed in control operations. Trapping success can be improved by trapping at a time of year when the animals are naturally more hungry and feral pigs have been more readily trapped when native foods are in short supply (Coblentz and Baber 1987). However, Saunders *et al.* (1993) found that when trapping feral pigs in Kosciusko National Park, New South Wales, Australia, 38% of the available pig population were not trapped due to trap shyness, the animals ate the food outside the baited traps but did not enter the traps. Choquenot *et al.* (1993), also in Australia, found that trapping feral pigs preferentially removes sows, possibly due to sex-related differences in accepting the trap bait, and that trapping efficiency was not improved by the use of the appropriately named Delilah traps in which sows in oestrus were placed in the traps as bait to encourage male animals. Trapping methods did not prove to be as effective as poisoning or shooting in a control operation on Isla Santiago in the Galápagos Islands, Ecuador, due to the difficulty in transporting the traps and the abundance of natural foods (Coblentz and Baber 1987). The problem of transporting traps also resulted in low trapping rates for a wild boar control programme in Great Smoky National Park, USA, as the traps were placed in open areas of grassland for ease of transport (Peine and Farmer 1990).

*Fencing*

62. Fencing has been used successfully to exclude wild boar from areas where their presence was not desired. For example, fencing was used in a feral pig eradication programme in ecologically important areas of the Hawaii Volcanoes National Park, USA. An area was cleared of feral pigs using other eradication methods (mainly hunting with dogs but also baiting and trapping), and the area was fenced off to prevent re-invasion from the surrounding areas (Hone and Stone 1989). The pig fence involved consisted of wire netting 80 cm (31.5 inches) high with 8 horizontal wires, the bottom of the fence was staked to the ground and attached to steel posts. Fence designs are varied and several types were tested against penetration by feral pigs in Australia. This testing showed that electrification significantly reduced the number of feral pigs breaching the fence (Hone and Atkinson 1983). Electric fencing has also proved an effective way of keeping wild boar and feral pigs out of young coconut plantations in west Sumatra (Schmidt 1986).

63. A disadvantage with fencing is that a fence is only ‘as strong as the weakest link’ and requires constant monitoring as, for example, a fallen tree can breach it. Fencing required to keep out the inherently stronger and nervous wild boar would need to be more substantial than the type required for normal domestic livestock. The initial cost of such a fencing system, particularly an electrified one, can be prohibitive to the smaller farmers. A maintenance programme is also required to check continually the condition of the fence and for an electric fence, to prevent grass and undergrowth from shorting out the current. Wild boar can root under fencing if the ground is sufficiently soft, although this can be prevented to some extent by burying the lower part of the fence into the ground or incorporating a snout wire, a length of barbed wire running along the ground at the foot of the fence.

64. For British wild boar farm enclosures, the British Wild Boar Association Guidelines quote that fencing ‘...around 1.5m (59 inches) high, with 40 cm (16 inches) or so underground or flapped over will be effective. As an added protection, electric fencing

is also extremely effective' (Farm Animal Welfare Council 1994). An example of a electrified fencing system typically in use on a wild boar farm is shown in Figure 5.

**Figure 5.** Fencing system with off-set electrical wires currently in use on a British wild boar farm.

*Supplementary Feeding*

65. To reduce agricultural damage by keeping the wild boar in the forested areas, supplementary feeding at a time when the crops are most likely to be damaged has been effectively implemented in regions of Poland (Mackin 1970). In Russia also, the planting of foraging fields containing maize, oats or potatoes actually within the forest has also deterred wild boar from raiding farmland (Telishevskiy 1990). These sacrificial crops require fencing and are only opened during times when agricultural damage is likely. Supplementary feeding can increase wild boar population numbers as the additional food improves the condition of the animals, with a subsequent increase in potential for agricultural damage.

*Other Measures*

66. A scheme involving the payment of a bounty on feral pig snouts has been tried in several countries to reduce wild boar or feral pig numbers. In Australia, for example, Choquenot *et al.* (1996) describes the advantages of a bounty system as including:

additional or essential income for farmers, grazers and trappers;

the provision of important scientific information;

a measurement of effectiveness of past control programmes.

Bounty systems though can be fraught with disadvantages, including:

being open to abuse from fraud;

leading to the deliberate spread of pest animals to provide future income;

the potential for costs to exceed total predation losses.

The Australian government began phasing out bounty payments on feral pigs in 1975, after declaring them ineffective as a pest control method (Choquenot *et al.* 1996).

# 3. Free-living Wild Boar in England

**South-east England**

67. To date, the presence of free-living wild boar has been confirmed by CSL in several areas of south-east England. Evidence was provided by field signs including rooting in woodland and agricultural land, wallows, farrowing nests, damaged fences and tracks. The tracks provided important confirmation of the other field signs. For example, a small patch of rooting could be mistaken for badger damage and conversely, rooting activity helped to prevent other animal tracks, for example deer or sheep, from being mistaken for wild boar tracks.

68. The free-living wild boar in south-east England are almost certainly breeding as a farrowing nest has been found and striped piglets have been sighted. CSL has confirmed piglet tracks in woodland. Although breeding can not be proven, the circumstantial evidence provided by the farrowing nest, piglet tracks and piglet sightings implies that breeding in the wild is occurring.

69. It was possible to briefly examine five carcasses from animals that had been killed by hunters in the south-east England area. All five carcasses were of male animals, four possessed tusk development and were estimated to be three to four years old. The fifth animal was a juvenile with no tusk development. All animals appeared to be in good condition and had the phenotypic appearance of a wild boar.

70. Numerous sightings and incidents involving free-living wild boar have come to CSL's attention but remain unconfirmed because CSL was unable to find any evidence to support the animal's presence. This could be due to the reports of wild boar activity being erroneous or conversely, animals had been present in the area but no evidence was found to substantiate this. For example, the ground may have been too hard and dry for tracks to be left or for rooting to occur or rainfall had washed the animals tracks away. Evidence of the animals may have been present, but was not found due to, for example, the large size of the woodland being searched.

71. Free-living wild boar have been confirmed by CSL, on the presence of field signs, to have been present in the following parishes of south-east England:

| | |
|---|---|
| Aldington - Kent | TR0636 |
| Appledore - Kent | TQ9529 |
| Bilsington - Kent | TR0434 |
| Lympne-Kent | TR1134 |
| Ruckinge - Kent | TR0233 |
| Stone-cum-Ebony - Kent | TQ9427 |
| Warehorne - Kent | TQ9832 |
| Wittersham - Kent | TQ8927 |
| Woodchurch - Kent | TQ9434 |
| Beckley - East Sussex | TQ8423 |
| Kenardington - East Sussex | TQ9732 |
| Peasmarsh - East Sussex | TQ8823 |

Udimore - East Sussex TQ8619

72. The two areas farthest apart in Kent and East Sussex which CSL has confirmed free-living wild boar are Udimore in East Sussex and Lympne in Kent (Figure 6). The two areas are a linear distance of approximately 32 km (20 miles) apart. The land between these two areas is a patchwork of mixed woodland and agricultural fields and free-living wild boar have been confirmed in many of these intermediate areas. The total area that free-living wild boar have been confirmed in to date, using 5 x 5 $km^2$ grids, is 175 $km^2$ (67.5 square miles). It is not known how large an area an individual group of animals will range over in south-east England or if each area supports a separate group of animals. Wild boar in an Italian environment are known to travel distances of up to 12 km (7.5 miles) a night in a circular foraging pattern (Boitani *et al.* 1994) so there is the possibility that the same group of animals are being confirmed in different areas.

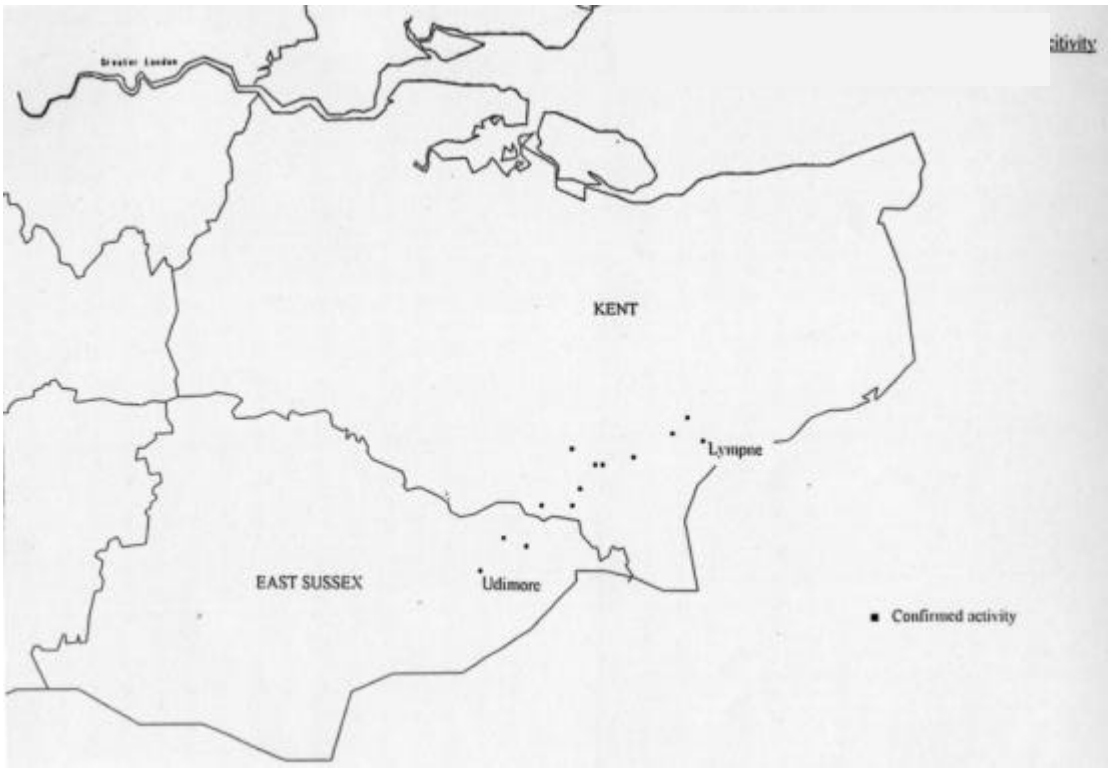



**Figure 6.** Distribution of confirmed wild boar activity in Kent and East Sussex.

73. When trying to determine in which areas free-living wild boar occur, local hunters are often reluctant to give information on areas where there have been sightings. These hunters are in the unusual situation of being able to hunt a prestigious sporting quarry with a marketable value, in their locality, completely for free. The hunters are secretive about where the animals are located for fear of attracting poachers or anti-blood sport campaigners and also a belief that 'MAFF will come and eradicate them all'. Information has been provided by these hunters for this report after assurances that confidentiality about the exact locations of the animals would be respected. At the opposite end of the scale the farming community are more readily talking about where wild boar have been seen. Certain farmers suffering economic loss from the animals want '...something done about the animals', although control measures such as fencing or a local cull are suggested more often than eradication. Other farmers CSL has spoken to have no wish to see the animals controlled. The free-living wild boar have

aroused considerable local interest and possess a certain novelty value that is tolerated as long as '...numbers do not get out of control'.

74. At least 39 free-living wild boar have been killed in the Kent and East Sussex area in the last five years. Shooting has accounted for 31 of the animals (Figure 7), road traffic accidents for 3, and 5 animals have been trapped alive and slaughtered for their meat. Confirmation of all these fatalities has been provided by interviewing the person or persons directly involved. The actual number of fatalities is likely to be higher as the above numbers are only the ones CSL has been able to confirm with the person(s) directly responsible. The exact number of animals present in south-east England is unknown. Accurate population counts of wild boar are notoriously difficult to obtain due to the animals typically secretive and nocturnal nature and is beyond the scope of this study.

**Figure 7.** A free-living wild boar shot in south-east England whilst rooting in a cereal field.

75. The areas where free-living wild boar have been confirmed is by no means a definitive list. The risk assessment field work involved following up on wild boar sightings and incidents of agricultural damage reported to local NFU or FRCA offices, and by investigating rumours circulating in the farming community. At no stage was the general public or farming community specifically asked, via the media, for information

on wild boar activity or sightings. A more comprehensive list of areas containing wild boar might have been available if publicity had been sought. However, this would have involved a considerable amount of time dealing with the media and the public and was beyond the scope of this study.

**Dorset**

76. The free-living wild boar in Dorset are believed locally to have escaped from a wild boar farm in the area of Toller Porcorum. Six animals were thought to have been involved in an escape, which occurred in April 1996. Four animals have since been accounted for by shooting, including a pregnant sow carrying six piglets, and a fifth animal was killed in a road traffic accident about 20 km (12.5 miles) from the original escape site. If six animals originally escaped only one should therefore still be at large.

77. FRCA report the Dorset animals to be inhabiting woodland in the areas of Mapperton (SY 5099), Powerstock Common (SY 5196) and Hooke Park (ST 5300). CSL has spoken to a farmer who has seen an animal on his land in Maiden Newton (SY 5997) and wild boar rooting damage has been confirmed by CSL in the areas of Hooke (ST 5300) and Higher Kingcombe (Figure 8). A gamekeeper responsible for woodland around the Mapperton area declined to discuss the wild boar situation with CSL when asked by the local NFU office. All the above mentioned areas are in the immediate vicinity of Toller Porcorum (SY 5697), the area where the animals are reported to have escaped from.


**Figure 8.** Distribution of wild boar activity in Dorset.

78. The exact number of free-living wild boar present in Dorset is unknown. However, from the rooting evidence confirmed by CSL, it is likely that more than one animal was

responsible. Local reports even suggest that there may be several dozen animals at large. The animals have either bred or more than six animals were involved in the original escape. The animals may be breeding as a farmer has reported seeing a sow with five piglets. The sighting of these animals was reported to the local police force who passed on the information to CSL.

**Rest of England**

79. Sightings of free-living wild boar have occurred periodically in several other areas of England, away from the previously discussed areas of Kent, East Sussex and Dorset. However, no farmers in any of these areas have reported any occurrence of agricultural damage and all CSL visits and inquiries have shed no light on the presence of any animals. This does not prove that no animals were present in the area, only that no substantiating evidence was obtained. Wild boar periodically escape from captivity (Baker 1990) and individual animals have been known to survive in the wild for several years. Wild boar range over areas of many kilometres, hence locating individual animals is extremely difficult and time consuming. Sightings of 'new' animals are likely to continue to arise as further escapes from captivity occur.

## 4. Free-living Wild Boar Damage In England

80. Several farmers in Kent and East Sussex have reported alleged wild boar damage to their fields and crops and some have reported wild boar predation on lambs. In Dorset, several farmers have also reported rooting damage to pasture and interference with domestic pig sows from free-living wild boar. All these farmers were visited by CSL to discuss the alleged involvement of wild boar.

### Lamb Predation

81. In March 1995 a report was made to ADAS (now FRCA) that a wild boar had predated two pedigree lambs. An ADAS investigation conducted at the time gave no reason to doubt the authenticity of the claim. Furthermore, other neighbouring farmers also made allegations of wild boar attacks on their lambs. For this risk assessment, all these farmers were visited and asked about their lambing situation with regard to wild boar (Table 2).

**Table 2.** Alleged lamb predation from free-living wild boar reported in south-east England.

| Farm Location | Date Farm Visited | Alleged Lamb Predation | Landscape Features |
|---|---|---|---|
| Beckley, East Sussex | 11 Feb. 97 | 15-20 lambs killed in 1994 - 1996 | Woodland in close proximity to field |
| Beckley, East Sussex | 27 Feb. 97 | 30 lambs killed in 1994 | Woodland borders field |
| Beckley, East Sussex | 11 Feb. 97 | 2 lambs killed in 1995 | Woodland borders field |
| Beckley, East Sussex | 11 Feb. 97 | 4 lambs killed 1995 | Woodland borders field |
| Peasmarsh, East Sussex | 14 Feb. 97 | 5 lambs killed in 1995 | Woodland borders field |

82. All reported lamb losses are from fields close to woodland in Beckley, East Sussex. Lambing took place outside and lambs were allegedly predated when only a day or two old. There was one exception of a farmer who lambed inside; his lambs were put outside when 10 - 15 days old, in a field bordering woodland, and two were killed on their first night outside. Evidence of free-living wild boar activity in the woodland around Beckley has been confirmed by CSL.

83. The farmer who allegedly lost 30 lambs was able to recoup some of his losses through an insurance policy, though he estimated himself to still be approximately £600 out of pocket. The farm that lost two lambs was also insured and able to claim against loss of livestock from a wild animal attack. Determining the type of 'wild animal' involved was not necessary for insurance purposes .

### Agricultural Damage

84. Damage to agricultural crops from free-living wild boar and confirmed by CSL in south-east England and Dorset has been tabulated (Table 3). Photographic evidence has been included where relevant to illustrate damaged areas (Figure 9 - 14).

85. Fields bordered by woodland appear to be particularly vulnerable to rooting, this was the case in both south-east England and Dorset. Wild boar are known to preferentially feed in the open under the increased security of darkness and further security is no doubt provided by the proximity of woodland.

**Table 3.** Agricultural damage from wild boar reported in England and confirmed by a CSL site visit.

| Damage Location | Date Visited | Agricultural Damage | Illustrated | Landscape Features |
|---|---|---|---|---|
| Beckley, East Sussex | 11 Feb. 97 | 5-10% of a pasture field rooted | | Field bordered by woodland on one side, agricultural land on three other sides |
| Beckley, East Sussex | a) 17 Jan. 97<br>b) 11 Feb. 97 | 5% of 1 pasture rooted<br>2% of hop field rooted | Figure 9 | Pasture field is in close proximity to woodland and the farmyard<br>Hop field bordered by woodland and agricultural land |
| Beckley, East Sussex | 26 Feb. 97 | 15% of recently sown wheat seed rooted | | Wheat field bordered by woodland, agricultural land and a minor road |
| Lympne, Kent | a) 12 Feb. 97<br>b) 27 Feb. 97 | a) 3% of 1 pasture field rooted on more than one occasion<br>b) Headland of wheat field rooted <1% | Figure 10 | a) Pasture field bordered on two sides by woodland and agricultural land<br>b) Wheat field bordered on all sides by agricultural land, woodland in close proximity |
| Peasmarsh, East Sussex | 26 Feb. 97 | 35% of 1 pasture field rooted | Figure 11 | Pasture field bordered by woodland and scrub |
| Appledore, Kent | 13 Mar 97 | Young wheat plants rooted <1% | | Wheat field bordered by woodland and agricultural land |
| Ruckinge, Kent | 25 Mar 97 | Young wheat plants rooted <1% | Figure 12 | Wheat field bordered by woodland and agricultural land |
| Beckley, East Sussex | 26 Mar 97 | Rooting in pasture <1% | | Pasture field bordered by woodland and agricultural land |
| Sellinge, Kent | 26 Mar 97 | Young barley plants rooted <1% | | Barley field bordered by woodland, scrub and agricultural land |
| Peasmarsh, East Sussex | 26 April 97 | 40-50% of headland bordering a clover field rooted | Figure 13 | Clover field bordered by woodland and agricultural land |
| Sellinge, Kent | 2 Oct. 97 | Freshly sown oats rooted two and five days after sowing <1% | | Oat field bordered by agricultural land and a minor road, woodland and a farmhouse in close proximity |

**Table 3.** continued.

| Damage Location | Date Visited | Agricultural Damage | Illustrated | Landscape Features |
|---|---|---|---|---|
| Aldington, Kent | 22 Oct. 97 | Young wheat plants rooted <1% | | Wheat field bordered by woodland, agricultural land and a minor road |
| Aldington, Kent | 22 Oct. 97 | Rooting along margins of young wheat field <1% | | Wheat field bordered by agricultural land and a minor road, No woodland in immediate vicinity. |
| Beckley, East Sussex | 21 Oct. 97 | 30% of pasture field rooted | Figure 14 | Pasture field bordered by woodland, agricultural land and a minor road. Group of eleven animals seen by a shepherd in the field, one sow shot dead. |
| Lympne, Kent | 19 Nov. 97 | <1% of pasture field rooted | | Pasture field bordered by woodland and agricultural land |
| Lympne, Kent | 19 Nov. 97 | Rooting along margins of young wheat field <1% | | Wheat field bordered by agricultural land and a minor road. No woodland in immediate vicinity |
| Higher Kingcombe, Dorset | 10 Dec. 97 | 5% of pasture field rooted | | Pasture field bordered by woodland and agricultural land |
| Higher Kingcombe, Dorset | 10 Dec. 97 | 3% of pasture field rooted | | Pasture field bordered by agricultural land and a minor road. Woodland in close proximity. |
| Higher Kingcombe, Dorset | 10 Dec. 97 | <1% of pasture field rooted | | Pasture field bordered by agricultural land and a minor road. Woodland in close proximity. |
| Higher Kingcombe, Dorset | 10 Dec. 97 | <1% of unimproved pasture field rooted | | Pasture field bordered by agricultural land, woodland and a wide shallow stream. |
| Higher Kingcombe, Dorset | 10 Dec. 97 | <1% of pasture field rooted | | Pasture field bordered by agricultural land and woodland |
| Higher Kingcombe, Dorset | 10 Dec. 97 | 5% of pasture field rooted | | Pasture field bordered by agricultural land, minor road and a strip of woodland |
| Hooke, Dorset | 10 Dec. 97 | 3% of pasture field rooted | | Pasture field bordered by agricultural land and woodland |

86. Concern was expressed by a farmer owning a small holding about the possible difficulty of selling or renting land that has been damaged by boar rooting. Damage by free-living wild boar will have a greater effect on the smallholder who has less management options for crop rotation or movement of livestock into undamaged fields.

**Figure 9.** Minor rooting in a pasture field illustrating the close proximity of the free-living wild boar to a farm yard and other livestock.

87. Hedging or fencing around arable land is rarely a barrier to free-living wild boar and in the south-east England and Dorset areas is often non-existent or in a state of disrepair, hence wild boar have few physical barriers to prevent their access to agricultural fields. However, even standard stock fencing would be inadequate to prevent movement of wild boar (Figure 15).

88. CSL has been informed by farmers in Kent and East Sussex that serious damage to mature maize crops, particularly from wild boar trampling, as opposed to eating of the crop, had become evident in previous years at harvest time. The growing crops appeared healthy from the periphery but had been trampled down in large areas in the

interior of the field. During the one harvest period the risk assessment covered, CSL was not made aware by any farmer of any damage from trampling that resulted in any economic loss to the harvested maize crop. This does not prove that damage had not occurred in previous years, only that no damage was reported in the year CSL monitored.

**Figure 10.** Rooting of pasture land used for sheep grazing in Lympne, Kent.

**Interaction with Domestic Pigs**

89. Evidence of free-living wild boar interacting with domestic pigs is particularly important regarding the transmission of disease. Southern England has numerous outdoor domestic pig units and three cases of wild boar coming into contact with domestic pigs have occurred.

90. In March 1997, a commercial pig breeder in Dorset discovered a free-living male wild boar amongst domestic pig sows in an outdoor pig unit. Wild boar had previously been seen in the area and the animal had breached two strands of electric wire to enter the unit. Three domestic pig boars in the unit prevented the wild boar from mating with any sows and the animal was shot by a farm hand. The wild boar was only a small animal, probably no more than 18 months old, and no challenge against the resident domestic pig boars. The farm manager was interviewed by CSL.

91. A Dorset farmer keeping only a few domestic sows of mixed breeds informed CSL that his sows had been visited at least three times in 1997 from a free-living male wild boar. Each visit resulted in a litter of piglets being born several months later. On one occasion the farmer watched a wild boar service a sow in a corner of the field; the animal had breached a two strand electric fence to access the sows. Wild boar have been confirmed by CSL to be present in the area and a litter of hybrid wild

boar/domestic pig piglets were observed on a visit to the farm. The farmer kept no domestic pig boars and gave the impression of enjoying the novelty of having his domestic sows serviced by a wild boar. Several of the hybrid piglets had been sold to neighbouring farmers where one promptly escaped; the animal was recaptured when it wandered back to its original enclosure.

92. In 1992, a large free-living male wild boar was shot amongst domestic sows in an outdoor pig unit in Kent. The animal was shot by a local farmer after it had serviced a domestic pig sow and attacked a domestic pig boar, gashing it in the side with a tusk. The resulting piglets failed to survive, the farmer believing the young sow was too inexperienced in motherhood. The farmer was interviewed by CSL.

**Figure 11.** Severe rooting of pasture in Peasmarsh, East Sussex.

**Road Traffic Accidents**

93. Free-living wild boar are a traffic hazard, particularly where a road dissects two areas of woodland. There have been reports of several accidents involving cars being damaged by colliding with wild boar on the A268, in East Sussex, which runs from Beckley to Peasmarsh. The local garage repair shop manager confirmed that he had repaired at least three wild boar damaged vehicles in November and December 1996. CSL confirmed another accident on this same stretch of road in February 1997. A group of eight or nine wild boar were reportedly crossing the road during darkness and were hit by oncoming cars. One animal was injured and a second smaller animal was killed outright, the injured animal had broken a leg and was shot by a local farmer whom CSL interviewed. The car, an Austin Metro, was considerably damaged. Both animals were under two years old and not fully grown; a large fully grown animal could have had more serious consequences for the car driver. In response to the increasing number of wild boar accidents, the local council erected two hazard warning signs depicting deer.

The occasional deer present in the area pose no hazard but deer signs were the nearest equivalent the council possessed to wild boar signs.

94. A young boar was reported by FRCA to be a road casualty in November 1996. The animal was believed to be one of the Dorset escapees and was struck down in Hawkchurch, Devon, some 32 km (20 miles) from the original escape site.

**Public Safety**

95. All Suidae (old world pigs), except any domestic form of *Sus scrofa*, are listed as dangerous wild animals under the Dangerous Wild Animals Act 1976, as amended in 1984 and there is a risk of an animal attacking a member of the public. Wild boar are described by the Farm Animal Welfare Council as 'highly strung, nervous animals which can be easily excited or frightened and thus become highly aggressive' (Farm Animal Welfare Council 1994). The wooded areas that free-living wild boar live in often include public footpaths and are used, particularly in the summer months, by camping groups, tourists and people walking their dogs. Dog owners in particular may be more likely to come into contact with free-living wild boar as a dog off its lead may scent and chase a wild boar, thus placing the dog in danger.

**Figure 12.** Rooting among a young wheat crop in Ruckinge, Kent.

96. There is an incident, documented by FRCA, of a family out walking coming across a group of free-living wild boar and being challenged by a sow from the group. The family turned back and a confrontation was avoided.

97. The domestic pig farmer previously mentioned in paragraph 89, claimed he was forced to flee from the large free-living male boar that entered the outdoor enclosure containing domestic sows. The animal charged the farmer who hastily climbed on to

the roof of an outbuilding. A shooting colleague was telephoned and the animal was shot in an adjacent field. The shooter, whom CSL interviewed, expressed relief claiming that had his shot missed, he would probably have been injured by the animal, as it was preparing to charge him.

98. A further incident occurred in August 1997, again in Kent. A farmer was harvesting a wheat field when he disturbed a free-living wild boar sow with six piglets. The irate animal charged and attacked the wheels of the combine harvester the farmer was aboard, before moving away with her piglets towards nearby woodland. The farmer, who admitted to being shaken by the incident, was interviewed by CSL.

**Figure 13.** Rooting amongst the headland of a clover field in Peasmarsh, East Sussex.

99. Another incident occurred in the Mapperton district of Dorset in October 1996 and again involved a farmer. The farmer inadvertently disturbed a free-living wild boar sow with five piglets and was charged by the animal, he retreated to his vehicle and drove away. The farmer has not been interviewed by CSL but reported the encounter to the local police who have confirmed the incident.

**Firearms**

100. Local concern has been raised in south-east England over the publicity caused by local and national media coverage attracting an irresponsible shooting element, particularly unauthorised shooting, in unsuitable areas using unsuitable weapons. Bullets from high calibre sporting rifles can travel for several kilometres whilst shot guns, firing standard game loads, unless fired at point blank range, will not kill a wild boar and a danger lies in a wounded animal becoming aggressive.

# 5. Evaluation Of Potential For Expansion And Future Areas Of Conflict

## Computer modelling

101. There are insufficient data to model the British populations of free-living wild boar with accuracy. The number of wild animals currently present, the annual rate of new escapes, the mortality, fecundity and dispersal rates are all unknown for the British populations. However, a recent publication (Howells & Edwards-Jones 1997) suggested that with a low level of new escapees the minimum viable population size was small. Alternatively, if one excludes their 'inbreeding depression' effect, for which they supply no direct evidence, the minimum viable population is less than 100 animals. Since CSL has no direct evidence, such as farrowing nests or piglet tracks, to support breeding populations outside the south-east of England, this modelling assumes a single population based on the confirmed locations of free-living wild boar in Kent and East Sussex. The projected expansion and population growth rates given below could however, be applied to other isolated breeding populations in the absence of any other data.

**Figure 14.** Rooting amongst pasture in Beckley, East Sussex.

102. The figures used below are taken from the literature on wild boar. Hybrid animals may breed earlier, have larger litters and may produce a second litter later in the year. Therefore, if some of the population includes hybrid animals as well as wild boars the population growth rates could be greater than given below.

*Population growth*

103. In order to produce population growth projections, data are required for fecundity and mortality rates. Figures of 4.95 piglets per litter (Boitani *et al*. 1995) and 4.36 piglets per litter (Peine & Farmer 1990) are used for annual fecundity rates. The most detailed mortality rates available are given in Jezierski (1977) for a Polish wild boar population, but take no account of animals alive before emigrating, alive at the end of the study, or animals killed by hunting. However, entering the available figures into a life table using the methods of Smith (1995), suggests annual mortality rates of 0.44, 0.65 and 0.40 for animals in their first, second and subsequent years. Accounting for possible uncertainties in the numbers of animals still alive and animals killed by hunting in the Polish work gives a range of annual mortality rates of 0.39, 0.52, 0.12 and 0.42, 0.67, 0.35 respectively. All these calculated mortality rates lie within acceptable limits (refer to Annex 1).

104. A simple model, with three age classes (1st year, 2nd year and breeding adults) was produced in STELLA®, and all combinations of fecundity and mortality rates were used to produce a range of six different possible population projections. The mean projected growth rate, *r*, is 0.111 per year, but ranges from 0.016 to 0.267. Even higher growth rates could occur during 'good' years for survival.

**Figure 15.** Damage to fencing from wild boar in south-east England.

105. Importantly, all projections of population growth predict a positive growth rate, i.e. it seems unlikely that a small population of wild boar will go extinct. Localised extinction only seems a possibility until a few years after successful breeding, while total numbers of animals are still low. These projections take no account of variations in the level of hunting, or any immigration to the population from new escapees.

106. There is no census of the current numbers of free-living wild boar in south-east England, but by plotting the spatial locations of the current confirmed locations, we can estimate minimum and maximum numbers.

Minimum: There may be up to seven breeding groups of boar (see paragraph 109) assuming that each group can occupy one 5 x 5 km square (= 9.6 square miles). This would give a population estimate of up to 49 animals if each group is composed of two adults and five young. Therefore a conservative estimate of at least 30 or so wild boar within breeding groups may be appropriate.

Maximum: A line surrounding all the south-east England confirmed locations (see paragraph 71 giving the confirmed locations) encompasses approximately 40 $km^2$ of woodland. Given a density of 3 - 4 free-living wild boar per $km^2$ of woodland this gives an upper estimate of 120 - 160 animals.

107. A mid-range figure of 100 animals can therefore be used as an example starting population to give projected population sizes in future years (Table 4), assuming no density dependent constraints on population growth. The maximum figures, for example, assume that every year survival is high and that no additional hunting or control occurs despite the large growth in population size. This data is represented graphically in Figure 16, over 15 years (to 2012). The large difference in possible population growth rates quickly leads to a very wide projected range of population sizes.

**Table 4.** Possible average, minimum and maximum population size predictions.

Initial population of 30 breeding animals, and growth rates (r) of 0.016, 0.111, and 0.267.

| | POPULATION SIZE ESTIMATE | | |
|---|---|---|---|
| YEAR | MINIMUM | AVERAGE | MAXIMUM |
| 1997 | - | 100 | - |
| 1998 | 102 | 111 | 127 |
| 1999 | 103 | 123 | 161 |
| 2000 | 105 | 137 | 203 |
| 2001 | 107 | 152 | 258 |
| 2002 | 108 | 169 | 326 |
| 2003 | 110 | 188 | 414 |
| 2004 | 112 | 209 | 524 |
| 2005 | 114 | 232 | 664 |
| 2006 | 115 | 258 | 841 |
| 2007 | 117 | 287 | 1066 |
| 2008 | 119 | 318 | 1351 |
| 2009 | 121 | 354 | 1711 |
| 2010 | 123 | 393 | 2168 |
| 2011 | 125 | 437 | 2747 |
| 2012 | 127 | 485 | 3481 |

*Spatial spread*

108. There are two simple ways to determine the possible area which the above population requires. The simplest is to divide the total population size by the density of wild boar to give an estimate of the area utilised in square kilometres. Assuming an average density of 3 - 4 $km^{-2}$ (Spitz *et al.* 1984, Spitz 1986) this predicts a total area of 42 - 56 $km^2$ (16 - 22 square miles) with breeding wild boar by the year 2002, using the data in Table 4. By using the minimum and maximum estimates, this gives us a projection of between 27 $km^2$ (10.4 square miles) and 101 $km^2$ (39 square miles) by the year 2002. This projection must be read with great caution, since it relies on three uncertain estimates (population mortality rates, initial population size and population density). In addition this projection is for the area of woodland which sustains the population. Since not all the habitat is suitable for wild boar then the total area of south-east England which would encompass these animals would be larger.

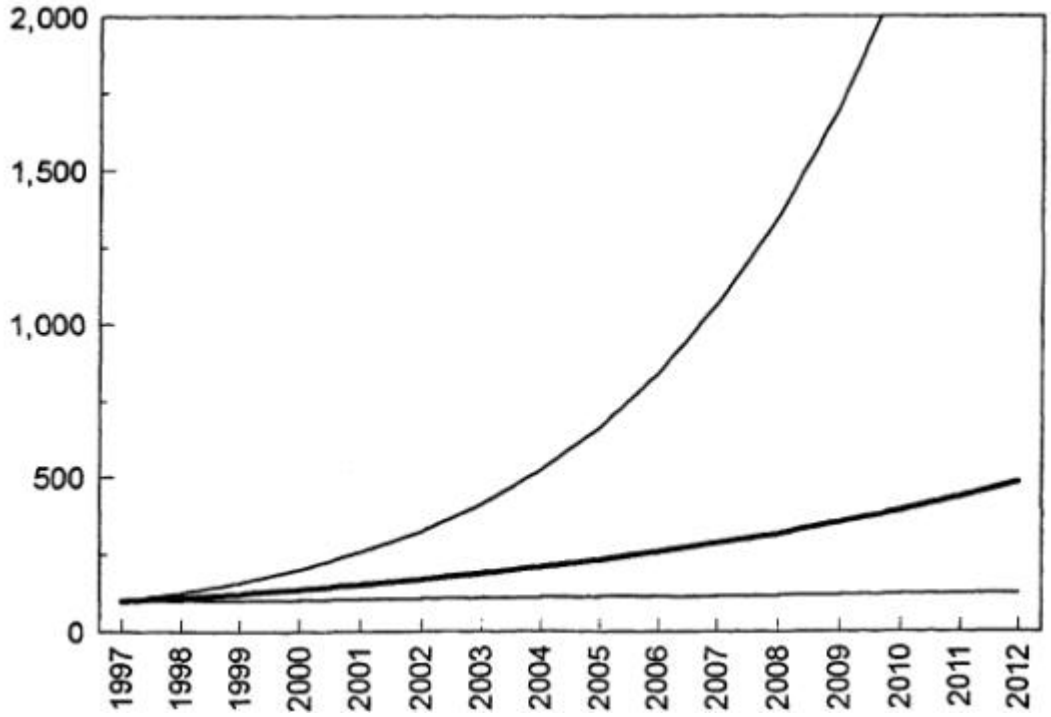



**Figure 16.** Projected wild boar population growth over 15 years in the south-east of England.

The lines represent minimum, average and maximum growth rates.

109. A more visually appealing way to model the spatial spread of wild boar is by utilising a very simple GIS model. The approach taken is to plot a 5 km grid over the south-east of England, showing the sea and urban areas. The model is seeded with the confirmed locations of wild boar (see section 71), where each 5 x 5 km square is one wild boar family home range. This results in seven 5 x 5 km squares with wild boar. More detailed models taking account of local habitat features could be constructed, but the total number of assumptions required for such models would be too great given the limited available data. In a Polish population between 12% and 32% of the two to five year olds emigrated (Jezierski 1977) and we use these two figures as extreme cases for dispersal probabilities from established local populations.

110. Population growth models predict that a breeding family will fill up this range (5 x 5 $km^2$) and animals will start dispersing five or six years after establishment. This model therefore uses a cellular automata approach and permits a 12% chance of dispersal to a neighbouring empty square after a six year delay (or a 32% chance after a five year delay). These figures give the minimum (and maximum) projected spatial growth rates.

111. Figure 17 shows the initial conditions assumed for the spatial model. Figure 18 shows the possible distribution of wild boar after five years. This shows that from the initial area of seven, 5 x 5 $km^2$ in which wild boar have been sighted, this will increase to between nine and 16 5 x 5 $km^2$. Thus the total area of south-east England which may encompass all sightings may be between 225 and 400 $km^2$ (87 - 154 square miles). This estimate is much greater than the previous estimate of between nine and 16 5 x 5 $km^2$ (3 - 6 square miles) since this will include large areas where wild boar are not living, such as small urban areas, open agricultural land, etc. The presence of other breeding groups of free-living wild boar, new escapes and occasional long distance dispersal may increase these projected areas.

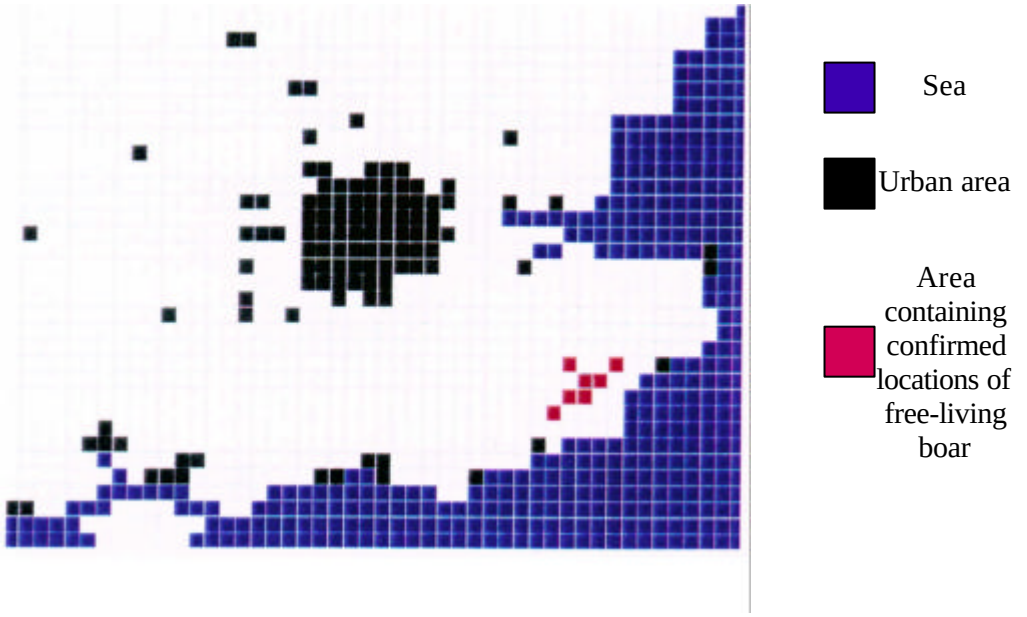
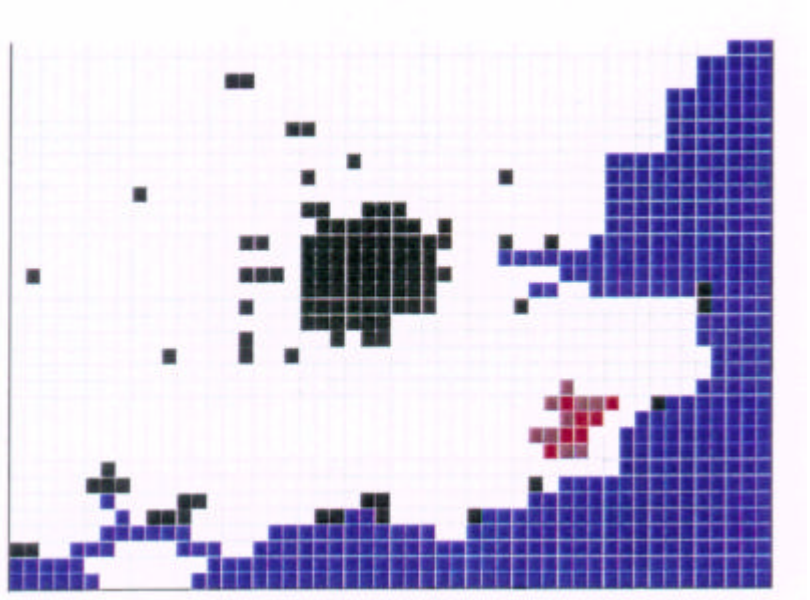



**Figure 17.** The current confirmed locations of wild boar in south-east England plotted on a 5x5 km grid.

112. A longer term projection, fraught with even more probability of error, gives a minimum and maximum area over which free-living wild boar may be sighted of between 350 and 1150 $km^2$ (135 - 444 square miles), after 15 years (2012; Figure 19).

113. By using these minimum and maximum projected spatial growth rates, estimates can be made for the annual geographical growth rate for any viable free-living wild boar population. Once reproduction has commenced, the geographical area which encompasses the population, is projected to grow at between 0.5 km and 1.1 km (0.3 - 0.7 miles) every year. This annual rate of growth could then be applied, with caution, to any other wild boar population in the UK.

Maximum



Minimum

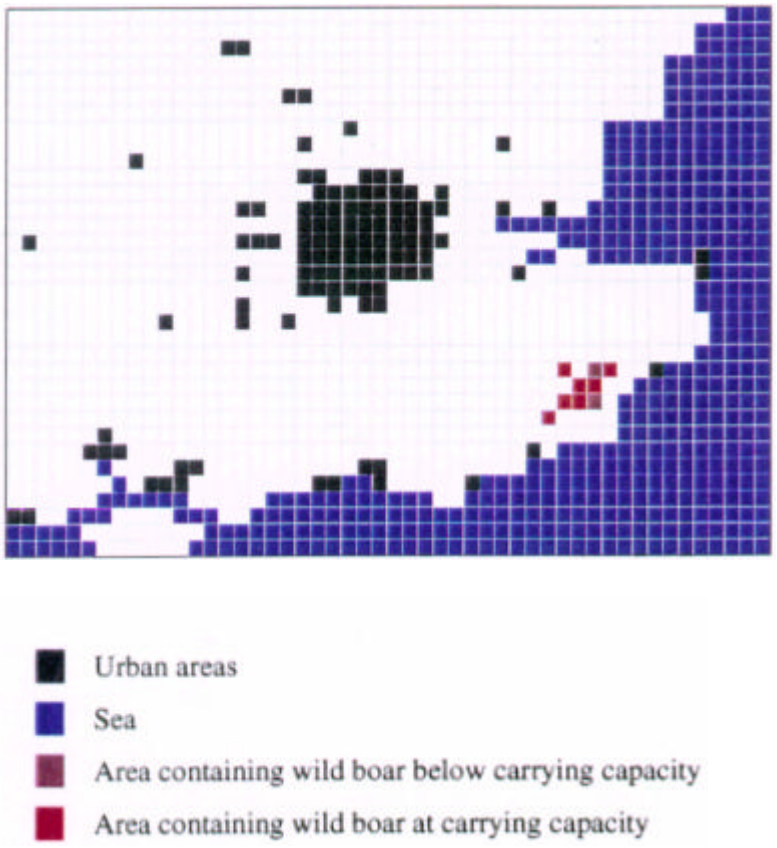
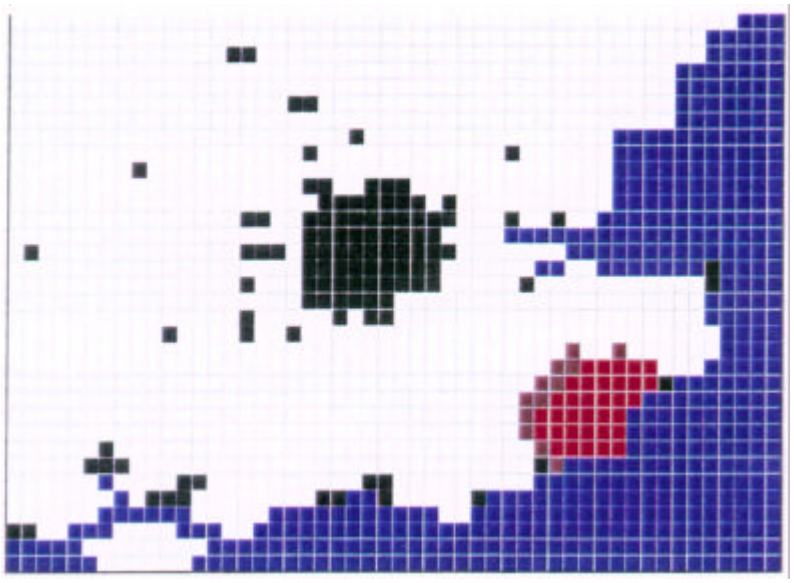



**Figure 18.** The maximum and minimum predicted spread of wild boar after 5 years. Using initial conditions described in para.110, after 5 years (2002).

Maximum



Minimum

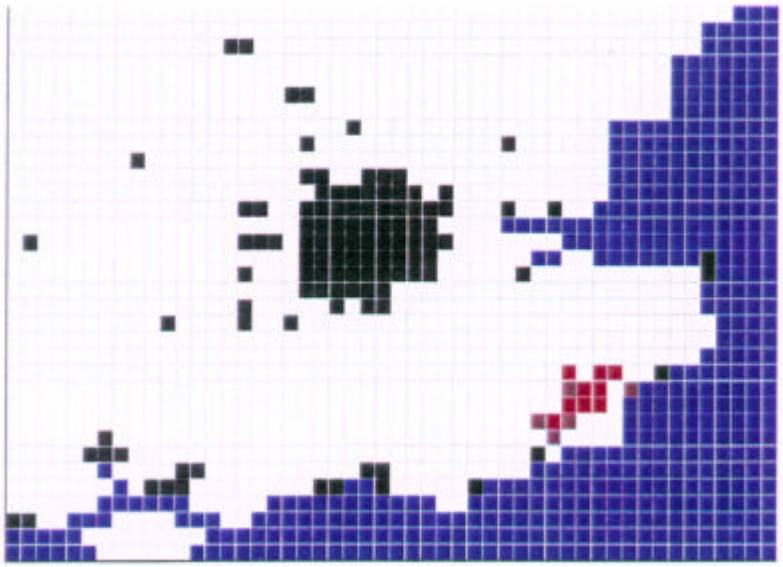


**Figure 19.** The maximum and minimum predicted spread of wild boar after 15 years. Using initial conditions described in para.110, after 15 years (2012). Legend as Figure 18.

## 6. Potential Control and Management Techniques For Use In England

114. There is currently insufficient knowledge of the free-living wild boar's ecology and behaviour in England, in an agricultural environment, to provide definitive management options. Nevertheless, free-living wild boar possess certain general behavioural characteristics that will need to be taken into account in developing any proposed management programme. Their primarily nocturnal activities, combined with their shy and secretive nature, make initial location of the animals difficult, especially in the summer and early autumn when crops and vegetation are high. When resting in cover they are well camouflaged despite their large size, and when approached do not readily bolt. They seldom frequent open spaces except under the cover of darkness and, particularly the sows, will spend most of the daylight hours resting in dense cover. Feeding locations are not used consistently. For example, a field rooted one night may not be visited again for several weeks, if at all. The male boars are generally solitary animals patrolling home ranges in southern England of unknown size. Thus, locating the animal can be difficult. Mature females and immatures will form groups of varying sizes covering a smaller home range than the boars, but location can again be difficult. Long distance movements occasionally undertaken by certain individual animals may see them far from their normal home range. A technique that may overcome the difficulties of locating animals is the appropriately named Judas technique, whereby an animal is trapped and fitted with a radio collar. On release the animal will rejoin or make contact with the group and radio-tracking will highlight the groups location, feeding and resting areas. This technique has been used primarily with feral goats although some success has also been recorded with feral pigs in Australia (McIlroy and Gifford 1997).

115. Below are listed the methods used in other countries to control or manage wild boar or feral pig populations. These methods can be employed individually or more usually in combination.

### Poisoning

116. Poisoning has proven to be successful in controlling feral pig numbers in several situations (McIlroy *et al.* 1989, Saunders *et al.* 1990, Coblentz and Baber 1987). The risk of killing non-target species in south-east England, such as foxes, badgers, domestic livestock and domestic pets would need to be taken into consideration. Baiting methods and baits should ideally be target species specific and humane. Currently no poisons are approved for wild boar control in the UK and any use could only occur after regulatory approval had been granted.

### Ground Shooting

117. Ground shooting has claimed several of the feral English wild boar, although the animals are difficult to shoot due to their shyness and nocturnal habits. The wild boar that have been shot by hunters in south-east England have either been flushed from a wood, shot when feeding on agricultural land or at a pre-baited area. The time of year is important as during spring and summer vegetative growth in the fields and woodland can effectively render the animals invisible, and the growth of brambles hinders human access into many areas. Continual shooting has the disadvantage of dispersing the animals into potentially new habitats, however, a correctly managed and sustained shooting programme using experienced personnel with suitable high calibre rifles may

be an effective management control option although safety issues would need to be addressed. The use of fixed shooting positions with large back stops, or shooting from high seats, would enhance safety.

**Aerial Shooting**

118. Shooting from helicopters, as used in Australia for controlling feral pigs (Hone 1990), has limitations for the control of the animals in south-east England. Wild boar, more so than Australian feral pigs, are nocturnal animals often only venturing out of thick vegetation to feed under the cover of darkness, rendering aerial shooting only possible with thermal imaging equipment. The high expense and loud noise generated from an aerial shoot in the vicinity of domestic stock would severely reduce the effectiveness of the method.

**Trapping**

119. Live trapping has been attempted in other countries for the control of feral pigs with mixed success (Brown 1985, Peine and Farmer 1990, Choquenot *et al.* 1993, Saunders *et al.* 1993). In south-east England, wild boar have occasionally been caught in traps set by farmers, although the animals trapped are generally inexperienced young males. Disadvantages with trapping include the unpredictable results and the labour intensiveness from continual baiting up and checking. An assessment of the problem of trapping non-target species would also be required.

**Hunting With Dogs**

120. Hunting with dogs is a management technique practiced in other countries, and is particularly useful for locating animals in thick vegetation and for removing residual pigs in a managed control programme (Caley and Ottley 1995, McIlroy and Saillard 1989). However, trained dogs are unlikely to be available in the UK and their use would be highly sensitive in the current climate of opposition to hunting with hounds.

**Fencing**

121. The use of fencing to keep feral pigs in, or out, of certain areas is a management option that has been used successfully abroad (Hone and Atkinson 1983, Hone and Stone 1989). However, the problem of fencing areas containing public footpaths would need to be addressed to allow continued public access while preventing movement of the animals. The strong fencing required to contain wild boar would cost more than normal stock fencing and a continual maintenance programme would be required, particularly if the fencing incorporates electric wires.

**Supplementary Feeding**

122. Supplementary feeding inside the forests has been carried out with some success in Poland and Russia (Mackin 1970, Telishevskiy 1990) to keep wild boar inside forested areas, and thus reduce agricultural damage from hungry animals foraging amongst growing crops. In southern England however, the woodlands in many areas may be too small and fragmented for the wild boar to be sufficiently contained within the woodland. Supplementary feeding can also actually assist the survival of wild boar and may therefore raise the rate of population increase.

**Miscellaneous Methods**

123. Short term measures that could be investigated to protect livestock or crops, particularly during vulnerable periods, would involve the use of flashing lights, scarecrows and loud noises such as generated by bird scarers. The advantages of the above are the relatively low costs and labour involved, however, their effectiveness is unknown and auditory scarers may well be impractical at night because they disturb local residents or have an adverse effect on livestock.

124. The development of reproductive inhibitors to control population numbers could also be considered as a long term management option, but this technique is not yet routinely used to control mammalian pests and is unlikely to be available for wild boar for many years.

**Management Considerations**

125. Any structural management of the population of wild boar in southern England would need to be supported by research into home ranges, population dynamics and seasonal habitat preferences.

126. Effective management of a population of feral pigs or wild boar can only be achieved by concerted action over a large area otherwise animals will continually re-invade from neighbouring areas. In southern England, the forested areas in the locality where wild boar have been found, have numerous different owners including the Forestry Commission, private nature reserves, financial institutions, farmers and private individuals. Conflicts of interest may arise between conservation organisations who wish to protect the animals, farmers who wish to cull the animals and hunters who wish to maintain the population for sport.

127. Management of wild boar would also be compromised by further escapes and thus ways of tightening up on wild boar holding/farming facilities would need to be considered.

128. Financial costs are an important consideration for any control programme. In France and Germany, for example, a well managed wild boar hunting season provides revenue which can be directed into wild boar management. This money is not currently generated in this country.

# 7. Discussion

## Population

129. A free-living population of wild boar has become established in an area of approximately 175 $km^2$ in the Kent and East Sussex area of England and a second population is present in a smaller area of Dorset. Circumstantial evidence implies that the free-living wild boar in south-east England are almost certainly breeding as a farrowing nest has been located, striped piglets seen on several occasions and piglet tracks have been found. The free-living Dorset wild boar may also be breeding as piglets have been sighted by a local farmer.

130. The computer modelling exercise indicates that the population of free-living wild boar in south-east England will have a positive growth rate. The 175 $km^2$ (67.5 square miles) where free-living wild boar have been confirmed could give a population estimate of 30 - 160 animals (assuming a density of 3 - 4 animals per 40 $km^2$ of woodland). Therefore using 100 animals as an example of a starting population, a five year projection gives an average population size of 169 animals with a minimum of 108 and a maximum of 326. Over 15 years this population estimate increases to an average of 485 animals, with a minimum of 127 and a maximum of 3481. A five year prediction shows that the area currently inhabited by the free-living wild boar may increase from 175 $km^2$ to 225 - 400 $km^2$ (87 - 154 square miles). Over 15 years this could increase to 350 - 1150 $km^2$ (135 - 444 square miles).

131. The animals are referred to throughout this report as free-living wild boar. The exact genetic composition of the animals is unknown; however, visual inspections of carcasses from animals shot in Kent showed the phenotypic appearance of wild boar with large head and shoulders, body weight carried forward from a small rump, long narrow snout, small ears, thick underlying brown pelage and a straight tail. Feral pigs (animals living wild with domestic ancestry) and hybrid animals (a wild boar and domestic pig crossbreed) typically have smaller head and shoulders, larger rumps, shorter snouts, larger ears, a more curly tail and lack the underlying thick brown pelage. It has not been possible to inspect a carcass from a free-living wild boar in Dorset.

132. It must be stressed that the reference to the free-living animals in southern England as 'wild boar' results from visual inspections only and cannot be regarded as proof of identity. Longer inspection periods were not possible as the carcasses have a monetary value and were immediately butchered and sold. More comprehensive investigations into the animals genetic composition are beyond the scope of this study. However, the likelihood that the free-living animals are feral pigs (free-living domestic pigs that have reverted to the appearance of the wild type) is extremely remote as no domestic pigs have been reported as escaped or have previously been seen in the area. It is possible that the free-living animals are hybrids resulting from crossing a domestic pig with a wild boar, with the cross most likely to have occurred prior to the animals escape from captivity. As previously discussed, wild boar farmers in this country often farm hybrid animals for their increased productivity. A hybrid animal containing only a small amount of domestic pig blood would still have the phenotypic appearance of a wild boar. The implications are that if the free-living animals in southern England are hybrids, then their increased breeding rates from early maturity, more frequent farrowing and larger litter size of typically 8 - 10 piglets compared to a wild boar's

average of five, will result in the animals spreading into new territory more quickly than wild boar.

133. If the free-living animals in southern England are pure bred wild boar, the sub-species is also unknown. Twenty-three sub-species have been described for wild boar (Mayer and Lehr Brisbin 1991) and sub-species of both Western and Eastern European animals may be present in southern England. The larger Eastern European animals have been imported into British wild boar farms to improve the blood lines of the smaller Western European animals initially used as farming stock.

**Habitat**

134. A wild boar's natural habitat is woodland and a preference for deciduous forests over conifer forests and heathland has been shown (Bruindesink 1995). The area of southern England that free-living wild boar are currently inhabiting appears therefore to be suitable, consisting of mixed woodland of fruit bearing trees such as oak, beech, sweet chestnut and hazel. CSL has noted wild boar rooting areas in Kent and East Sussex under sweet chestnut, acorn and hazel trees (Figure 20) and chestnuts, acorns and hazel nuts no doubt feature prominently in their diet during the winter. Food from agricultural crops are available as the woodlands often border on to agricultural land (Figure 21) and the woods are abundantly supplied with the essential requirement of water, from ponds (Figure 22) and natural streams, which are used as wallowing areas. Wallowing in mud is vital for cooling as wild boar possess no sweat glands and can suffer adversely in hot weather and numerous wallows have been located in Kent and East Sussex (Figure 23).

**Figure 20.** Free-living wild boar rooting under a tree in south-east England.

135. Secure areas are also a requirement for sheltering in during daylight hours and as a place for sows to farrow in. The woodlands in southern England provide many such areas as the storm damage suffered in 1987 felled many trees which have been left lying where they fell. Brambles and shrub have grown up around the fallen trunks frequently providing an impenetrable barrier to prevent human disturbance.

136. Food, water and secure shelter abound and in some woodlands the free-living wild boar are inadvertently given supplementary food at certain times of the year in the form of feed put out for pheasants. The implications for free-living wild boar in the UK are that as a former native species, with no natural predators, there are few obvious restrictions to stop a population, once established, from rapidly expanding.

**Figure 21.** Free-living wild boar habitat in south-east England; a mixture of woodland and agricultural land.

**Agricultural damage**

137. Evidence of agricultural damage has been found in both south-east England and Dorset, but further work remains to be done as only limited ground-truthing has been possible in the timescale of this risk assessment.

138. To date the economic losses to an individual farmer from free-living wild boar damage assessed by CSL are generally not high, although there is significant potential for increased damage in the future if the wild boar population grows. Rooting amongst newly sown cereal crops disturbed the drilled rows of germinating seeds but initial observations suggest a resulting negligible loss of crop at harvest. Rooted pasture fields have reduced amounts of feed available for livestock and in severe cases this will involve the cost of re-seeding. Soil exposed from rooting amongst pasture by free-living wild boar could infect the grass with potentially harmful soil micro-organisms.

This scenario has been highlighted by an unsubstantiated comment to FRCA from a Dorset farmer who alleged the loss of two cows from a *listeria* infection after eating grass previously rooted by free-living wild boar.

139. Damage to fencing presents the problem of livestock loss and necessitates immediate repair, disrupting working schedules. Free-living wild boar in southern England often pose more of a nuisance value than an economic liability, and farmers can spend considerable amounts of time replacing sods of grass overturned by nocturnal rooting. A farmer in Dorset routinely replaced turned over turf in several pasture fields only for fresh rooting to appear a few nights later. A CSL visit confirmed considerable fresh rooting on his pasture and many areas of old rooting were visible where attempts had been made to replace the turf.

**Figure 22.** The woodland interior provides food, water and shelter for free-living boar.

140. Agricultural crops known to be damaged by wild boar on the continent that are also grown in south-east England include potatoes, oats, rye, wheat, maize and barley (Mackin 1970, Genov 1981, Dardaillon 1987). Agricultural crops known to have been rooted in south-east England include grass pasture and freshly sown oats, barley and wheat.

141. Wild boar damage to agricultural crops is unpredictable and reported to be related to the natural food supply; when natural food abounds, agricultural loss is minimal. Only when the natural foods are all consumed, do the animals move into the agricultural crops (Mackin 1970, Andrzejewski and Jezierski 1978, Genov 1981, Sjarmidi *et al.* 1992). Agricultural damage in southern England may therefore be linked to the amount of natural foods available. In years of a plentiful supply of acorns, sweet chestnuts, or hazel nuts for example, little agricultural damage may occur. Conversely, damage may increase in years of poor natural food supply. Mackin (1970) further suggests that for

the wild boar in a Polish agricultural region, agricultural damage was dependent not on the density of wild boar in the study regions, but on the availability of natural foods such as beech nuts and acorns.

142. Further work on crop damage in southern England would be needed to identify the factors that influence crop damage, such as season, crop-type, proximity to woodland, the age of crop and time of harvest, the soil moisture levels and particularly the amount of natural food available.

**Lamb predation**

143. There were no reported incidents of free-living wild boar predating lambs in the 1997 lambing season in south-east England. The 1997 lambing season was monitored by CSL in the areas where previous losses had allegedly occurred and no lamb losses were reported. The reasons given to CSL by the farmers for the lack of predation in 1997 were an increase in indoor lambing, outdoor lambing occurring in fields away from woodland and the disturbance of the wild boar from shooting activity. CSL can neither confirm nor deny the validity of the above reasons.

**Figure 23.** A woodland stream in south-east England being used as a wallow.

144. As stated in the literature review, no examples can be found in the literature of wild boar, as opposed to feral pigs, attacking lambs. Conversely, the literature did not state that wild boar do not attack lambs, therefore the potential for lamb predation from the free-living wild boar in southern England still exists.

**Animal Health**

145. Wild boar have entered outdoor domestic pig enclosures and this is of great concern to the health of the domestic pig stock, particularly with regard to providing a transmission route for the spread of disease. An economically expensive scenario for the UK would be the occurrence of transmissible diseases such as swine fever or Aujeszky's disease in the domestic pig stock (or farmed wild boar stock) spreading into the feral wild boar population from contact between the animals. The feral wild boar would then become a reservoir for the disease with the potential to continually re-infect the domestic pig stock. Complete eradication of any disease could only then be achieved by the eradication of the whole feral wild boar population. Classic swine fever and Aujeszky's disease have both occurred in this country in the domestic pig stock and have been successfully eradicated at a large financial cost.

146. Wild boar and feral pigs are susceptible to acquiring an infectious disease from, for example, rooting among garbage and feeding on contaminated meat or meat products. Feral pigs in Australia are attracted to refuse tips and although there are no cases of refuse being eaten by wild boar in southern England, wild boar are known to frequent a designated picnic area amongst woodland. Litter, including discarded food, can accumulate around the dustbins in this area possibly providing a potential source of infection.

147. When considering diseases transmissible to humans, for example trichinosis, there are obvious implications regarding unregulated consumption of wild boar meat. Animals that have been shot in the Kent and East Sussex area are being skinned and butchered in an unregulated environment (Figure 24) and sold on the black market. The demand in the British Isles for wild boar meat currently exceeds the supply.

**Figure 24.** Farmyard butchering of a free-living wild boar shot by a hunter in south-east England

## Ecological Damage

148. Rooting amongst woodland bluebells *(Hyacinthoides non-scripta)* has occurred (Figure 25) in woodland harbouring wild boar which, if widespread, might be detrimental to this and other species of plants, although wild boar are reported from the literature to also have some positive effects on the woodland ecosystem; reduction of insect pest, soil aeration (Telishevskiy 1990, Brownlow 1994). However, exactly how the ecological balance of the woodland would be affected by the presence of a large omnivore that has been absent for 300 years is unknown.

149. It is known that established trees can be undermined by wild boar rooting amongst the roots and examples of such rooting have been seen by CSL in south-east England. In severe cases this can lead to the tree toppling in high winds. Deep rooting can also occur in woodland when, for example, the animals root down into an insects nest to eat the grubs. This deep rooting has also been observed by CSL in woodland in south-east England (Figure 26). Figure 27 depicts rooting from wild boar in a newly planted woodland area on a private estate. Unlike, for example fallow deer *(Dama dama*), which are widely implicated in damage to newly planted woodland trees in Britain, the wild boar have shown no interest in the tree saplings and have only rooted amongst the turf.

**Figure 25.** Rooting by free-living wild boar amongst bluebells on the woodland floor.

**Public Safety**

150. Concerns for public safety have been expressed and wild boar are officially recognised as a dangerous animal under the Dangerous Wild Animals Act 1976, as amended in 1984. Although when free-living wild boar in southern England are occasionally sighted during daylight, most commonly by farm workers, the animals usually immediately retreat to cover. However, incidents have shown that there is the risk of personal attack from an aggressive male or sow defending her young. The public safety issue is often referred to by some local people as "...an accident waiting to happen", and one farmer's wife (of the farmer whose combine harvester was attacked whilst the farmer was aboard) was sufficiently moved to erect a warning notice outside woodland on her land '...to protect the children' (Figure 28). However, other local people are less concerned, one hunter said he was '...perfectly happy' to let his ten year old daughter play in woodland where he himself had shot a number of free-living wild boar.

151. The question of safety can also be extended to domestic animals as wild boar are recognised as a potential danger to domestic dogs. For example, in Germany, warning notices are posted around forests containing wild boar warning dog owners to keep pets on a lead to minimise the risk from wild boar attack.

**Figure 26.** Deep rooting by free-living wild boar in a south-east England woodland. The depth of the rooting is highlighted by the wellington boot.

**Conservation**

152. The conservation importance of wild boar in the UK is also likely to be an issue. The Government is committed to conserve and enhance biodiversity in the UK and also to control alien species which threaten ecosystems, habitats or species (HMSO 1994). Wild boar are a former native species but their impact after an absence of 300 years, on current native flora and fauna is unknown.

153. The free-living wild boar in southern England (presuming they are wild boar and not a wild boar/domestic pig hybrid) could be considered a species of biodiversity value and a reintroduction (albeit accidentally) of a once native species or as a potential economic resource, to generate revenue from the sale of meat and from organised hunting fees, as is the case on the continent. The opposing argument states that they are now, after an absence of several centuries, an invasive species and a potential pest of agriculture, a threat to the health of domestic farm stock and a potential danger to people in the countryside.

**Farming**

154. The farming of wild boar is a viable enterprise and farms are spread throughout the UK. Many pure bred and hybrid wild boar farmers do not tag their animals, hence animals that escape into the wild cannot be traced to an owner. Wild boar have escaped from captivity in the past on several occasions (Baker 1990) and are likely to do so in the future. Regardless of the present populations of animals in south England and Kent, more animals are likely to find their way into the English countryside and an update in legislation may now be required to provide more accountability. Compulsory tagging or marking of all wild boar or hybrid animals in captivity would allow ownership and accountability of an escaped animal to be determined. As wild boar farms are spread throughout Britain, the potential for a population of escaped animals to establish a free-living population in the wild exists throughout much of the country.

**Figure 27.** Surface rooting in a newly planted private woodland.

## 8. Recommendations

155. This report has found evidence of a population of free-living wild boar in Dorset, Kent and East Sussex. Computer modelling suggests that the wild boar population in East Sussex and Kent is viable and will increase and spread. This risk assessment has shown that wild boar are a particular concern to the agricultural industry regarding crop damage and animal health. Wild boar are also an important concern in relation to public safety, road traffic accidents and conservation issues.


**Figure 28.** A warning notice on private woodland in south-east England.

Erected by a farmer after a confrontation with a free-living wild boar sow nursing her piglets.

156. It is therefore recommended that the Government formulate a policy with regard to wild boar and their management in the UK. The policy would need to resolve whether, for example, they should on balance be regarded as an undesirable invasive species or a re-introduced native species.

157. Three broad control and management options could be considered for the wild boar; total eradication, selective control or no control, although actual control methods may need further research. However, wild boar have a high reproductive rate and no natural predators in the UK. Their numbers are therefore likely to continue to increase and some form of management will be required in the future.

158. More research is required in order to fully understand the agricultural and ecological impact wild boar have in the UK and the genetic makeup of wild boar present. Wild boar and feral pig control and management procedures implemented in other countries have not always proved successful due to a lack of understanding of the basic biology, behaviour and ecology of the animal. Research will therefore enable the status of the animals to be determined and will enable any future management prescriptions to be cost-effective. Appropriate research would include:

(a) A study into the ecology, population dynamics and feeding behaviour of wild boar in the UK.

(b) Research into the impact the animals have on agriculture and animal health.

(c) The effects, whether adverse or beneficial, wild boar have on the native flora and fauna.

(d) Field trials of potential control and management techniques such as trapping, shooting and improved fencing design.

(e) An investigation into safety issues involving the public, farm and forestry workers and road traffic accidents.

159. It is further recommended that the current legislation governing the farming of wild boar is reviewed with the objective of reducing the likelihood of future escapes of farmed animals. Points to be considered are:

(a) The introduction of a compulsory identification scheme for all wild boar or wild boar and domestic pig hybrid animals to allow accountability should an animal escape from its enclosure.

(b) The introduction of a central register of all establishments housing wild boar or wild boar and domestic pig hybrid animals. No such register currently exists and this information would be required immediately in the case of an outbreak of disease.

(c) Whether the current keeping requirements are strict enough to prevent escapes.

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# 10. Annex 1

The most detailed data on wild boar mortality rates are given in Jezierski (1977). The data are derived from a capture-mark-recapture study in the Kampinos National Park near Warsaw between 1963 and 1973. This type of study rarely differentiates between animals which die and animals which emigrate, since neither are subsequently recaptured. The data presented the papers life table (Tables 1 and 2) are therefore biased due to preferential recording. An attempt was made to correct for this in the paper. In addition the original life tables exclude 55 animals which were alive at the end of the study (but whose ages are not given), and 162 animals which were shot.

Jezierski (1977) attempted to correct for the error caused by emigration by determining the number of immigrants of each age and sex class and eliminating an equal proportion of marked animals from the life table which would otherwise have been classified as dying. This excludes animals which were alive and leads to an overestimate of mortality rates.

For the purposes of this report, the exact number of these animals can be calculated and re-entered into the life table for the years prior to emigration, but removed from the 'at risk' category in the year they emigrated. This creates a fusion life table (Smith 1995). This is necessary since the animals are at risk of dying prior to their emigration, but did not die.

It is also necessary to include the 55 animals which were alive at the end of the study for the same reason. However, the ages of these animals cannot be directly calculated. Two approaches are used in this report. As a maximum estimate we assume they were all animals originally marked at the start of the study and so will tend to be in the older age groups. As a more conservative estimate, we assume the age distribution of these animals at the end of the study is in direct proportion to the age distribution of all of the other animals during the study.

A total of 162 animals were shot during the study, and most shot animals were in the first two age classes. We can therefore assume that 81 were shot in each of their first two years, although this will lead to a slight overestimate in mortality rates for the first two age classes.

In summary, since there is more than one method of attempting to correct the original life table, we have made a number of possible life tables and used them to estimate population growth rates. These figures therefore represent the extremes of population growth rates given an inherent similarity between the Polish and UK populations. Firstly the tables can be corrected purely by using the fusion life table approach to include emigrants prior to dispersal. Secondly, the fusion life table can be further corrected by assuming that the animals alive at the end of the study are in the older age classes. Lastly we can assume that these latter animals were distributed throughout the age classes in the same proportion as the other animals, and include animals killed by hunting.