"First Report on the State of the World's Animal Genetic Resources" (SoWAnGR)

Country Report of the United Kingdom to the FAO

Prepared by the National Consultative Committee appointed by the Department for Environment, Food and Rural Affairs (Defra).

Contents:

Executive Summary

This UK Country Report on Animal Genetic Resources is the United Kingdom's official contribution to the Food and Agriculture Organisation's "First Report on the State of the World's Animal Genetic Resources". It has been produced by a 24 member National Consultative Committee on Farm Animal Genetic Resources representing all main farmed species interests, a number of non-governmental organisations engaged in breed management and conservation and the leading institutes and University Departments involved in animal breeding and genetics. It fulfils one of the Government's obligations under the Convention on Biological Diversity (CBD) in relation to conserving biological diversity in food and agriculture.

The UK livestock sector is currently experiencing one of the longest economic downturns ever experienced in the industry. This has been exacerbated by a number of severe disease epidemics (e.g. BSE, Classical Swine Fever and FMD) which have reduced the competitiveness of the industry and inhibited trade in both breeding stock and livestock products. There is widespread concern felt in the industry as to the future viability of existing livestock production systems and that change is needed.

The Report describes the current state of the UK's livestock industry and the key role that the country's rich diversity of livestock breeds and commercial strains play in maintaining the economic and genetic sustainability of its farm animal production systems as well as being part of the country's rural culture. It also analyses the changing demands on national livestock production and future breeding programmes driven by the globalisation of livestock product marketing and by evolving Government policies on the environment, animal welfare and food safety. A review of what needs to be done to assist the industry to meet those demands by improving co-ordination among the relevant stakeholders and building capacity in the animal breeding and conservation sectors is given. National priorities for action are given as well as a number of recommendations relevant to both Government and the private sector on how the conservation and utilisation of the country's animal genetic resources can be improved.

The UK has a long history in developing breeds suited to the wide variety of production environments found throughout the British Isles, which have had a major impact on livestock farming systems throughout the world. In addition, the animal breeding sector responded very effectively to demands for increased production in the second half of the 20th Century by applying selection pressure to certain high yielding breeds, some imported, to improve production efficiency and yield especially in the dairy, pig and poultry sectors. However this has led to a reduction in the number of traditional native breeds which are utilised in mainstream production. As national policies change towards more environmentally and biologically sustainable systems of agriculture to deliver public goods, the utilisation of a wider diversity of locally adapted and traditional native breeds is expected to increase. The greater emphasis on diversification in the rural economy means that the substantial cultural value of the nation's "heritage" breeds can be utilised to enhance rural tourism and other rural businesses.

Conservation programmes, both *in situ* and *ex situ* for the country's breeds at risk (locally adapted, genetically distinct and rare breeds) have been well managed by NGOs and private breeders with the support of animal breeding institutes and universities. However there is an acknowledgement that greater national co-ordination of conservation activities is required to avoid overlapping of responsibilities and to fill gaps where certain breeds and necessary activities fall through the net. There is also a need for greater co-operation at European and international level to ensure that conservation activities are managed as cost-effectively as possible.

A need for a more active information infrastructure is argued for to enable all those involved in animal breeding to benefit more directly from the world-renowned expertise that exists in the UK in the management and sustainable development of our animal genetic resources.

A number of recommendations are made regarding the development of greater co-operation between Government, NGOs, private and commercial breeding organisations and scientific institutes at international, European and national level.

Revitalising international trade in the UK's animal genetic resources is considered a key priority to assist in maintaining a threatened animal breeding infrastructure by bringing in much needed income to fund evolving breeding objectives and to reclaim overseas markets lost through BSE and FMD trading restrictions.

The Report concludes with a strong recommendation to create a National Action Plan for Animal Genetic Resources based on the recommendations in the Report and to reconstitute the existing National Consultative Committee into a Steering and Advisory Committee on Animal Genetic Resources to draw up the Plan and drive it forwards.

The National Consultative Committee

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Mr Marcus Bates		British Pig Association
Professor Dianna Bowles		The Sheep Trust
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1. Assessing the state of agricultural biodiversity in the farm animal sector in UK

1.1. Overview of UK agriculture and livestock production.

Agriculture has played an important role in the production of food to ensure food security post-World War 2, has been an integral part of the rural infrastructure and has filled a valuable ecological function through conservation of biodiversity and the environment.

The agricultural area of the United Kingdom is 18.55 million hectares and can be split into three broad categories. The Western grasslands, hills and uplands account for approximately 55% of this area and the Eastern arable, grass crop and horticultural lowlands account for approximately 30%. The remainder is woodland, set-aside and other categories such as buildings, yards and roads. There is some cross-over between these three broad areas, but dairy cattle and lowland sheep are generally found on the Western grasslands, whilst upland and hill sheep, suckler beef cattle and farmed deer are concentrated in the Western hills and uplands. Intensive beef, pig and poultry enterprises are predominantly associated with arable production in the East of the country. The distribution of the main species of farmed livestock taken from the official Agricultural Census in June 2001 are shown by county (England and Northern Ireland) or unitary authority (Scotland and Wales) on the maps below.

The workforce engaged directly in UK agriculture is 550,000 persons (including spouses of farmers) or 2.2% of the national workforce in employment. Those engaged in any form of livestock production will be less, but the total including ancillary industries is approximately 12% of total UK employment. Agriculture's contribution to the total UK economy is £6.4 billion or 0.7% of national GDP at current prices. The economic importance of livestock production *per se* to the national economy is therefore very limited although it becomes more significant when supply industries and downstream industries dependent on livestock and livestock products are included. The overall UK agri-food sector accounts for about 8% of GDP.

Livestock production has undergone substantial changes in the past 15 – 20 years. Between 1985 and 2000 beef and veal production fell as poultry production increased. Sheepmeat and pigmeat production increased for most of that period but are currently declining. Egg and milk production have undergone a steady decline (Table 1).

Table 1
UK Agricultural Production in the Livestock Sector

	1985	1995	2000
Beef (000 t)	1137	1002	706
Sheepmeat (000 t)	315	403	389
Pigmeat (000 t)	976	1017	899
Poultrymeat (000 t)	850	1415	1513
Eggs (million dozen)	854	774	752
Milk (million litres)	15429	14015	13801

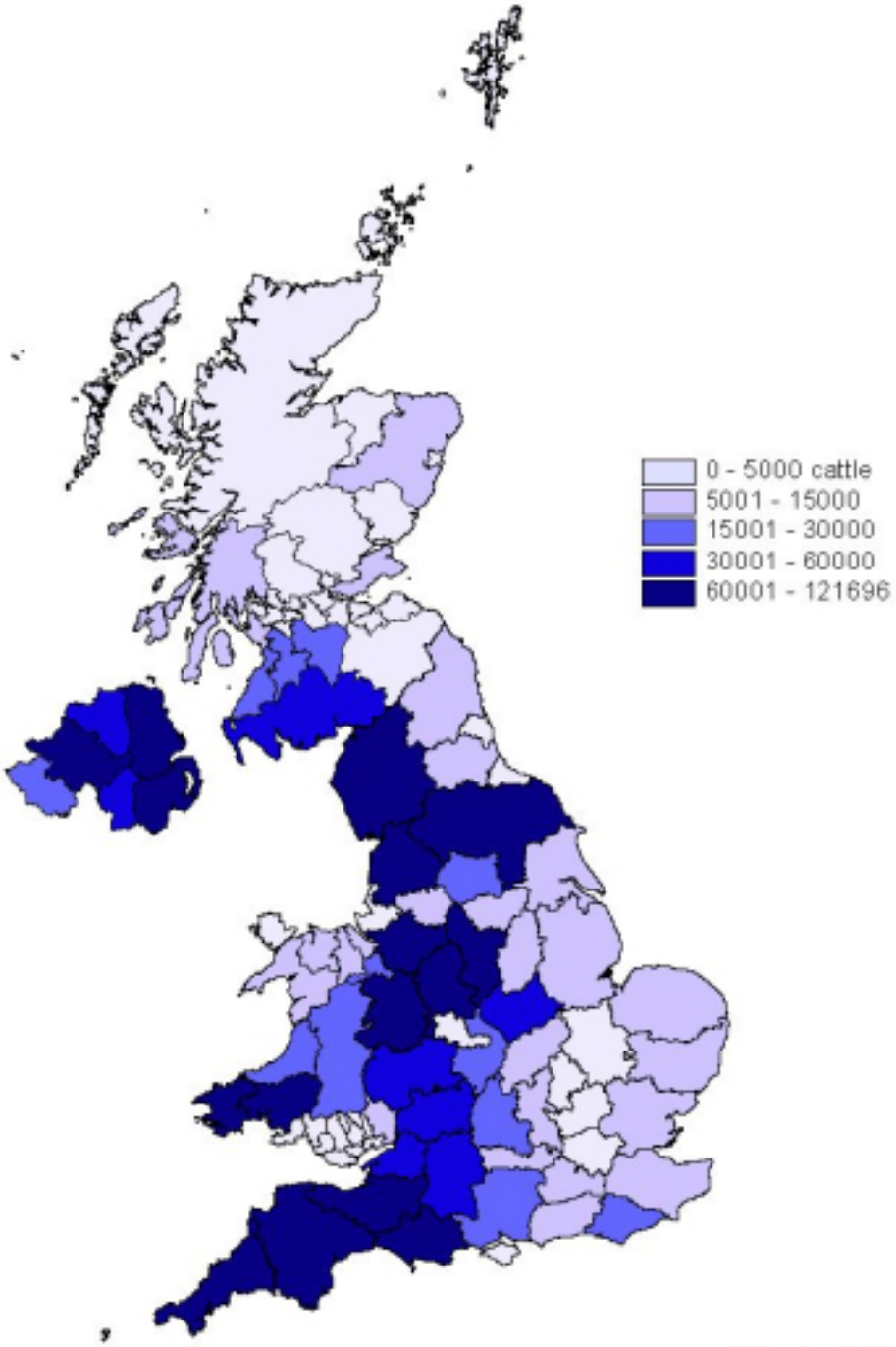
(Source: DEFRA: Agriculture in the UK 2001).

Equines are used purely for recreational purposes in the UK and are therefore not regarded as animals for agricultural production. There are social and cultural attitudes against horsemeat consumption and indeed the economic significance of the export market for horsemeat has reduced in recent years and has no implication for the development of AnGR within the UK.

DEFRA
Department for
Environment,
Food & Rural Affairs

June 2001 Agricultural Census
Distribution of Dairy Cattle
United Kingdom

national STATISTICS



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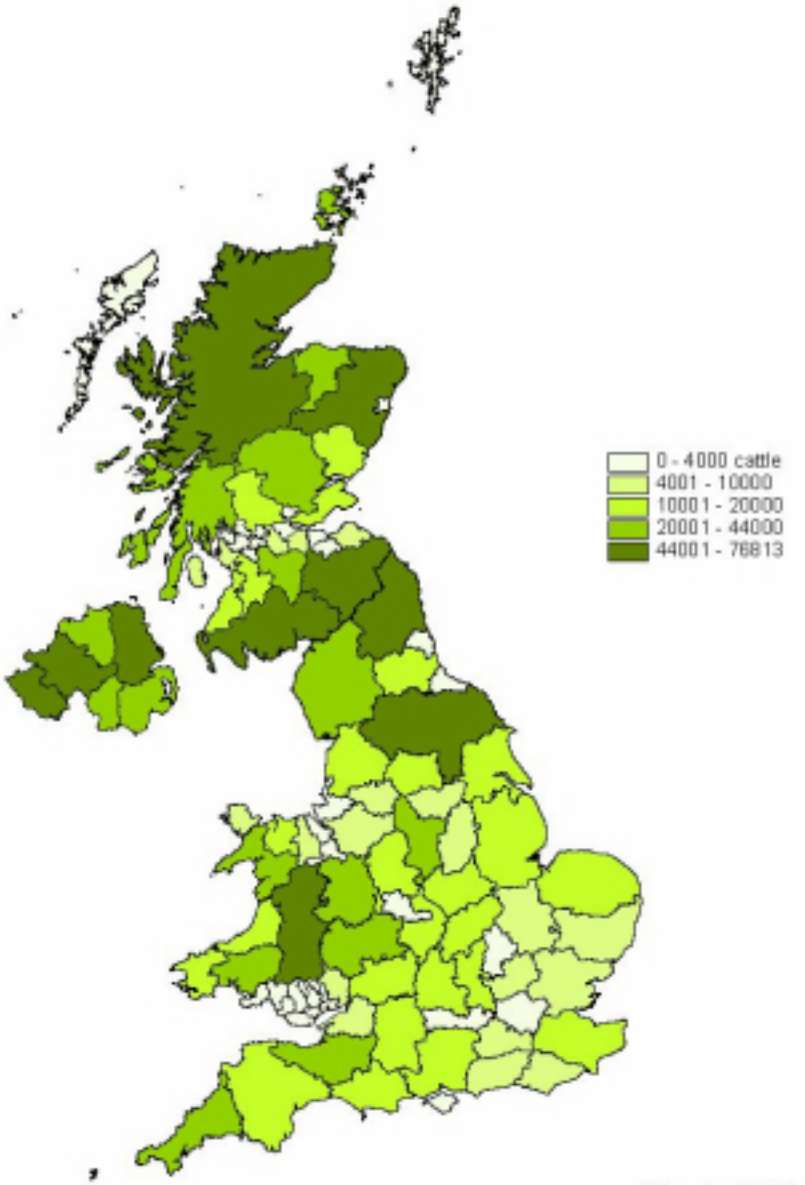
June 2001 Agricultural Census
Distribution of Beef Cattle
United Kingdom

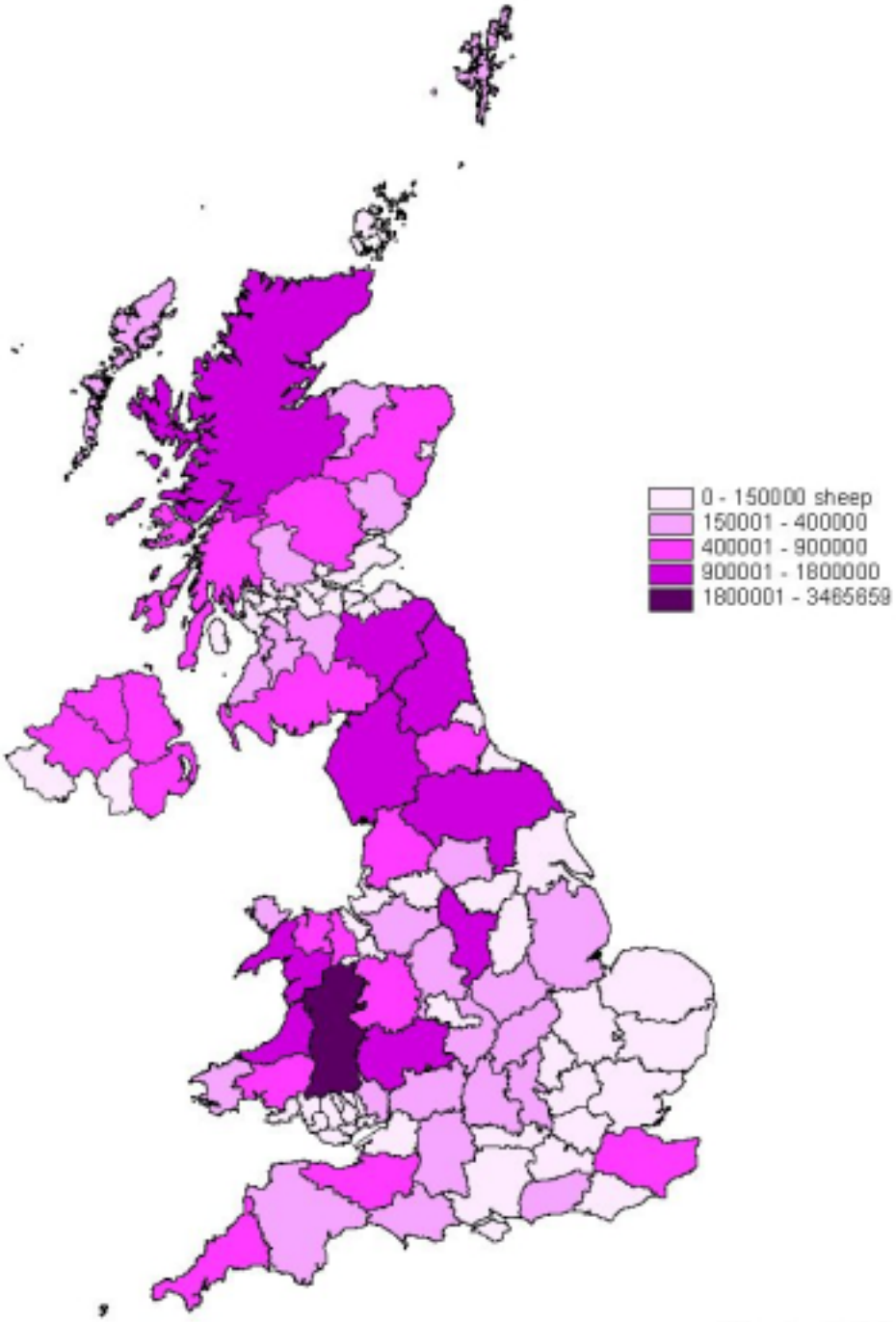
national STATISTICS



DEFRA
Department for
Environment,
Food & Rural Affairs

June 2001 Agricultural Census
Distribution of Total Sheep
United Kingdom

national STATISTICS



DEFRA
Department for
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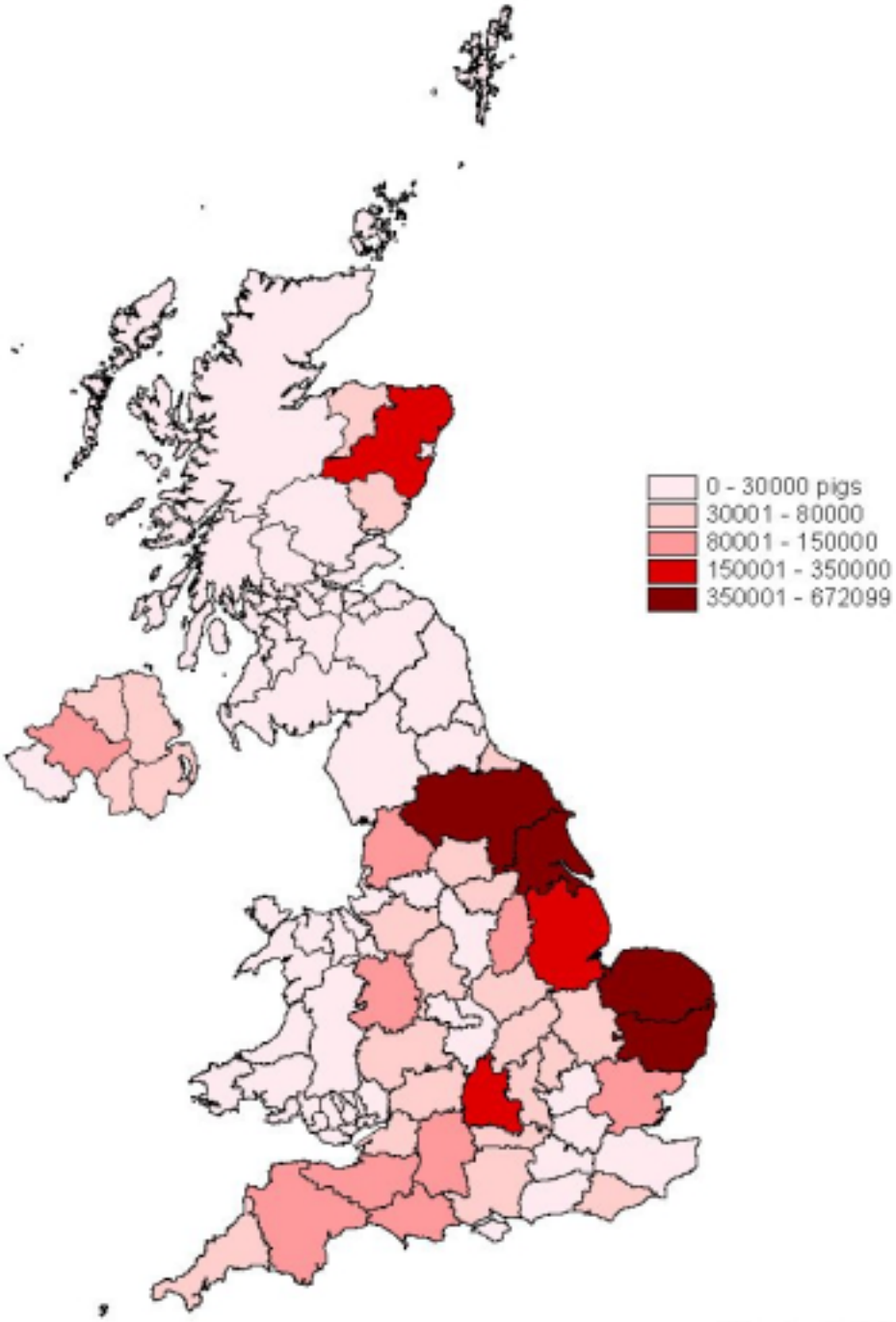
June 2001 Agricultural Census
Distribution of Total Pigs
United Kingdom

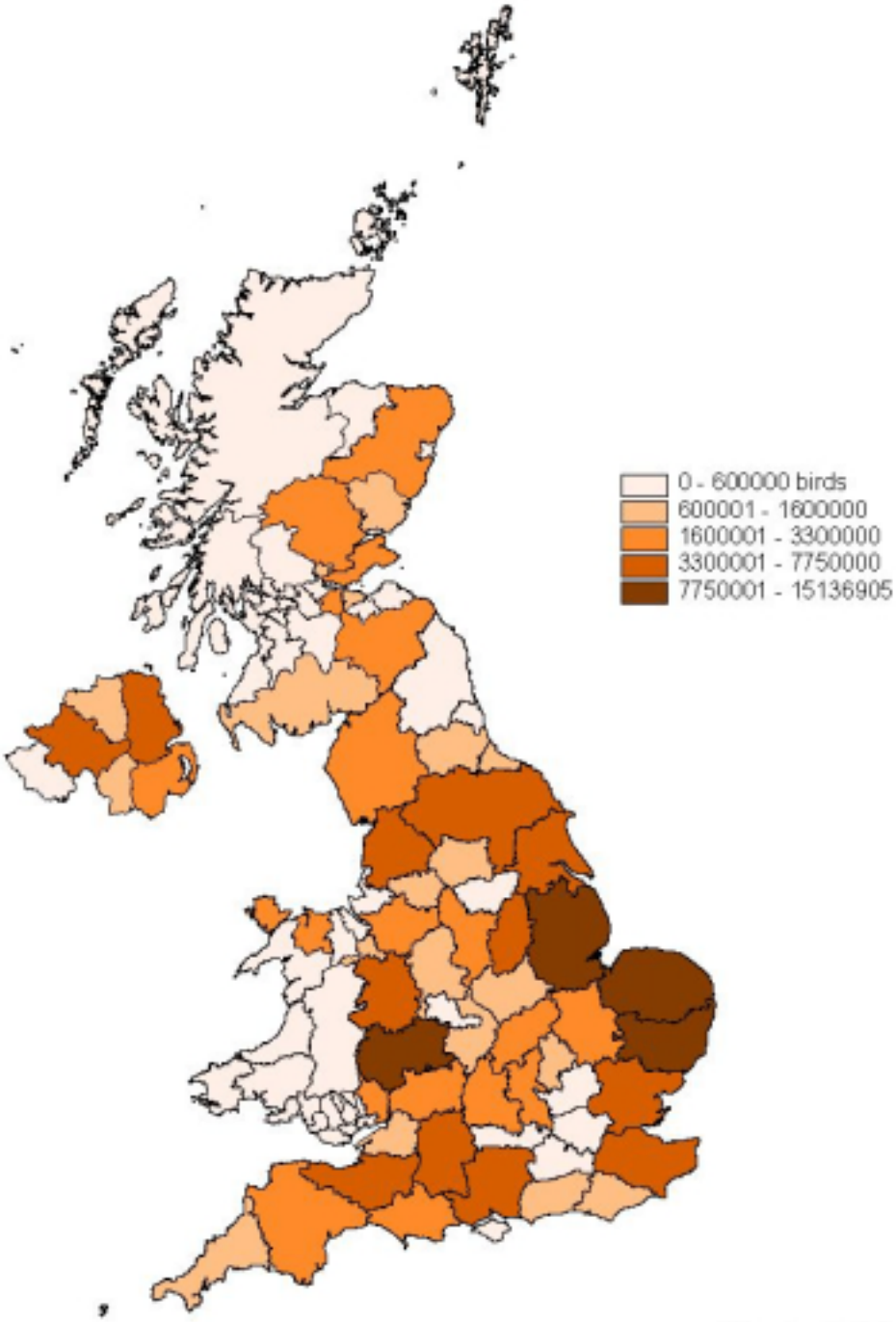
national STATISTICS



DEFRA
Department for
Environment,
Food & Rural Affairs

June 2001 Agricultural Census
Distribution of Total Poultry
United Kingdom

national STATISTICS



The year 2001 was an unusual year in terms of domestic and international trading patterns due to the widespread Foot and Mouth Disease epidemic. Exports were banned for most of the year, home production was reduced in the red meat sector and imports were raised to compensate. Therefore, 2000 figures represent a full year of more normal circumstances:

- 99% of UK beef and veal home-based production was supplied to the domestic market; 1% was exported under the Date Based Export or XAP Re-export Schemes; the UK is 79% self sufficient in beef and veal (Appendix 2).
- 66% of home production of sheepmeat supplies the domestic market and 34% goes for export; seasonal nature of lamb production creates a 34% import requirement from Australasia (Appendix 2).
- 70% of pigmeat production is consumed on the domestic market and 30% exported, a large proportion of exports being cull sows for German manufacturing; 34% of UK consumption of pigmeat is supplied by imports of pork loins, bacon and other cuts (Appendix 2).
- 88% of poultrymeat production is consumed at home and 12% exported; 21% of UK consumption is met by imports, much of it for manufacturing and added value processing. In the egg sector, 98% of eggs produced at home are consumed domestically and 2% exported, with 11% of UK supply imported (Appendix 2).
- 97% of home production of milk is drunk or processed into dairy products for domestic consumption and 3% exported. 11% of UK consumption is met by imports (less than 1% of raw milk is imported, but there is a substantial import trade in dairy products) (Appendix 2).

Meat consumption in the UK has seen steady growth over recent years. Per capita consumption of meat increased from 68.8kg in 1995 to 72.3kg in 2000 with a slight dip in 1995/96 when concerns over BSE were at their peak. However over the same period beef and veal consumption has declined in favour of poultrymeat and pigmeat. Average earnings have increased by 24% over the same period and this trend is likely to increase. However the percentage of total household consumption expenditure on food has declined from 11.2% to nearer 9.5% of which around 22% is consistently spent on meat and meat products. More money is now spent on eating out rather than at home, although there has only been a marginal increase in meat and dairy products eaten out.

Leather is an important part of UK livestock production, output and trade (Appendix 2). In 2000 18.4 million sheepskins and 3.2 million cattle hides were produced. However, the estimated UK value ex-abattoir for sheep skins fell from £115.2m in 1995 to £73.6m in 2000 and for cattle hides from £105.6m in 1995 to £89.6m in 2000 due mainly to a fall in world prices.

1.1.1. Land and livestock ownership

In England and Wales 67.6% and in Scotland 69% of the agricultural land is privately owned, and 34.2% and 31% respectively is rented for farming under some form of tenure agreement. In the pig and poultry sectors a large proportion of production is now owned by international companies who have vertically integrated livestock chain management enterprises supplying pigs and chickens from their own farms into their wholly owned slaughtering and processing plants. They sell directly to supermarkets with whom they have sophistically integrated trading relationships through Efficient Consumer Response (ECR) IT systems. A small number of holdings are co-operatively owned (e.g. Farmcare farms) but co-operatives have never been particularly successful in the British agricultural sector. Very little use has been made of

them in the UK, in contrast to developments in other European countries (Table 2).

Table 2
Turnover of Farmer Controlled Businesses (FCBs)
Compared to Agricultural Output

	Turnover of FCBs (ECU bn)	Total farmgate output (ECU bn)	FCB turnover as % of farmgate output
Sweden	8.2	3.2	259
Ireland	9.6	4.4	219
Denmark	12.1	6.7	180
Netherlands	22.4	17.0	132
France	52.6	42.2	125
Germany	39.3	33.6	117
Italy	16.5	31.2	53
UK	7.7	24.0	32

(Reference: COGECA/European Commission)

70% (up from 66.8% in 1995) of the land held under agricultural production in the UK is on the 17% of holdings of 100 hectares or more. Conversely 46% of holdings farm less than 20 hectares each but account for only 4% of agricultural land. In the major farmed species in the UK, herd and flock sizes have continued to increase over the past 5 years as farm incomes have fallen and producers need to improve economies of scale to survive, as Table 3 demonstrates. This is especially true of the pig and poultry sectors, which are not supported under the EU Common Agricultural Policy to the same degree as the other species and are therefore subject to stronger competition from the global market. Suckler beef herds and sheep breeding flocks are generally kept under more extensive conditions. In lowland areas they are usually kept as just part of the whole farm enterprise whereas in the uplands and hills, sheep and/or specialist beef enterprises tend to be the only form of agricultural production that is possible on the poorer quality of land. Dairy herds tend to be more specialised with more capital investment in milking parlours and equipment and therefore need to be larger than beef suckler herds to be economically viable.

Table 3

Average size of herd/flock on UK holdings			
	Average size of herd/flock (head)		
Species	1990	1995	2000
Dairy Cows	63.1	66.8	73.3
Beef Cows	21.6	25.2	28.0
Sheep Breeding flock	214.9	231.6	249.4
Pig Breeding herd	60.8	76.7	85.4
Fattening Pigs (>20kg)	367.4	450.7	501.3
Broiler Chickens	25,571	33,869	53,508
Laying fowl	950	1385	1482
	DEFRA: "Agriculture in the UK"		

1.1.2. Demand for livestock products and rural development

Over the past 5 years livestock production in the UK has been in decline and it is currently experiencing one of the longest economic downturns in the history of the industry. Farm incomes have fallen steadily (Table 4) since 1996 and costs of production have risen after a prior period of prosperity for the UK agricultural sector. Pigs, poultry, lowland cattle and sheep producers have been the worst affected principally because they are the enterprises which are the least supported under the CAP. The situation has been exacerbated by a number of severe disease epidemics (e.g. BSE, Classical Swine Fever and FMD) which have reduced the competitiveness of the industry and inhibited trade in both breeding stock and livestock products.

Table 4

Net Farm Income by type of farm (1989/90 – 1991/2 = 100)

	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99	1999/00	2000/01
United Kingdom									(prov.)
Dairy	127	144	121	148	120	77	46	34	30
Cattle and sheep (LFA)	142	164	117	182	180	97	47	29	45
Cattle and sheep (lowland)	177	229	174	190	156	15	-5	1	–
Cereals	159	153	207	327	291	100	50	80	30
General cropping	94	118	209	244	127	55	97	22	30
Pigs and poultry	80	23	48	102	93	32	-32	-8	65
Mixed	136	128	153	224	171	27	6	113	85
All Types (excluding hort.)	126	137	150	201	157	69	45	34	30

Source: Agriculture in the UK, DEFRA

The descriptors used by FAO for systems of food production do not permit an accurate definition of production systems used in the UK. They range from low-input extensive systems typified by sheep farms in the mountainous regions of Scotland, Wales and northern England, to the high-input intensive systems found mainly in the poultry, pig and dairy sectors.

The population of the UK is currently estimated at 59.7 million and is expected to grow at a rate of 0.4% per annum over the next 10 years, approximately 70% of which will be due to net inward migration. Demand for livestock products is therefore likely to experience only very limited growth in the UK. Rural areas are however expected to see twice this rate of population growth on average through migration out of former heavy industrial areas and urban centres. Some rural areas close to urbanised areas such as those within the South of England are likely to see more rapid growth than those in the more remote parts of the UK.

As traditional farming practices decline the number of persons employed in agriculture is expected to continue to fall. Growth in the rural economy is expected to come from non-farming enterprises such as tourism, service industries working from home and other small businesses. There will be more part-time farming enterprises. At the same time mainstream food production will increasingly be in the hands of larger land management businesses which are likely to be more vertically integrated and producing livestock products for specific markets. Nevertheless the areas of expected growth, such as in tourism, will often be linked to agricultural land practices.

The EU Rural Development Regulation implemented through the various national Development Plans within the UK is the principle policy mechanism through which sustainable rural development is being delivered. The aim is to develop the rural economy in a way that will avert the likelihood of rural poverty increasing as traditional agricultural businesses are restructured. There is widespread concern felt in the livestock industry as to the future viability of existing livestock production systems and how they will fit into the modern rural economy. It is widely acknowledged that change is needed to ensure future prosperity in the livestock sector.

1.2. Assessing the state of conservation of farm animal biological diversity.

The common species of farm livestock in UK are cattle, sheep, goats, pigs, poultry and horses and ponies. There are also small populations of deer, camelids and water buffalo. There are no wild ancestors of large domestic stock in UK, but there are some feral populations (Soay and Boreray sheep, Chillingham and Swona cattle, and goats), and there are wild relatives of domestic ducks and geese.

Most domestic pure breeds of farm livestock in UK are recorded in registration systems by breed societies, and are recognised by the EU. Performance recording and characterisation programmes, such as milk and weight recording and Best Linear Unbiased Prediction (BLUP) analysis for production and maternal traits etc., are carried out by the Meat and Livestock Commission (MLC), Animal Data Centre (ADC), milk recording organisations and major breeding companies for mainstream breeds and strains. Conservation Non-Governmental Organistions (NGOs) and special interest groups support *in situ* and on farm conservation of breeds at risk through breeding plans and genetic advice. *Ex situ* conservation is effected through gene banks maintained by breeding companies and conservation NGOs.

A complete list of all known breeds, both native and exotic, is given in Appendix 3 which is taken from the UK National Animal Genetic Resources (AnGR) Database. Population size is shown as the number of registered females of breeding age, but it should be remembered that there are significant populations of unregistered animals in some breeds (e.g. Aberdeen Angus, Ayrshire, Belgian Blue, Charolais, Hereford, Highland, Holstein, Limousin, and South Devon cattle, and many sheep breeds). In some breeds, separate within-breed groups are recognised (e.g. Traditional Aberdeen Angus, Guernsey Island, Traditional Hereford, Jersey Island and Traditional Lincoln Red cattle, Dorset Horn sheep, Welsh (feral section A) pony).

AnGR in the UK are currently divided into the following main groups of:

1.2.1. **Mainstream breeds** (native and exotic). Many breeds in this category (especially cattle) are influenced by imported genetic material. The dairy industry is dominated by the Holstein, and has small inputs from four other exotic breeds. Most red-and-white dairy breeds have experienced introgression from the Holstein. Three exotic breeds (Limousin, Charolais and Belgian Blue) are the most numerous in the beef industry, and most native beef breeds have experienced introgression from exotic breeds. Two exotic breeds (British Texel and Charollais) play a major role in the sheep industry. The pig industry is focused on the production of hybrids based upon lines or breeds of global importance. Poultry are maintained as strains rather than breeds. The equine industry accommodates a wide variety of breeds but none, apart from the Thoroughbred, is dominant. Conservation of mainstream

breeds is delivered by commercial companies for philanthropic purposes, for risk management or for assessing genetic progress. (Appendix 3 – Breed Status Code M)

1.2.2. **Breeds at Risk** (native and exotic). There are three main factors taken into account when assessing breeds at risk in the UK. Generally they are not used in mainstream production but are of particular interest because they are breeds:
~ with a particular local adaptation,
~ with distinctive genetic characteristics
~ that are rare and in need of more urgent conservation action.
These groups are not mutually exclusive and some breeds are locally adapted, genetically distinctive as well as rare (e.g. seaweed eating North Ronaldsay sheep and White Park cattle). There is ongoing debate at national level as to how best to categorise and prioritise breeds at risk especially as the need for international co-operation in conservation grows. For the purposes of the UK National AnGR Database (Appendix 3) the following two categories of breeds at risk are currently recognised:

1.2.2.1. **Locally Adapted and/or Distinctive Breeds.** There has been particular concern over native breeds that may not yet be rare, but have some specific local adaptation that may be of special interest from an environmental, heritage or some other regional rural development perspective (e.g. the Herdwick sheep in native Cumbrian habitat). In addition some native breeds have distinctive genetic characteristics (e.g. high prolificacy in some sheep; genetic isolation of the Jersey Island population of cattle) and are considered to have high priority for preserving and managing their genetic diversity. The Sheep Trust (ST) and Rare Breeds International (RBI) have been particularly active in highlighting the need to identify and conserve breeds of interest for both these reasons (See Appendix 3 – Breed Status Codes D and L).

1.2.2.2. **Rare Breeds.** In the UK, breeds defined as being rare must meet criteria defined by the Rare Breeds Survival Trust (RBST) in order to appear on a list available in the Government (House of Commons) Library (Requirements for Rare Breed Status Eligibility, RBST 2002). This list is updated and published annually by the RBST. Rare breeds become listed when numbers of purebred registered adult females fall below 3,000 (sheep, horses), 1500 (cattle), 1000 (goats, pigs) and they are allocated to one of seven categories on the basis of adult female numbers. In addition, a number of other factors are taken into account such as geographic distribution, current population trends and genetic diversity (Appendix 4). 72 breeds are currently listed as being rare by the RBST (Appendix 3 – Breed Status Code R).
In addition, there are a small number of breeds not currently listed as rare by the RBST which are numerically scarce and are being considered for listing or are recognised by other NGOs such as the RBI (Appendix 3 – Breed Status Code R*)

1.2.3. **Conservation for native breeds** is applied by several NGOs and private individuals through customised breeding programmes to minimise loss of genetic variability from founders compatible with a minimisation of introgression. Native breeds at risk have benefited from significant support programmes provided by NGOs in the last 10 years. Special interest groups within breeds apply breed improvement programmes. Programmes such as the

Heritage Gene Bank, Traditional Breeds Incentives, scrapie genotyping, and breed structure analysis, have all had a noticeable impact on native breeds at risk generally. Customised conservation programmes specifically for rare breeds have been designed and implemented by the RBST and a small number of other NGOs to deliver maximisation of entire breed genetic variability. In addition, rare breed support programmes are in place and the RBST is also currently raising funds and collecting semen for a national rare breeds *ex situ* conservation archive.

1.2.4. Organisation of the 241 **pure breeds of poultry,** bred primarily for the show-ring, is undertaken by the Poultry Club of Great Britain and the Rare Poultry Committee of the RBST. These are listed separately by species and type in Appendix 3.

1.3. Assessing the state of utilisation of farm animal genetic resources.

1.3.1. The UK has a long history in developing breeds suited to the wide variety of production environments found throughout the British Isles, which have had a major impact on livestock farming systems throughout the world. For example the UK was the largest global exporter of pure-bred breeding pigs prior to the 2001 FMD epidemic (See Table 5).

Table 5

Major Exporters of Pure-bred Breeding Pigs, 1998			
Rank	**Exporting Country**	**UK £'000**	**Number**
1	**United Kingdom**	**5352**	**28168**
2	United States	3787	19231
3	France	3070	19482
4	Denmark	1736	13411
5	Belgium/Luxembourg	1584	14801
6	Netherlands	1075	7543
7	Germany	677	2539
8	Austria	608	5333
9	Spain	370	1990
10	Canada	276	858

Source: MLC

In addition the UK animal breeding sector responded very effectively to demands for increased production in the second half of the 20th Century by applying selection pressure to certain high yielding breeds, some imported, to improve production efficiency and yield especially in the dairy, pig and poultry sectors. However this has led to a reduction in the number of traditional native breeds which are utilised in mainstream production.

1.3.2. Mainstream breeds (especially in dairy cattle, pigs and poultry) are utilised mainly in intensive high-input systems of production, where the primary objective has been to increase productivity and thereby efficiency of production, although these objectives are increasingly directed towards health and fitness. Their products are aimed at the mass market and they provide the major portion of the domestic and export food supply.

1.3.3. Systematic crossbreeding, within-breed strain crosses and hybridisation is widely practised in the pig and poultry industries. 79% of purchased boars (of which 47% are Large White) are supplied by four companies, and 70% of purchased hybrid gilts by three companies. The poultry breeding industry is

focused on the production of hybrids based upon 6-8 breeds of global importance. Six chicken breeding companies are responsible for 85% of global output, and two turkey companies for 98% of output. There is vertical integration through the industry.

1.3.4. Systematic crossbreeding and hybridisation is widely practised in the equine industries, apart from the Thoroughbred.

1.3.5. The majority of dairy cattle are purebred. There is some crossbreeding with beef bulls, but less than 50% of beef production comes from the dairy herd. Systematic crossbreeding, based on purebred populations, is normal in the beef and sheep industries.

1.3.6. Locally adapted breeds at risk, rare breeds and those found in a limited geographical area, are utilised mainly in more extensive low-input (but not low management) systems where their suitability to a particular local environment or farming regime may utilise a favourable genetic/environment interaction. Because of their low numbers and their distinctive characteristics, their products are used in niche markets, and the majority of breeds at risk including rare breeds benefit from outlets through direct sales, farm shops or small-scale specialist marketing schemes such as the RBST Traditional Breeds Meat Marketing Scheme (TBMMS).

1.3.7. Some breeds at risk, including rare breeds and all poultry breeds (as opposed to commercial strains) have very limited value in commercial production systems. Rare breed societies reported in 2002 that less than 10% on average of any rare sheep, goat, cattle or equine breed contributed significantly to production systems in their native region. They may however be used in cultural and historic activities. The cultural and heritage value of native breeds at risk remains a strong justification for their conservation. Horse and pony breeds are used in the leisure industry, and breeds of several species are used in nature conservation projects. Breeds at risk of all species continue to contribute through the showring, which represents a combination of cultural and breed promotion activity. An extensive survey on the changing utilisation and geographical distribution of rare breeds was carried out in the UK in 2002 and this demonstrated that keepers of rare farm animals are constantly searching for new and imaginative ways of deriving an income from them to secure their future. (Townsend S. 2002 RBST Breed Society Survey)

1.3.8. The utilisation of farm animal genetic resources is influenced by EU legislation, environmental regulations (e.g. nitrogen limits) and public awareness with regard to food security, environment and animal welfare. For example, the Welfare of Farmed Animals Regulations 2000/1, which applies to all farmed animals, contains specific requirements such as inspections, record keeping, freedom of movement, buildings and equipment and the feeding and watering of animals. Some species are subject to additional provisions such as methods of egg production for laying hens in battery cages, housing for veal calves and controls on the use of sow stalls in pigs as set out in their own individual schedules.

1.4. **Identifying the major features and critical areas of AnGR conservation and utilisation.**

1.4.1. The mainstream breeds and poultry strains are continually responding to the application of intensive selection pressure for high yield, aided by modern

technologies and the global exchange of breeding stock. However, selection procedures for mainstream breeds and strains have been or are increasingly being adapted to include functional characteristics. There is a need to strengthen the abilities of some sectors to address these functional characteristics within their breeding schemes. Weight of public opinion is likely to exert increasing influence on moderating intensive methods of production and this may have an impact through the modification and balancing of selection objectives.

1.4.2. There is a need to conserve native breeds at risk, especially those that are rare, to maintain biodiversity through minimising unmanaged introgression and by reducing loss of genetic variability within each breed as far as possible. The primary benefits are likely to be cultural, but the lack of alternatives to the dominant breeds in some sectors is a vulnerable position because reliance on a small array of breeds reduces the opportunity to adapt to changing environment or market demands.

1.4.3. Management policies to protect genetic diversity are also being applied through conservation grazing and ecological projects.

1.4.4. In order to assess conservation priorities for all native breeds at risk there is a need for improved census information and co-ordinated data collection systems. Long-term, in-depth characterisation studies for the purposes of accurately assessing breed utility are required. Associated with this the storage of germplasm and other genetic material for both breed analysis and conservation needs to be developed in a more co-ordinated way.

1.4.5. Selection programmes need to recognise the potential conflict between maintaining genetic variability and maximising genetic improvement. For example, the selection proposed under the National Scrapie Plan for homozygosity of the ARR allele at the prion protein will increase resistance of sheep to scrapie, but will reduce genetic variability. It is not fully recognised that intensive selection can lead to erosion of genetic variability and an increase in risks associated with inbreeding if populations are small. The implementation of genetic management solutions following such recognition is made more difficult by short-term pressures. There is a need to work with managers of such breeds to explain that by using modern methods of managing genetic variation, implementation need not be in conflict with such pressures.

1.4.6. The negative impacts of an unfavourable financial climate and a lack of career opportunity in livestock farming in the UK are discouraging potential new entrants to the industry, resulting in an increasingly ageing farming population. Successive UK Governments have had to respond to external pressures through the globalisation of food supply, WTO negotiations and reform of the EU Common Agricultural Policy as well as to internal pressures resulting from a succession of unprecedented livestock disease epidemics. As a result, unpopular measures have had to be implemented involving the livestock industry (e.g. amendments to the Animal Health Bill). This has led to distrust of Government policy towards livestock producers in some sectors of the industry. For all breeds at risk this disincentive to engage in livestock production is compounded by a lack of adequate markets and an historical lack of specific resource from Government.

1.5. **Assessment of Animal Genetic Resources in the UK's Overseas Territories**

The UK is responsible for assessing the state of the AnGR in the 15 Overseas Territories. A questionnaire was sent out to the appropriate authorities in these territories and a summary is given in Appendix 6.

2. Analysing the changing demands on national livestock production & their implications for future national policies, strategies & programmes related to AnGR.

Consumer demand is a significant driver of policy and standards, and value for money is still a main contributory factor in determining consumer-buying behaviour. Expenditure on food as a proportion of total household expenditure has decreased by 15% in the last five years, but efficiency of production remains a major driver of breeding policy in the livestock sector. The demand for lean meat and homogeneity of both fresh and processed products, particularly in the major supermarkets, also impacts on breeding policies across all species.

2.1. Reviewing past policies, strategies, programmes and management practices (as related to AnGR).

The policies applied to UK agriculture during the second half of the twentieth century favoured intensive systems of production, which maximised individual yield. A few breeds with high production capacity became dominant and the associated marginalisation of other breeds resulted in loss of farm animal biodiversity. The number of first inseminations of bovine semen in England and Wales from the mid-1960's onwards illustrates this point (Table 6).

Table 6
1st inseminations in England and Wales (%)

	1966-7	1976-7	1986-7	1991-2
Dairy breeds:				
Holstein-Freisian	80.9	93.0	94.4	95.6
Other exotic	0.04	0.05	0.10	0.10
Native	19.0	7.0	5.5	4.3
Beef breeds:				
Exotic	11.1	22.0	72.0	74.2
Hereford	61.8	61.1	20.6	18.2
Aberdeen Angus	19.3	11.9	5.5	5.8
Other native	7.9	4.9	1.8	1.8

N.B. Official data are no longer collected.

At the same time, native breeds at risk and rare breeds in particular have been disadvantaged by both the implementation of EU grading standards on fat class and conformation (as implemented in the UK), introduced in response to market demand for lean meat and carcase yield. Similarly erosion of the geographical spread of small abattoirs has inhibited the marketing of these breeds.

The dairy, pig and poultry industries have increasingly moved to global breed improvement policies. Dairy and poultry breeding have been strongly influenced by the import of North American genes. Programmes to conserve AnGR have been undertaken by commercial companies and marketing organisations (e.g. Milk Marketing Board Museum Bank of bovine semen established in 1969), as well as NGOs and private individuals (multi-breed collections).

In the past ten years, since the 1992 Rio conference (UNCED) when the UK Government became a signatory to the Convention on Biological Diversity, the EU Commission and Member State Governments have adopted legislation which has encouraged the development of environmental protection schemes to maintain biodiversity and to control pollution. The landmark EU Council Regulation (2078/92) on "agricultural production methods compatible with the requirements of the protection of the environment and the maintenance of the countryside" was a pre-cursor to legislation implemented through the EU Rural Development Regulation and National Rural Development Plans. Through this and other specific CAP instruments livestock producers have been increasingly encouraged to reduce stocking rates and become engaged in environmental management projects. This in turn has led to more extensive production systems, particularly in Less Favoured Areas and has re-awakened commercial interest in Britain's native breeds such as Welsh Black, Sussex and Aberdeen Angus cattle.

Although there was provision in Council Regulation 2078/92 for headage payments of 100 Euro per grazing livestock unit on endangered breeds of animal reared, this has never been implemented in the UK. In fact there have been no national initiatives set up as a result of UK Government legislation to specifically support endangered breeds. Those that exist have been funded and applied through the work of dedicated individuals, research institutes, breed societies and NGOs.

In response to public demand and stimulated by the BSE crisis in the UK in 1996, successive Governments have encouraged the development, through conversion grants, of organic livestock production although this still represents less than 2% of total UK production.

Another powerful driver has been animal welfare legislation. The two basic pieces of primary legislation are the Protection of Animals Act 1911 as amended, which contains the general law relating to cruelty to animals and the Agriculture (Miscellaneous Provisions) Act 1968, which further protects the welfare of all farmed livestock by making it an offence to cause or allow unnecessary pain or distress. This basic legislation has been more recently supplemented by the Welfare of Farmed Animals Regulations 2000/1. In some cases Animal Welfare Legislation in the UK has been introduced more rapidly than in other EU Member States as a result of political pressure and this has led to a competitive disadvantage to UK producers. The earlier banning of sow stalls in the UK is a case in point.

2.2. Analysing future demands and trends.

The economic framework within which the industry will need to work is one in which:

(i) the overall level of subsidy can be expected to reduce, and

(ii) subsidies that are paid may be re-directed towards activities concerned with protection of resources (i.e. environmental and natural resources, genetic resources of plants and animals), health and welfare of individual animals, and the safety and quality of the products

.

This re-direction will arise from regulatory, economic and social pressures. Central Government policy through DEFRA will play a central role in framing them, and will need to play a major role in developing the enabling policy framework required for the industry to re-structure itself to meet these new demands. "Forward Strategy for Scotland" will play an important part in restructuring Scottish agriculture as part of overall UK change as will similar strategies in Wales ("Farming for the Future") and Northern Ireland. Strategic frameworks are particularly critical in the management of

AnGR since the qualities of the AnGR used to address these future directions will determine the overall effectiveness of the policies.

The demands for the future that will shape AnGR are:

1. Financial pressures on the UK livestock industry to improve efficiency and remain competitive.
2. Environmental obligations entered into within the Kyoto and other protocols concerning gas emissions and wastes.
3. Regulations on animal care, welfare and management (e.g. space requirements for pigs and poultry, feeds in relation to BSE control, treatment with antibiotics) through national and EU bodies.
4. Environmental demands to enhance biological diversity in the countryside.
5. The effect of imports of livestock products of equivalent quality and assurance on the competitiveness of domestic production and the consequent need to import genetic material for the industry to compete.
6. Domestic and export market demands for higher quality and speciality produce.
7. The demands of the leisure and tourist industry (especially for equines and rare and unusual breeds).
8. Export demand for high quality breeding stock from the UK in the rapidly growing global livestock production sector.

Points 3 and 4 above are associated with, though not exclusively, an increase in non-intensive and organic farming. Point 5 is viewed as being associated with extensification, although conversely point 2 may be more compatible with intensification. Therefore, future demands may well be conflicting and difficult to reconcile.

Some trends in the roles of AnGR can be predicted from these broad demands:

2.2.1 The size of the national dairy cattle herd will contract. In the dairy sector, fewer animals kept in intensive systems will maintain production through higher individual yields and larger units. The average lactation yield of recorded Holstein cows in UK increased from 6760 kg in 1996/97 to 7280 kg in 2000/01. This trend is expected to continue.

2.2.2. Both the beef suckler herd and the national sheep flock are likely to decline as CAP support measures are decoupled from production. Individual yields will be static, and total production may fall as support payments and quotas are reduced. There may however be greater incentive to improve carcass quality as production will need to respond more directly to market signals both domestically and in the principle export markets.

2.2.3. Pigs and poultry will continue to increase output through higher individual yields, and attempts to reduce costs of production will continue in order to compete with imports and maintain exports. For example, hen-housed egg production in UK increased from 219 eggs in 1970 to 310 eggs in 2000 and further improvements will be essential for the industry to survive. The same applies to growing pigs and broilers.

2.2.4. Lower levels of production in some sectors may result in greater imports of food products, which may raise questions of food security and safety.

2.2.5. The growth in global demand for livestock products as *per capita* income increases is likely to stimulate a healthy demand for improved breeding stock. British breeding stock of all species and both indigenous and exotic breeds have a world-wide reputation for quality and integrity despite recent animal health problems. There is an opportunity for this demand to be met increasingly from the UK.

2.2.6. Native breeds at risk will target niche markets to provide consumer choice and product quality. Also, the greater emphasis on diversification in the rural economy means that the substantial cultural value of the nation's "heritage" breeds can be utilised to enhance rural tourism and other rural businesses.

2.2.7. It is likely that, as incomes continue to rise and more people live in smaller households, there will be two effects on meat demand trends:

(i) There will be an increase in demand for processed meats, ready meals and meat cuts with a very short preparation time. Consumers will pay for convenience. They will not be too concerned about the national origin of the meat in these products provided it meets food safety and quality assurance standards.

(ii) There will be an increasing demand for niche products of known origin and quality for "leisure" meal occasions whether in the home or eating out. This will lead to the fragmentation of a small but growing segment of the commodity markets into specialist meats defined by breed, region of origin, method of production (organic, free range etc) and so on. Therefore on the one hand there is likely to be an increasing demand for low cost, efficiently produced manufacturing meat from more intensive, integrated livestock systems, and on the other a smaller but growing demand for high quality meat distinguished by breed, regional identity or method of production. There may also be a growing demand for farmed deer, wild game and more exotic species such as wild boar, guinea fowl, ostrich and other introduced species. (See Appendix 5)

2.2.8. There is likely therefore to be a divergence in genetic requirements for these two markets:

For (i) there will need to be highly efficient breeds converting energy and protein, nitrogen and carbon as efficiently as possible into lean meat (to produce cheap manufacturing meat at least cost both to the producer and the environment by minimising ammonia and methane gas emissions).

For (ii) there will need to be more native breeds with a particular point of difference to sell into the leisure market. That difference might be associated with a traditional British breed or a particular flavour, region of the UK or production system. In any event there will be a demand for greater genetic diversity to develop products for this sector of the market. The same is also likely to apply to dairy products.

2.2.9. Government policy will continue to encourage economically and environmentally sustainable development. On the one hand there will be measures introduced to further enhance biological diversity in the countryside in which native farm animal genetic resources already play a role. On the other hand, in order to meet agreed targets on reduced greenhouse gas emissions by 2010 there will be increasing pressure to reduce ammonia and methane emissions from livestock enterprises. This could favour more intensive production systems and breeds which are more nitrogen and carbon efficient.

2.2.10. New market opportunities may require the use or development of new genetic types or combinations.

2.3. Discussion of alternative strategies in the conservation, use and development of AnGR.

A fundamental question is whether the UK wishes to maintain its AnGR as a cultural heritage, and to what extent such resources are critical to security of the animal production industry and of food supply. Most main commercial livestock populations, breeds and strains in the UK if eliminated by disease, for example, could be restocked from abroad. However this would be at considerable cost and disruption to rural communities and economies. The permanent loss of rare and native breeds at risk would have small (although in some cases locally significant) effects on production, but there would nevertheless be a substantial loss to national biodiversity and heritage. The permanent loss of breeds and thus of diversity might also have an impact on long term genetic progress and on the country's ability to adapt populations to new or changing environmental or production niches. Overall, food security, social, environmental and economic arguments strongly favour maintaining adequate capacity for livestock production and AnGR management.

There is also the question of how UK wishes to maintain capacity and encourage breed development. This will encompass a broad range of issues concerned with rural communities and economies, production systems, products and product qualities, environmental management, and the inter-relationship between them. In this context the advantages and disadvantages of sustainable intensification, extensification and organic production are relevant. Two different and contrasting strategies for AnGR will emerge and co-exist. These strategies need to be co-ordinated with the development of policies on the issues listed above.

Existing approaches to conservation have been led by mainly NGO driven *in situ* programmes supported by *ex situ* conservation of endangered native breeds. These can be separated into breeds that may be relatively numerous in situ, but restricted to a limited geographical region, and rare breeds that are numerically small but often more widely dispersed. The former are used commercially and are sensitive to subsidy regimes. The latter are largely kept on small units or utilised in tourism and leisure. These approaches have proved effective, but the recent FMD outbreak demonstrated the vulnerability of both groups of breeds. Ongoing conservation policy needs to combine *in situ* programmes with the development of systematic cryo-conservation schemes, and will require the continued and co-ordinated involvement of breed societies and NGOs in the wider conservation objectives, together with support in providing information, management tools and training.

2.3.1. In the dairy, pig and poultry sectors, breeds that currently are mainstream will remain globalised with regular exchange of genetic material, and with breed development in the hands of private breeding companies supplying multi-national markets. The advantage of operational efficiency of the breeding companies in these sectors must be balanced by a need to ensure that the development of these AnGR is compatible with UK policies (i.e. reflecting the changing demands of society for higher priority to traits associated with animal welfare and product quality) through:

~ clear information to stakeholders on policy implications for breed development

~ forward planning of the information infrastructure required to address these policies

~ education of farmers to use the tools available.

2.3.2. Beef and sheep breeds are less globalised but the mainstream breeds still have a strong international presence, necessitating similar needs to the other sectors. Failure to recognise these needs may jeopardise the ability of the industry to meet changing demands because of limited information on AnGR and lack of ability to interpret and use it.

2.3.3. The previous emphasis on selection for maximum individual production will be modified by the changing demands of society to give higher priority to traits associated with animal welfare and product quality. Such demands will need to be met in association with active management of genetic diversity and reductions in the rate of loss of genetic variation. Attention also should be directed to the development of genebanks as a long-term reserve, and to molecular work. Genebanks should be an important component of programmes for AnGR.

2.3.4. Native breeds at risk, including rare breeds, either will be diverted to non-agricultural purposes (e.g. amenity centres or conservation grazing), or will supply specialist niche markets. Horse and pony breeds will be used mainly in the leisure industry. Their conservation depends primarily on the dedication of small breeders, who are either small-scale producers or part time breed enthusiasts. The former are vulnerable in times of economic downturn, and require financial support to survive. The latter may lack experience of livestock and require practical advice on animal breeding and husbandry. The limitation to such developments will be lack of characterisation of some breeds, poor knowledge transfer infrastructure to transmit information to stakeholders, and the lack of ability of stakeholders to interpret the information.

2.3.5. Technical capacity in the UK on livestock AnGR is well developed, and has much to offer the global community. The framework to utilise the UK's capacity is incomplete. Modern techniques are used in breed development in all sectors, and advanced technology is applied in the pig and poultry sectors, but the management of risk associated with loss of genetic diversity is less straightforward and less widely implemented. Problems of rapid inbreeding and difficulty of access to information (e.g. large scale industry data on genetic markers for health and welfare) need to be addressed. Practical programmes for the conservation, use and development of AnGR of native breeds at risk have been driven by a number of NGOs. However significant benefits would be derived from the national co-ordination of all NGO programmes by a central body.

2.3.6. Attention also should be directed to the development of genebanks as a long-term reserve, and to molecular work. Genebanks should be an important component of programmes for AnGR. There is no co-ordinated strategy for cryo-preservation of valuable genetic material in the UK across all groups of native breeds. A number of commercial and NGO managed genebanks exist to fulfil particular requirements for the organisations involved but there is a need for a co-ordinated national policy based on sound genetic information and accurate characterisation of breeds.

2.3.7. Some AnGR in UK are uniquely British. The government has the responsibility under international conventions for overseeing their maintenance and utilisation.

2.4. Outlining future national policy, strategy and management plans for the conservation, use and development of AnGR.

2.4.1. The national policy in UK for conservation of AnGR does not currently lie with Government, and has fallen within the remit of NGOs and individuals. The most effective strategy for future policy will be for joint responsibility of effort and resourcing by Government and private agencies.

2.4.2. National policy will be limited on one hand by reform of the CAP, EU enlargement, globalisation of trade and by WTO decisions, and influenced on the other hand by the demands of society with regard to product cost, security and quality, environment and animal welfare.

2.4.3. Agri-environmental schemes will be applied increasingly to accommodate and reconcile these demands. The Policy Commission on the Future of Food and Farming published a report on "Farming and Food – a sustainable future" in January 2002. Its recommendations on how these demands might be implemented are being considered by Government and will form the basis for policy direction on livestock and other agricultural production in England over the next few years. Similar policy documents have been prepared to provide a framework for agri-environmental policy within the devolved administrations in Scotland ("Strategy for Scottish Agriculture"), Wales ("Farming for the Future") and Northern Ireland.

2.4.4. Regionalisation in England may become increasingly evident, encouraged by the policy of devolution for Scotland, Wales and Northern Ireland. This may encourage the use of locally adapted breeds where their adaptation has a local value.

2.4.5. Native breeds may need to be protected from total substitution by imported breeds by better guidelines and provision of incentives and/or by improvement to fill a functional role in the livestock industry. Programmes need to be designed so as to retain the diversity among breeds and, so as to ensure their survival and potential for improvement, minimise loss of variability within breeds and inbreeding.

2.4.6. There will be a need to maximise the use of existing national expertise in conservation methodology and increase appropriate human resources.

2.4.7. It is likely that Government will wish to develop a specific policy on plant, animal and microbial genetic resources for the first time in the near future. Also in early 2002 the EU Commission proposed a new Council regulation on the conservation, characterisation, collection and utilisation of genetic resources in agriculture that will replace a similar Regulation 1467/94 which expired in 1999. The new Regulation, if adopted, is expected to more actively encourage *in-situ* on-farm conservation projects rather than pure research, and pan-European rather than specifically national projects will be favoured.

3. Reviewing the state of national capacities & assessing future capacity building requirements.

3.1. Assessment of national capacities. The structure of advice and technology transfer mechanisms has changed dramatically in the recent past. The extension and advisory services (e.g. experimental husbandry farms, testing stations, etc.) previously available through governmental and quasi-governmental bodies have been scaled down or discontinued in the last 20 years. A structure remains in place in Northern Ireland, and a network of demonstration farms in England and Wales is envisaged. Technology transfer to farmers in the field of AnGR has largely been taken over by commercial companies. The focus of their attention on maximising profit from a few major breeds led to the formation of conservation NGOs to support many of the UK's native breeds and provide advice on conservation programmes.

3.1.1. **DEFRA** maintains a national database of domestic breeds of cattle, sheep, horse/pony, pig and poultry, which includes basic data of numbers of breeding males and females, and this information is transferred to DAD-IS and the European Association of Animal Production (EAAP) Database in Hanover, Germany. Detailed surveys of large farm livestock were carried out in 1994, 1998 and 2002, to collect information from breed societies, livestock organisations, breeding companies and livestock consultants. This information was transferred indirectly to DEFRA, and there is a need for more effective direct information transfer. More detailed analyses of data for many breeds are maintained by Rare Breeds International and Rare Breeds Survival Trust. Surveys on poultry have been conducted infrequently.

3.1.2. **Individual breed societies, producer groups** and some NGOs are responsible for maintaining herd, flock and studbooks and for recording the information that goes in them. They are also responsible for deciding what needs to be done to improve or enhance the breed. These are private sector organisations often with non-profit charitable status, and independent of government. Many individual breed society records exist only in paper format, which hinders breed analyses for the purposes of genetic conservation. The Government's activity is largely limited to ensuring that those societies that wish to be recognised under the EU zootechnics legislation, which covers cattle, horses, pigs, sheep and goats, meet the necessary requirements. These set out basic rules regarding entry of animals into herdbooks, and the acceptance of pedigree animals into herdbooks of the appropriate society, when the animals are exported from one EU Member State to another. The objective of the legislation is to promote and enhance the trade in pedigree animals, and aid has been given to export organisations such as the British Livestock Genetics Consortium. There is little interface between the registration programmes and the DEFRA database. Some societies use blood-typing and DNA profiling for parentage verification, and some societies are interfacing registration procedures with submission of records to the British Cattle Movement Service (BCMS), under the responsibility of DEFRA. From 28 September 1998 onwards all cattle in Great Britain receiving a passport are recorded on a computer database managed by BCMS, which is responsible for maintaining a national register of births, deaths and imports of cattle, issuing cattle passports and processing of cattle movement information. Keepers of cattle are legally obliged to notify BCMS about all movements of cattle. Breeds are registered on the BCMS system, but these are not verified nor do they distinguish between herd book registered and non-registered purebred cattle

3.1.3. **Performance recording, genetic evaluation and genetic improvement** programmes are carried out by milk recording organisations, genetic evaluation organisations, MLC (Sire Referencing and Signet), Scottish Agricultural College (SAC), Holstein UK, dairy cattle, pig and poultry breeding companies, and the national equine centre. Some private groups, NGOs and individuals also carry out performance recording.

In **dairy cattle**, genetic improvement programmes are in place for Holstein, Friesian, Ayrshire, Jersey and Guernsey. The major programme is for the Holstein, but progress and directions in the UK are much influenced by importation of semen. . Improvement is managed by international or national breeding companies, involving farmers in progeny testing, but only 55% of farmers produce recording/production data. Superior genetic merit is widely disseminated using AI, mainly but not exclusively for purebreeding. Goals and genetic trends are regularly available and reviewed. In pure-breeding programmes, yield, quality, disease resistance, longevity, conformation and locomotion are the main production and adaptation traits included. Reproduction rate and feed efficiency are not yet included. These goals are combined to focus upon lifetime productivity. Selection tools used in breeding programmes include phenotypic appraisal, pedigree and progeny information, individual performance, predicted breeding values and multiple trait selection indexes. The schemes are operated entirely through NGOs with major contributions from breeding companies (scheme design and operation), recording organisations (recording services), breed societies (pedigree and recording services, and type evaluations) and the MDC levy board (evaluation services).

Genetic improvement programmes are in place for many **beef breeds**. These programmes are managed indirectly by individual breeders, co-operatives, and breed societies through their input to the performance recording and genetic evaluation service provider (MLC), and are supported by levy board funds. Only 10% of breeders use MLC services, and this combined with the small proportion of animals with performance records, inhibits effective gene flow of improved material through the industry. Gene flow passes into only a small proportion of the national herd. Superior genetic merit is usually available to all farmers using the breed, through AI, for both purebreeding and crossbreeding. Goals and genetic trends are regularly available and reviewed. There are two separate breeding goals, both orientated towards terminal sire breeds/strains, one for carcass value and one for calving ease. Index scores for merit in these goals are derived from records and EBVs on weight (birth, 200 and 400 day), muscling score, fat depth, muscle depth, calving ease, and gestation length. Resources are derived mainly from private breeders, including a few co-operatives (management and purchase of records), with a substantial proportion from the MLC levy board (recording and evaluation services), and from breed societies (pedigree services).

Sheep breeds have a similar structure to beef cattle, but there are few Continually Introduced Breeds, and co-operatives (sire referencing schemes) have a more important role. There are separate breeding goals for the terminal sire, crossing and hill breeds. For most terminal sire breeds the goal is lean growth. Index scores are derived from Estimated Breeding Values (EBVs) for live weight at 20 week of age, ultrasonic fat depth and ultrasonic muscle depth. In some breeds computer tomography is used to provide direct estimates of lean and fat weight (the two components of the breeding goal) on

a proportion of (elite) animals. In crossing breeds, the breeding goal usually comprises measures of maternal performance including litter size, lamb weaning weight and ewe mature weight, in addition to growth or lean growth. In hill breeds the breeding goal is usually based on the traits already mentioned, though recently some breeds have adopted new indexes where the goal includes carcass weight, carcass fatness, carcass conformation, lamb survival, weaning weight, ewe longevity and fleece weight. Index development is in progress for most sectors. DNA-based tests for genetic resistance to scrapie are being widely used, and this is likely to increase as part of a Government led plan to eradicate the disease (the National Scrapie Plan - NSP). This will pose a threat to AnGR if due consideration is not given to the need to maintain genetic diversity, since the frequency of resistant genotypes is low or zero in some breeds. In view of this DEFRA has been conducting a voluntary genotype survey of rare breed flocks with the RBST during 2002.

Comment: Geoff?

Genetic improvement programmes are in place for the intensive sector of the **pig and poultry** industries, and are managed by international breeding companies. Poultry are increasingly concentrated in large flocks (Table 7), and DEFRA statistics show that 75% of breeding sows in England and Wales are kept in 780 large units, some of which are in multiple ownership. Objectives are specific to lines, and consider product yield, product quality and reproduction rate, disease and stress resistance. The weights in the goal differ among lines. Dissemination is as crossbreds. Goals are regularly made available to all farmers although genetic trends are not always readily made available. Genetic resources are derived almost exclusively from breeding companies.

Table 7
Poultry: UK laying flock

% of flock size	1976	2000
Under 5,000 birds	20	6
5 - 20,000 birds	30	15
20,000 + birds	50	79

In the **equine** sector some breed organisations and equestrian sporting bodies record the athletic performance of registered horses for monitoring purposes only. Breed improvement is in the hands of individual breeders who focus on athletic performance rather than productivity.

3.1.4. **Characterisation** is extensive for many mainstream breeds. Some native breeds at risk including rare breeds have had preliminary studies carried out ('The Adaptation of Rare Breeds of British Livestock to Different Environments: A Review', Mercer et al, 1998), but there are large gaps for many native breeds particularly with regard to local adaptation. In all species there are opportunities to increase returns, reduce costs of production and/or make genetic improvement more sustainable, through the wider uptake of performance recording and genetic evaluation. There are also opportunities from recording and evaluating a more comprehensive set of animal characteristics, especially those associated with health, adaptation, welfare/fitness, longevity and product quality.

No specialised **dairy cattle** are being developed for specific production sub-environments within the UK, and much of the development is linked to the wider North American environment and less strongly to other Western European environments. The biggest opportunities lie in more recording and appropriate use of traits related to health and longevity. Other opportunities may arise from the development of alternative production environments such as organics.

Work is in progress to enable development of **beef cattle** AnGR to better exploit the production systems in UK, involving better recording of maternal data and development of information systems to help choose the appropriate AnGR. In beef cattle, the most important opportunities arise from better information on maternal traits since it will likely encourage a wider breed usage and use of more appropriate selection goals within maternal breeds. An additional dimension is the recent interest in the development of composites.

Development work with **sheep** is breed-specific, with the exception of the National Scrapie Plan (NSP), and is targeted towards retaining the local adaptations of the breeds concerned. These adaptations are primarily concerned with the ability to cope with feed resources and climatic conditions associated with uplands and hill land. However, in breeds regarded as terminal sires there is continuing development of growth and muscling traits. There is increasing development interest in genetic resistance to disease, exemplified by the NSP with resistance to gastro-intestinal worms being a specific area that may be addressed in the future.

Development within **pig breeds** does not cater for sub-environments within the UK except perhaps for adaptation to outdoor bred pig systems. However there is interest in surveying minority breeds for any special qualities they may possess, and in examining breeds for their value in different production environments, such as organic systems.

Development within **poultry breeds** will probably be targeted towards adaptation to environments that exclude battery cages for laying hens and to development of and response to new markets such as free range and organic systems for both hens and broilers. Many of the drivers for change originate primarily from welfare concerns.

In pigs and poultry, the most likely reason for improved usage of AnGR is a tougher emphasis by Government on the control of environmental pollution and enhancement of animal welfare, which may lead to new production environments. This will require a review of goals, and may stimulate the development and use of more breeds/strains. In addition the transfer of genes between breeds/strains is important in pigs and poultry to achieve such goals.

There may also be some potential for greater diversity in the utilisation of native breeds and strains for the hotel / restaurant / catering and home hospitality sectors of the market to provide greater consumer choice and interest

Specific action plans (e.g. R&D programmes) are in place for some of these opportunities, although in ruminants there are many organisations which will need to contribute in order to take them forward and make the initiatives effective.

3.1.5. **Population trends** are monitored by a variety of organisations, mainly NGOs. The **dairy industry** is dominated by the Holstein to such a degree that the next three most popular dairy breeds (Jersey, Ayrshire and Guernsey) comprise only 4.5% of the purebred population. The **beef industry** is led by four exotic breeds (Limousin, Charolais, Simmental and the Belgian Blue, which has heavy usage through AI) and one native breed (Aberdeen Angus). However native breeds have achieved increased numbers since the 1998 survey, whereas the numbers of exotic breeds have remained static during that period (Table 8).

The national sheep flock has a uniquely stratified structure with distinct hill, upland and lowland breeding strategies passing breeding stock from one stratum to the next from the top of the pyramid downwards. It relies heavily on 7 breeds (3 mountain, 1 crossing sire, 3 terminal sire) of which 5 are native breeds (Scottish Blackface, Welsh Mountain, Swaledale, Bluefaced Leicester, Suffolk) and two are exotic breeds (Texel and Charollais). In recent years there has been an increase in the number of self-contained flocks, which has increased the population of general-purpose breeds. This probably is the result of increased biosecurity in the wake of disease outbreaks, which had a severe effect on the population of some breeds. Primitive (primarily Northern Short-Tailed) breeds also have increased in number (Table 8).

Table 8
Trends for Groups of Breeds
Number of breeding females 1994-2002 (% change)

	1994-1998	**1998-2002**
Beef cattle:		
Native breeds	1.3	17.3
Exotic breeds	46.8	-1.1
Sheep:		
Primitive breeds		15.8
General-purpose breeds		24.9
Crossing sire breeds		-44.2
Terminal sire breeds		-10.9

The pig and poultry industries are dominated by hybrid stock, based on a hierarchical pyramidal structure of nucleus breeding stock where genetic improvement of purebred populations takes place and multiplier units where parent hybrids are produced. Breed type in pigs has changed from almost exclusive dependence on the Large White and Landrace breeds to a greater use of the imported Duroc. Maternal lines of Duroc developed in the UK have been incorporated into hybrids in response to the move to outdoor systems (which now comprises 25% of all breeding sows) and to satisfy the demand for higher meat quality. The infusion of genes from the Chinese Meishan to impart fecundity has been far less successful and further importations are unlikely. There is a significant "fancier" element within the poultry industry which is recognised as a leisure pursuit, but which plays no real part in the maintenance of commercial AnGR.

The equine industry is comprised increasingly of crossbred animals and modern sport-horses. Some native breeds in particular geographical locations are valued for their environmental management role in controlling scrub (e.g. the New Forest Pony)

3.1.6. **The sustainability of each system** must be evaluated in the context of the criteria defined in the current DEFRA sustainable development policy aim and objectives. These include promoting a sustainable, competitive and safe food supply chain, enhancing opportunity in rural areas, ensuring the prudent use of natural resources compatible with protection and improvement of the environment, conserving and enhancing biodiversity and maintaining high standards of animal health and welfare. "Forward Strategy for Scottish Agriculture" outlines similar sustainable development criteria for the Scottish livestock sector. It is anticipated that livestock farming in the UK will polarise into three broad sectors within the next decade (Brigstocke 2001)

1. High input systems, contained mainly within the pig and poultry industries, mostly based in the arable based eastern half of the country, and the dairy industry, will focus on intensive, technical efficiency with significant vertical integration and involvement of major multiple retailers. They may conflict with environmental and animal welfare concerns.
2. Extensive grass-based low and medium input systems based mainly on beef cattle and sheep in the western lowland pastures, uplands and hills will be characterised by high environmental output and diversification, and are likely to depend on environmental/rural development subsidy.
3. Niche markets will cater for specialist production from locally-adapted and rare native breeds and will be associated with the maintenance of rural infrastructure and biodiversity. Much of this production will evolve around the main conurbations associated with farmers' markets and more affluent consumers.

3.1.7. **The ability for capacity building** will be realised most effectively by the maintenance of a network of organisations in UK, by the effective employment of existing human resources, and by maintaining the international pathways of communication. A network needs to include all sectors in the livestock industry (breeders, breed societies, research institutes, conservation NGOs, commercial organisations) focused round a central database (e.g. BCMS for cattle).

4. Identifying national priorities for the conservation and utilisation of AnGR.

National priorities should recognise the framework prepared by FAO, and the main elements of the FAO Global Programme for the management of AnGR provide a guide for national programmes. They are

1. **Identify** and understand those unique genetic resources which collectively comprise the global gene pool for each of the important species domesticated and used to provide food and agriculture.
2. **Develop** and properly utilise the associated diversity to increase production and productivity, achieve sustainable agricultural systems and meet demands for specific product types.
3. **Monitor** those resources which are at risk or being substituted.
4. **Preserve** the unique resources for which sufficient current demand does not exist.
5. **Develop and utilise human resources** for the management of AnGR and the maintenance of diversity.
6. **Communicate** the importance of AnGR.

4.1. National cross-cutting priorities.

The development of a new strategy for AnGR is fundamental to the creation of a policy to achieve the objectives detailed by FAO.

Improving the information infrastructure is a priority if breed utilisation and development is to be effective. Information from farmers made available through recording schemes and appropriately linked databases will be necessary to address the increasingly complex livestock objectives required to meet the needs of society and commerce. This involves many stakeholders including the public. There is a need to improve the quality of the information recorded and extend it to include more information on animal health and welfare. This will lead to better breed choice and more appropriate breed development.

Training in genetic management and the operation of livestock conservation and improvement schemes needs to be reviewed and brought up to date in agricultural colleges and universities.

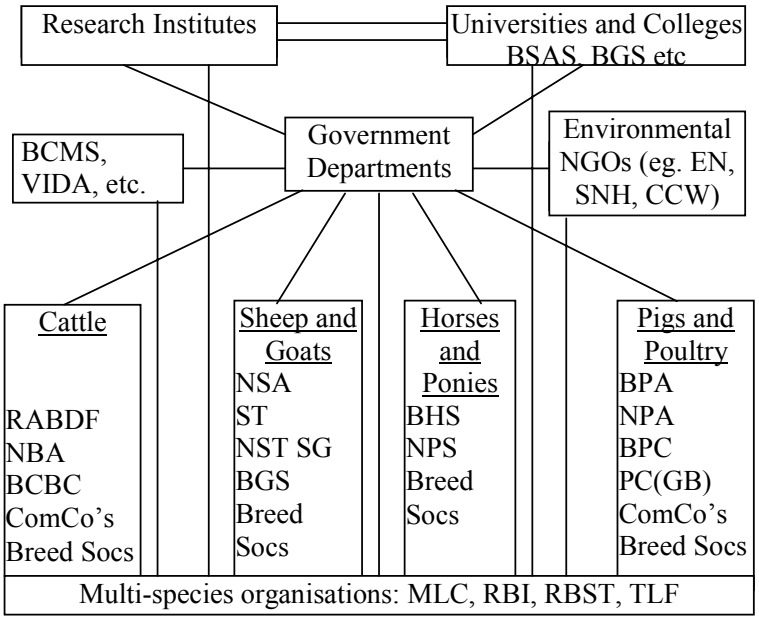
Raising awareness throughout society of AnGR, highlighting the importance of its conservation and appropriate development is a priority, both by education outside the livestock industry and dissemination of information within it.

Technology transfer is effective in some areas of the livestock industry. For example, MDC Evaluations Limited (a genetic evaluation organisation funded by levy) provides impartial information to all dairy farmers, and MLC provides similar information for beef and sheep breeders through BLUP programmes. DEFRA's Sustainable Livestock Production LINK programme has been instrumental in funding Research in collaboration with breeding companies and research institutes into the identification of useful QTLs for commercial pig, poultry and beef genetic improvement programmes and new approaches to the sustainable use of genetic variation in livestock. But there is a need for far greater uptake of these various programmes among those breeds where the need for genetic improvement at commercial breeding level is most acute – particularly in the sheep and specialist beef sectors.

Integration of a wider diversity of AnGR in mainstream systems of production is likely to take place very slowly, and measures must be applied to focus and strengthen conservation.

4.1.1. **The need for a national strategy** for the conservation and utilisation of AnGR requires the creation of a network of stakeholder organisations representing all sectors of the industry (Figure 1). This requires that Government databases (e.g. BCMS, Veterinary Investigation Diagnostic Analysis (VIDA), National AnGR Database etc.) are integrated wherever this is legally permissible, and become more user-friendly and accessible by stakeholders in the industry. A strategy also requires cross-referencing throughout the network to avoid unnecessary duplication of resources. Development of standardisation of criteria for recognition of breed status between NGOs and governmental organisations also needs to be considered. (Alderson G L H. 2001. Criteria for the Recognition and Prioritisation of Breeds of Special Genetic Importance. (Personal Communication)). Breed societies, NGOs and special interest groups, which focus on specific issues (e.g. Northern Short-Tailed Sheep Group on scrapie; the Beef Improvement Group on composite breeds of beef cattle), need to be included in the network of co-operation as described in Diagram 1:

Diagram 1 - Organogram of UK organisations involved in AnGR
(See Appendix 1 for Glossary of abbreviations)



4.1.2. **DEFRA and devolved administrations' objectives** for the countryside must be addressed. In the post Second World War period, the policy of successive British Governments to ensure security of food supply for UK, compounded later by production subsidies under the CAP, led to increased production in many sectors. During the 1980s and early 1990s this led to an expansion in ruminant livestock production, especially sheep, until quota ceilings were reached in those species. This led to over-production in certain commodities, notably beef, dairy products (where intervention "mountains" of beef and butter developed) and lamb. As a result the CAP is being reformed so that subsidies are increasingly paid into "public goods" (such as protecting and enhancing the environment, rural development and diversification of farm businesses, animal welfare, consumer assurance on food safety, etc) rather than on production per se. Specific issues, such as greenhouse gas emissions and the production of environmental pollutants, need to be addressed.

The reform of the CAP, to reduce direct production support measures and encourage more environmentally sustainable production, is likely to favour a revival in more traditional native breeds which can thrive under low input systems and which can deliver specific environmental benefits through local adaptation. It will also increase the emphasis on longevity, which will help to reduce wastage.

Extensification is now being encouraged in the beef and sheep sectors through the reduction in stocking densities on grazing land. There is provision under the Rural Development Regulation (Council Regulation 1257/99 implemented under Commission Regulation 1570/99) to provide production support on a headage basis to breeds (cattle, sheep, pigs and poultry) that satisfy certain numerical and environmental criteria set by the EU. None of the national programmes in the UK has implemented this measure, in part because of the inappropriately low allocation of EU rural development resources to the UK.

Globalisation and the development of international retailing has ensured that adequate food supplies in most products are available 52 weeks of the year whether home produced or imported. The domestic poultry and pigmeat sectors which are relatively unprotected are particularly losing market share to cheaper imports which are in abundant supply.

4.1.3. **Environmental factors.** Programmes for AnGR must be compatible with environmental priorities. A regional pilot initiative by English Nature concerned with holistic environmental land management, proposes tiered payments for environmental projects, and includes a Traditional Breeds Incentive whereby the use of appropriate native breeds of livestock approved by Traditional Livestock Foundation qualifies for an extra tier of support grant. The integration of livestock in ecological projects sets a precedent for an holistic approach to conservation by securing wildlife conservation and associated environmental benefits and promoting the conservation of native AnGR on a whole farm basis.

4.1.4. **Improved training and knowledge transfer** is a basic requirement. Lack of expertise and knowledge is evident across many levels. The following two areas are of particular importance:

Training in Animal Genetics: Genetic management from conservation to improvement is inadequately serviced at all levels within the education system. Conservation philosophy and methodology relating to AnGR is largely absent from programmes of education, although modules for conservation biology have been introduced in some degree courses. Understanding of the operation of improvement schemes is also poor and should be better covered in agricultural colleges and universities. There is a lack of new graduates in genetics courses associated with agriculture. Opportunities for extension work using NGOs could usefully be encouraged

Training in Management of AnGR Land-based practical education delivered through the traditional County Colleges has been significantly reduced, as they have changed their curricula towards a range of Higher Education courses up to post-graduate level. There has been no adequate replacement for the Agricultural Training Board. The County Colleges are a potential resource therefore, which could become regional centres offering training, advice, information and business support, through workshops and training programmes, internet-based courses, seminars and full-time education. Introductory courses for part-time farmers and breed enthusiasts with no agricultural background has also been identified as a key need, particularly in encouraging AnGR conservation.

Training for existing livestock farmers could benefit from the development of a network of demonstration farms. DEFRA have initiated discussion on a recommendation of the Policy Commission on Food and Farming to establish such farms.

There is also a need to offer more management courses for students in the environmentally and economically sustainable livestock and land management systems of the future.

4.1.5. **Breed characterisation and evaluation**: Information on performance standards for mainstream breeds is often made available to and aimed at the commercial

interests of the provider only. Similarly BLUP, EBVs and Profit Index (PIN) for dairy breeds along with other valuable genetic evaluation programmes are directed at mainstream breeds only. They fail to benefit many native breeds at risk. It is, however, the case that effective and efficient improvement schemes can not be operated in breeds with limited numbers of animals or limited numbers recorded, and further information on breeds at risk is likely to require more, rather than redirected, input of resource.

There is a need therefore to expand knowledge of native breeds at risk which may possess specific traits which could be of potential benefit not only in future commercial production, but also in delivering environmental, human health, animal health or animal welfare benefits.

Information on genetic/environment interactions, especially with regard to locally adapted breeds (e.g. their use in conservation grazing) is provided by the Grazing Animals Project (GAP) in 'Breed Profiles'. Incentives for the greater utilisation of native rare and locally adapted breeds are being provided through brand names linked to breeds (e.g. Aberdeen Angus), to localities (e.g. Lakeland lamb) or through specific conservation schemes (e.g. the Traditional Breeds Meat Marketing Scheme). The devolved administrations in Scotland, Wales and Northern Ireland are now encouraging the promotion of products from their native breeds (e.g. Welsh Black) as a part of their national heritage. There are numerous more localised 'breed led' branding initiatives such as for Herdwick, Rough Fell, Blackface, Swaledale and Dalesbred sheep, and Sussex, Devon, Hereford and Beef Shorthorn cattle. Confusion sometimes arises where a breed carries the name of its locality or region (e.g. Cotswold sheep), and a certified brand is applied to any animal from that region not just to the breed. Training in whole chain marketing and awareness campaigns are therefore needed to develop such schemes.

The ability to improve mainstream AnGR in the directions that are commensurate with the delivery of public goods and new marketing opportunities will depend on the information infrastructure available for recording appropriate traits.

4.1.6. **Genetic diversity:** Information on genetic diversity (e.g. genetic distance, heterozygosity, inbreeding, breeding programmes) and specialist production systems for native breeds is provided by research institutes, universities and conservation NGOs, but currently is fragmented and would benefit from central co-ordination and further research.

Because resources are limited, prioritisation of breeds is necessary. The UK Government has recognised the rare breed categorisation given in Appendix 4 but additional criteria such as distinctiveness and local adaptation as identified by FAO might also usefully be used to prioritise breeds at risk which are not necessarily rare but may still need to be conserved.

Further research is necessary on the value and economic viability of rare and locally-adapted breeds in low-input systems of production. As priorities for agriculture, farming and rural development change in the UK, a need for more information on the value of native breeds is emerging. Some native breeds at risk may well have traits that are of particular value in delivering environmental benefits. For example, some breeds may have specific adaptations that enable them to thrive in low-input systems of production or are particularly efficient in the utilisation and retention of nitrogen.

There is an urgent need to

(i) encourage breeding organisations responsible for mainstream breeds to incorporate selection procedures to manage genetic variation within their breeding populations
(ii) encourage statement of policy on their management of variation
(iii) use these procedures to reduce the rate of loss of genetic variation

4.1.7. **Cryopreservation** of genetic material plays a role in both

a) breed improvement programmes (currently most in use for mainstream breeds)

b) the preservation of genetic variability (currently most in use by native breeds at risk).

Gene Banks are maintained by bull breeding companies, pig breeding companies, and several NGOs, but a central national register for all breeds is required.

4.1.8. **Rural infrastructure.** Under the Rural Development Regulation, implemented through the four national Rural Development Plans, there are various schemes available that encourage the development of rural businesses. They may include the utilisation and marketing of products, such as meat, wool, amenity and activity centres etc, associated with particular species and breeds of farm animal – particularly where identifiable rural skills are required.

A new EU Council Regulation on the conservation, characterisation, collection and use of genetic resources in agriculture is likely to replace Council Regulation 1467/94, which expired in 1999. The new Regulation is intended to provide a platform for partial EU funding of nationally managed pan European programmes for AnGR projects. It will focus on in situ and on farm conservation projects, characterisation studies and development of European databases.

4.2. National priorities among animal species, breeds, country's regions and rural communities.

All breeds will benefit from improving the national information infrastructure to help both characterisation and sustainable development of AnGR. Whilst conservation of mainstream breeds (such as those that benefit from the programmes of international breeding companies) is ensured by the financial incentives of commercial companies and by the support of major breed societies, their sustainable development is not guaranteed. Commercial breeding companies are more likely to respond to international rather than exclusively national demands for breed conservation. National priorities for conservation support need to be directed primarily to native breeds that are locally adapted, have distinctive genetic characteristics, or are rare particularly with regard to long-term sustainable programmes which will reinforce the economic structure of rural society and at the same time protect the environment.

4.2.1. **Locally adapted breeds** (those so perceived are designated L in Appendix 3) are important because of their value in agri-environment schemes (e.g. for maintenance of ecological systems and for efficiency of production in local environments) and are vulnerable because of their limited geographical distribution. The value of local adaptation is seen in the increased interest in grass-fed beef and the ability of some native breeds to thrive on semi-natural rough grazing. Also the Sheep Trust has an active cryo-preservation programme for native sheep breeds, including both long-term and “immediate use” storage

to maintain genetic diversity in threatened breeds. Such developments could be encouraged through the following mechanisms:

~ **Incentives to maintain local native breeds** could be applied through National Development Plans under the Rural Development Regulation. The FMD 2001 outbreak severely threatened some local breeds such as the Herdwick, Rough Fell and South Country Cheviot which lost 35-40% of their population.

~ **Support for national and regional native breeds** could also be applied through DEFRA for England and the devolved administrations for Scotland, Wales and Northern Ireland through agricultural development and whole chain marketing schemes.

~ **The Traditional Breeds Incentives** scheme, launched by English Nature, in co-operation with Traditional Livestock Foundation, could be extended to become a national scheme, and could include assistance with setting up breeding units.

~ **Grazing Management Projects** (such as the Grazing Animals Project – GAP) that encourage the use of locally adapted native breeds for environmental management purposes could be further encouraged.

4.2.2. **Distinctive breeds** (designated D in Appendix 3) are important because distinctiveness is identified by FAO as a high priority criterion and because of its cultural interest. Native breeds at risk with special morphological characteristics, performance characteristics or great genetic distance should be identified and prioritised in conservation programmes. Such breeds are of particular interest under the Convention on Biological Diversity (CBD). Their genetic importance may justify incentive payments without the qualification of environmental factors, and they should have priority in characterisation studies.

4.2.3. **Rare breeds** (designated R or R* in Appendix 3) are high priority for conservation because their low numbers are associated with increased loss of genetic diversity, or extinction in extreme circumstances. Rare breeds currently identified as high priority for AnGR conservation programmes are listed and revised annually by the RBST (Appendix 4). The RBST has implemented a range of support programmes for breed conservation and utilisation over many years, and is currently developing a privately funded conservation archive for all UK listed rare breeds including a cryogenic storage facility and germplasm collection schemes. An archive and library to store knowledge and information regarding UK rare breeds is also in progress. The RBST has also developed pedigree analysis software and is currently implementing a national conservation breeding programme which utilises results from the analysis. This work is to be encouraged from a national perspective.

4.2.4. Significant benefits would be derived from the co-ordination of all AnGR NGO programmes through a proposed **national co-ordinating committee,** which also should include in its remit the evaluation of other species that currently have only peripheral importance (deer, wild boar ,rabbits, camelids, water buffalo, etc. – see Appendix 6). A concerted conservation strategy defining national priorities in relation to all breeds at risk needs to be agreed and applied among breeders, NGOs, breed societies, research institutes and Government.

Particular actions might include regular surveys of breed populations, preparation and advice on breeding programmes, development of gene banks, promotion of marketing and research opportunities, and interaction with Government. It should also address the requirement for specific areas of rare breed research and database construction, and make specific provision for all breeds at risk within legislation applied at the national level.

4.2.5. **Purebreeding programmes in mainstream livestock breeds** require an improved information infrastructure and more proactive management of genetic variation to secure more holistic breeding goals and their long term sustainability, respectively.
In poultry, goals are being extended to cover wastage within commercial environments, including longevity of breeding stock, such as the laying period in hens. Developing understanding of the breadth of diversity and the threats to it in all species is ongoing.
One issue that is of concern is the risk of migration of AnGR out of the UK particularly within the pig sector as commercial breeding companies relocate abroad where legislative constraints may be less onerous and the wider industry more commercially viable. At present breeding stock is produced domestically under conditions which satisfy stringent UK demands on animal welfare and food hygiene. This advantage may be eroded if key AnGR are lost to countries with different breeding goals.

5. Recommendations for enhanced co-operation in the field of farm animal biodiversity.

5.1. Recommendations.

5.1.1. **International co-operation** on AnGR currently is achieved effectively through several channels. These should be reinforced and become more interactive:

5.1.1.1. **The National Co-ordinator for Animal Genetic Resources (NC)** acts at Governmental level for the UK and plays an active role through the European Regional Focal Point (ERFP) of FAO. The NC represents the UK on animal genetic resources at the FAO Intergovernmental Commission on Genetic Resources for Food and Agriculture.
Data on AnGR in the UK is submitted to the DAD-IS database in Rome through the NC. There is a pressing need for greater harmonisation of databases at national, European regional and global level. It is hoped that a part EU funded 5th Framework Programme (FP5) project (EFABIS) started in 2002 will enable the software programmes to accomplish this to be developed. This work should be encouraged.
It is UK Government policy to conserve and enhance biodiversity, and to lead integration of these with other policies across Government and internationally. Therefore the UK should play an active role in developing pan-European AnGR conservation activities especially as animal breeds do not respect national boundaries and international co-operation has cost-benefits.

5.1.1.2. **Rare Breeds International** interacts with FAO at the global level and EAAP at the European regional level, advising member NGOs with regard to evolving international standards. Procedures for biological impact studies have also been developed and can be used in a national context to minimise substitution of native by exotic AnGR (Rare Breeds

International 2001, Personal Communication). Stronger collaboration between RBI and the ERFP for AnGR is recommended particularly in the area of establishing internationally recognised criteria for endangerment across Europe.

5.1.1.3. **Research institutes and NGOs** effect collaboration at European regional level under EU legislation, and also at a global level for some breeds and research topics. Animals were inadequately represented in projects approved under FP5; only 4 out of 21 projects were concerned with AnGR. A collaborative proposal (the so-called DIVA project) to establish a network of excellence focusing on AnGR seeks to re-dress the balance in FP6. UK institutes should be active in pursuing such funding opportunities for AnGR research and development.

5.1.1.4. **International trade.** FAO should be aware of the effects of international trade on AnGR. It is recommended that FAO should enhance its ability to provide unbiased advice on breeds to enable developing countries to make better-informed decisions on the breeds that are most likely to contribute to national development in their own particular circumstances. The use of high-genetic non-adapted animals may cause problems.

The UK has an active export market, which can underpin the conservation of AnGR, and which may assist in the alleviation of hunger and poverty in some areas of the world. Prior to the recent BSE, Classical Swine Fever and FMD outbreaks, exports of pig breeding stock had a value of £100M annually (including hybrid parent stock). Similarly British exporters of cattle and sheep breeds have historically had a huge impact on the development of AnGR around the world. Every effort should be made to facilitate the re-establishment of this business where there is genuine demand, by seeking the lifting of restrictions imposed as a result of the recent disease status of the UK. Some UK developed poultry strains are used world-wide, as indeed some valuable genetic material is imported. It is important that conservation of indigenous breeds should never be used as a reason for inhibiting the international exchange of useful genetic material. Revitalising international trade in the UK's animal genetic resources is considered a key priority to assist in maintaining a threatened animal breeding infrastructure by bringing in much needed income to fund evolving breeding objectives associated with sustainable development of the livestock sectors in the UK.

5.1.1.5. **Imported products.** It is important to minimise the dangers to the conservation of AnGR arising from the importation of food and other animal products infected by zoonotic and other notifiable animal diseases by ensuring effective border controls.

5.1.1.6. **International Collaboration.** In view of the increasing globalisation of commercial animal breeding (especially in the dairy, pig and poultry sectors) and the fact that the long-term economic sustainibility of commercial breeding companies cannot be guaranteed it is recommended that FAO keeps a close watch on their commercial viability and competitiveness and the high performance AnGR that they retain. The loss of such resources could have serious consequences for global food security in the future and collaborative international action would need to be taken to restore those resources.

5.1.2. **European Regional Co-operation**:

It is recommended that European and more especially EU Member States' co-operation on AnGR be encouraged at Governmental, NGO and Research Institute level, particularly in the area of conservation and utilisation of genetic resources. There are cost benefits to a European approach to these issues and the principal vehicle to greater co-operation is through the ERFP (See 5.1.1 above) with technical back-up from the European Association of Animal Production (EAAP). The UK should continue to play a full role in the development of the ERFP. There are a number of priorities that should be progressed at European level:

~ standardise criteria for the categorisation and prioritisation of breeds in AnGR.

~ harmonise national AnGR databases with the EAAP database in Hanover and DAD-IS

~ develop joint AnGR conservation management plans through the ERFP and EAAP.

~ harmonise zootechnical and disease control regulations in relation to AnGR at EU level

5.1.3. **National Co-operation.**

Programmes for the conservation of AnGR will be applied most effectively by the joint efforts of Government and private organisations and individuals. Government should be urged to provide pump-priming funds to the livestock breeding sector, noting that the issues are environmental and cultural, not solely agricultural. More importantly, the public at large through voluntary contributions should be encouraged to provide subsequent inputs of expertise and finance. The existing collaborative framework in the UK between academia and the livestock industry can be developed by improving networks such as Faraday Partnerships to facilitate flows of concepts and information, promote the partnership ethic, promote core research and promote business-relevant postgraduate training.

5.1.3.1. **Mainstream Breeds.** Recommendations for co-operation on breeds used in mainstream agriculture are catered for under overall national agricultural policy and commercial interests in the UK. Mainstream breed interests are well represented by a range of species associations (NBA, NCAD, NSA, BPA, NPA, BPC etc) who also represent the interests of individual mainstream breed societies. The recommendations for national co-operation in this report therefore focus principally on the enhancement of farm animal genetic diversity and the specific actions needed to encourage the conservation and utilisation of our native and exotic breeds at risk.

5.1.3.2. **Breeds at Risk (Locally adapted, Distinctive and Rare).** National co-operation is recommended in the following areas:

~ **Evaluation of global status.** Recognising the value of wider dispersal of each breed (subject to the correct environment), and evaluating each national breed population in the context of its global status is recommended. In doing so, due consideration must be given to the

divergence over time of populations separated by barriers to gene flow and/or contrasting environment

~ **Use of biological impact studies.** Assessment of the possible effect of substitution of native AnGR by exotic breeds by the application of genetic (biological) impact studies (Rare Breeds International 2001) preceding importation, including the evaluation of incoming genetic material is considered advisable.

~ **Provision of dedicated resources.** Provision of specific resources for native breeds at risk, including dedicated public and private funding where available, through collaboration within a concerted national conservation strategy (see 4.1.1. above) is recommended. The following projects have been identified as collaborative ventures worthy of co-ordinated national support:

Longer Term Projects

- The creation of national rare, locally adapted and distinctive breeds gene banks
- The creation of a national rare breeds library

Medium Term Projects

- The development of communication networks among Government, Breed Societies, NGOs, extension services and research institutes
- The maintenance and improvement of the Breed Society infrastructure
- The characterisation of breeds for the purposes of linking local and specific adaptations and niche markets or specialist uses

Short Term Projects

- The construction.and maintenance of a national rare breeds pedigree database
- Assistance with provision of computerised recording systems to Breed Societies

5.1.4. **National NGOs.** There is an urgent need for more effective co-ordination and complimentary action among NGOs and breed organisations operating at the national level. Harmonisation of conservation criteria and goals with regional and global policy is unlikely to be effective until this is achieved. Criteria for recognition and prioritisation of native breeds have been identified and are under review with EAAP and FAO (Alderson G.L.H, 2001). These procedures could help to form the basis of a national programme for conservation of native AnGR.

5.1.5. **Human resources.** The UK has a significant reservoir of human resources with international experience, and with expertise in the practical management of minority AnGR and the methodology of genetic conservation. These resources should be harnessed through workshops and seminars to disseminate a wider understanding of AnGR and ability both nationally and internationally.

5.1.6. **National Action Plan** The creation of a National Action Plan, facilitated through the National Co-ordinator, for the conservation and utilisation of AnGR in the UK based on the recommendations in this Report is strongly recommended. A possible template for the process that might be followed in establishing a NAP is given in Appendix 8.

5.1.7. **National Steering Committee.** The initiative created by SoWAnGR has established a valuable foundation in the form of the NCC on which to build an

ongoing structure for the effective monitoring and management of AnGR in UK. The creation of a Steering and Advisory Committee in the UK is strongly recommended.

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Appendix 1

Glossary of Organisations:
ADC: Animal Data Centre
ARAD: Agriculture and Rural Affairs Department of the Welsh Assembly
BCMS: British Cattle Movement Service
BGS: British Grassland Society
BPA: British Pig Association
BPC: British Poultry Council
BSAS: British Society of Animal Science
CCW: Countryside Council for Wales
DARD: Department of Agriculture and Rural Development, Northern Ireland
DEFRA: Department for Environment Food and Rural Affairs
EN: English Nature
GAP: Grazing Animal Project
MDC: Milk Development Council
MLC: Meat and Livestock Commission
NBA: National Beef Association
NCAD: National Cattle Association, Dairy
NGOs: Non Governmental Organisations
NPA: National Pig Association
NSA: National Sheep Association
NST SG: Northern Short-Tailed Sheep Group
PC (GB) Poultry Club of Great Britain
RABDF: Royal Association of British Dairy Farmers
RI: Roslin Institute
RBI: Rare Breeds International
RBST: Rare Breeds Survival Trust
SAC: Scottish Agricultural Colleges
SEERAD: Scottish Executive, Environment and Rural Affairs Department
SNH: Scottish National Heritage
ST: Sheep Trust
TLF: Traditional Livestock Foundation
VIDA: Veterinary Investigation Diagnostic Analysis

Appendix 2
Production, Import and Export Data (Source: Agriculture in the UK 2001, DEFRA)

Table 2 - Meat

UK supply and use of meat ('000 tonnes, dcw)										
	Beef & Veal		Mutton & Lamb		Pork		Bacon & Ham		Poultry meat	
	1995	2000	1995	2000	1995	2000	1995	2000	1995	2000
Home-fed production	1 002	706	403	389	791	725	245	209	1 415	1 513
Imports from: the EU (k)	145	133	15	17	168	269	228	268	249	321
the rest of the world	67	64	132	117	-	5	-	-	2	34
Exports to: the EU (l)	263	11	191	132	167	175	5	9	108	116
the rest of the world	72	-	2	1	22	33	1	1	55	58
Total new supply	880	892	356	390	771	790	467	468	1 503	1 694
Increase in stocks	- 23	- 21	4	- 5	-	- 7	- 1	- 1	3	- 13
Total domestic uses	903	913	352	395	771	798	468	468	1 500	1 707
Home-fed production as % of total new supply for use in UK	114%	79%	113%	100%	103%	92%	52%	45%	94%	89%
Closing stocks	56	40	15	9	11	8	2	4		

Table 3 - Milk

UK supply and use of milk (million litres)		
Year	**1995**	**2000**
Production	14 259	14 078
Imports	181	105
Exports	185	445
Total domestic use	14 255	13 738
of which:		
For liquid consumption	6 922	6 768
for manufacture	6 918	6 550
of which:		
Butter (i)	273	270
Cheese	3 182	3 032
Cream (i)	279	266
Condensed milk (j)	661	522
milk powder - full cream	623	932
milk powder - skimmed	1 422	889
other	480	640
Dairy wastage and stock change	113	91
Other uses (k)	301	329

Table 4 – Milk Products

UK Supply of Milk Products		Butter		Cheese		Cream: fresh, frozen and	sterilised
Year		1995	2000	1995	2000	1995	2000
Production (c)		133	132	362	340	281	270
Imports from:	the EU	49	80	187	225	4	10
	the rest of the world	65	38	23	30	-	-
Exports to:	the EU (d)	47	39	39	48	77	86
	the rest of the world	6	6	16	10	2	1
Total new supply (d)		194	204	517	536	207	193
Increase in stocks (e)		- 8	- 5	-5	0	. .	. .
Total domestic uses (d) (e)		201	209	522	536	207	193
Production as % of total new supply for use in UK		69%	64%	70%	63%	136%	140%
Closing stocks (e)		11	17	17	10	. .	. .

UK Supply of Milk Products (contd)		Condensed milk		Milk powder full cream		Skimmed milk powder	
Year		1995	2000	1995	2000	1995	2000
Production		181	162	90	105	117	83
Imports from:	the EU	12	14	8	11	14	13
	the rest of the world	-	-	-	-	-	-
Exports to:	the EU	24	29	27	27	40	77
	the rest of the world	41	3	50	74	16	35
Total new supply		129	144	21	15	74	- 16
Increase in stocks		- 2	- 1	1	- 1	- 7	- 66
Total domestic uses		130	145	20	16	82	50
Production as % of total new supply for use in UK		141%	112%	n/a	n/a	157%	-527%
Closing stocks		10	7	3	2	11	5

Table 5 – Hens' Eggs

UK Supply of eggs (million dozen)		1995	2000
UK production of eggs for human consumption		774	752
of which:	eggs sold in shell	663	615
	eggs processed	112	136
Imports from :	the EU	64	91
	the rest of the world	1	2
Exports to :	the EU	20	15
	the rest of the world	2	3
Total new supply		818	827
Production of eggs for human consumption as % of total new supply for use in UK		95%	91%

Table 6 –Hides and Skins Production

UK slaughterings (incl. OTMS) of Cattle and Sheep (millions) = No. of Hides and Skins available		
Year	**1995**	**2000**
Total Cattle	3.3	3.2
Steers & Young Bulls	2.5	2.3
Bulls & Cows	0.8	0.9
Total Sheep & Lambs	19.2	18.4
Ewes & Rams	2.0	2.4
Lambs & Other Sheep	16.7	16.0

Table 7 – Leather Production

UK Leather Production		
Year	**1995**	**2000**
Wet Blue & Crust Tonnes (000)	43.4	46.0
Footwear, Upper, Lining, Ft² (Mill)	64.6	53.0
Footwear Bottoms, Tonnes (000)	1.7	1.1
Garment and Gloves Ft² (Mill)	32.0	21.0
Upholstery Ft² (Mill)	67.4	68.0
Chamois Ft² (Mill)	8.5	1.4
Shearling Skins (Mills)	0.5	0.4
Industrial Tonnes (000)	0.5	0.4
Other Ft² (Mill)	5.0	3.5
Total Finished Ft² (Mill) Equivalent	186.1	163.3

Source: ONS & BLC Estimates

Table 8 – Leather Trade

UK International Trade (`000 Tonnes)				
	Value (£million)		**Volume ('000 tonnes)**	
Year	**1995**	**2000**	**1995**	**2000**
Raw Hides and Skins				
Imports	97.0	63.6	63.1	50.1
Exports	213.7	143.1	113.4	117.3
Simply Tanned Leather				
Imports	36.2	31.6	11.0	7.4
Exports	50.2	53.0	16.9	29.6
Dressed Leather				
Imports	152.6	117.1	21.4	10.1
Exports	222.5	171.1	13.0	12.9

Source: HM Customs & Excise

Appendix 3 : UK National Database for AnGR

BREED GENERAL			BREED STATUS					BREED UTILISATION	
					conservation programmes in plac				
SPECIES	BREED NAME	Registered breeding females, UK^^	BREED ORIGIN (N=Native; E=Exotic)	BREED STATUS IN UK (M=Mainstream; D=Distinctive; L=Locally Adapted; R=Rare)	IN SITU	EX SITU	ORGANISATION(S) or SCHEMES^ RESPONSIBLE	PRIMARY USE IN THE UK	INFORMATION SOURCE
Cattle	Aberdeen Angus	11500*	N	M	Beef records	S/E	BS, MLC	Beef, Terminal Sire	BCMS, RBI, BS
Cattle	A. Angus (orig. popn.)	<150	N	R	BA, NM	S	RBST,TBMMS^	Beef, Terminal Sire	RBST, BS
Cattle	Angler Rotvieh	40	E	R**					BCMS, RBI
Cattle	Ankole	15	E	R**					BCMS, RBI
Cattle	Armoricaine	25	E	R**					BCMS, RBI
Cattle	Aubrac	50	E	R**					BCMS, RBI
Cattle	Ayrshire	7000	N	M	Milk records	S	BS, MDC	Dairy	BCMS, BS
Cattle	Bazadaise	300	E	R**					BCMS, RBI, BS
Cattle	Beef Shorthorn	582[2]	N	R	BA, NM, TBI	S	EN, RBST, TBMMS^	Beef suckler	RBST, BS
Cattle	Belted Galloway	1400[2]	N	R,D,L	BA, NM, TBI	S	EN,RBST,RBI,TBMMS^	Hill beef suckler	RBST, BS
Cattle	Bison	45	E	R**					BCMS
Cattle	Blonde d'Aquitaine	8500	E	M					BCMS,RBI,BS
Cattle	Blue Albion	95	N	R*	BS			Beef suckler	BCMS, BS
Cattle	Brahman	35	E	R**					BCMS, RBI
Cattle	Bretonne Pied Noire	10	E	R**					BCMS, RBI
Cattle	British Belgian Blue	10000	E	M					BCMS,RBI,BS
Cattle	British Friesian	12000	E	M	Milk records	S		Dairy	BS
Cattle	British White	1368[3]	N	R	BA, NM, TBI	S	EN,RBST,RBI,TBMMS^	Beef suckler	RBST, BS
Cattle	Brown Swiss	1200	E	R**					BCMS, BS
Cattle	Charolais	15000	E	M					BCMS,RBI,BS
Cattle	Chianina	75	E	R**					BCMS,RBI,BS
Cattle	Chillingham	17[4]	N	R	RH	B[1]	BS,RBST	Feral	RBST, BS
Cattle	Danish Red	4	E	R**					BCMS, RBI
Cattle	Devon	1534*	N	L	NM,TBI,records	S	BS,EN,RBI	Beef suckler	BCMS,RBI,BS
Cattle	Dexter	3000*	N	D	BA,TBI,records	S	BS,EN,RBI	Dairy / Suckler	BCMS,CLL
Cattle	Galloway	3500	N	L	TBI,records	S	BS,EN,RBI	Hill beef suckler	BCMS,RBI,BS
Cattle	Gasconne	25	E	R**					BCMS,RBI
Cattle	Gelbvieh	350	E	R**					BCMS,RBI,BS
Cattle	Gloucester	389[1]	N	R	BA, NM, TBI	S	EN,RBST,TBMMS^	Dairy, Beef Suckler	RBST, BS
Cattle	Groningen Blaarkop	30	E	R**		S			BCMS, RBI
Cattle	Guernsey	4500	N	M	Milk records	S	BS,MDC	Dairy	BCMS,BS
Cattle	Guernsey (Island)	1569	N	R*			BS	Dairy	BS
Cattle	Hereford	6500	N	M	Beef records	S	BS,MLC	Beef, Terminal sire	BCMS,RBI,BS
Cattle	Hereford (original)	350[6]	N	R	BA, NM, TBI	S	EN,RBST,TBMMS^	Beef, Terminal sire	RBST, BS
Cattle	Highland	2500	N	D,L	TBI,NM,records		BS,EN,RBI	Hill Beef suckler	BCMS,RBI,BS
Cattle	Holstein	1000000+	E	M					BS
Cattle	Irish Moiled	225[1]	N	R	BA, NM, TBI	S	EN,RBST,TBMMS^	Dairy, Beef Suckler	RBST, BS
Cattle	Jersey	11000	N	M,D	Milk records	S	BS,MDC	Dairy	BCMS, BS
Cattle	Jersey (Island)	4588	N	D, L	Milk records	S	BS	Dairy	BS
Cattle	Kerry	90[3,£]; 1000[2,$]	E	R[1]	BA, NM	S	RBST,TBMMS^	Dairy, Beef suckler	RBST, BS
Cattle	Limousin	17000	E	M				Beef, Terminal Sire	BCMS,RBI,BS
Cattle	Lincoln Red	1521	N	D	TBI, records	S	EN, BS	Beef suckler	BCMS,RBI,BS
Cattle	Lincoln Red(original)	<150[6]	N	R	BA, NM	S	RBST,TBMMS^	Beef suckler	RBST, BS
Cattle	Longhorn	1500[2]	N	R	BA, NM, TBI	S	EN,RBST,TBMMS^	Beef suckler	RBST, BS
Cattle	Luing	1700	N	R*	Beef records			Hill beef suckler	BCMS, BS
Cattle	Maine-Anjou	90	E	R**					BCMS,RBI,BS
Cattle	Marchigiana	70	E	R**					BCMS,RBI,BS
Cattle	Meuse-Rhine-Isse	2800	E	R**					BCMS,RBI,BS
Cattle	Montbeliarde	1300	E	R**					BCMS,BS
Cattle	Murray Grey	600	E	R**					BCMS,RBI,BS
Cattle	N.D.S.	25	N	R*	BA,TBI,records	S	EN,CLL,RBI	Dairy, hill suckler	RBI,CLL
Cattle	Normande	120	E	R**					BCMS,RBI,BS

Cattle	Norwegian Red	10	E	R**					BCMS,RBI,BS
Cattle	Parthenaise	70	E	R**					BCMS,RBI,BS
Cattle	Piedmontaise	350	E	R**					BCMS,RBI,BS
Cattle	Pinzgauer	5	E	R**					BCMS,RBI,BS
Cattle	Red Poll	814[2]	N	R	BA, NM, TBI	S	EN,RBST,RBI,TBMMS^	Dairy, beef suckler	RBST, BS
Cattle	Romangnola	45	E	R**					BCMS,RBI,BS
Cattle	Salers	2500	E	R**					BCMS,RBI,BS
Cattle	Shetland	300[4]	N	R	BA, NM, TBI	S	EN,RBST,[RBI],TBMMS^	Dairy, Beef suckler	RBST, BS
Cattle	Shorthorn	3500	N	R*	TBI/records	S	EN,MDC	Dairy	RBI,CLL
Cattle	Simmental	8900	E	M				Beef suckler	BCMS,RBI,BS
Cattle	South Devon	11500	N	M	Beef records	S,E	BS,MLC	Terminal sire	BCMS,RBI,BS
Cattle	Sussex	2000	N	AR, D	TBI,records	S	BS,EN,RBI	Lowland beef suckler	BCMS,RBI,BS
Cattle	Swedish Red & White	50	E	R**					BCMS,RBI,BS
Cattle	Swiss Grey	7	E	R**					BCMS,RBI,BS
Cattle	Swona	10	N	R*				Feral	RBI,BS
Cattle	Vaynol	32[5]	N	R	BA, NM, TBI	S, B[1]	RBST,TBI,[-]TBMMS^	Conservation	RBST,BS
Cattle	Welsh Black	9000	N	M,L	TBI/records	S,E	BS,EN,RBI	Upland beef suckler	BCMS,CLL,RBI
Cattle	White Galloway	150	N	R*				Upland beef suckler	BCMS
Cattle	White Park	525[2]	N	R	BA, NM, TBI	S	EN,RBST,TBMMS^	Beef suckler	RBST, BS
Cattle	Whitebred	120	N	R*	TBI		EN,RBI	Crossing bull	BCMS,RBI,CLL,BS
Equine	Alpine		E	R**					
Equine	American Quarter		E	R**					
Equine	American Saddle		E	R**					
Equine	Andalucian		E	R**					
Equine	Appalousa		E	R**					
Equine	Arab		E	M					
Equine	Ardennes		E	R**					
Equine	Bavarian		E	R**					
Equine	Camargue		E	R**					
Equine	Caspian	250	E						RBI,CLL,BS
Equine	Cleveland Bay	300[2]	N	R	BA	S[1], B[2]	BS,CLL,RBST,RBI	Middleweight leisure	RBST, BS
Equine	Clydesdale	500[4]	N	R	BA	S[1], B[2]	BS,RBST	Heavy leisure	RBST, BS
Equine	Connemara		E	R**					
Equine	Dales Pony	850[2]	N	R	BA, TBI	S[1], B[2]	BS,EN,RBST	Pony, leisure	RBST, BS
Equine	Dartmoor Pony	330[4]	N	R,L	BA, TBI	S[1], B[2]	BS,EN,RBST	Pony, leisure	RBST, BS
Equine	Eriskay Pony	150[2]	N	R,D,L	BA, TBI	S[1], B[2]	BS,EN,RBST	Pony, leisure	RBST, BS
Equine	Exmoor Pony	575[2]	N	R,D,L	BA, TBI	S[1], B[2]	BS,CLL,EN,RBST,RBI	Pony, leisure	RBST, BS
Equine	Falabella		E	R**					
Equine	Fell Pony	400[4]	N	R,D,L	BA, TBI	S[1], B[2]	BS,EN,RBST	Pony, leisure	RBST, BS
Equine	Fjord		E						
Equine	Friesian		E						
Equine	Hackney		N	R*				Leisure	RBI,NPS
Equine	Haflinger		E	R**					
Equine	Hanoverian		E	R**					
Equine	Highland Pony	658[1]	N	R	BA,TBI	S[1]	BS,EN,RBST	Pony, leisure	RBST, BS
Equine	Icelandic		E	R**					
Equine	Irish Draught	120[4]	E	R[1]	BA	S[1], B[2]	RBST	Middleweight, leisure	RBST, BS
Equine	Lipizzaner		E	R**					
Equine	Lusitano		E	R**					
Equine	Morgan		E	R**					
Equine	New Forest Pony		N	R*,L	TBI		BS,EN,RBI	Pony, leisure	RBI, NPS
Equine	Palomino		E	R**					
Equine	Percheron		E	R**					
Equine	Russian		E	R**					
Equine	Shetland Pony		N	R*,D	BS,EN,RBI			Pony, leisure	RBI, NPS
Equine	Shire	1800[2]	N	R	BA	S[1]	BS,RBST	Heavy, leisure	RBST, BS
Equine	Skewbald/Piebald		N	R*					
Equine	Spotted		N	R*				Leisure	NPS
Equine	Suffolk	69[4]	N	R,D	BA	S[1], B[2]	BS,RBST	Heavy, leisure	RBST, BS
Equine	Tennessee		E	R**					
Equine	Tersk		E	R**					

Equine	Trakehner		E	R**					
Equine	Welsh		N	M	TBI			Pony, leisure	NPS
Equine	Welsh (Feral Section A)	<900[1]	N	R	BA, TBI	S[1]	BS,EN,RBST	Semi-feral	RBST, BS
Goat	Angora		E	M					
Goat	Bagot	80[1]	N	R	BA,TBI	S[1]	RBST,RBGS^	Leisure	RBI, RBST, BS
Goat	Boer		E						
Goat	British Alpine		E						
Goat	Golden Guernsey	700[2]	N	R	BA	S, S[1]	RBST,RBI,RBGS^	Dairy	RBST, BS
Goat	Nubian/Anglo Nubian		E						
Goat	Saanan		E						
Goat	Toggenberg		E						
Pigs	Berkshire	391[8]	N	R	BA, NM	S, S[1]	BPA,RBST,TBMMS^	Meat	BPA,RBST,RBI
Pigs	British Landrace	5538	N	M		S	Commercial	Meat; crossbreeding	
Pigs	British Lop	162[7]	N	R	BA, NM	S, S[1]	BPA,RBST,TBMMS^	Dual Purpose; meat	BPA,RBST, RBI
Pigs	British Saddleback	414[8]	N	R	BA, NM	S, S[1]	BPA,RBST,TBMMS^	Dual-purpose; meat	BPA,RBST, RBI
Pigs	Duroc	1203	E	M					
Pigs	Gloucestershire Old Spot	628[8]	N	R	BA, NM	S, S[1]	BPA,RBST,TBMMS^	Dual Purpose; meat	BPA,RBST, RBI
Pigs	Hampshire	21	E	M					
Pigs	Kune-Kune		E	R**					
Pigs	Large Black	377[8]	N	R	BA, NM	S, S[1]	BPA,RBST,TBMMS^	Dual Purpose; meat	BPA,RBST, RBI
Pigs	Large White	6432	N	M		S	Commercial	Meat; crossbreeding	
Pigs	Middle White	233[8]	N	R	BA, NM	S, S[1]	BPA,RBST,TBMMS^	Meat	BPA,RBST
Pigs	Oxford Sandy & Black	129	N	R*				Dual Purpose; meat	BS
Pigs	Pietrain	363	E	M					
Pigs	Tamworth	214[8]	N	R	BA, NM	S, S[1]	BPA,RBST,TBMMS^	Dual Purpose; meat	BPA,RBST, RBI
Pigs	Welsh	548	N	M		S	Commercial	Meat	RBI, CLL
Sheep	Badger Face Welsh	3500	N	R*	TBI,SG		BS,EN,NSP	Upland lamb	BS
Sheep	Barbados Black Belly		E	R**					
Sheep	Balwen	2000[3]	N	R	SG, BA, NM, TBI	S[1], B	BS,RBST,RBGS^,NSP,TBMMS^,	Upland Lamb	BS, RBS, RBI
Sheep	Beltex	2000	E	R**					BS,RBI
Sheep	Berrichon du Cher		E	R**					
Sheep	Beulah		N	M,L	SG		NSP	Upland lamb	
Sheep	Black Welsh Mountain	7200*	N	M	SG		NSP	Lamb	BS,RBI
Sheep	Blackface (Scottish)		N	M,L	SG, records		BS,NSP,SAC	Mountain lamb	
Sheep	Bleu du Maine	6000	E	M					BS,RBI
Sheep	Bluefaced Leicester	13189*	N	M	SG, records		BS,NSP,SAC	Crossbreeding	BS,RBI
Sheep	Border Leicester	3500*	N	M	SG, records		BS,NSP,SAC	Crossbreeding	BS,RBI
Sheep	Boreray **	93	N	R,D,L	SG, BA, NM, TBI	S[1], B	EN,RBST,RBGS^,NSP,NSTSG,TBMMS^	NST,Lamb	NSTSG,RBST,BS
Sheep	Brecknock Hill		N	M,L	SG		NSP	Hill lamb	
Sheep	British Friesland	360	E	R**					BS,RBI
Sheep	British Milksheep	1232*	N	R*D	BA,SG,TBI,records		CLL,EN,NSP,RBI,SAC	Crossbreeding/dairy	BS,RBI,CLL
Sheep	British Texel	115000	E	M					BS,RBI
Sheep	Cambridge	800*	N	R*	SG,TBI,records		EN,NSP	Crossbreeding	BS
Sheep	Castlemilk Moorit	688	N	R,D	SG, BA, NM, TBI	S, S[1], B	EN, NSP, RBST,RBGS^,TBMMS^	NST,Lamb	NSTSG, RBST, BS
Sheep	Charmoise	370	E	R					BS,RBI
Sheep	Charollais	22500	E	M					BS,RBI
Sheep	Cheviot	43000*	N	M,L	SG		NSP	Hill lamb	BS,RBI
Sheep	Clun Forest	4886	N	M	SG,records		NSP	Lamb	BS,RBI
Sheep	Colbred		E	R**					
Sheep	Contentin		E	R**					
Sheep	Corriedale		E	R**					
Sheep	Cotswold	712[1]	N	R	SG, BA, NM, TBI	S[1], B	EN,NSP,RBST,RBGS^,TBMMS^	Lamb; Longwool	RBST, BS
Sheep	Dalesbred	37500*	N	M,L	SG		NSP	Mountain lamb	BS,CLL
Sheep	Derbyshire Gritstone	2250*	N	R*,L	SG,TBI		EN,NSP	Hill lamb	BS,CLL
Sheep	Devon & Cornwall L'w	2750*	N	R*	SG,TBI		EN,NSP	Lamb; Longwool	BS,CLL
Sheep	Devon Closewool	4340*	N	M	SG	NSP		Lamb	BS,RBI
Sheep	Dorset Down	2034[1]	N	R	SG, BA, NM, TBI	S, S[1], B	EN,NSP,RBST,RBGS^, TBMMS^	Terminal sire; Down	RBST, BS
Sheep	Dorset Horn	2386	N	R*D	SG,TBI,records		EN,NSP	Lamb	CLL
Sheep	Est a Laine Merino		E	R**					
Sheep	Exmoor Horn	20000	N	M,L	SG		NSP	Upland lamb	BS,RBI

Sheep	Finnsheep		E	R**					
Sheep	Galway	150[2]	E	R[1]	SG, BA, NM	S[1], B	RBST,RBGS^,TBMMS^	Lamb; Longwool	RBST, BS
Sheep	Gotland	450	E	R**					NSTSG,RBI
Sheep	Greyface Dartmoor	1685[1]	N	R	SG, BA, NM, TBI	S, S[1], B	EN,NSP,RBST,RBGS^, TBMMS^	Lamb; Longwool	RBST, BS
Sheep	Hampshire Down	4050*	N	M	SG, records		NSP	Terminal sire; Down	BS
Sheep	Hebridean	2298[1]	N	R,D,L	SG, BA, NM,TBI	S[1], B	EN,NSP,NSTSG,RBST,RBGS^,TBMMS^	NST, Lamb	NSTSG, RBST, BS
Sheep	Herdwick	45000	N	D,L	NM,SG,TBI	S, E	EN,NSP,RBI,ST	Mountain lamb	RBI, ST
Sheep	Hill Radnor	1539[1]	N	R	SG, BA, NM, TBI	S[1], B	EN,NSP,RBST,RBGS^,TBMMS^	Hill lamb	RBST, BS
Sheep	Icelandic	300	E	R**					BS,NSTSG,RBI
Sheep	Ile de France	500	E	R**					RBI
Sheep	INRA 401		E	R**					
Sheep	Jacob		N	M,D	SG, records		NSP	Lamb; wool	
Sheep	Kerry Hill	2550[1]	N	R	SG, BA, NM, TBI	S[1], B	EN,NSP,RBST,RBGS^,TBMMS^	Hill lamb	RBST, BS
Sheep	Leicester Longwool	420[1]	N	R	SG, BA, NM, TBI	S, S[1], B	EN,NSP,RBST,RBI,RBGS^,TBMMS^	Lamb; Longwool	RBST, BS
Sheep	Lincoln Longwool	1345[1]	N	R	SG, BA, NM, TBI	S[1], B	EN,NSPRBST,RBGS^,ST,TBMMS^	Lamb; Longwool	RBST, BS
Sheep	Llandovery Hill		N	M	SG		NSP	Upland lamb	
Sheep	Llanwenog	1944[1]	N	R	SG, BA, NM, TBI	S[1], B	EN,NSP,RBST,RBGS^,TBMMS^	Lamb; Shortwool	RBST, BS
Sheep	Lleyn	129643	N	M	SG, records		NSP	Lamb	BS
Sheep	Lonk	3500	N	R*,L	SG,TBI	S	EN,NSP,RBI,ST	Hill lamb	CLL,,ST
Sheep	Manx Loghtan	1253*	N	R	SG, BA, NM, TBI	S[1], B	EN,NSP,NSTSG,RBST,RBGS^,TBMMS^	NST, Lamb	RBST, NSTSG, BS
Sheep	Meatlinc	1000	N	R*	SG, records		NSP	Terminal sire	BS
Sheep	Merino (Tasmanian)		E	R**					
Sheep	North Country Cheviot	86000*	N	M,L	SG, records		NSP	Upland lamb	BS, RBI
Sheep	Norfolk Horn	1061*	N	R	SG, BA, NM, TBI	S, S[1], B	EN, NSP,RBST,RBGS^,TBMMS^	Heath lamb	RBST, BS
Sheep	North Ronaldsay **	666*	N	R,D,L	SG, BA, NM, TBI	S[1], B	EN,NSP, RBST,RBGS^,TBMMS^	NST, Lamb	NSTSG, RBST, BS
Sheep	Oldenburg		E	R					
Sheep	Oxford Down	1529[1]	N	R	SG, BA, NM, TBI	S[1], B	EN,NSP,RBST,RBGS^,TBMMS^	Terminal sire; Down	RBST, BS
Sheep	Poll Dorset	21470	E	M					BS, RBI
Sheep	Polwarth		E	R**					
Sheep	Portland	1339*	N	R	SG, BA, NM, TBI	S[1], B	EN,NSP,RBI,RBST,RBGS^,ST,TBMMS^	Heath lamb	RBST, BS
Sheep	Romney		N	M,L	SG		NSP	Lamb, wool	
Sheep	Rouge de l'Ouest		E	M					
Sheep	Rough Fell	12000*	N	L	SG,TBI	S, E	EN,NSP,RBI,ST	Mountain lamb	BS,RBI,ST
Sheep	Roussin	400	E	R**					
Sheep	Ryeland	3000[3]	N	R	SG, BA, NM, TBI	S[1], B	EN,NSP,RBST,RBGS^,TBMMS^	Terminal sire	RBST, BS
Sheep	Shetland (SSBG)	2500*	N	R*,D,L	SG,TBI,records		EN,NSP,NSTSG,RBGS^,TBMMS^	Hill lamb	BS,CLL,NSTSG
Sheep	Shropshire	1453[3]	N	R	SG, BA, NM,TBI	S[1], B	EN,NSP,RBST,RBGS^, TBMMS^	Terminal sire, lamb; Down	RBST, BS
Sheep	Soay **	1107*	N	R	SG, BA, NM, TBI	S[1], B	EN,NSP,NSTSG,RBST,RBGS^,TBMMS^	NST,Lamb	RBST, NSTSG, BS
Sheep	South Wales Mountain		N	M,L	SG		NSP	Upland lamb	
Sheep	Southdown	1600[4]	N	R	SG, BA, NM, TBI	S[1], B	NSP,RBST,RBGS^,TBMMS^	Terminal sire, lamb; Down	RBST, BS
Sheep	Suffolk	56600*	N	M	SG, records	S, E	MSP, MLC, Commercial	Terminal sire	BS, RBI
Sheep	Swaledale	750000*	N	M,L	SG, records	S	BS,NSP,RBI,Commercial	Mountain lamb	BS, RBI
Sheep	Teeswater	429[2]	N	R	SG, BA, NM, TBI	S[1], B	EN,NSP,RBST,RBGS^,TBMMS^	Crossing sire, Longwool	RBST, BS
Sheep	Vendeen	620	E	R**					BS,RBI
Sheep	Welsh Hill Speckled		N	M,L	SG		NSP	Hill lamb	
Sheep	Welsh Mountain	250000*	N	M,L	SG, records		NSP	Mountain lamb	BS
Sheep	Wensleydale	1624[2]	N	R	SG, BA, NM, TBI	S[1], B	EN,NSP,RBST,RBGS^,TBMMS^	Crossing sire, Longwool	RBST, BS
Sheep	White Face Dartmoor	2094[4]	N	R	SG, BA, NM	S[1], B	NSP,RBST,RBGS^,TBMMS^	Lamb, Longwool	RBST, BS
Sheep	Whitefaced Woodland	656*	N	R	SG, BA, NM, TBI	S, S[1], B	EN,NSP,RBI,RBST,RBGS,ST,TBMMS^	Hill lamb	RBST, RBI, BS
Sheep	Wiltshire Horn	3000[2]	N	R	SG, BA, NM, TBI	S[1], B	EN,NSP,RBST,RBGS^,TBMMS^	Terminal sire, Lamb; Shortwool	RBST, BS
Sheep	ZWARTBLES	1406	E	R**					
Poultry and other Domestic Fowl									
Ducks	Abacot Ranger	>100		E, endangered				increasing	BS
Ducks	Appleyard	60		critical				declining	BS
Ducks	Appleyard Bantam	130		vulnerable				stable	BS
Ducks	Aylesbury	100		endangered				increasing	BS

Ducks	Baldwin			E				believed extinct	BS
Ducks	Bali	<20		E, critical				increasing	BS
Ducks	Black East Indian	>500		E, secure				stable	BS
Ducks	Blue Swedi	<40		E, critical				declining	BS
Ducks	Call (Decoy)	>5000		E, secure				increasing	BS
Ducks	Campbell	>10,000		E, secure				stable	BS
Ducks	Cayuga	200		E, vulnerable				stable	BS
Ducks	Crested	<100		E, endangered				declining	BS
Ducks	Crested Bantam	>200		E, vulnerable				increasing	BS
Ducks	Duclair (Rouen)	<50		E, critical				increasing	BS
Ducks	Gimbsheimer	>5		E				recent import	BS
Ducks	Hookbill	30		E				recent import	BS
Ducks	Huttegem			E				extinct	BS
Ducks	Indian Runner	>1000		E, secure				increasing	BS
Ducks	Magpie	60		critical				declining	BS
Ducks	Muscovy	>5000		E, secure				stable	BS
Ducks	Orpington	>100		endangered				increasing	BS
Ducks	Overberg	30		E				recent import	BS
Ducks	Pekin	>100		E, vulnerable				stable	BS
Ducks	Penguin			E				believed extinct	BS
Ducks	Pommern	2		E				recent import	BS
Ducks	Saxony	150		E, vulnerable				stable	BS
Ducks	Shetland	<60		critical				stable	BS
Ducks	Silver Bantam Duck	50		E, critical				increasing	BS
Ducks	Stanbridge White			E				possibly extinct	BS
Ducks	Streicher			E				believed analogue of Abacot Ranger	BS
Ducks	Welsh Harlequin	<80		critical				declining	BS
Ducks	Whaylesbury			E				believed extinct	BS
Geese	African	50		E, critical				stable	BS
Geese	American Buff	<20		E, critical				declining	BS
Geese	Brecon Buff	<50		critical				stable	BS
Geese	Celler	>5		E				recent import	BS
Geese	Chinese	>150		E, vulnerable				stable	BS
Geese	Czechoslovakian	<10		E				recent import	BS
Geese	Diepholzer	<5		E				recent import	BS
Geese	Elsasser	<5		E				recent import	BS
Geese	Embden	>120		E, vulnerable				increasing	BS
Geese	Faroese	<10		E				recent import	BS
Geese	Greyback	<5		E, critical				declining	BS
Geese	Pilgrim	<60		E, endangred				stable	BS
Geese	Pomeranian	<40		E, critical				stable	BS
Geese	Roman	<70		E, endangered				increasing	BS
Geese	Sebastopol (curly)	<60		E, critical				increasing	BS
Geese	Sebastopol (smooth)	<15		E, critical				increasing	BS
Geese	Shetland	<25		critical				declining	BS
Geese	Steinbacher	>80		E, endangered				increasing	BS
Geese	Toulouse	>100		E, endangered				increasing	BS
Geese	West of England	>50		critical				stable	BS
Miniature poultry	Ancona	>500		E, secure				stable	BS
Miniature poultry	Andalusian	<100		E, endangered				stable	BS
Miniature poultry	Araucana (British)	>600		E, secure				increasing	BS
Miniature poultry	Aseel	>100		E, vulnerable				increasing	BS
Miniature poultry	Australorp	>2800		E, secure				stable	BS
Miniature poultry	Barnevelder	>300		E, at risk				stable	BS
Miniature poultry	Brahma	<200		E, vulnerable				stable	BS
Miniature poultry	Campine			E				possibly extinct	BS
Miniature poultry	Cornish (Indian) Game	>800		E, secure				stable	BS
Miniature poultry	Creve Coeur			E				believed extinct	BS
Miniature poultry	Croad Langshan	>300		E, secure				stable	BS
Miniature poultry	Derbyshire Redcap	<20		E, critical				stable	BS
Miniature poultry	Dominique	<50		E, critical				stable	BS

Miniature poultry	Dorking	<250		E, at risk				stable	BS
Miniature poultry	Faverolle	>900		E, secure				increasing	BS
Miniature poultry	Friesian	>80		E, endangered				declining	BS
Miniature poultry	Frizzle	>1000		E, secure				stable	BS
Miniature poultry	German Langshan	>100		E, vulnerable				stable	BS
Miniature poultry	Hamburgh	>900		E, secure				stable	BS
Miniature poultry	Houdan	<70		E, critical				declining	BS
Miniature poultry	Ixworth							believed extinct	BS
Miniature poultry	Kraienkoppe	<60		E, critical				declining	BS
Miniature poultry	La Fleche			E				believed extinct	BS
Miniature poultry	Lakenvelder	<60		E, critical				stable	BS
Miniature poultry	Legbar							believed extinct	BS
Miniature poultry	Leghorn	>1500		E, secure				stable	BS
Miniature poultry	Malay	>200		E, at risk				stable	BS
Miniature poultry	Marans	>500		E, secure				stable	BS
Miniature poultry	Minorca	>500		E, secure				stable	BS
Miniature poultry	Modern Game	>2000		E, secure				stable	BS
Miniature poultry	Modern Langshan			E				believed extinct	BS
Miniature poultry	New Hampshire Red	>300		E, secure				increasing	BS
Miniature poultry	Old English Game	>10000		E, secure				stable	BS
Miniature poultry	Orloff	<70		E, critical				declining	BS
Miniature poultry	Orpington	>1500		E, secure				stable	BS
Miniature poultry	Plymouth Rock	>1800		E, secure				stable	BS
Miniature poultry	Polish	>1600		E, secure				stable	BS
Miniature poultry	Rhode Island Red	>1000		E, secure				stable	BS
Miniature poultry	Rhodebar	<40		critical				declining	BS
Miniature poultry	Rumpless Game	>500		E, secure				increasing	BS
Miniature poultry	Scots Dumpy	<100		E, endangered				stable	BS
Miniature poultry	Scots Grey	>250		E, at risk				stable	BS
Miniature poultry	Shamo	>350		E, at risk				stable	BS
Miniature poultry	Silkie	>750		E, secure				increasing	BS
Miniature poultry	Spanish	<60		E, critical				stable	BS
Miniature poultry	Sumatra Game	>200		E, vulnerable				stable	BS
Miniature poultry	Sussex	>2000		E, secure				stable	BS
Miniature poultry	Thuringian Bearded	>150		E, new import				increasing	BS
Miniature poultry	Transylvanian Naked Neck	<120		E, vulnerable				declining	BS
Miniature poultry	Vorwerk	<150		E, vulnerable				stable	BS
Miniature poultry	Welbar							Possibly extinct	BS
Miniature poultry	Welsummer	>1600		E, secure				stable	BS
Miniature poultry	Wyandotte	>4000		E, secure				stable	BS
Miniature poultry	Wybar	<50		critical				increasing	BS
Miniature poultry	Yamato	>120		E, vulnerable				increasing	BS
Miniature poultry	Yokohama (English Type)	>100		E, endangered				stable	BS
Miniature poultry	Yokohama (German Type)	<100		E, endangered				declining	BS
Poultry	Ameraucana	>40		E, critical				stable	BS
Poultry	American Game	<50		E, critical				stable	BS
Poultry	Ancona	>750		E, secure				stable	BS
Poultry	Andalusian	<80		E, critical				declining	BS
Poultry	Appenzeller	<200		E, at risk				declining	BS
Poultry	Appenzeller Barthuhner	<40		E, critical				declining	BS
Poultry	Araucana (Rumpless)	<100		E, endangered				stable	BS
Poultry	Araucana Spitzhauben (Br)	>640		E, secure				increasing	BS
Poultry	Aseel	>600		E, secure				stable	BS
Poultry	Augsburger	<25		E, critical				declining	BS
Poultry	Australorp	>500		E, secure				stable	BS
Poultry	Barnevelder	<450		E, at risk				stable	BS
Poultry	Belgian Game	<40		E, critical				declining	BS
Poultry	Braekel	<40		E, critical				declining	BS
Poultry	Brahma	<560		E, secure				stable	BS
Poultry	Brazilian Shamo	<30		E				recent import	BS
Poultry	Breda			E				possibly extinct	BS

Poultry	Brockbar							believed extinct	BS
Poultry	Brussbar	4		critical				stable	BS
Poultry	Cambar							believed extinct	BS
Poultry	Campine	<110		E, endangered				declining	BS
Poultry	Canadian Game	<20		E, critical				stable	BS
Poultry	Cobar	<10		new breed				stable	BS
Poultry	Coveney White							believed extinct	BS
Poultry	Crested Legbar	<100		endangered				stable	BS
Poultry	Creve Coeur	<30		E, critical				declining	BS
Poultry	Croad Langshan	>400		E, secure				stable	BS
Poultry	Derbyshire Redcap	<220[9]	N	R	PM		RBST	declining; Meat & Eggs	BS
Poultry	Dominique	<30		E, critical				stable	BS
Poultry	Dorbar							believed extinct	BS
Poultry	Dorking	>600[9]	N	R	PM		RBST	increasing; Meat & Eggs	BS
Poultry	Dorset							possibly extinct	BS
Poultry	Exmoor							believed extinct	BS
Poultry	Faverolle	<350		E, at risk				declining	BS
Poultry	Fayoumi	<100		E, endangered				stable	BS
Poultry	Friesian	<70		E, critical				stable	BS
Poultry	Frizzle	<60		E, critical				stable	BS
Poultry	German Langshan	<40		E, critical				declining	BS
Poultry	Golden Essex							believed extinct	BS
Poultry	Hamburgh	>350		E, secure				stable	BS
Poultry	Houdan	<50		E, critical				declining	BS
Poultry	Indian/Cornish Game	>500[9]	N	R	PM		RBST	declining; Meat	BS
Poultry	Ixworth	<120[9]	N	R	PM		RBST	declining; Meat & Eggs	BS
Poultry	Jersey Giant	<100		E, endangered				stable	BS
Poultry	Kraienkoppe	<60		E, critical				declining	BS
Poultry	La Fleche	<60		E, critical				stable	BS
Poultry	Lakenvelder	<80		E, critical				declining	BS
Poultry	Legbar	<50		critical				declining	BS
Poultry	Leghorn	>800		E, secure				declining	BS
Poultry	Lincolnshire Buff	>250		at risk				increasing	BS
Poultry	Malay	>120		E, vulnerable				stable	BS
Poultry	Marans	>3000		E, secure				stable	BS
Poultry	Marsh Daisy	<60		critical				declining	BS
Poultry	Minorca	>200		E, vulnerable				declining	BS
Poultry	Modern Game	>60		E, critical				stable	BS
Poultry	Modern Langshan	<40		E, critical				declining	BS
Poultry	New Hampshire	>280		E, at risk				stable	BS
Poultry	Norfolk Grey	>70		critical				declining	BS
Poultry	North Holland Blue	>60		E, critical				declining	BS
Poultry	Old English Game	>3000		E, secure				stable	BS
Poultry	Old English Pheasant Fowl	>100[9]	N	R	PM		RBST	declining; Meat & Eggs	BS
Poultry	Onagadori	>40		E, critical				stable	BS
Poultry	Orloff	>40		E, critical				declining	BS
Poultry	Orpington	>1500[9]	N	R	PM		RBST	stable; Meat & Eggs	BS
Poultry	Penedesencas	<40		E, new import				increasing	BS
Poultry	Plymouth Rock	>200		E, vulnerable				declining	BS
Poultry	Polish	>400		E, secure				increasing	BS
Poultry	Rhode Island Red	>1500		E, secure				stable	BS
Poultry	Rhodebar	<50		critical				declining	BS
Poultry	Rumpless Game							believed extinct, ? Small pop. in IOM	BS
Poultry	Satsumadori	<100		E, endangered				increasing	BS
Poultry	Scots Dumpy	>420[9]	N	R	PM		RBST	stable; Laying hens	BS
Poultry	Scots Grey	<100[9]	N	R	PM		RBST	declining; Meat & Eggs	BS
Poultry	Shamo	>600		E, secure				stable	BS
Poultry	Sicilian Buttercup	<60		E, critical				declining	BS
Poultry	Sicilian Flowerbird			E				U.K.	BS
Poultry	Silkie	>4000		E, secure				stable	BS
Poultry	Spanish	<100		E, endangered				stable	BS

Poultry	Sulmtaler	<40		E, critical				stable	BS
Poultry	Sultan	<100		E, endangered				stable	BS
Poultry	Sumatra Game	<70		E, critical				stable	BS
Poultry	Sussex	>3600[9]	N	R	PM		RBST	increasing; Meat & Eggs	BS
Poultry	Taiwanese Shamo	>50		E, critical				stable	BS
Poultry	Thai Game	>30		E, critical				increasing	BS
Poultry	Transylvanian Naked Neck	<60		E, critical				stable	BS
Poultry	Venezuelan Game	<40		E, critical				increasing	BS
Poultry	Vorwerk	<70		E, critical				declining	BS
Poultry	Welbar	<200		vulnerable				stable	BS
Poultry	Welsummer	>3000		E, secure				stable	BS
Poultry	Wyandotte	>1300		E, secure				stable	BS
Poultry	Wybar	<20		critical				stable	BS
Poultry	Yamato	>140		E, vulnerable				increasing	BS
Poultry	Yokohama (British Type)	<100		E, endangered				stable	BS
Poultry	Yokohama (German Type)	<70		E, critical				declining	BS
Poultry	Yorkshire Hornet							believed extinct	BS
True Bantams	Barbu D'Anvers	>3000		E, secure				stable	BS
True Bantams	Barbu De Grubbe	<40		E, critical				increasing	BS
True Bantams	Barbu De Watermael	>380		E, secure				increasing	BS
True Bantams	Barbu D'Everberg	<40		E, critical				increasing	BS
True Bantams	Barbu D'Uccle	>1500		E, secure				stable	BS
True Bantams	Booted (Old English)	4		E, critical				declining	BS
True Bantams	Burmese	2		E, critical				declining	BS
True Bantams	Dutch	>3000		E, secure				stable	BS
True Bantams	Japanese	>1800		E, secure				stable	BS
True Bantams	Ko Shamo	>600		E, secure				increasing	BS
True Bantams	Nankin	<50		E, critical				declining	BS
True Bantams	Ohiki	<40		E, critical				increasing	BS
True Bantams	Pekin	>4000		E, secure				stable	BS
True Bantams	Sabelpoot (Cont. Booted)	<60		E, critical				declining	BS
True Bantams	Sebright	>1700		E, secure				stable	BS
True Bantams	Tuzo	>200		E, vulnerable				increasing	BS
Turkeys	American Mammoth Bronze			E				included in Standard Bronze	BS
Turkeys	Beltsville			E				probably extinct	BS
Turkeys	Bourbon Red	<100		E, endangered				increasing	BS
Turkeys	British Blue	<100		endangered				stable	BS
Turkeys	British White	<35		critical				declining	BS
Turkeys	Broad Breasted Bronze	>500		E, secure				stable	BS
Turkeys	Broad Breasted White	>5000		E, secure				stable	BS
Turkeys	Buff	<35		critical				declining	BS
Turkeys	Cambridge Bronze							included in Standard Bronze	BS
Turkeys	Cornish Palm	<20		E, critical				stable	BS
Turkeys	Crolwitzer (Pied)	>130		E, vulnerable				stable	BS
Turkeys	Holland			E				probably extinct	BS
Turkeys	Narragansett	>10		E, critical				declining	BS
Turkeys	Nebraskan Spotted	>25		E, critical				stable	BS
Turkeys	Norfolk Black	>300		at risk				stable	BS
Turkeys	Ronquieres			E				probably extinct	BS
Turkeys	Standard Bronze	>350		E, at risk				increasing	BS

Population number/status/breeed type Footnotes

[1] flock/herd/stud books 1999 + 2000

[2] RBST survey of breed societies conducted for the NCC, 2002

[3] Breed Society livestock Survey 2000

[4] MAFF FAnGR report, 1998

[5] flock/herd/stud book 1999

[6] Breed Society Survey 2001

[7] BPA annual pig bloodline survey, 2001

[8] BPA annual pig bloodline survey, 2002									
[9] 2002 compiled by RBST council member Andrew Sheppy (AJS)									
[7] RBI survey of breeds for NCC									
[£] numbers in UK only									
[$] numbers worldwide									
^^	Number of breeding females								
**	Additional feral population								
R[1]	RBST imported category - see Appendix 5								
R*	Other Numerically Scarce Breeds At Risk - as defined by RBI								
R**	Exotic breeds classified rare in the UK								
NST	Northern Short-Tailed								
Source of information/organisations:									
BPA	British Pig Association								
BS	Breed Society/Association/Group/Club								
CLL	Countrywide Livestock Ltd								
EN	English Nature								
MDC	Milk Development Council								
MLC	Meat and Livestock Commission								
NPS	National Pony Society								
NSTSG	Northern Short-tailed Sheep Group								
RBI	Rare Breeds International								
RBST	Rare Breeds Survival Trust								
SAC	Scottish Agricultural College								
ST	Sheep Trust								
Conservation programmes:									
B	Bloods stored within RBGS								
B[1]	Bloods held for population DNA analysis								
B[2]	Bloods currently being collected for population DNA analyses								
BA	Breed Analysis								
BSA	Breed Structure Analysis								
NM	Niche Marketing								
NSP	National Scrapie Plan								
PM	RBST Poultry Monitoring Scheme 2002								
RBGS	Rare Breeds Genotype Survey								
RH	Reserve Herd								
S	Semen stored								
S[1]	Semen currently being collected								
SG	Scrapie Genotyping								
TBI	Traditional Breeds Incentives								
TBMMS	Traditional Breeds Meat Marketing Scheme								

Appendix 4

REQUIREMENTS FOR UK RARE BREED STATUS ELIGIBILITY

The Rare Breeds Survival Trust (RBST)

In 1968, the Royal Agricultural Society of England and the Zoological Society of London formed a working party to save endangered breeds of livestock, which in 1973 became the Rare Breeds Survival Trust. The Trust has since served to promote and conserve rare and threatened breeds of farm livestock within the UK and is the national rare breed NGO. The RBST currently lists 72 breeds of farm livestock (cattle, goats, horses, pigs, poultry[1] and sheep) using a set of guidelines based upon conservation criteria to identify the breeds which it supports. The rare breed populations meeting these criteria are continually monitored and a current list published in the Trust quarterly publication, *the ARK*.

How Rare Breed status is acquired

The requirements governing acceptance onto the RBST list of rare breeds are given below:

Section A: Genetic Basis

1) The Trust considers for listing only those animals in a breed which are fully registered and have no recorded input [2] from other breeds. This 'original population' may constitute all or part of a breed.

2) In addition, the breed should have been in existence for at least 40 years plus 6 generations. (where a generation (years) is as follows: Cattle - 6, Sheep - 4, Goats - 5, Horses - 10, Pigs - 2, Poultry - 2). All breed societies applying for acceptance by the Trust need to submit a complete set of herd/flock or stud books spanning the 40 years plus 6 generations period referred to above.

3) The RBST may occasionally accept breeds that are not eligible under the terms of 1) and/or 2), if the Trust considers a breed to be of sufficient genetic conservation importance.

Section B: Numerical Basis

1) A breed (or 'original population') will be listed by the RBST if there are fewer than the following number of registered adult females in existence: Cattle 1500, Goats 1000, Horses 3000, Pigs 1000, Sheep 3000.

2) The trend in annual registrations per year over the past 5 years is also considered, in addition to population density and geographic distribution.

A Guide to the Categories (Registered adult females)

Category	Cattle	Goats	Horses	Pigs	Sheep
1. Critical	<150	<100	<300	<100	<300
2. Endangered	250	167	500	167	500
3. Vulnerable	450	300	900	300	900
4. At Risk	750	500	1500	500	1500
5. Feral [3]	N/A	N/A	N/A	N/A	N/A
6. Imported [4]	N/A	N/A	N/A	N/A	N/A
7. Traditional	1500	1000	3000	1000	3000

Breeds listed by the RBST

	CATTLE		EQUINES		PIGS	SHEEP & GOATS (G)
Category	***Breed*** [5]	***Original Population*** [6]	***Breed*** [5]	***Original Population*** [6]	***Breed*** [5]	***Breed*** [5]
1. Critical	Irish Moiled	Lincoln Red	Cleveland Bay		-	Boreray
	Shetland	Aberdeen Angus	Eriskay pony			Castlemilk Moorit
	Vaynol		Suffolk			Bagot (G)
2. Endangered	Gloucester	-	Fell pony		British Lop	Leicester Longwool
	White Park		Exmoor pony		Tamworth	Norfolk Horn
						Teeswater
						Whitefaced Woodland
3. Vulnerable	Beef Shorthorn	Hereford	Dales pony	Feral Welsh Mountain Pony (Section A)	Berkshire	Balwen
	Red Poll		Dartmoor pony		Large Black	Cotswold
			Highland pony		Middle White	North Ronaldsay
						Portland
						Soay
						Golden Guernsey (G)
4. At Risk	-	-	Clydesdale		British Saddleback	Dorset Down
					Gloucestershire Old Spots	Greyface Dartmoor
						Hill Radnor
						Lincoln Longwool
						Llanwenog
						Manx Loghtan
						Shropshire
						Southdown
						Wensleydale
5. Feral	Chillingham	-	-		-	Boreray
						Soay
6. Imported	Kerry	-	Irish Draught		-	Galway
7. Traditional	Belted Galloway	-	Shire		-	Hebridean
	British White					Kerry Hill
	Longhorn					Oxford Down
						Ryeland
						White Face Dartmoor
						Wiltshire Horn

Footnotes

[1] Poultry - the RBST is currently reviewing its poultry programme and will be publishing a revised list of poultry breeds and population figures at the end of 2002. Currently, the poultry breeds recognised by the Trust are the large fowl types (i.e. not bantams or miniatures) of the following breeds: Cornish/Indian Game, Derbyshire Redcap, Dorking, Ixworth, Old English Pheasant Fowl, Orpington, Scots Grey, Scots Dumpy and Sussex.

[2] Where listed breeds have operated grading up policies in the past, these are no longer permitted (from 2001) unless specific breeding programmes have previously been agreed with the Trust.

[3] Feral – to include populations of domestic animals no longer managed by man.

[4] Imported – to be eligible for this category a breed must qualify on the grounds that it is seriously endangered in its own country and the UK is its main breeding centre. Any breed currently listed in this category which does not meet these criteria must have been supported as a rare breed by the Trust prior to category revision in 2001.

[5] All breeds listed by the Trust in 2001 will continue to be supported as a whole breed.

[6] All 'original populations' of breeds will be listed under this heading where it is only this proportion of the breed that is recognised as rare by the RBST.

Appendix 5 Minor Species

The traditional livestock industry was altered significantly during the twentieth century by the importation of exotic species of domestic livestock. This was particularly evident during the last four decades of the century, and extended the choices available to livestock farmers. In recent years a further change has become evident. Encouraged by the Government policy of diversification, new species have been introduced to the UK. Currently, they remain minor species and comprise an insignificant part of the livestock industry, but they are increasing in importance.

Game Birds

There are nearly 3,000 species of Galliformes in the world. This includes about 50 species of pheasant, about 20 species of grouse, 110 species of Old World partridge, 20 New World quails, 6 species of guineafowl, 2 species of turkey, 50 species of cracid in Central and South America, and 20 species of megapode in the South Pacific, Indonesia and Australasia. The birds or their eggs are eaten almost everywhere they occur.

The World Pheasant Association is the responsible authority. Most of its work takes place outside UK, but much of the experience resides within the UK. The perceived needs are for a globally coherent plan of action to conserve wild relatives of domestic species, and for appropriate collaboration for *in situ* and *ex situ* programmes. Distinction must be drawn in UK between species which are entirely wild and naturally adapted (e.g. grouse), and those which are subject to closely controlled (often intensive) management (e.g. pheasant).

Racing pigeons are a separate category. As a guide to their importance as a leisure pursuit in the UK, they consume circa 50,000 tons feed per annum.

Goats

Pedigree animals are registered in the UK by their respective breed society to monitor population trends, but there are many non-pedigree goats. Goat-keepers must register details of their stock annually with DEFRA.

The most common commercial dairy breeds are the British Saanen and the British Toggenburg. The Golden Guernsey is a minority dairy breed. There is a voluntary system of milk recording, and milking competitions at shows. Dairy hygiene regulations applied since 1995 have greatly reduced the number of small dairy herds, and the number of registered dairy goats has fallen from 5,137 in 1990 to 2,699 in 2000. At the same time, the demand for goats' milk and dairy products has developed large commercial units. Currently, there are about 50 commercial dairy herds, the largest comprising 3,000 goats. Pygmy goats are kept as pets, and now are almost as numerous as dairy goats. Angora, cashmere and Boer goats were imported during the 1980s. The annual production of mohair is 25,000 tons, indicating 5-7,000 production animals. The British Angora Goat Society organises a buck evaluation scheme based on body and fleece characteristics. Cashmere goats were introduced first as an alternative to sheep. The Scottish Cashmere Producers Association organises a fleece competition and fleece evaluation service. There is a carcase competition at the Royal Show, and the Boer is the only specialised meat breed.

Adult goats in dairy and meat production systems are housed to reduce the need for anthelmintic treatment, which requires subsequent discard of milk (7 days) and delay in slaughter of meat animals (30 days). Milk is valued for its anti-allergic properties, and goat (including kid) meat is popular among some ethnic groups.

The Bagot Goat Society registers and monitors Bagot goats. Information is held in detailed computer records, and information is available through a website. Bagot goats are browsers, rather than grazers, and have value in conservation grazing projects. Feral goats also are used in conservation grazing for scrub control. They are found in upland areas of Scotland, Northern Ireland and Snowdonia, and are a distinct genetic resource. There are probably less than 1,500 breeding females, and the impact of the FMD 2001 outbreak is unknown.

Goats are vulnerable to a policy to eliminate scrapie-susceptible genotypes.

Rabbits

The main breeds are New Zealand White, Californian and All Grey. The annual production of rabbit meat in UK is 2-3,000 tonnes. A further 5,000 tonnes is imported from China, Hungary and Poland. The market requires either whole carcases of 2-3 kg, or portioned pre-packed.

Domestic rabbits are maintained in an intensive indoor industry. The UK welfare code for rabbits requires a minimum space of 0.56 sq m per adult rabbit, whereas in other countries cage sizes are typically half that size.

Deer

Red and Fallow are two main species farmed in UK, plus a few farms have some Wapiti (Canadian Elk) as hybrids with Reds. Other species, such as Sika and Pere Davide, are present in parks. Red deer are farmed in all areas of UK. Fallow deer are more common in England and Wales, with only a few units in Scotland. There are significantly more wild relatives than farmed deer of all species, plus some additional wild species - Roe, Muntjac and Chinese Water Deer. Deer of all species may be introduced to enhance tourist-based diversification on farms. Recreational shooting of deer may be part of park enterprises.

The British Deer Farmers Association is the responsible authority. There are circa 250-300 farms with deer, and the national farmed herd is circa 30-35,000 (excluding park deer), of which more than 75% are Red, and comprising 12-13,000 breeding hinds and 300-350 breeding stags. The venison market increased during the BSE crisis, and continues to find favour as a low-fat meat.

Wild Boar

Wild boar were hunted to extinction in Britain circa 400 years ago. They were re-introduced in 1981. The British Wild Boar Association was set up in 1989, and controls a register of pure breeding stock of circa 2,000 breeding sows (2001). There are circa 100 farms in UK with wild boar, including 30 farms in Scotland which are members of the Scottish Wild Boar Association.

Herds have been expanded by the importation from Sweden and Denmark of breeding stock of eastern European origin. Demand for wild boar meat exceeds supply. The annual UK wild boar market is estimated at 500,000 kg. All wild boar meat labelled and sold as such must be derived from animals of at least 93% wild boar ancestry.

It is mandatory under the Dangerous Wild Animals Act 1976 for wild boar farms in England and Wales to be licensed by the local authority.

Camelids

The British Camelid Owners and Breeders Association is the responsible authority. There are circa 50 members with average flock size of 20 animals.

Alpacas are kept primarily for their high quality fibres (fibre diameter 18-30 microns). The under-supply in the marker currently is met by imports. Llamas are traditionally pack animals in UK, and are kept for trekking or as companion animals. Guanacos and vicuna are wild ancestors, and very few are kept in UK. Alpaca and vicuna were imported by IGER as possible alternatives to sheep because of their different grazing behaviour.

Ostriches and Rheas

African Black is the most common breed, and tolerates the British climate. There is a strong domestic market, and the shortfall in supply is met by imports from South Africa. Feathers are marketed in UK or exported to Spain and Italy. Hides realise £35-120 each. There are circa 100 registered producers in UK.

The ostrich is classified as a wild exotic bird and is subject to the Dangerous Wild Animals Act 1976.

Appendix 6 – Overseas Territories

The UK has 15 Overseas Territories. Of these, three have no livestock present whatsoever, namely – **Gibraltar**, the **British Antarctic Territory**, and **South Georgia and the South Sandwich Islands** (the latter having nothing other than 2,000 feral reindeer).

Of the remaining territories, two have livestock present, but none of which is farmed, only feral. These are the **British Indian Ocean Territory**, and **Ascension Island**.

The final 10 territories have farmed livestock. Little information is available for **Montserrat**, and the livestock industry there has been severely affected by volcanic activity in recent years, with most animals being exported to more suitable locations. **Pitcairn Island** has evidence of goat and poultry production, but little in the way of formal agriculture (the island has only around 50 inhabitants). Majority of food is imported from New Zealand. The **Turks & Caicos Islands** experience problems with feral goats, donkeys, horses and cows, which threaten the natural ecology of the islands. The island has no permanent pasture, so livestock keeping is unlikely to play a major role. The British Virgin Islands do produce poultry and livestock, but little information is held on this.

Countries for which more detailed information is held are as follows:

Anguilla

Livestock numbers were gathered in Anguilla prior to Census Day, in May 2001. The most numerous AnGR are poultry, kept in a few large poultry farms rather than widespread poultry ownership. Goats are the most widely owned livestock. There are very few cattle.

Bermuda (see table below)

Number	Livestock Farms	Average size
4	Dairy – large scale commercial	100
10	Pigs – small scale commercial	5
1	Poultry – large scale commercial	1800

No rare or endangered species of farmed animals are present. Economics linked to the dairy industry are the only figures that can be established with any degree of accuracy. Local dairy industry produces all of the fresh cow's milk available. 1.75 million quarts were produced in 2001, with an estimated wholesale value of $1.5 million. Local egg production is difficult to estimate due to lack of statistics from the farmer. Goats and sheep are all 'backyard' operations, of which the economic value is difficult to ascertain.
Of the estimated 1,500 riding horses, approximately 70 are used in carriage horse work or to provide riding lessons. The rest are essentially for recreational use. The overall value of these commercial enterprises is not measured.
Priorities for developing the use of livestock are:

- Protecting lands for agricultural use
- Increasing efficiency of dairy animals
- Diversifying genetics to produce animals resistant to the heat
- Improvement of the care and keeping of other farm animals

Cayman Islands (see table below)

No. of beef cattle farms	91	**No. of meat goat farms**	34
Average no. of males per farm	0.9	Average no. of males per farm	1.2
Average no. of females per farm	6.0	Average no. of females per farm	10.6
Total population	1 382	Total population	1 366
No. of pig farms	6	**No. of Horses** (estimate)	
Average no. of males	1.5	Total population	300
Average no. of females	15		
Total population	708		

Falkland Islands

No of farms = 91; Average size = 12,500ha; Type of farm = small scale commercial;
Type of production system = low input

Breeds: Sheep – mainly Corriedale and Polwarth;
Cattle – Ayrshire dairy cows, Red Poll, Aberdeen Angus, Hereford, South Devon, Lincoln, Belted Galloway; Pigs – Large white, Saddleback, Gloucester Old Spot, Large Black, Welsh;
Goats – Cashmere and Boer;
Guanaco – introduced from Chile/Argentina in the early 1930's living a "feral" existence on Staats Island; Reindeer – introduced from South Georgia in early 2001 and 2002. Total – 60 (Originate from Norwegian reindeer introduced to South Georgia between 1910 – 25);
Rabbits – both European and American cottontail rabbits were introduced in the19th century

At present sheep are the only important commercial species kept primarily for their wool. In future it is hoped to build up a lamb/mutton export market followed by a beef export market further down the line. The Falkland Islands have a high animal health status. As well as continuing the current exports of wool and meat the possibility of live animal exports either regionally or further afield is being considered for the future.

All livestock in the Falkland Islands are farmed extensively with low inputs of concentrate feeding, artificial fertilisers and animal medicines. The products from these animals (meat and wool) are, therefore, free from additives, antibiotics and other types of residues commonly found in the more intensive farming systems practised in many parts of the world. This has considerable marketing potential in the light of food scares experienced in Europe and North America in recent years.

St. Helena (see table below)

Number of livestock farms – 116; Average farm size – 0.5 – 20 acres
Numbers of breeding animals by species:

Cattle	249
Pigs	71
Sheep	443
Goats	696
Donkeys	56
Poultry	5170

Types of farm - subsistence 60, smallholder 40, commercial 16;
Types of production - high input and medium input.

There is no information provided on the breeds used within each species. Improved breeds are imported periodically. The essential meat products to the Island are beef, pork and sheepmeat. Priorities for the development of the use of livestock are beef (organically produced) and pork

processing for local consumption. The Agriculture & Natural Resources Department currently runs an island wide veterinary programme to minimise worm and parasite burdens on a six weekly cycle for all animals.

Tristan Da Cunha

No islanders own farms, but each family owns livestock that are free range. Breeds used are as follows:
Cattle – Hereford, Welsh Black and Dairy Shorthorn
Sheep – Northern Cheviot and Scottish Blackface.
All animals are crossbreeds.

Each species used is equally important, as the island relies on the stock for eggs, milk and meat. No eggs, beef or mutton are imported. All animals are farmed only for local consumption. No animals are exported.

Appendix 7

National Action Plan – Proposed Template
(a) Showing processes, areas of activity and outputs
(b) Showing the inter-relationships between the inputs and outputs of each process