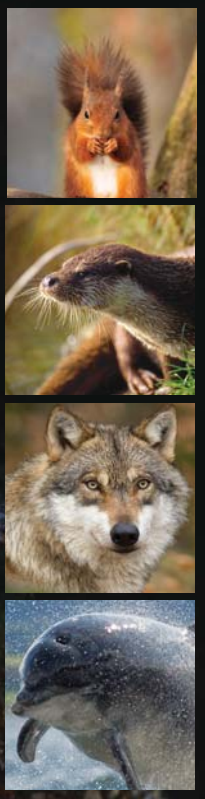

people's trust for **endangered species**

The State of Britain's Mammals 2011

Written by David Macdonald
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Contents


Laurie Campbell

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Preface

On this anniversary, the tenth of our annual perspectives on *The State of British Mammals*, we notice with surprise that despite their proper prominence in Macdonald & Tattersall's original *Britain's Mammals: The Challenge for Conservation in 2001*[1], with which PTES launched its campaign for British mammals, there has been no further mention of red foxes! Since foxes are surely the most beautiful, and arguably the most interesting, of British mammals, let us remedy that immediately by reference to one of the most extraordinary mammalogical discoveries of the year: red foxes perform 'mouse jumps' (launching almost vertically to land pulverizingly, front feet first, onto an indiscreetly squeaking mouse) most often, and most successfully, on a north-south axis, apparently using a 'vision' of magnetic north as a precise range-finder with which to gauge infallibly the length of their pounce on that axis[2].

Scarcely less remarkable is the spate of science policy currently erupting. So, what has changed for British mammals in the decade since 2001? For most of those years, the answer might have been a dour 'not much!' – especially considering the UK's failure to meet the Convention on Biological Diversity target to halt biodiversity loss by 2010 (shifted to 2020 under the Nagoya commitment). Suddenly, however, it's all-change. But, first a reminder that, having identified four broad categories of issues facing British mammals - conflict with non-native species, toxic habitats, disappearing habitats and direct conflict with man - the 2001 report listed five implements for tackling these issues - legal and policy framework, monitoring and research, conflict resolution, ecological restoration and conservation and welfare. Macdonald & Tattersall nominated their top ten personal priorities for mammal conservation (addicts can check the second ten in the original report): establish a national mammal monitoring network; alter the land-use planning system to improve care for species; accelerate shifts in agricultural policy to foster landscape-scale conservation; extend legal protection to include local wildlife sites, buffer zones and corridors; ensure that conservation advice is scientifically robust; carry out large-scale experiments and long-term studies; heighten the focus on the effects of pollutants on wild mammals; rationalise responsibility for management of alien species; increase the range of biodiversity performance indicators to include mammals; and coordinate the energies of mammal organisations. We also advocated the idea, proposed earlier, of creating large wilderness zones from marginal farmland and perhaps fenced to contain predators.

How is the scorecard, after ten years? Disappointingly, the UK still lacks an all-encompassing national mammal monitoring network[3], although the Tracking Mammals Partnership[4] made a brave, but now wavering, attempt to monitor 35 terrestrial mammal species. So, as in 2001, mammal conservationists still cannot match the birders whose *2010 State of the UK's Birds*[5] reported, with mournful precision, that the lapwing has declined by 45% since 1970, the turtle dove by 89% and the grey partridge by 90% - perhaps things aren't so bad for mammals – but we still don't know!

Moving through the list, regarding the robustness of evidence, in 2003 the Centre for Evidence-Based Conservation (CEBC) was established. In 2008 the GB Non-Native Species Secretariat was formed and six widespread bat species (Daubenton's, lesser horseshoe bats, noctules, common and soprano pipistrelles and serotines), were included as biodiversity performance indicators[6].

The tremors of environmental earth-movements began to stir with Intergovernmental Panel on Climate Change reports, the 2005 Millennium Ecosystem Assessment[7], and the government's Chief Scientific Advisor, Sir John Beddington's, initiatives on food security. In 2010, the Marine Bill, WWF's *8th Living Planet* Report[8], then, Global Biodiversity Outlook 3[9] and The Economics of Ecosystems and Biodiversity[10] crystallising the emerging realisation that the human enterprise has been free-loading on nature. Next, Natural England, bravely emerging from the Comprehensive Spending Review, bloodied but unbowed, published its audit *Lost life: England's lost and threatened species*[11], identifying nearly 500 animals and plants that have become extinct in modern times, and 1 000 native species that face worrisome threats. September 2010 saw the publication of Sir John Lawton's review, *Making Space for Nature*[12] with its catchy advice of 'better, bigger, more, joined', ranking the priorities for improving management of protected areas, increasing their size, creating new ones and joining them up. Similarly, the GBO3 predicted that by 2050 some 200 000km^2 of European marginal farmland would become available for rewilding. May 2011 saw the launch of the EU biodiversity strategy, linked to targets agreed at the CBD in Nagoya in October 2010. June greeted the UK National Ecosystem Assessment (NEA)[13], which not only assesses but values Britain's nature and the ecosystem services it provides – including mammals. The June crescendo was the Natural Environment White Paper *The Natural Choice: securing the value of nature*, developing a 50-year vision from colossal public consultation and moving towards a landscape-scale approach to conservation.

So, more than the deckchairs have been rearranged on this Titanic: in 2005 the American mink was renamed *Neovison* and the British water vole became *Arvicola amphibious,* but these roses still smell the same, invasives still threaten natives[14]. And the 2001 Top Ten have not yet been toppled from their pedestal (although climate change is nudging up the charts). But 2011 sees a tectonic change in the frameworks within which they will now be tackled, so this tenth anniversary of PTES' mammal campaign and of our annual state of Britain's mammals reports, may truly offer hope of many happy returns for Britain's mammals.

David Macdonald and Dawn Burnham




UK BAP process

The history of formal wildlife conservation in Britain spans over 60 years of designation for Sites of Special Scientific Interest (SSSIs) through the National Parks and Access to the Countryside Act 1949, and includes 30 years of protected species legislation. This started with the Wildlife and Countryside Act in 1981 offering protection for water voles and red squirrels (and birds), replacing the Conservation of Wild Creatures and Wild Plants Act 1975 and the Protection of Birds Acts 1954 to 1967. Then the Protection of Badgers Act in 1992, and the Conservation (Natural Habitats &c.) Regulations in 1994 added bats, dormice, otters, Scottish wildcats, and all species of dolphins, porpoises and whales to the list of mammals with formal protection. The current legislation is consolidated by the Conservation of Habitats and Species Regulations 2010 for England and Wales. For Scotland this is in combination with the 1994 Regulations, and for Northern Ireland, the EC Habitat Directives are covered by the Conservation (Natural Habitats, &c.) Regulations (Northern Ireland) 1995 (as amended).

During the last 15 years significant and direct effort for species conservation has taken the form of the UK Biodiversity Action Plan (BAP)[15], launched in 1994, resulting from the Government's commitment to the Convention on Biological Diversity (CBD) 'to achieve by 2010 a significant reduction of the current rate of biodiversity loss' signed at the Rio Earth Summit in 1992. The original BAP list of priority habitats and species included 20 mammals, ten terrestrial, with individual Species Action Plans (SAPs): water voles, brown hares, hazel dormice, otters, red squirrels, barbastelles, Bechstein's bats, greater horseshoe bats, lesser horseshoe bats and (what were then called) common pipistrelles; and ten cetaceans: minke whales, northern bottlenose whales, harbour porpoises, common dolphins, bottlenose dolphins, atlantic white-sided dolphins, white-beaked dolphins, killer whales, long-finned pilot whales and Risso's dolphins. Three group SAPs for baleen whales, toothed whales and dolphins covered all cetaceans occurring in British waters except for harbour porpoises. Lead Partners were responsible for overseeing National SAPs that set the priorities, targets, actions and timescales for individual species, with Local Biodiversity Action Plans (LBAPs) implemented by local partners and supporting the delivery of national priorities alongside those identified locally.

Since the creation of the initial UK BAP, devolved governments for England, Northern Ireland, Scotland and Wales became responsible for the environment and produced their own country biodiversity strategies from 2001, which have superceded the UK BAP, but which all include common elements, notably the BAP priority habitats and species. At the time of publishing *British Mammals: The Challenge for Conservation*[1], the first five years of the BAP process was evaluated in the Biodiversity Challenge report. The performance of a subset of 14 Habitat Action Plans (HAPs) and 57 SAPs, including just two mammals, otters and dormice, were evaluated according to three criteria (improving biological status, planned actions taken and impact). Of the habitats, five (36%) were judged to be making signs of recovery, and one was declining, although for six there was no agreed programme of work. Of the 57 species, 17 (29%) were showing signs of recovery, including otters. At that time threats that might thwart proposed actions for mammal SAPs were cited as land use change, environmental pollution and other human impacts.

By 2005, after ten years of the BAP process, some of the original targets were met and some were expired (such as giving legal protection to water voles, and preventing the spread of grey squirrels into key red squirrel areas). Revised targets were developed which were 'SMART' (Specific, Measurable, Achievable, Relevant and Time bound) and more quantitative than the originals, made possible by the knowledge acquired in the preceding decade, with the goal of better focussing

Terry Whittaker

Brown hares were one of the original 20 mammal species put on the BAP list in 1994, and recent reporting shows that their numbers are now increasing.

delivery and monitoring progress towards the 2010 target.

Eight more terrestrial mammals were added when the first full UK BAP review was completed in 2007: hedgehogs, Scottish wildcats, mountain hares, harvest mice, pine martens, polecats, noctules, brown long-eared bats, and common pipistrelles were replaced by the now distinct soprano pipistrelles. Overall the number of species for all taxa was almost doubled to 1 149, and the revised priority list also included 16 new habitats bringing the total to 65.

The fourth reporting round of the UK BAP was published in 2010 showing progress for priority species and habitats that were on the list prior to the 2007 review. 52% of species targets were met and 17% were not achieved, whilst on habitats, 26% were met and 30% were not achieved. The remainder were either not known or not reported. Eight species were lost since 1994, but 40 (11%) species and 8 (18%) habitats were increasing, 144 (39%) species and nine (20%) habitats were stable, 88 species (24%) and 19 habitats (42%) were declining but the rate of decline was slowing for nine habitats (20%) and 28 species (8%).

Of the ten original terrestrial mammals with SAPs, targets were either exceeded or achieved for four: otters, water voles, pipistrelles and greater horseshoe bats. Trends for five priority species were encouraging, like the otter's continued recovery, increasing numbers for brown hares, and greater and lesser horseshoe bats, and the polecat's slow recovery. But seven priority mammal species, including some of the most endangered, were still declining: red squirrels, Scottish wildcats, mountain hares, harvest mice, dormice and, in rural areas, hedgehogs. Water voles too, though their targets were exceeded and their numbers were fluctuating and probably increasing in many areas of England, Scotland and Wales (except for the South). Three bat populations are thought to be stable (soprano pipistrelles, noctules and brown long-eared bats), but disappointingly there is not enough monitoring to know for pine martens, Bechstein's bats and barbastelles.

The last 15 years have seen some successes, particularly recovery of some rare species, such as otter due to cleaner rivers (page 6). However with the ongoing decline of once common species, such as hedgehogs (page 6), it is widely accepted that the CBD 2010 targets were missed. In general progress has been better for species that were restricted in range that could benefit from targeted, site-based conservation efforts. There has been less progress towards the targets for habitats and many widespread species, leading to a shift of emphasis. From 2009 the ecosystem approach was widely adopted, with the emphasis on wider, more integrated actions for species and habitats, supplemented by species-specific actions for those requiring targeted help. The scale of delivery has also been increased, with large landscape-scale conservation schemes being undertaken and planned. Natural England implemented this approach through its 'Securing biodiversity'[16] framework. In the future, there are plans to improve the integration of species' needs into habitat management by achieving greater heterogeneity in habitats, which will help by creating more niches within even small sites.

Pine marten genetics

Pine martens suffered from heavy persecution in the 19th century, and although now abundant locally in Scotland, remain Britain's second rarest carnivore[17]. However, despite being listed on Schedule 5 of the Wildlife and Countryside Act 1981, and being a UK BAP priority species, pine martens may threaten capercaillies[18], and therefore there is no consensus on their restoration in England through a reintroduction programme to date[19]. SNH can licence control of pine martens for the purpose of conserving wild bird populations, subject to evidence that they are responsible for wild bird decline. In May 2011 the Vincent Wildlife Trust (VWT) published the news that DNA tests of a pine marten scat have provided the first unequivocal evidence that pine martens are in the Lake District (in Grizedale Forest)[20]. However this is only the third scat found in England in the last 10 years. Pine martens found in England and Wales are genetically the same – haplotype a – as most pine martens in Scotland, and differ from historic pine marten populations in England and Wales – haplotype i. Even more intriguingly, two pine marten kits on the Isle of Eriska off the west coast of Oban were found to be of haplotype i. The VWT have recently completed a survey of Argyll and Kintyre to study the genetic composition of these populations further – they are currently awaiting DNA results[20].

In May 2011 the European Union proposed a new EU biodiversity strategy following the new strategy and targets agreed at the CBD in Nagoya in October 2010. There are six main targets and 20 actions in line with the new commitment to 'Halting the loss of biodiversity and the degradation of ecosystem services in the EU by 2020, and restoring them in so far as feasible,' and the 2050 vision 'By 2050, European Union biodiversity and the ecosystem services it provides – its natural capital – are protected, valued and appropriately restored for biodiversity's intrinsic value and for their essential contribution to human wellbeing and economic prosperity, and so that catastrophic changes caused by the loss of biodiversity are avoided.' The six targets are: full implementation of EU nature legislation to protect biodiversity; better protection for ecosystems, and more use of green infrastructure; more sustainable agriculture and forestry; better management of fish stocks; tighter controls on invasive alien species; a bigger EU contribution to averting global biodiversity loss. Resultant changes to the UK BAP are expected to be agreed by the end of 2011. The countries of the UK are also responding to the new CBD and EU commitments by updating their biodiversity strategies. England has recently published a new England Biodiversity Strategy, hot on the heels of the Natural Environment White Paper, and the other countries are planning updates over the next year. Likely common themes are the need to better take into account the values of biodiversity and ecosystem services in decisions and policies; an even greater shift towards conservation at a landscape scale (e.g. new 'Nature Improvement Areas' announced in England); and putting people at the heart of conservation.




UK BAP priority species

Over the past nine years we have focussed on a variety of priority species including water voles[21], mountain hares[22], dormice[19], small dolphins[21] and rare woodland bats[17]. For our ninth UK BAP update we follow the progress of three: a new priority species, hedgehogs, the welcome recovery of otters to English rivers, and the lamentable plight of our much loved but seriously troubled red squirrels.

Hedgehogs

Hedgehogs were once common throughout Britain and frequent visitors to many of our childhood gardens. However, PTES and British Hedgehog Preservation Society's (BHPS) national survey, *HogWatch* (2006), revealed that tens of thousands of the general public think hedgehogs are declining. The available survey data, from PTES' *Mammals on Roads* (annually since 2001) and *Living with Mammals* (since 2006) surveys, and British Trust for Ornithology's bird surveys (collecting mammal data since the 1990s) indicate downward trends sufficiently worrying that in 2007 hedgehogs were designated a UK BAP priority species[15]. Hedgehogs were estimated at about 1.5 million (1.1 million in England, 310 000 in Scotland and 145 000 in Wales) in 1995[23], which is an order of magnitude smaller than the 30 million estimated in the 1950s, and road casualty counts carried out between 1990 and 2001 suggest they declined by as much as half in that decade alone[24]. Their decline is probably due to rural habitat fragmentation, pesticide use (reducing prey) and hedgerow loss. Hedgerows and field margins are important for hedgehog foraging and movements in the rural east of England[25], large roads can block their movements[26] whilst badger predation can locally eliminate them[27]. In urban areas back gardens are probably smaller and less well connected than in the past and building developments dissect previously available habitat and cause population isolation. The Species Action Plan prioritises determining their habitat requirements on farmland and the impact of incidental deaths through trapping and gamekeeping.

Urban hedgehogs prefer the invertebrate-rich gardens of semi-detached and terraced houses over those of detached houses and roadside verges and tend to be more active after midnight when the risk of encountering human foot or road traffic is reduced[28]. *Hedgehog Street*, launched in June 2011 by PTES and BHPS, is raising awareness amongst the general public to encourage the creation of connectivity and shelter in gardens for hedgehogs. Through creating rough areas for shelter, providing small holes in fences, and discouraging the use of slug pellets, which may be detrimental to hedgehog reproduction, people can create community wide hedgehog-friendly landscapes.

Otters

Otter recovery is linked to cleaner rivers following a ban on most chemicals used in sheep dipping in the late 1990s. The first English otter survey in 1977-79 revealed otter signs in only 5.8% of 2 940 sites surveyed. Even in Scotland otter presence in 1977-79 hovered at 57% of over 1 000 sites surveyed, although populations in the Northern Isles, Western Isles, North Highland, West Highland and Dumfries and Galloway areas were largely unaffected by the otherwise widespread decline. The original Species Action Plan aimed to maintain and expand otter populations and, by 2010, to restore breeding otters to all catchments and coastal areas where they have been recorded since 1960. Specifically, the revised (2006) Biodiversity Action Plan target was for otters to have returned to at least 997 10km squares in England by 2010 and 1 084 by 2015, and 1 024 10km squares in Scotland by 2015. In England, the most recent national survey[29], completed in 2010 by the Environment Agency with co-funding from PTES, revealed that already there were signs of otters in 1 085 10km squares, with 56% of 3 327 survey sites recorded positive (an increase of 62% since the 2000-02 survey and 915% since the 1977-79 survey). Likewise, in Scotland, otter signs were recorded in 92% of 1 376 survey sites (1 265), in the 2003-2004 survey[30]. Otter range has increased in all regions of England, and notably, in Scotland, otter signs have been found in Glasgow, Edinburgh and Dundee. They may have reached carrying capacity (defined as over

Laurie Campbell

80% of survey sites positive for two successive surveys at least five years apart) in SW England and the River Wye catchment (populations in Northumbria, Cumbria, Wessex and the upper Severn are probably close). Otters in Scotland are virtually ubiquitous and probably at carrying capacity in the northern parts of their range, in the outer islands and Dumfries and Galloway. As of 2005, the percentage of 10km squares found positive for the presence of otters was 65% in Northern Ireland and 79.8% in Wales.

Recovery has been attributed to the ban on organochlorine pesticides in the 1980s, legal protection under the Conservation of Wild Creatures and Wild Plants Act 1975 since 1978 (otter holts were also protected under the Wildlife and Countryside Act 1981 in 1982) and improvement in river water quality since the 1970s. The result has been natural expansion from remnant populations, helped, locally, by reintroductions of captive-bred and rehabilitated otters, for example, in East Anglia, Yorkshire and the upper Thames. Monitoring, initially by the Nature Conservancy Council and the Vincent Wildlife Trust, and latterly by the Environment Agency and SNH, has been vital and full recovery across England is likely within the next two decades. However, otters remain absent from most of Sussex. Remaining concerns include road casualties, environmental toxins including river acidification, degradation and modification of river and riparian habitats, deaths in fish and crustacean traps, drowning in crab and lobster pots in coastal areas, and potential conflict with fisheries and fishermen. Whilst the implication is that otter numbers as well as distribution have increased, it is not currently possible to estimate otter abundance from spraint abundance. Research investigating the possibility of assessing numbers of otters from DNA, or from volatile compounds, in spraint is on-going.

Red squirrels

Red squirrels were historically widespread throughout Britain, but have suffered a dramatic decline of more than 50%[15] over the last 50 years while expanding throughout Scotland. They were designated a UK BAP Priority Species in 1997. The main threat is the invasive grey squirrel, introduced to the UK in the late 19th and early 20th centuries. Grey squirrels are able to digest acorns more successfully than red squirrels and out-compete reds for forage in woods where oak trees constitute more than 14% of the canopy. Additionally, greys are carriers of the squirrel poxvirus (SQPV), transmitted through direct contact and environmental contamination[31,] which is lethal to reds[32]. Developing best practice survey and monitoring continues to be an important conservation action and a recent study showed that baited counts, compared with standard visual counts, increased detectability of squirrels. Extended durations of baiting could attract non-residents, so baited surveys should not be too long and also should be diffuse to avoid promoting disease transmission between squirrels[33]. Unlike SQPV, adenovirus is a naturally occurring enteric disease in red squirrels, albeit so far occurring at low levels, but localised outbreaks could be detrimental to fragile populations. The disease has so far been recorded in Merseyside, Anglesey, Cumbria, Northumberland and Scotland[34].

Nowadays, Scotland contains more than 75% of the UK red squirrel population, although greys are absent from only parts of the red's Scottish range – primarily in the Highlands[35] (a grey squirrel was caught in Inverness in 2007 and, in 2010, one was killed on Skye[36]). Probably reds will survive only in conifer patches in Scotland and a few other areas free of greys. A priority woodlands analysis in 2005[37], co-funded by PTES and others, aimed to identify the major Scottish woodlands that may support red squirrel populations. Next came the Scottish Red Squirrel Action Plan[38] and then the development of red squirrel strongholds by the Forestry Commision and SNH. In 2009 a total of 18 stronghold sites, plus the Isle of Arran, were identified as foci of red squirrel conservation. Elsewhere in the UK hope rests with islands (the Angelsey Red Squirrel Project and the Wight Squirrel Project). The first case of SQPV in Scotland was discovered in 2005 – so, in the continued absence of a vaccine, the omens for the red squirrel in the UK are bleak.


Laurie Campbell




Monitoring trends

From a global perspective, in 2001[1], of the 66 mammal species ordinarily resident in Britain, twelve terrestrial species and five cetaceans were listed in the IUCN 2000 Red List. Of these otters, harbour porpoises, lesser horseshoe bats, Bechstein's bats, barbastelles and, nationally, wildcats, were listed as Vulnerable. Bottlenose and Risso's dolphins were Data Deficient, and the remainder classed as Lower Risk. Then, as now, no British mammal was classified as Endangered or Critically Endangered internationally, except the migratory fin, blue and sei whales that pass through British waters, and northern right whales, which may now be extinct in the North Atlantic.

Otters, Bechstein's bats and barbastelles improved their status to Near Threatened in the 2008 IUCN Update[39], and lesser horseshoe bats and harbour porpoises to Least Concern, though Scottish wildcats are undoubtedly critically endangered in Britain. Chinese water deer, an introduced species, changed from Lower Risk to Vulnerable due to mounting evidence of its shrinking native range. Monitoring has revealed bottlenose and Risso's dolphins as Least Concern, but now northern bottlenose whales, already depleted by whaling, are further vulnerable to anthropogenic sound, so are listed as Data Deficient. Killer whales and long-finned pilot whales are also considered Data Deficient due to suspicions that each may comprise more than one species.

Just over half of Britain's terrestrial mammals (35 species) are monitored in sufficient detail and scale to assess national population changes. The data are compiled by the Tracking Mammals Partnership (TMP) (consisting of 25 collaborating organisations, including PTES). While deer, bats and mustelids are relatively well monitored others, for example most small mammals other than dormice, are not. There's new hope in the form of the Mammal Society's mini-mammal monitoring programme, involving harvest mouse nest searches, field vole signs searches, bait tubes and low and intensive live-trapping in spring and autumn. Ten non-native species are monitored by the TMP four of which (brown rat, grey squirrel, sika and muntjac) are increasing and problematic for our native fauna[4].

Although many of Britain's mammals apparently declined significantly in the past 25 years, some appear to have stabilised or even increased in the last decade. Of the 25 monitored mammal species native to Britain, half are either stable (not necessarily in a good state) or increasing, while only three are in decline. Trends for UK BAP species are summarised in the table opposite. Of the 11 of Britain's 17 native bat species for which data are available, four (greater and lesser horseshoe bats, Natterer's bats, and common pipistrelles) are increasing, and seven (whiskered bats, Brandt's bats, Daubenton's bats, serotines, noctules, soprano pipistrelles, and brown long-eared bats) are stable. Bats are generally benefiting from changes in farming practice, whilst awareness and stronger legal protection have helped to safeguard bat roosts.

Terry Whittaker

Hedgehogs have decreased in recent decades (see page 6) but moles may be increasing, following the banning of strychnine in 2006 (see page 15). The British Mole Catchers Registry reports a sharp rise in mole numbers in recent years.

Of the carnivores, feral cats and American mink declined during the past decade due to control, native badgers, otters, stoats and weasels increased whereas foxes and polecats appear stable. Stoats and weasels may benefit from the extended breeding periods of small mammals following warmer and shorter winters and badger numbers in Britain have risen by approximately 25% in the past decade.

Of five monitored deer species, three increased in the past 10 years: native roes as well as the introduced sika, and Reeve's muntjac. Numbers of fallow and red deer have stabilised during the past decade, following significant increases during the 1990s.

Population densities of brown rats have increased significantly, following urban development, as have grey squirrels. Both of these introduced species are implicated in predating song bird eggs and chicks. In contrast, house mice have stabilised.

Marine mammal monitoring

Marine mammals are challenging to monitor because they spend most of their lives under water and are difficult to identify. Their inaccessibility means that research costs are high. A cetacean surveillance strategy, led by JNCC, is under development and should be finalised and implemented in their Marine Biodiversity Monitoring Programme due in 2013/2014. Three international surveys have greatly improved our current knowledge, though more reliable abundance and population information is required. For the BAP species within three grouped action plans, trends are unknown for all toothed whales (long-finned pilot, northern bottlenose, Sowerby's beaked, True's beaked, killer, sperm and Cuvier's whales), four out of six baleen whales (sei, blue, northern right and humpback whales) and five out of six dolphins (common, Risso's, white-sided, white beaked and striped dolphins). Harbour porpoises, bottlenose dolphins, minke and fin whales are thought to be stable. The harbour seal has experienced a marked decline in the UK range (e.g. 40% between 2001 and 2006 in Orkney and Shetland and 22% on the east coast of England in 2002) and was made a BAP species in 2007.

BAP species update

UK BAP terrestrial species Comments; key actions (KA); new targets (NT)	**TMP 10 year trend (% change)**	**UK BAP trend**	**State of knowledge (see key bottom)**	**UK BAP 2010 target status**
Water vole Nationally the positive range expansions are now just about outweighing the declines. KA: more funding for mink control, large scale habitat creation, sensitive management of water courses. NT: increase in range by 55 new occupied 10km squares by 2015; 60 by 2020 and 55 by 2030.	Decline	Fluctuating – probably declining	S	Exceeded
Wildcat (2007) KA: Monitoring, assessment of genetic risks, identify priority habitats.		Substantial decline		
Hedgehog (2007) Decline linked to warmer winters (disrupted torpor), drier springs (limiting earthworms, slugs and snails), garden pesticides and road traffic accidents. Decline is statistically significant only in Wales during the past decade, but their main predator, the badger, continues to increase.	No change	Rural decline		
Red squirrel KA: Identify priority woodland; research to control grey squirrels; protection from squirrel poxvirus.	Decline	Declining	S/MR	Unknown
Brown hare Aim to retain as common farmland animal; agri-environment schemes to be main delivery mechanism.	No change	Increasing	S	Unknown
Mountain hare (2007) Upland habitats susceptible to climate change.	Decline	Declining		
Otter KA: Monitor the continued recovery and health of the population through post-mortem and tissue analysis.	Increase	Increasing	S/MR	Achieved
Pine marten (2007) KA: Promote reafforestation, consider reintroductions.		Unknown		
Harvest mouse (2007) KA: Develop monitoring, link landscape features to create accessible corridors to aid colonization, agri-environment schemes.		Declining		
Dormouse National Dormouse Monitoring Programme of nest-boxes at 250 'key sites' across England and Wales, reintroductions to 11 counties and *Hedgerows for dormice* project.		Declining slowly	S/MR	Some progress
Polecat (2007) Polecats spread throughout Wales and parts of England between 1992 and 2007 coincident with mink control.	No change	Slow recovery		
Barbastelle National Bat Monitoring Programme Woodland Survey - longer data run will be needed before a UK barbastelle trend can be produced and this is not expected by 2011.		Unknown	I	Achieved
Bechstein's bat Monitoring began in 2008, but of >300 sites surveyed by the Bat Conservation Trust in 2009/2010, Bechstein's was confirmed at only one.		Unknown	I	Some progress
Noctule (2007) Destruction of roost sites through deforestation and removal of winter roosts in buildings threatens remaining populations. Bat Conservation Trust field survey suggests signs of increase in Scotland, but more data required.	No change	Decline?		
Soprano pipistrelle KA: Focus on promoting maintenance of traditional landscape and boundary features (including highways) and woodland. Maintenance and enhancement of wetland and waterbodies for insect prey.	Stable	Fluctuating probably stable	S/MR	Achieved
Brown-long eared bat (2007) Roosts in buildings vulnerable to development, renovation, exclusion and toxic timber treatment. Colonies may be affected by the rise in barn conversions.	Stable	Decline?		
Greater horseshoe bat Conservation work has focused on ensuring maternity sites and hibernation sites remain in good condition and on improving environmental conditions around maternity roosts.	Increase (32%)	Increasing	S/MR	Exceeded
Lesser horseshoe bat KA: Create or retain suitable habitat or landscape features throughout range and continue to protect and monitor designated sites and roosts. Ensure non-BAP habitats are managed for mosaic of habitat use.	Increase (41%)	Increasing	S/MR	Some progress

S Sufficient; S/MR Knowledge sufficient to make some impact, but more research needed; I Insufficient




Monitoring issues

In 2001, *Britain's Mammals: Challenge for Conservation* ranked mammal monitoring, as the highest priority for UK mammal conservation[1]. Since then, the impact of climate change has now joined habitat loss amongst the forces threatening mammals. Even more reason for the original first priority to remain top of our list.

Volunteers have a lot to contribute to mammal monitoring, not least because the task is extensive. Different species often require different monitoring techniques, perhaps more so than is the case for monitoring birds. Newman *et al.* (2003)[40] report on the ways various mammal monitoring protocols can be used by volunteers. For example, 1km transects detected some species, but missed others. Deer, rabbits and hares with indiscriminate defecation habits, tend to be well represented on multi-species surveys, as are carnivores like foxes which advertise their presence with conspicuously placed droppings. Larger, heavier species leave more obvious footprints and some species have characteristic field-signs, such as badger setts, beaver lodges, squirrel bark-chewing etc. Bats are most effectively monitored by ultrasound surveys, leaving few field-signs outside roosts. Others, however, are consistently underestimated by general field-sign surveys: mice, voles and other small mammals are easily overlooked.

Monitoring mammals can be very tough work, requiring long hours, repetition, and considerable skill. Volunteers can contribute meaningfully, and do so to many surveillance and monitoring schemes run by several NGOs and other organisations including PTES. Amateurs have long been the mainstay of bird surveys, but their involvement in mammal monitoring is less established. One reason is that many mammal surveys rely on detecting and identifying field signs, which may be difficult. Appropriate, field-based training is essential[40,41]. Supervision and early correction of mistakes greatly improve volunteer-performance, sometimes to a level comparable to that of professionals. Matching tasks to individual volunteer-traits is essential. Valuable co-benefits of volunteering are public education, engagement and awareness of conservation. For example, diverse stakeholders (gamekeepers, fisheries staff, conservation professionals, land managers, and local residents) have combined to eradicate invasive American mink in the Cairngorms National Park, protecting native water vole populations[42]. There, volunteers were trained by professionals to find mink signs and to maintain mink rafts, and set live traps, while a network of professional biologists ensured volunteers did not feel obliged to participate beyond their sense of comfort and competence.

Climate change impacts

An aspect of climate change whose importance for mammals has only recently become clear is, as distinct from warming trends, climate variability. This compromises animals' ability to optimise their behaviour and life-history strategies when the weather is less predictable. Mammals are adapted to average and extreme weather patterns experienced by their ancestors; both are now changing, so how will mammals cope? Only monitoring can provide the data.

European badgers are a good model[43] because earthworms, their principal food in the UK, are highly sensitive to microclimate (with worm availability linked to mild, moist soil conditions). Over the past two decades badger populations throughout Britain have benefited from milder winters, with increased survival of older individuals and those in poorer condition, which would historically have succumbed when frost limited earthworm availability. Milder winters have also produced fatter females, better equipped to complete their pregnancy, thereby creating a baby boom. While relaxation of the rigors of winter food scarcity have increased badger populations overall, cubs face increased mortality in drier springs when earthworms are less bountiful and they can also suffer dehydration[43]. A further twist is that mild, damp winters tempt individuals above ground from their usual winter lethargy, out and about where they suffer heavier road traffic mortality[43].

Beavers and their kits in Norway survive better when rainfall is within the limits of historical patterns of variation and, paradoxically, wet spring weather that speeds vegetation growth turns out to be bad for beavers because the wood is less digestible[44].

Climate warming and variability is likely to affect the UK's mammalian hibernators, hedgehogs, dormice and bats, that rely on hibernation in order to maximise seasonally available resources. When animals hibernate they conserve the energy stored in their fat during periods when food is scarce, but when they are abnormally active, or if minimum temperatures are much higher than the normal range, they risk using up their stored energy more quickly. Climate variability may also cause hibernators to act out of synchrony with their environment. For example, warm winters could leave young hedgehogs at risk if hedgehog mothers give birth relatively late in the year. In this scenario, pups would not have time to put on sufficient weight to hibernate successfully and would starve. Coupled with drier springs that limit their food availability when they wake up, the effects on population trends could be far reaching.

Volunteers have been trained in Scotland to assist on a project setting and maintaining mink rafts to help eradicate the American mink from the Cairngorms National Park.

Helen Gray

Deer browsing can obliterate the understorey of woodlands, which in turn means that species like small mammals suffer a lack of habitat.

Nida Al Fulaij

Invasive species

Conflict with non-native species was identified as a serious issue facing British mammals in our 2001 report[1] and, ten years on, 5% of all priority species and 9% of vertebrates with Biodiversity Action Plans (BAPs) list non-native species as a threat. Non-natives are also identified as a threat to 32% of priority habitats[14]. Invasive, non-native species (both plants and animals) are widespread in the UK, their cost to the British economy is estimated at £1.7 billion per year[45], and they impact on native mammals through predation, competition, hybridization and transmission of diseases. Some of Britain's most emblematic species, like red deer and Scottish wildcats, are threatened by invasive species, as are water voles and red squirrels, which have been extirpated by invasives over large areas of England and Wales.

There are 14 non-native mammal species in Britain, if you define a non-native species as one transported by people outside its natural geographical range. Five arrived approximately 1 000 years ago: rabbits, fallow deer, ship rats, house mice, brown hares; while the others arrived a hundred years or so ago: grey squirrels, American mink, sika, roe deer, muntjac, Chinese water deer, edible dormice, ferrets and brown rats. Feral cats could be added to this list, though more responsible cat ownership seems to be reducing their numbers. Brown hares and roe deer are generally considered as native, but brown hares (a BAP species since 1995) were introduced by the Romans from continental Europe, and roe were reintroduced from mainland European stock in the 19th Century, having been extirpated from England in the 18th century due to overhunting and loss of forest cover, so only the roe in Scotland are strictly native. In our invasives report[14] we developed the idea of ecological citizenship for those introduced species that have become absorbed into rearranged natural communities.

American mink, Japanese sika and brown rats are listed amongst the worst 100 species in the European invasive species database (DAISIE: Delivering Alien Invasive Species Inventories for Europe). Three more, grey squirrels, rabbits and house mice, are listed in the global equivalent (GISD: Global Invasive Species Database). Invasive deer species are generally on the increase, as are native deer[18]. Muntjac are expanding their range the most rapidly of all UK deer, and account for 22% of road traffic accidents involving deer in England alone, with an economic impact estimated at more than £10 million per year[18]. Sika occupy approximately 36% of the red deer's range and hybridize with them. Such genetic mixing is cause for serious conservation concern especially since their hybrids are difficult to detect by eye, and may disrupt locally adapted genetic profiles[14]. Similarly, ferrets hybridize with polecats, and feral cats with Scottish wildcats, and both their hybrids are difficult to discern from true polecats and Scottish wildcats, seriously hindering protective legislation enforcement in the case of Scottish wildcats[46]. American grey squirrels are still expanding their UK range, having devastated the native red squirrel through a combination of a competitive advantage (digesting acorns more effectively) and carrying disease (see page 7).

Invasive species on the decline include rabbits and possibly Britain's most notorious and widespread invasive, American mink[47], responsible for decimating the native water vole. Efforts to control mink have succeeded where intensive trapping has been repeated and sustained, and a cordon sanitaire is currently being implemented between Ullapool and the Dornoch Firth, designed to halt their spread to the north of Scotland.

Conservationists face paradox, inconsistency and ethical challenges when deciding how to manage invasive species. For example, what to do about Chinese water deer, of which there are more in Britain than survive in their native range. What if a threatened native British mammal is simultaneously an introduced invasive as is the case with hedgehogs in North Uist, Benbecula and South Uist in the Outer Hebrides? There they reduce the breeding success of wading birds at protected nesting areas. Management so far has involved, successively, killing the hogs by lethal injection and translocating them to the mainland, their detection currently aided by sniffer dogs[48].

In line with the Convention on Biological Diversity the Invasive Non-native Species Framework Strategy for Great Britain emphasises that prevention is better than cure[49], and it is illegal to allow any animal which is not normally resident in Britain to escape or be released into the wild under section 14 of the Wildlife and Countryside Act 1981. Natural England's policy on invasives remains pragmatic, aiming to prevent any releases that have an impact on native wildlife, but taking account of people's enjoyment of some non-native species in the attempt to strike a balance between preventing harm and allowing limited releases of individual animals (for example, rehabilitated grey squirrels).




Wildlife disease: badgers and bTB

Bovine tuberculosis (bTB) was first identified in a badger in 1971 on a cattle farm undergoing a prolonged episode of this chronic respiratory disease. Bovine TB is caused by a bacterium *Mycobacterium bovis*, and spreads via aerosol droplets, through direct contact or exposure to bacteria in the environment, or through bites. Badgers, which may have contracted bTB originally from cattle, are now a maintenance host for it, and can survive for several years while infected. Estimates of the average infection prevalence in badgers where bTB is endemic include 15.9% in adults and 9.0% in cubs[50,51], although there are marked local differences[52], and detailed post mortem can reveal twice as many infected badgers as standard protocols[53]. Amongst other wildlife, there are only rare infections in small mammals[52], but higher prevalence in both wild and park deer. Ultimately, elimination of bTB in Britain would require disease control in badgers and cattle, and perhaps deer too.

Controlling bTB in cattle has been a challenge since Robert Koch discovered it in 1882 and in 1890 developed the first tuberculin used in diagnosis – in those days many people died from milk-borne *M. bovis*. In 1935 the government launched the first voluntary regular skin testing and compulsory slaughter (with compensation) of cattle, and in 1950 a national compulsory TB eradication scheme began. Test reactors fell from nearly 15000 in 1961 to 569 in 1982. However, continuing higher incidence in the SW suggested another source, so from 1973 to 1998, cattle test-and-slaughter was complemented with different badger culling strategies: gassing (1975-82), clean ring (1982-86), live test (1994-96) and interim (1986-97). None appeared to work. Then, the Krebs Review (1997) recommended the Randomised Badger Culling Trial (RBCT), to quantify the impact of culling badgers on the incidence of TB in cattle. Begun in 1998, this provides the foundation for judging what to do next[54].

The RBCT, costing nearly £50 million, involved 30 100km^2 high-cattle-incidence areas grouped into 10 triplets; areas within each triplet were randomised to proactive culling, reactive culling and no culling. The crucial comparison is between the cattle herd breakdowns (i.e. detected infections) in proactive and no culling areas, of which c. 50% were due to badgers prior to culling[55]. An important idea, advanced to explain the failure of earlier badger control, was the perturbation effect, whereby the consequences of killing some badgers increased the ranging behaviour and susceptibility of the survivors, so that transmission of disease to cattle could be, perversely, worsened [52,56]. Therefore, it is relevant to compare the change in herd breakdowns within the culling area and in a 2km perimeter surrounding it (where culling was shown to have perturbed badger populations[56],) and to make that comparison for a) the 4-7 years of the RBCT starting after the first proactive cull (culling ended in 2005), b) the post-cull years and c) the entire period. The results (Table 1), for which the wide variations (95% confidence intervals) are as meaningful as the central estimates, show that while culling was underway herd breakdowns decreased in proactive core areas (relative to no-cull areas – in absolute terms they got worse in both areas), but increased in the perimeter. The perturbation effect had waned by 18 months after culling treatments ended, although, over the entire period, farmers in the perimeter still tended to suffer a worsened breakdown rate - a cost borne by perimeter farmers, offsetting the benefit accrued by core farmers. Importantly, over nine years, and taking together BOTH the core and perimeter of an extrapolated 150km^2 circular control zone, the estimated net benefit was found to vary from 3-21% (Table 2). In 2007, the authors of the RBCT concluded 'These results combined with evaluation of alternative culling methods, suggest that badger culling is unlikely to contribute effectively to the control of cattle TB in Britain'[57]. With the longer run of data, society must reconsider whether this benefit is worthwhile, in the context of the annual cost of bTB to the taxpayer of £90 million.

Nida Al Fulaij

Finding a strategy to deal with and reduce the incidence of bovine TB has been an issue for over a century. The fact that cattle come into contact with wildlife which carry the disease only exacerbates the issue.

In 2010 the government launched a consultation regarding culls in England that would each cover at least 70% of land within a minimum of 150km^2 (larger area reduces the relative size of the perturbed perimeter) and might each involve killing about 1 500 badgers over four years - the culling done during six-weeks annually, by licensed groups of farmers or their agents. One estimate is that five years' culling with 2.5 years post-culling might prevent 22.6 confirmed breakdowns, saving £610 200, (against the cost of conducting five annual culls estimated as £2.14 million for cage trapping, or estimated at £562 500 by farmers shooting)[58]. Defra's consultation document observed 'the estimated net impact on farmers actually carrying out culling under licence is negative (a net cost)' and continued 'there could be a problem if farmers expect net benefits when they originally apply for a licence, but find that the expected benefits do not materialise. The problem is that if some farmers decide to abandon the cull part-way through, then there is a risk that the operation will make bTB worse'.

Whether such culling is worthwhile depends not only on whether society judges these gains to merit the costs (financially and in badgers, and whether measured over four years (the proposed licence period) or 9.5 years (the RBCT evaluation period)), but also whether the attempt to mimic the RBCT results can be achieved[59]. The huge practical task and financial commitment facing the farmers, the likelihood of protest, and use of an untested method (shooting), and the legality (under the Bern Convention) of scaling up this type of control to a sufficient proportion of the 39 000km^2 of Britain (c. 30% of England) in which bTB is endemic to make significant inroads into the national problem (such scaling up – currently discounted by the Secretary of State - might involve killing about 100 000 badgers over four years) all need to be considered. Is this plan the least worst option? It's a tough call, considering the livelihoods and human anguish at stake, but considering the uncertainties, the costs and seemingly poor return on capital, the impacts on badgers and societal disquiet, the English proposal doesn't look promising.

However, on 19th July the Secretary of State announced that she is 'strongly minded to allow controlled culling' by farmers and landowners, under licences to be issued by Natural England under the Protection of Badgers Act 1992, with the aim of providing local relief but not national disease control. While up to 10 licences might be issued annually, the first year would involve a pilot phase to evaluate the humaneness and operational effectiveness of shooting in two areas. The crucial task of evaluating whether the rate of herd breakdowns in culled areas is statistically different from that in comparable non-culled areas is likely to take 4-10 years, and the feasibility of making this evaluation will depend on the so-called statistical power provided by the sample, and made much harder by the likelihood that the results will be more variable than in the RBCT because licensees may be somewhat variable in their approaches. It is essential to develop the procedures for analysing success before starting the intervention.

Since, where badgers are undisturbed by culling, an estimated 50% of cattle are infected by other cattle[55], in the long run bTB is most likely to be controlled by an integrated programme involving surveillance and pre-movement testing of cattle, improved herd biosecurity and diagnosis and, eventually, cattle vaccination, together with vaccination of badgers. The goal is an oral vaccine, but an injectable TB vaccine for badgers is now available and a five-year, Defra-funded, Fera-managed, trial began in Gloucestershire in 2010, with some landowners also starting their own programmes. While injecting badgers is immensely time-consuming, so too are current farmer-led culling proposals, and vaccination, although still unproven, not only lacks many of the disadvantages of culling, but might have a better chance of working. Against the uncertainties of culling, four years may not be so long to wait, and there are plenty of useful cattle control measures to be getting on with in the meantime.

Table 1. Percentage change in herd breakdowns within the culling area and in a 2km wide perimeter surrounding it[58].

	a) During trial	b) Post-cull years	c) Entire period
RBCT trial area	-12.4 to -32.7% Est -23.2%	-19.1 to -42.0% Est -31.5%	-20.2 to -33.9% Est -27.4%
2km perimeter	-0.6 to +56.0% Est +24.5%	-27.4% to +26.0% Est -4.4%	-14.6 to +37.4% Est +8.3%

a) During trial: the four to seven years of the RBCT starting after the first proactive cull (culling ended in 2005) until one year after the last proactive cull
b) The post-cull years: from one year after the last proactive cull to Feb 2011
c) Entire period: from the completion of the initial proactive cull until Feb 2011

Table 2. Percentage change in herd breakdowns of core and perimeter over nine years (five annual culls and then four more years) extrapolated from estimates in Table 1 (C A Donnelly, *pers. comm.*).

Extrapolated consequences of badger culling in minimum licenceable cull area for predicted herd breakdowns	i) Cull years	ii) Post-cull years	iii) Entire period
150km^2 circular culling area plus 2km wide perimeter surrounding it	+9 to -17% Est -4%	-8 to -33% Est -21%	-3 to -21% Est -12%

i) Five years from the initial proactive cull (assuming annual culling, with five such culls)
ii) The following four years: from 12 to 60 months after the final proactive cull
iii) After nine years: from the completion of the initial proactive cull until 60 months after the fifth annual cull. (If the removal area had 'hard edges' and thus no perimeter perturbation, the reduction in bTB incidence might be 20-34%).




Human wildlife conflict

Of course, all the conservation problems faced by wildlife are ultimately due to people, and over the years of these annual reports we have documented problems for British mammals due to persecution, exploitation, agricultural intensification, habitat fragmentation, development and invasive species. However, sometimes wild mammals cause problems to people, and conservation biologists give this the general name of human-wildlife conflict - its resolution is central to conservation worldwide. In the State of Britain's Mammals series we have reported on damage caused by rabbits, deer and moles to forestry, agriculture and other human activities[14,18,22], and the economic cost of damage to foresters and farmers[14]. We have reported on deer and road traffic collisions[14,17,18,60], conflict between seals and marine fisheries[22], and otters and freshwater fisheries[22], and the impact of wind turbines on bats[18,60].

Regulation is crucial to conflict management, and was reviewed last year by Heydon *et al.*[61]. The Convention on the Conservation of European Wildlife and Natural Habitats 1979 and the Habitats Directive 1992 stipulate that human interests, whether cultural, social or economic, must be taken into account in applying protective measures. One mechanism for doing so is the granting of licences derogating the protective provisions that are otherwise prohibited by law. In England, c.4000 licences are issued annually permitting activities affecting protected species, almost a thousand of these are aimed at preventing serious damage by wildlife. It is estimated that wildlife licences are relied on by more than 100000 people to resolve human-wildife conflict (generally <1% of a species' population is affected), and thresholds are set to ensure that control measures do not cause long-term damage[61].

Killing common mammals, often dubbed 'pests', such as foxes, rabbits or commensal rodents, is generally unrestricted so long as due attention is paid to animal welfare and the prevention of cruelty. The range of legal control methods is limited for some species, such as rabbits and moles (see facing page). The 'Rodenator' (an American device that uses an explosive gas mixture to destroy animal burrows) is illegal in England for killing animals, but a legal technicality means that it can be used to collapse empty burrow systems – Natural England advises against its use. Options for acting against protected species (e.g. badgers, otters and bats) are restricted, often attract public opposition, and, in the case of European Protected Species (otters and all bats), the law places an onus on people to accommodate wildlife, irrespective of cost or inconvenience. About 40% of licences for prevention of damage are issued under the Protection of Badgers Act (mostly for actions against badger setts - few licences are issued to kill badgers). For a rare or recovering species, such as otters, licences for control are unlikely to be justified. Some angling groups claim that otters are now so abundant that they should be culled to limit damage to fisheries but the majority of complaints about otter predation on rivers have arisen where fisheries are suffering from one or more environmental problems - over-abstraction, pollution, habitat damage. Bats in houses pose problems but the emphasis is on tolerance (<2.5% of over 2000 cases visited in 2008-9 were granted exclusions).

Bats and badgers (and to a lesser extent dormice and water voles) are also affected by development. Development licensing has increased, driven by the growth in development and recognition of the need for protected species in planning. Developments affecting European Protected Species can be licensed only when projects are for 'imperative reasons of overriding public interest' and there must be no adverse impact on the population of the protected species. Certain mitigation and compensation measures (e.g. provision of new or artifical roost sites for bats, or artificial setts for badgers) can be a condition of these licences.

Other wildlife disease issues

Over the last decade, in the State of Britain's Mammals series, badgers and bTB have featured consistently on centre stage for their impact on farming[63,18,22]. Deer also have the potential to act as a source of bTB to cattle, and are hosts to ticks and their pathogens which affect cattle, sheep, grouse and people, for which the greatest threat is Lyme disease[18]. Other wildlife diseases that both infect Britain's mammals and directly threaten people through risk of serious illness, include rabies in bats[60] and Giardia and Cryptospiridium in water voles[60]. Leptospirosis, or Weil's disease, has recently been added to the list for water voles - the overall prevalence rate of nearly 43% in WildCRU's study of reintroduced voles was significantly higher than the 6.2% found in extant populations of wild voles. This suggests that the reintroduced voles may be more susceptible to acquiring leptospires, though their relatively higher densities compared with the depleted natural population may also have accounted for greater disease prevalence. Disease is always a serious consideration with deliberate reintroductions and also for accidental ones. For example, Bavarian beavers can carry a parasitic tapeworm *Echinococcus multilocularis,* potentially harmful to human health. This parasite has not been found in Great Britain but if any of the illegally released Tayside feral beavers are infected, it could become established in the Scottish wildlife. The parasite does not occur in Norway, and so Norwegian beavers, (the source population for the Knapdale trial, page 19) are not carriers.

Infectious diseases can have damaging consequences for mammal populations, particularly those that are already small or isolated. Some diseases have been introduced to the UK along with their non-native mammal host, such as squirrel poxvirus carried by grey squirrels and responsible for fatalities in red squirrels[22,60]. Natural movements within and between populations can also lead to infections capable of ravaging populations, illustrated by the phocine distemper virus (PDV) outbreak of 1988 in which 18000 harbour seals were washed up along the shores of Europe and the UK, and the second outbreak in 2002, both originating in seals from the Danish island of Anholt[19,60].

There is a need to find a balance between tolerance of wildlife problems and acceptance of the legitimate role of active intervention, including killing, where justified, in wildlife management.

Problems and solutions to mole damage

European moles are blamed for damage to farming, amenities and gardening. Their underground feeding tunnels and molehills peak in spring and autumn[62]. Damage to gardens, golf courses, bowling greens and cricket pitches may be aesthetic and/or financial, whereas damage to racecourses, grass airstrips and sports fields may also present risk of injury. Farmers report contamination of silage with *Clostridium* (when soil bacteria are gathered up with grass during silage production) causing poor fermentation and preservation, covering pasture with soil, injury to animals, weed invasion and subsequent degeneration of pasture, and damage to machinery, drainage systems, watercourses and young plants.

WildCRU's 1992 study showed that British farmers widely perceived moles as pests. Reported mole damage was generally slight, but could be more severe locally, and only half of farmers reporting damage actually attempted to control moles[62]. Reported losses were greatest on farms consisting primarily of pasture with some silage production, and farmers in central/eastern counties (where soil quality was better) were less likely to list moles as pests than farmers in the north, south or west and Wales[62].

The most commonly reported methods of mole control among farmers in 1992 were strychnine poisoning (41%), trapping (37%) and gassing (14%)[62]. Strychnine was considered the most cost-effective method of controlling moles, but it is an extremely dangerous alkaloid poison, causing death through asphyxia due to paralysis of the respiratory muscles. Since the introduction of the 1963 Animals (Cruel Poisons) Regulations, strychnine could legally be used only against moles. Suggested reasons for this anomaly are that: mole damage is perceived to demand action; it is the only poison cost-effective on an agricultural scale; no alternative has been found; and moles die underground where their deaths cannot be seen[62]. In 2006 strychnine was withdrawn, as part of the EU Pesticide Review. No other poisons are approved for controlling moles in the UK, but two fumigants (Luxan Talunex and Phostoxin), which produce phosphine gas, are approved for mole control and kill-trapping, using spring-traps such as scissors and Duffus traps, is widely used. The welfare implications of fumigants may be exacerbated by inconsistent production of gas and uncertainty regarding the volume of tunnels to be treated; exposure to sub-optimal concentration-time doses may result in prolonged symptoms of poisoning (uncoordinated movements, rapid respiration and convulsions) followed by recovery or death. Previous research questions the humaneness of mole spring-traps[62], and at present they are exempt from testing and approval under the Spring Traps Approval Order (made under the Pests Act 1954), because the Small Ground Vermin Traps Order 1958 permits their use.

The proposals contained in the Agreement on International Humane Trapping Standards do not currently apply to mole traps, but the EU has declared its intention to extend these to other species in due course, and moles may be among these. Mole traps may therefore need to meet appropriate standards in the future. At WildCRU we are currently researching the welfare impact of both gassing and spring-trapping of moles with a view to informing future legislation.

Rabbits, one of our common species, are often dubbed pests and are subject to unrestricted control as long as it is carried out humanely.

Terry Whittaker




Overcoming habitat loss and fragmentation

Since the retreat of the last glaciations 19 mammal species have been lost from the British fauna, seven – beavers, wild boar, moose, aurochs, lynx, brown bears and wolves – attributed to anthropogenic persecution, habitat loss and fragmentation[1]. The drastic changes in habitat structure combined with the losses of large mammal communities has affected ecosystem dynamics across the country, so ecological restoration at the landscape scale is a conservation priority in the UK[64].

The concept of rewilding promotes the restoration of large core areas, connectivity and the reintroduction of keystone species, and is guiding thinking for ponies in the New Forest, beaver in Knapdale, wild boar in Glen Affric and wild boar, European elk and wolves in Alladale. Even on our small island there is room for rewilding: population density in the Scottish Highlands is only 8.6 people per km^2 – a gloriously beautiful landscape, but with dysfunctional ecosystems. Thousands of trees are being planted in the Scottish Highlands to restore the habitat to facilitate the conservation of resident species and the reintroduction of missing ones.

Alladale is a 90km^2 Highland estate with a traditional sporting estate history. The new management vision includes wild boar, European elks, brown bears, lynx and wolves and, equally controversially, a fence to create a landscape scale, enclosed restoration project. Key challenges include: how much space is available around the Alladale Estate for a fenced reserve? Is this sufficient to support a wolf population? Will wolves limit deer numbers within a closed system with beneficial cascading effects throughout the food web? At 90km^2, much smaller than the average wolf territory of 200 km^2, Alladale is too small to house this top carnivore. However, surrounding Alladale are numerous other traditional sporting estates before a major road or rail line divides them from the rest of the Highlands – an area known as the North Ross Deer Group. Sandom, Bull and Macdonald[65] estimate 1 200km^2 – twice the size of Isle Royale National Park (home of a long-term predator-prey study of wolves and moose in the USA) could conceivably be used within a fenced reserve if all landowners of the relevant sporting estates were willing to enter into a conservancy type arrangement, as often seen in Southern Africa. Only 37 buildings or small clusters of buildings would be encompassed within that area. Modelling suggests that within small closed systems the probability of wolf population survival over 100 years, and their impact on red deer, would depend on their social response to limited space. One simulation suggests that at one pack per 200km^2 the wolves are likely to survive, but to impact little on deer numbers; another suggests that at one pack per 150 or 100km^2 they are likely to reduce deer numbers, but also to face a greater risk of extinction. The impact on red deer is relevant because at about 300 000-350 000 in Scotland, they are running out of resources, and limiting woodland regeneration.

Eurasian lynx might play a similar role in rewilding, but be less problematic than wolves. Previously thought to have become extinct due to climatic change between 10 000 and 4 000 years ago, more recent evidence raises the possibility that lynx survived in Britain until medieval times and that their demise owed more to anthropogenic factors, such as deforestation, declining deer numbers and persecution[18]. We reported on models of lynx reintroduction in 2008, which suggest that there is enough suitable habitat in Scotland and northern England to support 450 animals.

Excitement at the possibility of reintroducing extirpated species should not blind us to the need to restore those just hanging on, such as Scottish wildcats, which disappeared from southern Scotland, England and Wales by the mid to late 19th century as a result of forest loss, hunting for fur and persecution. The development of sporting estates in Scotland from the mid-19th century led to a further decline and by the early 20th century wildcats were believed to be on the brink of extinction and restricted to the far north-west Highlands. Re-forestation after the establishment of the Forestry Commission in the early 1900s probably aided its re-colonization over much of northern Scotland, but probably at precariously low numbers, one guess being as few as 400 individuals[66]. The greatest threats are hybridization and disease transmission from the feral/domestic cat and persecution[66]. Is there anywhere wildcats can be re-established where they won't come into regular contact with feral cats? Kilshaw and Macdonald evaluated the feasibility of reintroducing Scottish wildcats into an area within a 50km radius of the Alladale Wilderness Reserve. The habitat there is only middling for wildcats but it could be enhanced and people (and thus feral cats) are few. Modelling suggested the area might support just over 200, and perhaps more if habitat linkage was improved. Reintroduction would surely necessitate adaptive management, and intensive monitoring. Minimising adult mortality rates through reducing persecution or examining the use of road passes could improve population viability. Simulating release of 10 males and 10 females, followed by long-term annual supplementation of at least one male and

Wild boar are one of seven mammal species lost to the UK since the last glaciation due to either human persecution, habitat loss or fragmentation - or a combination of these factors.

WildCRU

one female, should ensure population viability after 100 years. Kilshaw and Macdonald's study highlighted the urgency of improving the captive population, of which only five females and four males (out of 78+) are suitable for breeding (according to their pelage (N.Buck *pers comm*., 2008)) and their genetics may be even worse. Modelling indicated that the captive population only has a 94% chance of surviving the next 50 years unless the number of individuals capable of breeding is increased to greater than 14 and the percentage of females breeding annually is increased. Furthermore, the current captive population is unlikely to withstand supplying individuals for reintroductions and for this it needs to be more than 30 individuals. Other than suitable habitat, prerequisites for reintroduction include sufficient suitable captive candidates, reduced threat of hybridization and thus feral cat control, community education and approval (especially where grouse occur).

Landscape scale is perhaps the most difficult thing to achieve for restoring habitats, and can determine whether a keystone species contributes successfully to ecosystem function or becomes a conservation blight. For example wild boar, nature's ploughs, disturb the soil and increase plant species richness. Disturbance is an ecological necessity to maintain biodiversity but only where it occurs at the intermediate scale. So wild boar may be a beneficial habitat engineer in an expansive landscape, but a pest doing so in a small bluebell wood. Size matters, especially in an ecologically impoverished landscape, and joining up habitat offers hope. Rewilding is about creating a national ecological network of core areas and corridors. The Wildlife Trusts have embarked on a campaign to 'expand on these [wildlife havens] and create '*A Living Landscape*' where our nature reserves are integral parts of wider functioning landscapes and not isolated oases.'

Restoring ecosystems, and their mammals, can add other tangible values to human well-being, as recently assessed by the UK National Ecosystem Assessment (NEA)[13]. The NEA highlighted the contribution that UK mammals make. For example species such as rabbits maintain certain habitats of high biodiversity value through essential grazing. Beavers are noteworthy due to their ecosystem engineering effects on habitats and their water purification actions (see page 19).

Lost life: England's lost and threatened species[11]

'In raising awareness of species loss and decline through this report, we do not seek to turn the clock back to some species-rich point in the past. Rather, we wish to inform the choices that will determine which species will remain and thrive in our future.' Produced to coincide with the International Year of Biodiversity in 2010 this report identifies, for the first time, nearly 500 animals and plants that have become extinct in England in the recent past. This includes 12% of land mammals including six species that are probably well-known to most people: wolves (lost in the late 1200s), brown bears (late first century), lynx (early first century), beavers (late 1700s, now under trial reintroduction in Scotland), wildcats (lost from England in the late 1800s, currently persisting in the north of Scotland), and, perhaps least known, greater mouse-eared bats (lost in the 1980s). The report also highlights other species of concern, and suggests that red squirrels (page 7) are highly likely to be lost from the mainland in the next 20-30 years unless effective action is taken.

Terry Whittaker

Rewildling parts of the countryside could see the return of large predators such as wolves, though most likely in large fenced areas.




Reintroductions

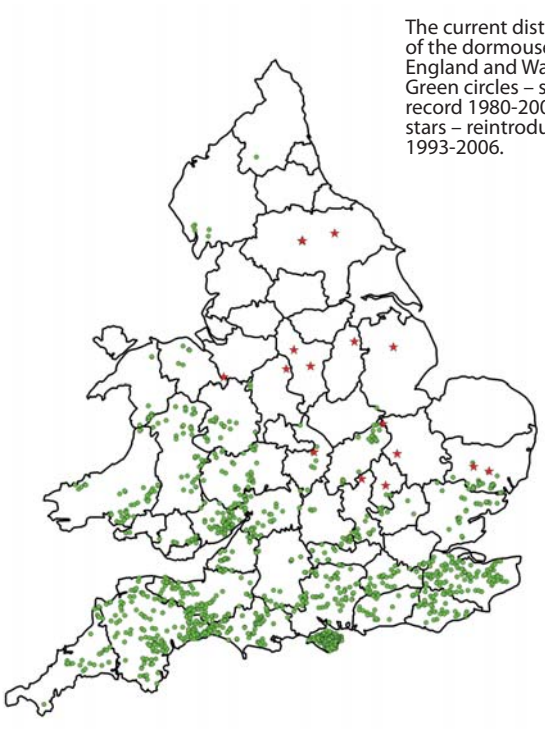
Reintroductions of either captive-bred or translocated animals have become an increasingly important part of conservation in the UK. Indeed, the restoration of native species to their former range is a legal requirement under the Convention on Biological Diversity and the Habitats and Birds Directive. In past years we have reported on a number of reintroductions of water voles in the south of England[21], the establishment of several semi-wild beaver 'populations'[22], thoughts of reintroducing Eurasian lynx, and estimates of the numbers of lynx that could be supported in Scotland[22], as well as the restoration of Alladale Estate in Scotland[60].

Reintroductions require a suitable source of animals, somewhere suitable to release them, funding to cover the costs, and public support. Reintroductions necessarily involve considerable logistics and manpower at several stages: obtaining or rearing animals, transporting animals to the release site, the release itself and post-release monitoring, and thus usually involve significant costs. The trial reintroduction of beavers to Knapdale, for instance, is costing approximately £2 million[67]. For this reason, as well as the fact that many reintroductions fail, reintroductions should always be thought of as a last resort, where the chance to restore the species naturally is not possible.

The requirement for animals of appropriate genetic provenance came to light recently in Scotland, where feral beavers are living wild in Tayside. Although beavers elsewhere in Scotland have been released under licence, the Tayside beavers have been either illegally released, or have escaped from private collections, and so the decision was taken to attempt to recapture them. This decision was made principally because they are not part of a planned, licenced and monitored release project, but an additional concern was that the Tayside beavers are believed to be 'eastern form' European beavers, originating from Bavaria, whereas the beavers that once inhabited Scotland were thought to be 'western form' beavers, from Norway (as were the beavers released in Knapdale).

Hazel dormice, once widespread, have disappeared from half their former range in England and are now found mainly in the south, with tiny populations in Northumberland and Cumbria. Loss of dormouse range is probably due to changes in woodland management, farming practices, loss of hedgerows and the fragmentation of woodland. The *Great Nut Hunt* of 1993 confirmed the loss of range, and the dormouse reintroduction programme (a partnership between PTES, Natural England, Royal Holloway, University of London, the Common Dormouse Captive Breeders Group, ZSL and Paignton Zoo) began in the same year with the aim of re-establishing dormice to counties from which they had been lost (and which they were unlikely to recolonise naturally). Now 14 woodlands in 10 counties are home to hazel dormice. A total of 681 animals have been released and the latest PTES reintroduction took place in 2009/2010 in a privately owned woodland in Warwickshire. The dormouse population at the very first release site at Brampton Wood in Cambridgeshire, initially released in 1993, has expanded and is now considered to be self-sustaining, and most other earlier reintroductions are at least showing signs of success. Second generations have been produced at 14 of 17 reintroductions; only three are known to have failed, and dormice have dispersed from the release woodland in at least three of 17 projects assessed[68]. Woodland fragmentation and lack of suitable management remains a problem, and thus, although the signs so far are encouraging, expanding the available habitat around dormouse release sites and increasing connectivity to neighbouring woodlands will be a crucial part of the long-term restoration of dormice to England. PTES' *Hedgerows for dormice* (HfD) project revealed that only 14.3% of hedgerows surveyed across 11 counties were in favourable condition. Hedgerows most commonly failed on excessive gappiness and need to be rejuvenated by coppicing or laying to encourage new growth from the base, along with having larger gaps filled by new planting.

There have been a number of local water vole reintroductions throughout the UK in recent years. All water vole reintroductions require the removal of American mink but habitat quality is also an issue. Experimental reintroductions in the Upper Thames by researchers at WildCRU, involving 532 water voles released at 12 sites over three years, demonstrated that greater widths of riparian vegetation increased both individual survival rates and population densities in the established populations[69]. Thick and extensive riparian vegetation provides increased protection from predation (thus increasing survival rates) and a greater total amount of food (which supports a greater number and greater density of voles). However the high densities achieved in these conditions mean that each individual vole has less food and so matures more slowly. Given the limited resources available for such projects, water voles should always be released into the most suitable habitat. Practical guidance for planning or carrying out water vole reintroductions is available in the *Water Vole Conservation*



The current distribution of the dormouse in England and Wales. Green circles – species record 1980-2008; red stars – reintroduction 1993-2006.

Mitchell-Jones, A.J. and White, I. (2009) *Folia Zool.* – 58(3): 341–348

Handbook, which is being updated this year for a third edition.

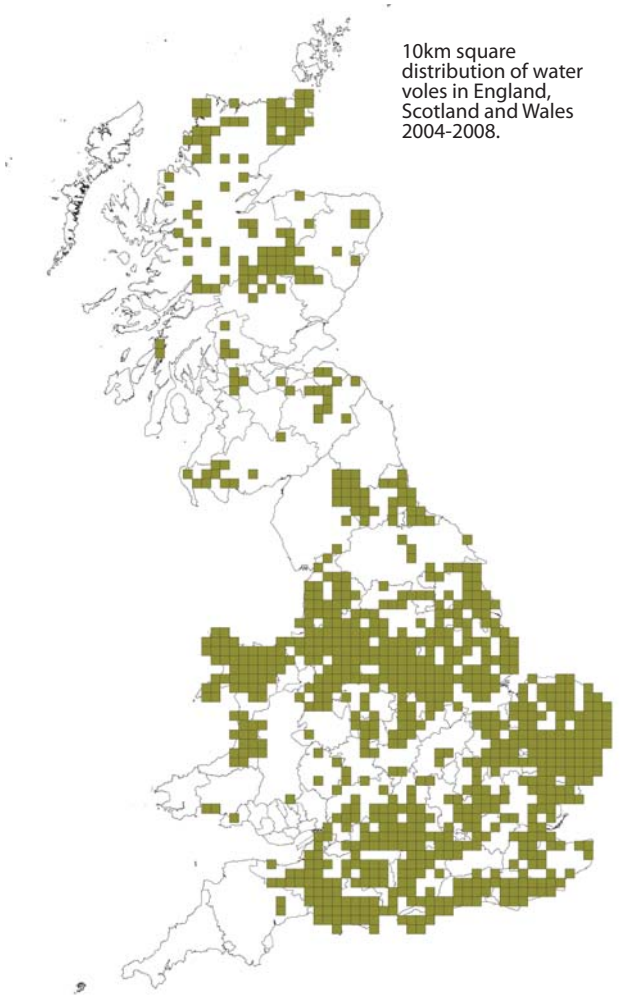
Following over a decade of deliberations, feasibility studies and public consultations, in May 2008 the Scottish government approved a conditional licence for the Scottish Wildlife Trust and the Royal Zoological Society of Scotland to undertake a five year trial reintroduction of up to four families of beavers in the Knapdale Forest estate, mid-Argyll, Scotland. Beavers last existed in Scotland 400 years ago. The aims of the trial, which is part-funded by PTES, are to assess not only the ecology and the establishment of the beavers, but also their impacts on the environment. The success or failure of the trial will be based on diverse but specific criteria, relating to the ability of the reintroduced population to sustain itself, the effects of the beavers on biodiversity, the economic effects of the beavers, and the cost of their reintroduction and ongoing management. The first beaver families were released in May 2009 and monitoring continues for five years. After the end of the trial SNH will report to the Scottish Government which will decide whether or not European beavers should be reintroduced to Scotland.

Of the fifteen beavers released, during the first year of the trial, three deaths, all males, were recorded, one dispersal of a female sub-adult and the disappearance of three females from the release area. However, at least two beaver families had successfully established territories and both produced young in the first year post-release and two young pairs are also settling down[67]. Dam building by the beavers has already had an impact on the local environment, most notable being the flooding of part of a circular footpath around one of the lochs, which has been turned into a 'beaver detective' feature for visitors to the site, with the construction of a purpose-built detour path that includes a section of floating pontoon to provide views of the beaver dam and pond.

A recent study commissioned by Natural England and PTES[70] concluded that beaver reintroduction to England was also feasible and that many benefits such as the potential of beavers to assist with river and floodplain restoration were possible. Following this, the Beaver Advisory Committee for England (BACE) was established in July 2010, to help provide independent advice and information, and to act as a focal point for discussion about the reintroduction of beavers into England. Groups in both England and Wales are considering experimental reintroductions to answer some of the questions about the impact of beavers in a human landscape.

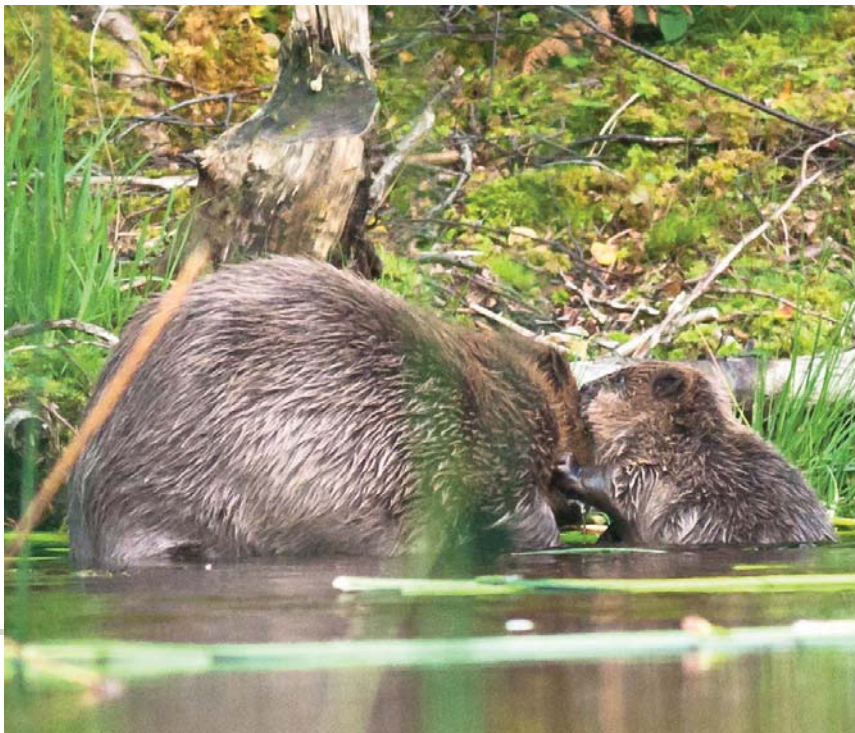
Reintroductions of red squirrels to bolster small remnant populations on Anglesey, following the ongoing cull to remove grey squirrels from the island, have succeeded and Anglesey will likely soon be a national stronghold for the species. Most recently, six animals sourced from captive collections in Norfolk and Kent were released on the Plas Newydd Estate, home of the Marquess of Anglesey, run by the National Trust on the banks of the Menai Strait. Animals were housed in forest enclosures for a few weeks and then released over the winter of 2008. The squirrels bred successfully and now are seen regularly across the estate.

Plans to reintroduce red squirrels to Cornwall were announced in June last year, supported by Prince Charles, patron of the Red Squirrel Survival Trust. This will be the first reintroduction to an area from which red squirrels have disappeared (red squirrels were last seen in Cornwall in 1984) and the first reintroduction to England. However, a prerequisite is the elimination of grey squirrels from the area, requiring significant resources and enormous effort with no guarantee of success, which is one of the reasons the project is not supported by the Cornwall Wildlife Trust. The two proposed areas are The Lizard peninsula and West Penwith, both being surrounded by water on three sides, and therefore, more easily defendable against recolonisation by greys. Nevertheless, grey squirrel eradication from the area (and from the required buffer zone) is challenging and the proposal is receiving some opposition from animal rights groups.



10km square distribution of water voles in England, Scotland and Wales 2004-2008.

Produced by the National Water Vole Database and Mapping Project, a partnership project hosted by Hampshire and Isle of Wight Wildlife Trust and supported by The Wildlife Trusts, the Environment Agency, People's Trust for Endangered Species and Scottish Natural Heritage.



Steven Gardner




Countryside legislation

Agricultural land covers 76% of Britain, providing habitat for at least 40 mammal species. Agricultural intensification since the mid-20th century has contributed to severe population declines of birds, invertebrates and mammals and, as a consequence, mammal conservation directly depends on the management of farmland landscapes. Governments are challenged to reverse these declines by devising agricultural policies that balance food production while promoting farmland biodiversity.

Biodiversity losses can be directly attributed to habitat loss and fragmentation, changes in management practices (e.g. neglect of hedgerows) and the use of agro-chemicals (e.g. nitrates) and of poisonous substances (e.g. rodenticide). But, can losses also be indirectly linked to policy frameworks that have failed to create, maintain and improve agricultural habitats? For example, hedgerows are important resources for food and for landscape connectivity for 10 out of the 18 UK BAP mammal species[71]. However, and despite 41% of hedgerows in England being actively managed under agri-environment schemes (AES), the length of 'managed' hedgerows has decreased by 6.2% (between 1998 and 2007) with a large proportion turning into lines of trees and relicts due to lack of management.

In England, 66% of farmland is under AES agreements[71]. AES provide payment to farmers and landowners to voluntarily manage their land in an environmentally sensitive manner, enhancing landscapes, maintaining historical interest and encouraging access to the countryside. The first AES in England was the Environmentally Sensitive Areas (ESA) scheme, launched in 1987 as a response to rapid agricultural intensification 'to offer incentives to encourage farmers to adopt agricultural practices which would safeguard and enhance parts of the country of particularly high landscape, wildlife or historic value'[71]. The national Countryside Stewardship Scheme (CSS) followed in 1991 to cover most important areas outside the ESAs.

By the late 1990s, agricultural policy started to focus on sustainable development with subsidies being decoupled from production. Government payments to farmers underwent major changes in 2005, partly to integrate lessons learnt from previous schemes, and partly to ease payments to farmers. Currently, farmers receive a single-farm payment (Single Payment Scheme, SPS) for cross-compliance, which involves applying certain obligatory standards in order to achieve environmentally friendly farming practices and to keep their land in good agricultural and environmental condition, regardless of production. Cross-compliance includes requirements covering public, plant and animal health, the environment, animal welfare and landscape features. On top of this, ESA and CSS schemes were closed for intake in 2004 (to be phased out in 2014) and were substituted by Environmental Stewardship (ES). ES gives farmers additional financial support when delivering effective environmental management on their land beyond cross-compliance. It is delivered by Natural England (NE) on behalf of Defra as part of the Rural Development Programme for England and it has £3.1 billion for 2007-2013[71]. Similar schemes are in place in Wales, where a system of tiers ensures a basic level of standard cross-compliance and a second tier covers specific improvements to habitat and species management. Similarly, a system of 'funding packages' offered by the Scotland Rural Development Programme replaces previous schemes and aims to support rural Scotland until 2013.

There are three elements to ES: Entry Level Stewardship (ELS) (including the new 2010 Uplands ELS), Organic Entry Level Stewardship (OELS) (and Uplands OELS), and Higher Level Stewardship (HLS). ELS is a 'broad and shallow' scheme aimed at encouraging extensive participation by following an 'entry-for-all' approach and open to all farmers who wish to undertake simple management options. OELS operates in a similar manner but is open to all organic farmers. ELS and OELS include options that may directly target the conservation of small mammal species (together with birds and invertebrates) because they are designed to improve boundary and linear features, including protection and maintenance of stone walls, earth banks, woodland edges, beetle banks and ditches. For example, six-metre-wide grassy field margins, an ELS option, can support greater levels of small mammal biomass (including bank voles, wood mice and common shrews) than unmanaged narrow margins. The ELS scheme also aims to address and reduce other landscape-scale issues such as diffuse

Three-quarters of the British countryside is farmed. Detailed legislation exists to protect the wildlife which shares it with us.

Nida Al Fulaij

pollution caused by fertilisers and pesticides (adversely affecting riparian species such as water shrews, water voles and otters).

In contrast, HLS is more demanding, with agreements tailored to local circumstances and farmers expected to undertake higher levels of management to deliver focused environmental benefits in high-priority situations and areas[71]. Options potentially beneficial to mammals include: management of hedgerows (dormice) or ditches (water voles) of very high environmental value; preservation of ancient trees (bat roosts); maintenance of woodland, orchards and scrub; recreation of arable mosaics within low-input cereal crops (brown hares); enhanced strips for target species on intensive grassland; and maintenance of reedbeds/fens (otters and water voles). UK BAP Priority species are also used to assess the effectiveness of management options (e.g. erecting bat boxes) measured by using specific 'indicators of success' (e.g. bat boxes being occupied). Farmers receive payments if they follow the prescriptions, even when failing to meet target indicators.

As opposed to ESA and CSS, which only covered key areas and habitats designated for their unique environmental features, ELS can voluntarily be joined by all, while only HLS entrance is competitive after an initial Farm Environment Plan (FEP) assessment. Consequently, although HLS attracts the highest payments and has the potential to deliver the maximum environmental benefits, HLS only comprises <10% of AES agreements. It is encouraging that NE has just announced record numbers of HLS applications to start in 2011, with a doubling in HLS intake projected for 2012[71].

Despite much publicised 80% increases in HLS funding, the NFU blames delayed payments and late 2010 freezes in HLS and FEPs start dates, for causing disappointment, confusion and misunderstanding within the agricultural community. Landowners have also complained about the difficulty of understanding terms that can be defined differently across schemes.

In addition to custody of the countryside, farmers face diverse pressures (e.g. foot and mouth, climate risks, badger debate). To help them, NE has an advisory system in place for HLS applications, but ELS advice is only offered to agreement holders. ELS schemes currently recommend an online application process with the aim of cutting costs and requiring less paperwork from farmers. However, this loses the benefits of face-to-face advice, and the tailoring of AES to particular ecological and business situations[72]. Despite high levels of ELS uptake and a great choice of options, without advisory input, most farmers may continue to choose popular options that are perceived as easier to undertake (e.g. boundary and lowland grassland), but that will not achieve the desired environmental outcomes. In 2008, only 20 options (out of 62) accounted for 90% of points scored within total ELS schemes [71].

Recent studies have highlighted that substantial biodiversity gains can be achieved by targeting farmers to join AES schemes within specific areas. A landscape-scale approach would benefit numerous organisms by increasing landscape connectivity, by addressing issues that extend beyond local farm/field conservation (e.g. whole catchments which benefit species such as otters and water voles) and by including organisms of various mobility levels. The 2011 White Paper recommends the creation of Nature Improvement Areas, to provide larger and connected sites for wildlife to 'live in and adapt to climate change'. Although ELS remains untargeted, a promising new geographical approach to HLS targeting has now been implemented.

Recent changes to ES have given greater consideration to energy crops, climate change and include new and amended options, making ES a stronger conservation tool to achieve best practice. Considering that ES payments amount to £400 000 million per year, tax-payers may expect these changes to deliver significant biodiversity returns. The White Paper suggests that the Natural Capital Committee puts a value to nature to merge green goods and ecosystem services with economic thinking. Although there is no doubt that AES are the major policy instruments for delivering environmental benefits and to contribute to mammalian conservation on farmland, AESs effectiveness remain uncertain. It is vital for conservation that ES schemes are coupled with rigorous monitoring programmes on many organisms (not only birds) that assess AES effects and allow for regular fine-tuning of options. The integration of scientific research within ES is therefore imperative for successful biodiversity conservation.




People's Trust for Endangered Species

Since 1977 PTES has been working hard to ensure a future for endangered species around the world, from Namibia to Nepal, Cameroon to Cambodia. Among the many animals we have helped to protect are bats in western Ukraine, hoolock gibbons in India, Persian leopards in Iran and neotropical otters in Mexico. In Africa we have supported the conservation of hyaenas and Rothschild's giraffes in Kenya, Sclater's guenons in Nigeria and cross river gorillas in western Cameroon.

But over the years PTES has received an ever-increasing number of requests for help here at home to fund research into the best ways of protecting our native mammals. It seemed that although there was a well-established network of organisations looking after different species groups there was no organisation that raised and disbursed funds to look after all of our mammals species on a national level. Consequently, ten years ago we launched a campaign to raise funds specifically to help safeguard British mammals and their habitats: Mammals Trust UK. In the past decade we have granted over one million pounds to mammal projects. We are proud of such a huge achievement and very grateful to those supporters and friends who have enabled us to do this.

We have over sixty mammal species here in the UK, over half are marine mammals that visit our waters but are not permanent residents and a surprising quarter of our mammal species are bats. Bats are a group of mammals we have worked hard to support. Our funds have been instrumental in setting up and maintaining new methods in monitoring Bechstein's bats – one of our most elusive mammals. We supported the innovative research at Sussex University developing lures that used their social calls to locate these secretive animals. This enabled the Bat Conservation Trust to devise a National Bechstein's survey, which we also supported for several years, using the ultrasonic lures in the field to determine the full extent of the species' range, including, just recently, a breeding colony discovered as far north as Worcestershire.

For almost ten years we've funded work at Royal Holloway, University of London, identifying, protecting and extending key sites for water voles across the UK. The drastic decline in our water vole populations during the nineties was a shock for the conservation community and, along with many other conservation organisations, universities and statutory bodies, we have been working hard to try to stop the decline. As a result of the National Key Sites project a series of 24 lowland and upland core priority areas have been established with appropriate habitat management instigated to ensure the survival of water voles long into the future.

One innovation we're very proud of is our internship awards. To ensure that the work we are carrying out and funding today will continue to be safeguarded and built upon in the future, we are nurturing the next generation of conservationists as they leave university. Work experience is increasingly hard to come by, especially in this sector, so we annually award grants to enable these budding scientists to gain the valuable skills that they need. In total we have supported over fifty graduates, giving them the chance to work with leaders in the field, and gain the confidence that they need.

Over the past decade we have worked on most mammal species in the UK: polecats and pine martens, barbastelles and beavers, hedgehogs, hares and harvest mice. The fortunes of some of these animals have seen an upturn over the past decade, whilst the full plight of some of our other species has only just been realised. We still have a long way to go to ensure that we know not only how all of our mammal species are faring but also to have stopped the decline of so many of them. We aim to do this through innovative research, practical conservation and raising awareness to safeguard both the animals and the environments in which they live.

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Development Manager

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People's Trust for Endangered Species

In 2001 People's Trust for Endangered Species began to focus particular attention on conserving wild mammals and their habitats throughout the British Isles by creating a special fund called Mammals Trust UK (MTUK). Through this fund we support and commission practical conservation research and we raise awareness by involving people in conserving mammals. We work in partnership with other voluntary organisations, wildlife experts, government and industry. Our aims in conserving our wild mammal populations are:

- to raise funds for research and practical conservation based on sound scientific understanding
- to increase public awareness, bring together those with an interest in mammal conservation and share knowledge
- to create opportunities for people to participate actively in mammal monitoring and conservation projects across the UK
- to manage key conservation sites to protect them for the future and to create opportunities for education, recreation and enjoyment of our natural heritage.

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people's trust for endangered species

WildCRU

The Wildlife Conservation Research Unit's mission is to undertake original research on aspects of fundamental biology relevant to solving practical problems of wildlife conservation and environmental management.

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WILDCRU
Wildlife Conservation Research Unit

The State of Britain's Mammals 2011 is the ninth of the annual updates following the publication of *Britain's Mammals: The Challenge for Conservation* for the launch of Mammals Trust UK in 2001. Copies of all publications can be obtained by contacting the People's Trust for Endangered Species at www.ptes.org

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