



State of Nature 2016

England

England's natural heritage includes a range of special habitats, each home to rich and diverse flora and fauna. Of particular interest are the remnant lowland heathlands in the south of England, and the wide open blanket bogs of the Pennines. Broadleaved and coniferous woodland habitats, including most of the UK's lowland and wet woodland, support around a quarter of our breeding bird and butterfly species, and all of our bat species. England's varied urban green spaces provide refuge to species that may have lost significant semi-natural habitat elsewhere. Yet all of this diversity is contained in the one-third of the land area not dominated by arable farmland or improved grassland.

The history of wildlife recording in England over the last three centuries means that our knowledge of the species present is among the best in the world. The position of England on the edge of continental Europe, and our relatively wet and mild climate, has resulted in a distinctive mix of species. It also means that as species' ranges shift north as the climate warms, we may increasingly see new species colonising¹.

Changes in England's landscapes

England's landscapes have been shaped by hundreds of years of human influence, and about 10% of the land area is classified as urban. Large-scale loss of habitats such as lowland heathland (80%) and unimproved neutral grassland (97%)² means that the remaining areas are crucial for many specialist species, such as heath tiger beetles and pink waxcaps.

There are, however, still many places for wildlife, even within an increasingly fragmented landscape. Acknowledgement of this fragmentation has led to habitat and species restoration being increasingly planned at a landscape scale, with projects

underway to restore, recreate and connect habitat patches across England.

What can we do?

Well-planned, targeted and sufficiently resourced conservation action can turn around the fortunes of our wildlife. This report showcases conservation projects that are addressing some of the key threats and problems facing English wildlife, and are fine examples of how partnership projects are bringing nature back, both locally and nationally.

For guidance on how to understand the graphs and results presented in this report, please turn to pages 20–21.



Pink waxcaps

Richard Becker (Alamy Stock Photo)

- **Over the long term, 60% of vascular plant species declined and 40% increased. Over the short term, this pattern was unchanged.**
- **62% of butterfly species declined and 38% increased over the long term, while over the short term, 50% of species declined and 50% increased.**
- **Over the long term, 49% of bird species declined and 51% increased. Over the short term, 62% of species declined and 38% increased.**
- **Since 1970, the Wild Bird Indicator has declined by 6%, but the Farmland Bird Indicator has fallen by 56%. The Farmland Butterfly Indicator has declined by 27% and the Woodland Butterfly Indicator by 51% since 1990.**
- **Over 6,000 species that are known to occur in England have been assessed using modern Red List criteria. 728 (12%) are at risk of extinction from Great Britain.**
- **It is largely thanks to volunteers that we can show these measures in this report.**

The wider context

This report is a companion to the *State of Nature 2016* report, which makes an assessment of the fortunes of wildlife across the UK, its Crown Dependencies and Overseas Territories. We would encourage readers to refer to that report (available at rspb.org.uk/stateofnature) for the wider context within which the state of nature in England, the pressures acting upon that nature, and the conservation responses required to help it, should be considered. Furthermore, our ability to measure change in nature is better at a UK scale – we can draw upon a greater volume of data, for more species and from more sources, as most biological monitoring and recording is conducted at the UK level.

That said, this *State of Nature 2016: England* report represents a step forward in our ability to report on England's biodiversity. Since the first report was published back in 2013, we have developed new country-specific metrics of change for all of the UK's four nations. The new English measures, presented alongside existing national biodiversity indicators and alongside UK metrics, improve our understanding of how England's nature has changed, and the scale of the challenge that faces us.

A look back

A new, objective approach to measuring the depletion of nature compared to natural, undamaged ecosystems is featured in the UK report. National measures of the Biodiversity Intactness Index (BII) provide us with one way to assess the extent of the loss of nature due to human activities going back centuries³. BII values below 90% indicate that ecosystems may have fallen below the point

at which they can reliably meet society's needs. Therefore the value for England – 80.6% – gives great cause for concern. Of the 218 countries for which BII values have been calculated, England is ranked 28th from the bottom.

This assessment of the degradation of natural ecosystems should, in fact, come as no great surprise given what we know of the loss of wildlife-rich habitat before we were able to assess the state of nature using the measures presented in this report. Little of this earlier loss has been quantified, and that which has, has usually been measured at a UK scale – however, those measures do draw on data from England. The facts remain stark:

- 97% of the lowland meadows in England and Wales were lost between the 1930s and 1984².
- 80% of the UK's lowland heathland – the great majority of it in England – has gone since 1800².
- The area of coppiced woodland fell by 90% between 1900 and 1970².
- Wetlands were drained at a rate of 1,000km² per year in the middle of the 19th century².

Hence, while *State of Nature 2016: England* focuses on recent and ongoing change, it should be remembered that there were dramatic changes prior to this. All the evidence suggests that the starting “baseline” used for the measures in this report is that of a country already much poorer in nature.



Key findings

We show trends in English species over the long term (around 1970 to 2013) and the short term (2002 to 2013). Details of how these measures were calculated, and caveats around how they should be interpreted, are given in the UK report. The measures were based on quantitative trends in either abundance or distribution for 1,387 terrestrial and freshwater species over the long term, and 836 species over the short term. For guidance on how to understand the graphs and results presented in this report, please turn to pages 20–21.

Trends in the abundance and distribution of species

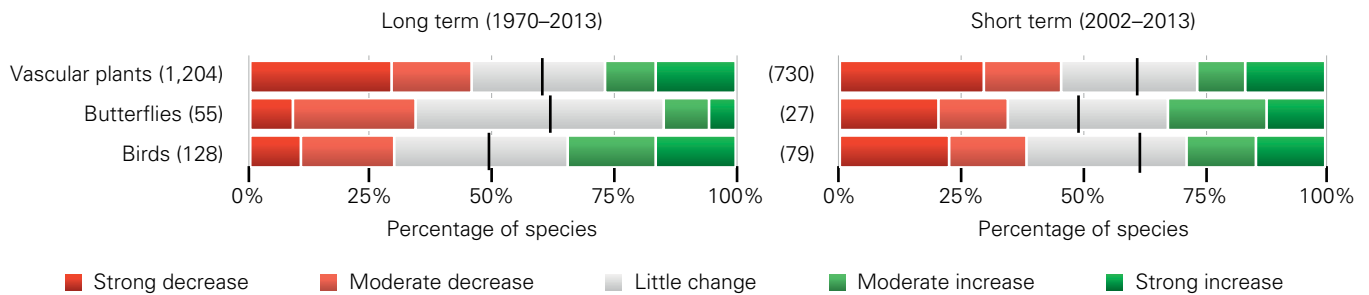


Figure 1

The percentage of species in each trend category over the long term and the short term. The line in the “little change” category shows the division between declining species on the left, and increasing species on the right. The values in brackets show the number of species assessed.

We have quantitative assessments of the change in population or distribution for terrestrial and freshwater species across three taxonomic groups: vascular plants, butterflies and birds. Marine species are assessed at a UK level and are not included in metrics presented here.

- Over the long term, 60% of vascular plant species declined and 40% increased. Among these, 46% showed strong or moderate declines, 27% showed little change, and 27% showed strong or moderate increases. Over the short term, this pattern was unchanged.
- 62% of butterfly species declined over the long term, and 38% increased. Among these, 35% showed strong or moderate declines, 50% showed little change, and 15% showed strong or moderate increases. Over the short term, 50% of species declined and 50% increased.
- Over the long term, 49% of bird species declined and 51% increased. Among these, 30% showed strong or moderate declines, 36% showed little change, and 34% showed strong or moderate increases. Over the short term, 62% of species declined and 38% increased.



Pheasant's eye



English biodiversity indicators

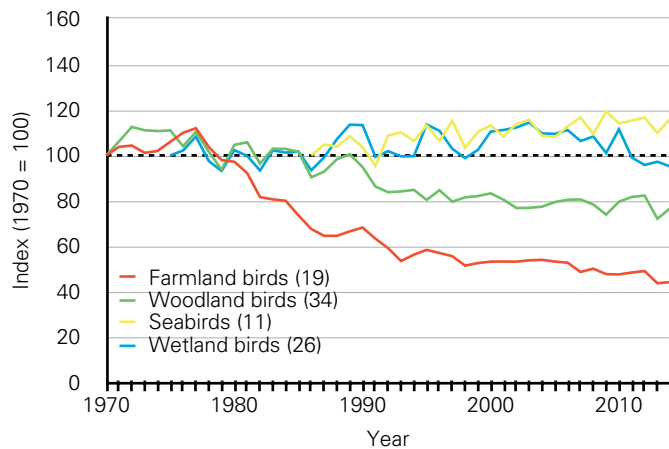


Figure 2
England Wild Bird Indicator, by habitat from 1970 to 2014⁴.

- The England all-species Wild Bird Indicator (not shown on graph) has fallen by 6% since 1970, with a small decline in recent years.
- The England Farmland Bird Indicator has declined by 56% since 1970, with the indicator for farmland specialists declining by 72%. The Woodland Bird Indicator is down 23% on its 1970 value, although it has been largely stable in recent years.
- The England Seabird Indicator has increased by 16% since 1986; trends vary by feeding strategy, with surface-feeding species declining by 22%, compared to diving species that have increased by 138%. The increasing trend has largely been driven by the rapidly expanding gannet colony at Bempton Cliffs in Yorkshire.

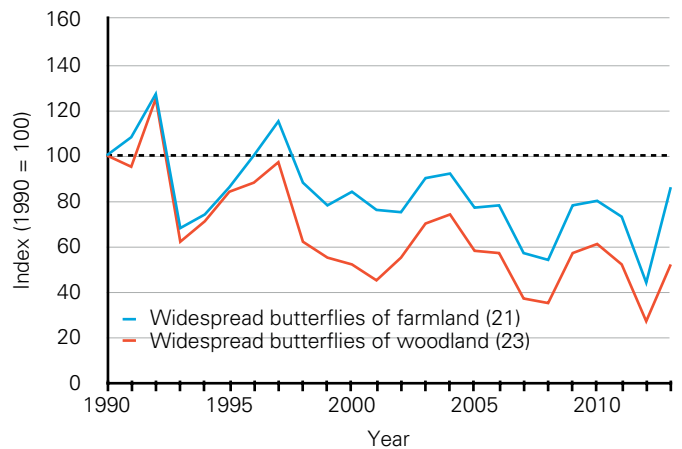


Figure 3
Indicator of widespread butterflies of farmland and woodland in England from 1990 to 2013⁴.

Butterflies have been monitored systematically in the UK since the late 1970s. Sufficient data are available to calculate indicators for butterflies in England from 1990 onwards. While this period straddles our long and short-term periods, we felt the patterns here were of interest.

- Since 1990, the Farmland Butterfly Indicator has fallen by 20%. This is classified as an ongoing moderate decline over the period of the indicator⁵. Species showing particular declines include the gatekeeper, large skipper and white-letter hairstreak.
- The Woodland Butterfly Indicator, which includes species such as the speckled wood, marbled white and brown argus, declined by 48% between 1990 and 2013. Over the last decade, the trend has been uncertain, but between 1990 and 2003 it was classed as a moderate decline⁵.

English Red List analysis

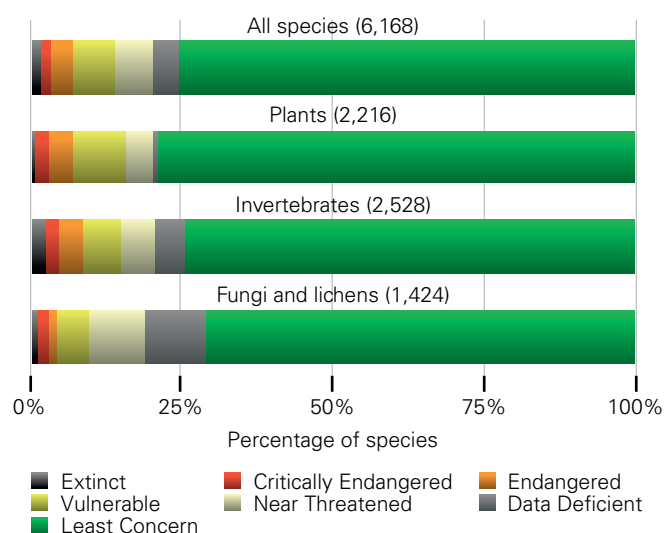


Figure 4

The percentage of species across all species assessed (top bar) and by broad taxonomic group, in each risk category, based on the likelihood of extinction from Great Britain. Species considered threatened with extinction from Great Britain are those classified as Critically Endangered, Endangered or Vulnerable in the most recent IUCN Red List assessments.

- Red Lists attempt to identify species at risk of extinction, using a standardised approach that allows for comparison across species and geographic regions.
- Of the 6,168 species in England that were assessed using modern Red List criteria, 728 (12%) are thought to be at risk of extinction from Great Britain. This percentage includes 8% of fungi and lichens, 11% of invertebrates and 15% of plants.
- Of the species assessed, 92 (1.5%) are known to have gone extinct from Great Britain. Some were last recorded many years ago, such as the mazarine blue butterfly (with few records since the late 19th century); while others have been lost more recently, such as the Essex emerald moth, which has not been recorded since the early 1990s.
- The recent *Birds of Conservation Concern 4* assessment⁶, which used different criteria from IUCN Red Lists, assessed 234 bird species that occur in England. 63 species (27%) were red-listed in the UK.



Summary of UK key findings

Since the first *State of Nature* report was published in 2013, substantial effort has been made to improve our ability to report on how wildlife is faring across England and the rest of the UK. Here we present a summary of the UK findings to add further context to the England-specific results in the rest of this report. These measures were based on quantitative trends in either abundance or distribution for 3,816 terrestrial and freshwater species over the long term and 3,794 species over the short term.

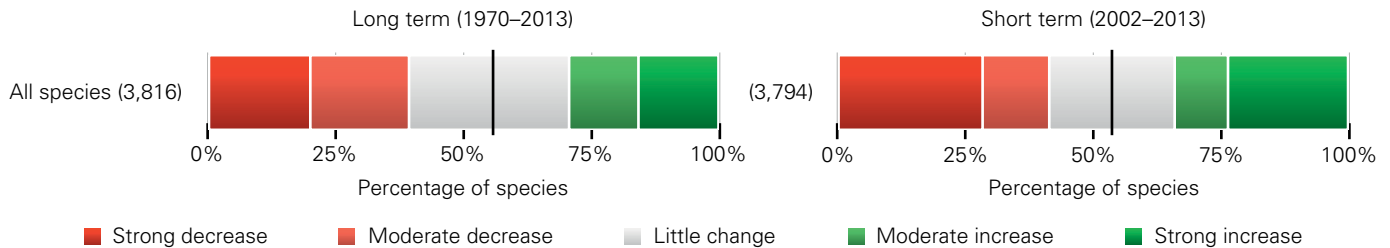


Figure 5

The percentage of species in each trend category across the UK over the long term and the short term. The line in the “little change” category shows the division between declining species on the left, and increasing species on the right. The values in brackets show the number of species assessed.

- Over the long term, 56% of species declined and 44% increased. Among these, 40% showed strong or moderate declines, 31% showed little change, and 29% showed strong or moderate increases.
- Over the short term, 53% of species declined and 47% increased. Among these, 41% showed strong or moderate declines, 25% showed little change, and 34% showed strong or moderate increases.

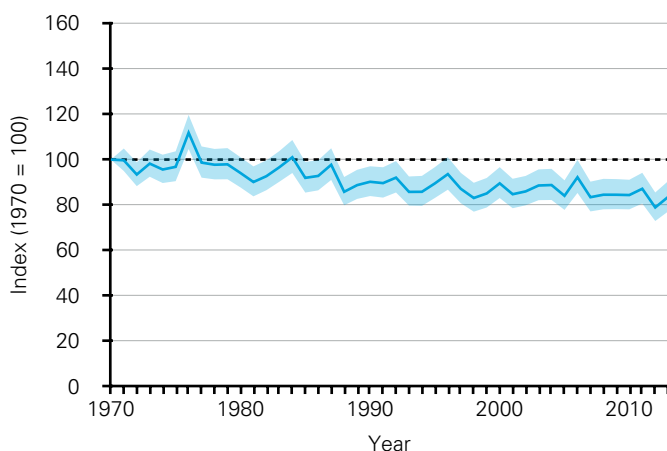


Figure 6

The Abundance and Occupancy Index shows change in the status of 2,501 terrestrial and freshwater species, based on abundance data (899 species) and occupancy data (1,602 species).

- The Abundance and Occupancy Index has fallen by 0.4% each year, on average, over our long-term period, resulting in a 16% decline in total. Over our short-term period, the decline was 0.18% per year. There was no significant difference in the rate of change over the two periods.

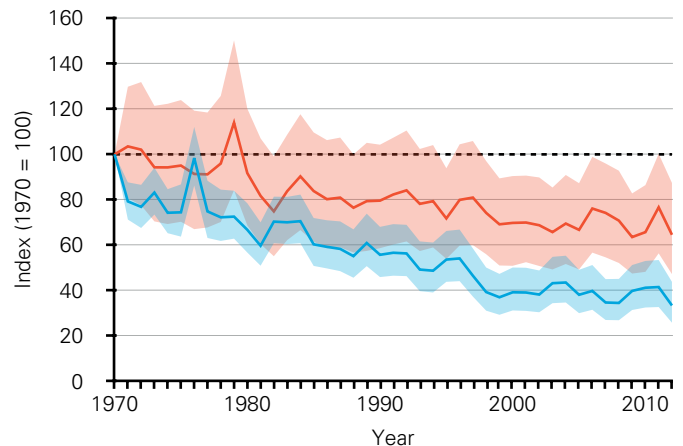


Figure 7

The UK Priority Species Indicator shows the Abundance Index (blue) for 213 priority species, and the Occupancy Index (red) for 111 priority species⁷. The shaded areas show the 95% confidence intervals.

- The official UK Priority Species Indicator reports on the trends of the UK's highest conservation priorities⁷. The indicator has two measures, one of abundance, the other of occupancy: since 1970 they have fallen by 67% and 35% respectively.
- Over our short-term period, the indicator of average abundance has fallen by 12%. Over the same short-term period, the indicator of occupancy has fallen by 6%.

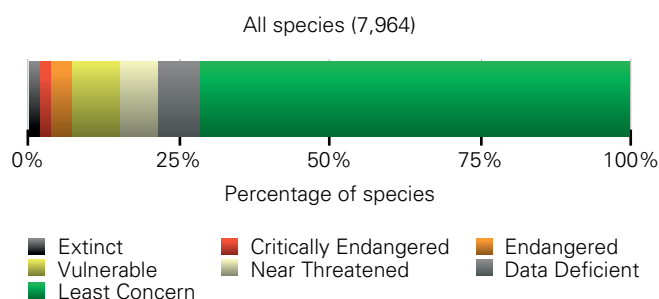


Figure 8

The percentage of species in each category, based on the likelihood of extinction from Great Britain. Species considered threatened with extinction from Great Britain are those classified as Critically Endangered, Endangered or Vulnerable in the latest IUCN Red List assessments.

- Of the nearly 8,000 species assessed using modern Red List criteria, 15% are extinct or threatened with extinction from Great Britain.

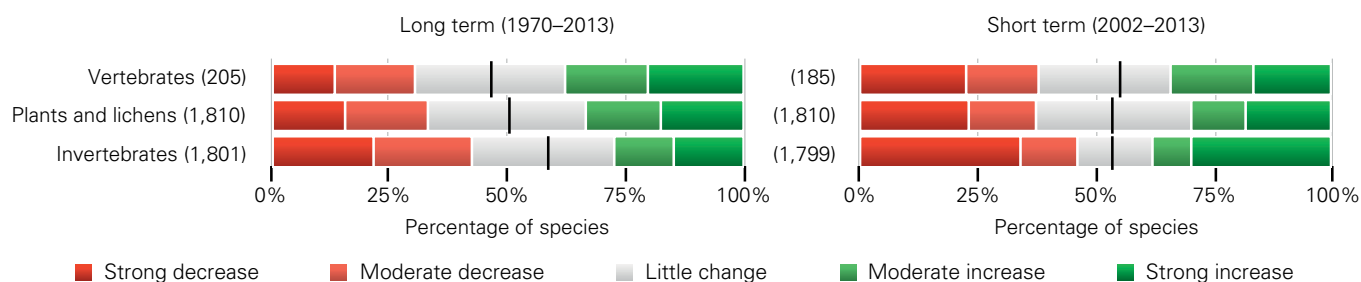
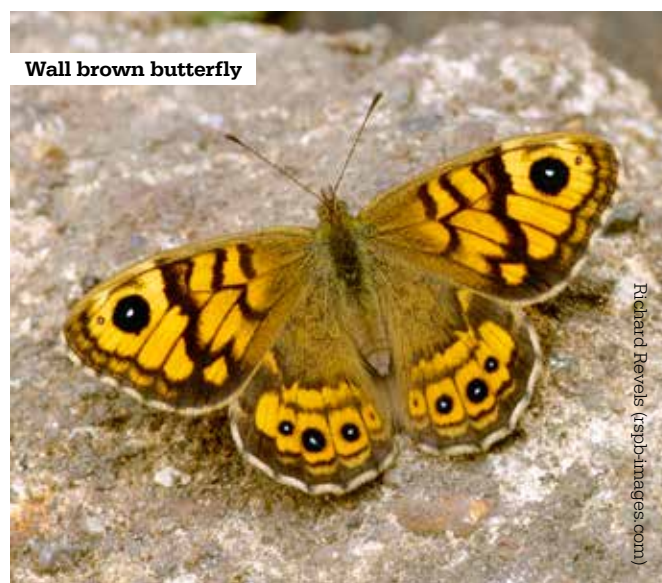


Figure 9

The percentage of species in each trend category over the long and the short term. The line in the “little change” category shows the division between declining species on the left and increasing species on the right. The values in brackets show the number of species assessed.

- Over the long term, 47% of vertebrate species declined and 53% increased. Among these, 31% showed strong or moderate declines, 31% showed little change, and 38% showed strong or moderate increases. 55% of species declined and 45% increased over the short term.
- 50% of plant and lichen species declined and 50% increased over the long term. Among these, 30% showed strong or moderate declines, 36% showed little change, and 34% showed strong or moderate increases. Over the short term, 53% of species declined and 47% increased.
- Over the long term, 59% of invertebrate species declined and 41% increased. Among these, 42% showed strong or moderate declines, 31% showed little change, and 27% showed strong or moderate increases. 54% of species declined and 46% increased over the short term.

Trends in the abundance and distribution of marine species by broad taxonomic group (not pictured)

- 34% of marine vertebrate species declined and 66% increased over the long term. Among these, 28% showed strong or moderate declines, 14% showed little change, and 58% showed strong or moderate increases. Over the short term, 46% of species declined and 54% increased.
- Over the long term, 38% of marine plant species declined and 62% increased. Among these, 6% showed strong or moderate declines, 69% showed little change, and 25% showed strong or moderate increases. 31% of species declined and 69% increased over the short term.
- 75% of marine invertebrate species declined and 25% increased over the long term. Among these, 38% showed strong or moderate declines, 49% showed little change, and 13% showed strong or moderate increases. Over the short term, 50% of species declined and 50% increased.



How are we helping nature in England?

A key step in helping a species to recover is identifying and addressing the factors that are currently limiting its numbers and distribution. This needs to be followed by action at an appropriate scale. The needs of some species may be met by delivering broad habitat management actions, but tailored action will often be essential for some of the species most vulnerable to extinction.

The range of specific actions required varies from species to species but includes combating non-native invasive species; reintroduction or translocation; targeted habitat management or restoration; and combating wildlife crime or unsustainable harvesting.

Protecting the best places for nature is a key part of our conservation response, and designated sites, such as Special Protection Areas, currently cover 8% of England. However, this total falls well short of the global target of at least 17% of land area managed for nature⁸. It is also important to note that a protected area designation does not mean that a site is safe from pressures, or that it is being managed effectively.

The following case studies illustrate how species recovery projects can work at a local and landscape scale to address the pressures facing nature. Underpinning all of this is our ability to track what is happening to the state of nature.

Addressing the impact of non-native invasive species

Invasive non-native species (INNS) can pose a real threat to native species by preying on them, competing for resources or damaging vulnerable habitats. The brown rat is one such species, as it can have a very significant effect on seabird colonies⁹.

Many seabird colonies are on islands, where seabirds can breed away from mammalian predators: the introduction of brown rats can dramatically change that. Brown rats prey upon young seabirds, reducing the number of fledglings to zero in some cases. It has been shown in many parts of the world that rat eradication is necessary to enable seabird populations to recover¹⁰.

Case study

Helping seabirds to recover on the Isles of Scilly

The distribution of several seabird species in England is restricted by the presence of non-native rats on otherwise suitable islands. Successful rat eradication can lead to rapid re-colonisation by seabirds and this is one of the aims of the Isles of Scilly Seabird Recovery Project.

The Isles of Scilly are of international importance for seabirds, supporting over 8,000 breeding pairs of 13 species¹¹. However, the number of seabirds breeding within the Isles of Scilly archipelago has decreased by almost 10% in the last nine years. The recovery project aims to reverse this decline and is a joint venture between the RSPB, the Isles of Scilly Wildlife Trust, the Isles of Scilly Area of Natural Beauty, the Duchy of Cornwall and Natural England.

A key component of the initiative is the removal of the non-native brown rat

from the islands of St Agnes and Gugh – a particular challenge given that both islands are inhabited by people. To date, this is the largest community-based island restoration project in the world¹².

Extensive consultation with the community established that there was total support for rat eradication on the islands. Following meticulous planning, including a detailed feasibility study and baseline surveys, rat removal was carried out successfully by contractors during the winter of 2013/14. Rats were not recorded after 30 November 2013 and detailed checks in early 2016 have confirmed that the islands have remained officially rat free under international protocol.

It did not take long for seabirds to respond, with 10 Manx shearwater chicks fledging from St Agnes and

Gugh in September 2014 and European storm petrels breeding on the islands in 2015. These were the first breeding records of the two species on St Agnes and Gugh in living memory.

Retaining rat-free status can be challenging on inhabited, ferry-connected islands where rats occur on neighbouring land, so biosecurity work will continue, alongside monitoring to assess the benefits to plants, invertebrates, land birds and the endemic Scilly shrew.

Jaclyn Pearson
RSPB Project Manager
Isles of Scilly Seabird Recovery Project



Genevieve Leaper (rspb-images.com)

Manx shearwaters have bred on St Agnes and Gugh for the first time in living memory following rat eradication

Species recovery at a landscape scale

The removal of invasive non-native species is only feasible on larger islands, such as Britain, if it is approached at a landscape scale, rather than just by action on a local patch, since by their nature these species are good at colonising.

American mink became established in Britain in the 1950s, and occupy a different niche to our native predators, leaving many vulnerable prey species with no strategy for avoiding predation. Removal of this introduced species in several areas of the UK is now starting to have an impact on its population as a whole¹³, but it requires a large collective effort, as outlined below in the case study of work in Eastern England.

Case study

Eradicating mink in Eastern England

Water voles declined rapidly in their former East Anglian stronghold between 1990 and 2000¹⁴, as a result, in part, of predation by introduced American mink¹⁵. In order to tackle this decline, many organisations are working together to co-ordinate mink trapping, following guidelines set out by the Game and Wildlife Conservation Trust¹⁶.

In the absence of regional funding for professional mink trappers, it was decided to opt for landscape-scale co-ordination of volunteers. Since 2001, the project has expanded from just a few dozen traps and mink monitoring rafts in Suffolk and Norfolk, to a network spanning more than 10,000km² across East Anglia and parts of the Midlands. Wildlife is reaping the benefits.

While each county or river catchment area co-ordinates its own mink and water

vole work, partners pool their data and knowledge at an annual meeting and map the project to identify gaps in mink control. The collated water vole and mink records are then passed on to the National Water Vole Database.

Mink control is co-ordinated by Wildlife Trusts in Suffolk, Essex, Kent, and Herts and Middlesex. There is also a specific Norfolk Mink Project and smaller projects in Cambridgeshire based on river catchments and drainage boards. Support from key RSPB reserves has helped to further reduce gaps in coverage. The long-term success of the project is due to the co-ordination of local stakeholders, the co-operation of landowners and input from many volunteers.

At a regional level, water voles are recovering from their low point in 2006. At a catchment scale, although mink

control must continue, fewer mink are found each year and the benefits to water voles are clear.

For example, repeated water vole surveys¹⁷ were undertaken at 3-km intervals along the Rivers Deben and Alde in 1997/98 and 2003, and showed rapid declines. Mink control commenced in each catchment and by 2007 water vole site occupancy had increased from 0% to 55% on the main River Alde, and from 40% to 80% on the Deben¹⁸.

Darren Tansley
Essex Wildlife Trust



Margaret Holland

Water voles are beginning to recover in East Anglia thanks to mink eradication

Habitat restoration

While not necessarily easy, relatively simple actions on a landscape scale can result in major habitat changes by allowing extensive natural regeneration. This in turn enables species to recolonise the revitalised habitat, or if required, they can be given a helping hand through targeted reintroduction projects.

Here we give two examples of work attempting to restore peatland habitats, which have suffered through many decades of atmospheric pollution, drainage, inappropriate grazing and burning. The work being done in upland peatlands will also have significant economic benefits through the protection of major carbon stocks, restoration of drinking water catchments and flood mitigation.

Case study

Delamere's Lost Mosses – reintroducing the white-faced darter

The lowland peatlands in north-west England, known as mosses, have long been affected by drainage to allow conversion to farmland, forestry or development. This has led to the loss of the species adapted to survive on them¹⁹, such as the white-faced darter dragonfly, which was lost from Delamere in 2003.

In partnership with the Forestry Commission and Natural England, Cheshire Wildlife Trust is trialling the reintroduction of the white-faced darter through the Delamere's Lost Mosses Project. This project aims to restore 120 hectares of Delamere Forest – the dragonfly's last breeding site in Cheshire.

Restoration began by removing the conifers that were drying the drained peat soils. The next step was to raise water levels across Delamere using

peat dams, plastic piling and metal sluices. Volunteers also removed established bramble scrub and birch, some of which was then used for charcoal production. Some mossland species had managed to hang on in the wet ditches without competition from more vigorous plants, and so provided a source for recolonisation.

Doolittle, a recovering mossland, was chosen for the reintroduction as it met all the dragonfly's requirements: a well-developed Sphagnum moss community, permanent open water, cotton-grass for adult emergence, heathland shrubs for shelter and good connectivity to other recovering sites to facilitate dispersal. The four-year reintroduction process started in 2013 and in April of each year, two-year-old larvae were taken from the Natural England donor sites in Staffordshire and Shropshire. At all stages of the project, IUCN wild invertebrate translocation guidelines were followed. Adults emerged over the subsequent weeks and the population was monitored by counting the larval skins left behind on vegetation following emergence. Sphagnum moss containing darter eggs and hatchlings was translocated each August to strengthen the population. While the future of the white-faced darter in Delamere is still uncertain, the future of the mosslands that they depend on is now more secure.

Chris Meredith
Cheshire Wildlife Trust



White-faced darter

Greg Osborne

Case study

Restoring bogs for wildlife and people

As well as having an important role in species conservation, upland peat restoration also benefits people by facilitating ecosystem services such as carbon storage and improved water quality. United Utilities has been working with the RSPB and Natural England at Dove Stone in the Peak District since 2007 to restore blanket bog, as part of its Sustainable Catchment Management Programme. The site is now part of the UK's largest LIFE project – MoorLIFE 2020 – a Moors for the Future Partnership initiative.

Thanks to agri-environment funding, tenant farmers have reduced sheep numbers to allow vegetation to recover. Sphagnum mosses, a key feature of blanket bog, are being reintroduced and are now slowly recolonising naturally. Alongside blocking gullies, and the re-vegetation of bare peat, this work has transformed the formerly eroding peatlands into wetter, more diverse habitats.

Peat soils dominate in many upland drinking water catchments. When peat dries out, carbon is lost to the atmosphere, and sediment and dissolved carbon enters streams. This increases drinking water treatment costs. Hydrological monitoring shows that the restoration has quickly contributed to reducing peat particles in the water and data indicate that colour production is increasing at a slower rate than expected without interventions. These improvements should help to reduce water treatment costs in the future²⁰.

Numbers of breeding golden plovers, curlews and dunlins have also increased in the area. This pioneering work by United Utilities is a good example of how landscape-scale habitat restoration can result in multiple benefits for wildlife and people.

Dave O'Hara, RSPB Senior Site Manager

Creating space for changing populations

With the impact of climate change becoming ever-more apparent, the distributions of many species are changing in response. Many habitats across England will be important for species spreading northwards, and for new species colonising from the south. Protected areas will be vital for this, and heathlands provide a good example of the issues that these sites face^{21,22}.

Much of our lowland heath is found in the south of England, but there are also heathlands further north, and as our climate warms, these pockets will be valuable spaces for heathland species to spread into. Butterfly Conservation have been actively creating new heathland habitat in the Midlands to allow such movements.

Case study

Re-creation of lowland heathland for the silver-studded blue butterfly

Butterfly Conservation is re-creating heathland habitat for a regionally important population of the nationally threatened silver-studded blue butterfly. The site, at Prees Heath, is one of a series of heathland fragments in north Shropshire, isolated by decades of land use changes that accelerated over the second half of the 20th century.

The project site consists of half of a 126-hectare registered common that was largely converted to arable cultivation after use as a World War II airfield; around 80% of its former semi-natural habitat was lost as a result.

With the last West Midlands' population of silver-studded blues now confined

to less than four hectares of suitable habitat, the project has sought to revert 25 hectares of land to heathland and acidic grassland. This land was farmed for potato and bean crops as recently as 2004. Inversion of the enriched soil to expose the raw sand sub-soil commenced in 2007. This was followed by acidification, then various phases of seeding with ling brash from suitable donor sites in the area and bell heather seed harvested from the site itself.

The control of invasive vegetation has been the main ongoing maintenance, while the target heathland and grassland vegetation has successfully established itself at varying rates over most of the area under reversion.

Management of the Prees Heath Common reserve now focuses on providing the specific micro-habitat conditions required by silver-studded blues, including the presence of black ants that protect the butterfly's early life stages. Current conservation measures for the butterfly's population also include attempting to safeguard breeding habitat on the other half of the common, which has no protective designation and is under threat from intensifying arable management following changes in ownership.

John Davis and Stephen Lewis
Butterfly Conservation



Re-creating habitat for silver-studded blue butterflies at Prees Heath

Tom Brereton

Silver-studded blue butterfly



Making land work for wildlife and people

The main land use in England is agriculture and changes in management techniques over recent decades have resulted in declines in many farmland species. Paying farmers to encourage wildlife through agri-environment schemes is now a well established approach to help wildlife recover in our farmland; however, we still need to know more about the total benefits that nature receives from these schemes. An overview of agri-environment schemes is given below.

Case study

Can environmental stewardship benefit farmland wildlife?

Finches and buntings bursting out of a field of crops and a barn owl skimming over a meadow are welcome sights to David, the owner of Sunnymead Farm, a mainly arable farm in Essex. And the good news is these wildlife spectacles are not incompatible with a highly profitable business.

Such benefits can be achieved by careful environmental stewardship^{23,24}, such as maintaining patches of semi-natural habitat that offer food and shelter to wildlife, and reducing the use of pesticides and fertilisers wherever possible.

These, and an array of other environmentally-friendly land management practices, are options in the agri-environment schemes offered

by the governments across the UK. They can also be undertaken voluntarily by farmers for their own interests, or as part of industry-led initiatives.

It has been clearly demonstrated that such practices can dramatically enhance breeding and foraging opportunities for birds, pollinating insects and other wildlife on a farm; the challenge is to influence populations on a national scale.

2015 saw the launch of a new scheme in England – Countryside Stewardship – following on from predecessors that were first introduced in the 1990s. Thanks to continuing research on how best to combine options on the ground, the design and implementation has altered considerably over time.

Agri-environment schemes are currently funded by the EU Common Agricultural Policy (CAP) and the UK Government, and work via individual agreements whereby farmers receive payments based on the cost of implementing specified conservation activities and the profits foregone.

Options are varied, but their aim is to conserve important ecological and historical features, to protect soils and key habitats, and to provide food and shelter for wildlife. It is also possible to apply collectively across a landscape to work in partnership with neighbouring landowners, and 19 of these new collaborative projects have been funded in the new 2015 Countryside Stewardship scheme.

Much of England is farmland, and agri-environment schemes are the main conservation mechanism used across the majority of this area. Nevertheless, the question of whether this is working at the national level remains unanswered, as good evidence of national-scale increases in farmland birds is lacking.

Recent work has revealed evidence of a broad-scale positive response to key options by some target farmland birds, such as chaffinches and tree sparrows, but other species, such as the turtle dove and corn bunting, continue to decline^{25,26,27}. Further investigation of the outcome of conservation activities, including the combinations of options in different landscapes, is required to determine whether the positive changes seen on individual farms can be achieved at much larger scales.

David Noble
BTO



Careful environmental stewardship can support wildlife

David J Slater (djs@bto.org.uk)

Protecting England's special habitats

Some aspects of the English landscape have a high cultural significance, and are valued deeply by many parts of society. Trees, whether in woodlands or within an open landscape, have a strong meaning for people, and grand ancient “veteran” trees especially so. England has a significant number of these trees, which connect us to our past.

Case study

Safeguarding England's veteran trees

England has a very rich legacy of ancient and other veteran trees; most notably yews, our longest-lived trees, and ancient mediaeval oaks, the second longest-lived native trees. England also has a heritage of hunting forests and deer parks, which are now rich in ancient and veteran trees. Nowhere else in Northern Europe do trees so clearly reveal the mediaeval countryside²⁸.

Ancient trees provide habitat for an array of organisms, including exceptionally rare and largely unprotected species-rich communities associated with wood decay,

hollowing trunks and branches, the bare surfaces of trunk and boughs, and roots. Localised concentrations of ancient trees, or “old growth” where there has been a continuity of old trees into the past, are supremely important reservoirs of biodiversity, but even isolated trees in highly fragmented landscapes can be a high conservation priority for their decaying wood habitat.

In addition, the genetic variability inherent in long-lived trees may prove invaluable in the search for disease resistance and adaptability to climate change.

The Ancient Tree Hunt database has records of more than 122,500 specifically identified and surveyed ancient, veteran and notable trees in England (nearly 80% of the UK's total). It also has records of more than 360 high and medium value “hotspots” or concentrations of ancient trees²⁸, many of which will be historic wood pasture or parkland sites.

The recording of priority wood pasture and parkland habitats, and of individual trees, lags behind that of woodland. There is no precise figure for the extent of wood pasture and parkland in the British Isles, but it is believed that we hold a significant proportion of its European extent.

This lack of survey data means it is hard to quantify changes in the extent and quality of veteran trees. It is imperative that stakeholders work together now to secure the protection of nationally important special trees and old growth habitats.

This means promoting the value of the legacy passed to us, often by beneficent and foresighted tree owners. We must protect the trees from damage; provide guidance on appropriate management; close the legal loopholes that allow special trees to fall through the protection and policy net; and through planting, regeneration and the creation of dead wood habitat on trees, ensure that appropriate successors are in place to provide ancient trees for the future.

Jill Butler
Woodland Trust



Ancient trees provide habitat for many rare and threatened species

Richard Bedford (ispbimages.com)

Sharing our space effectively with urban wildlife

Green spaces are becoming increasingly important in the ever-denser urban environment of England's cities. Engagement with the urban human population is crucial for the success of projects aiming to promote and conserve England's urban wildlife, and charismatic species are a vital tool in spreading the word on wildlife-friendly urban spaces.

Case study

Tackling a prickly problem: England's first Hedgehog Improvement Area

Consistently voted one of the nation's favourite animals, the hedgehog is able to survive and thrive in a variety of habitats²⁹. However it is completely reliant on access to well-connected patches of habitat where it can forage and find refuge³⁰.

Sadly, the increase in the density of housing and the penchant for neater gardens means that huge swathes of urban and suburban areas are now inaccessible for this creature – a problem that could be easily rectified if people created small holes in their garden fences and walls³¹.

Building on the success of the joint People's Trust for Endangered Species and British Hedgehog Preservation Society's Hedgehog Street campaign³², the Warwickshire Wildlife Trust has created a 90-hectare Hedgehog Improvement Area (HIA)³³ in Solihull. This innovative project incorporates two large parks – Solihull Metropolitan Borough Council's Elmdon Park and Warwickshire Wildlife Trust's Elmdon Manor nature reserve – and surrounding private gardens with a view to creating a model hedgehog haven.

Within the area, hedgerow restoration will be undertaken and residents will be encouraged to not only create hedgehog holes in their walls and fences, but try to manage their gardens in a wildlife-friendly manner.

This year the team running the project will monitor the movement of hedgehogs throughout the HIA, measuring the success of the actions that have been put in place.

An important aspect of this project is the involvement of the general public, not only in undertaking improvements in their own gardens, but also in being asked to become Wildlife Guardians. These are people who will manage green areas and create a central reserve within them from which the hedgehog population will be able to disperse. It is hoped that the HIA will be successful and will become a model example that can be replicated across the country.

Nida Al-Fulaij
People's Trust for Endangered Species



Hugh Clark

Creating a small hole in your garden fence will help hedgehogs get around

Monitoring wildlife: getting the public involved

Citizen science – the involvement of volunteers in gathering valuable and valid environmental data – has really come to prominence in recent years. Among the burgeoning number of projects at a local and national scale, the innovative approach to gathering bat data in Norfolk described below really stands out as an inclusive project making a difference to our knowledge.

Case study

A novel approach to bat monitoring

The Norfolk Bat Survey was originally set up in 2013 by staff at the British Trust for Ornithology (BTO) through personal interest. It has since enlisted over 800 volunteers, with the aim of improving local knowledge and interest in bats.

These volunteers sign up and borrow a passive bat detector from one of 21 centres. They leave the detector outside at three different locations within a 1-km square for a single night, and bat calls are automatically recorded and saved to a memory card. After three days, volunteers return the detector and post the memory card containing bat recordings to the BTO. The data are analysed using algorithms that help assign bat calls to species and then volunteers are sent a report with the results of their survey within a few days of taking part³⁴.

Since 2013, volunteers have surveyed 1,146 1-km squares (more than 20% of Norfolk). This has generated over 1.2 million bat recordings, making this one of the most extensive high-quality datasets for bats anywhere in the world.

At a local scale, the Norfolk project has improved our understanding of the patterns of occurrence and activity of all species from the near ubiquitous common pipistrelle to the locally scarce Leisler's bat³⁵. It has also demonstrated the cost-effectiveness of setting up a network of centres across a survey area from which anyone can borrow a passive detector for a few days.

Our choice of centres has given us the opportunity to work with a wide range of communities and organisations that already had their own network

of volunteers or members, opening up citizen science to a new set of people.

Building on the Norfolk Bat Survey a much larger acoustic bat project began across southern Scotland in May 2016, in partnership with the Bat Conservation Trust, National Trust for Scotland and with funding from Scottish Natural Heritage.

More broadly, with bat detectors recording more than just bats (for example, we already have over 300,000 recordings of bush-crickets from Norfolk), there is clearly an exciting opportunity for "bat recording" to contribute more widely to biological recording in the future.

Dr Stuart Newson
BTO



Since 2013, volunteers have collected more than 1.2 million bat recordings

Stuart Newson

How to interpret this report

We have included this section to help you understand the different measures presented in the *State of Nature 2016* UK and country reports and how they should be interpreted.

WHAT DATA HAVE WE USED FOR ENGLAND?

- We have quantitative assessments of the change in population or distribution in England for 1,387 terrestrial and freshwater species. For the UK summary, we present trends in abundance and occupancy for 3,816 native terrestrial and freshwater species.
- These trends came from a wide range of sources.
- Details of the datasets behind our analyses, and the species they covered, are given online at rspb.org.uk/stateofnature

WHAT TIME PERIOD DOES THIS REPORT COVER?

- For English and UK results we show trends in our species from around 1970 to 2013 (our long term period) and from 2002 to 2013 (our short term period).

WHAT ARE THE GRAPHS TELLING ME?

In each section of the report we present the relevant results for England or the UK to show the following:

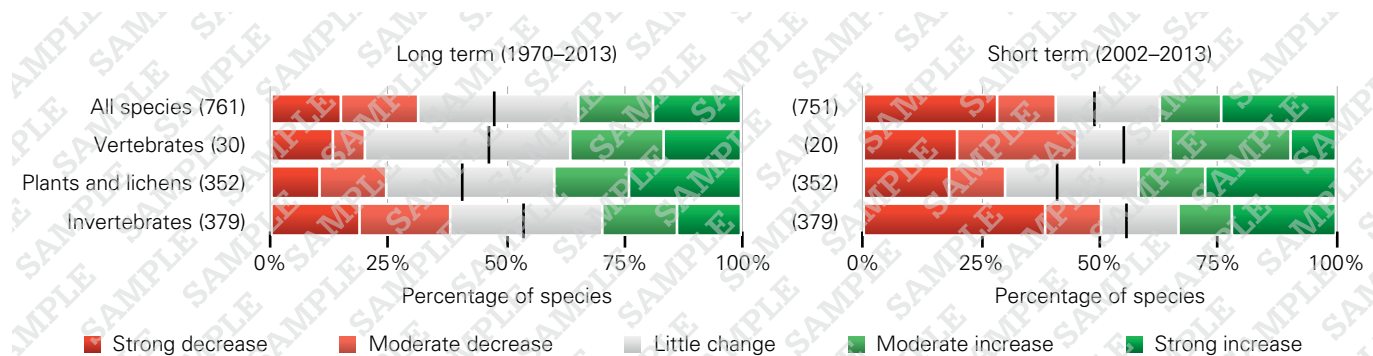
- **Categories of change**
The percentage of species in each trend category.
- **Change over time**
The change in the status of species at a UK level, over time, based on abundance and occupancy data.
- **Extinction risk**
An assessment for each species occurring in England, of the likelihood of extinction from Great Britain.

Further details on how these measures were calculated, and caveats around how they should be interpreted, are given on pages 74–77 of the UK report (available at rspb.org.uk/stateofnature).

Please note that due to the change in species composition, and in some cases data sources, our measures are not directly comparable with those presented in the first *State of Nature* report.

Categories of change

Each species was placed into one of five trend categories based on annual percentage changes for populations in England and across the UK.



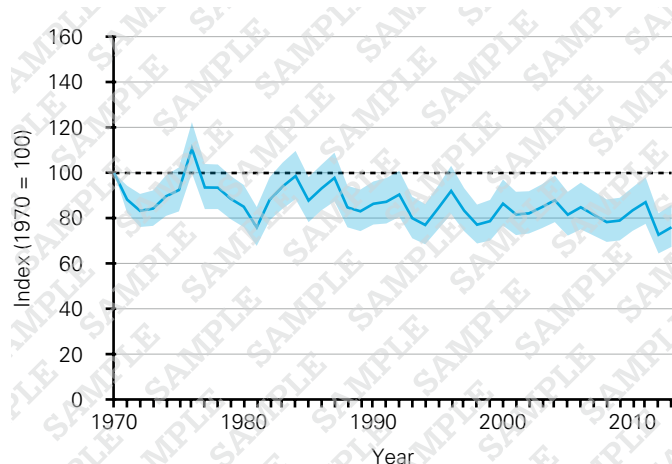
Results reported for each figure include:

- The overall percentage of species that increased and decreased in each time period. The vertical line across the white “little change” segment of the graph shows the division between declining species on the left, and increasing species on the right (this is broadly equivalent to the metric reported for the first *State of Nature* report).
- The percentage of species that showed strong or moderate changes, and those showing little change, in each time period.

Thresholds for assigning species’ trends to the five categories are given on pages 74–77 of the UK report.

Change over time

These graphs combine abundance data (based on a species' population size) across species into geometric mean indicators for taxonomic groups for which data are available. In the case of the UK, the indicator also combines occupancy data (the proportion of 1-km² grid cells occupied by a species). This relies on the assumption that proportional changes in occupancy and distribution are equivalent (for more detail, see pages 74–77 in the UK report).



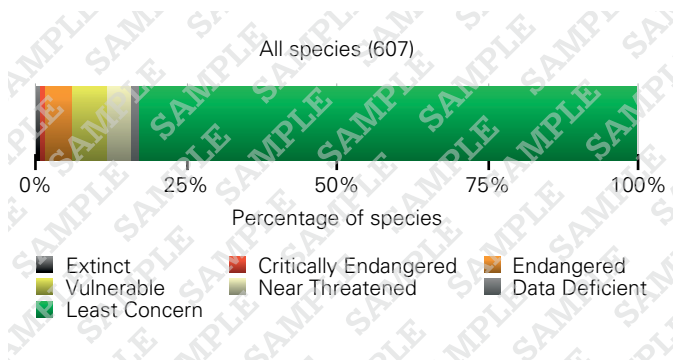
Results reported for each figure include:

- Total percentage change in the indicator over the long term and the short term.
- Annual percentage change over the long term and the short term.
- We assessed change over the period by comparing the rate of change of the indicators between the *prior* (~1970–2002) and *recent* (2002–2013) time series, and report the test statistic (t) and the level of significance (p).

Extinction risk

We summarised the Great Britain Red Lists to present the proportion of species in each threat category overall, and by different taxonomic groups. We interpret existing Great Britain Red Lists, based on those species occurring in England and in the UK.

These figures represent the ultimate threat of extinction from Great Britain. While the proportion of species listed as Least Concern is considerable, the number of species that are at risk of extinction from Great Britain and Ireland is worthy of note.



Results reported for each figure include:

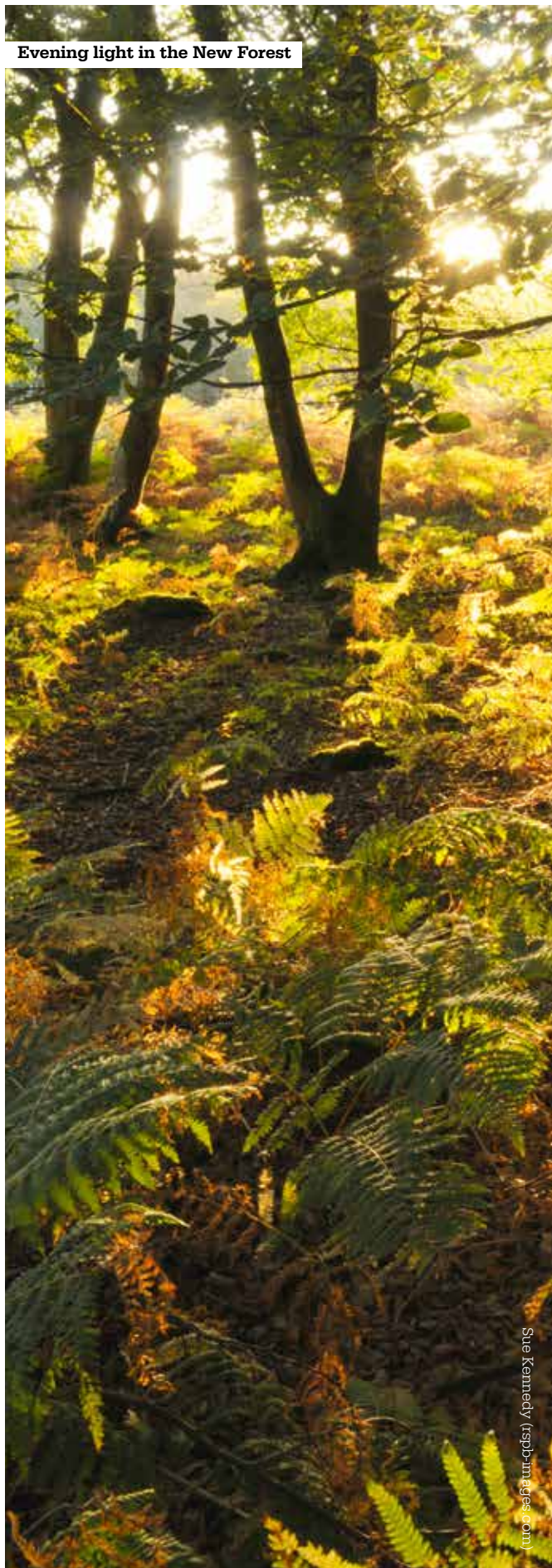
- The overall percentage of species that occur in England and were assessed, that are regarded as at risk of extinction from Great Britain. This includes species that have been classified as Critically Endangered, Endangered or Vulnerable in the latest IUCN Red List assessments.



References

- 1: RSPB (2016) *The nature of climate change*. RSPB, Sandy.
- 2: UK NEA (2011) *The UK National Ecosystem Assessment*. UNEP-WCMC, Cambridge.
- 3: Newbold T, et al. (2016) Has land use pushed terrestrial biodiversity beyond the planetary boundary? A global assessment. *Science* 353: 288–291.
- 4: Defra (2016) England biodiversity indicators. Available at: gov.uk/government/statistics/england-biodiversity-indicators
- 5: Brereton T and Roy D (2015) Assessing change in England, Scotland and UK butterfly indicators. In: *Biodiversity 2020 Indicators 2015 Assessment*. Defra.
- 6: Eaton MA, et al. (2015) Birds of Conservation Concern: the population status of birds in the United Kingdom, Channel Islands and Isle of Man. *British Birds* 108: 708–746.
- 7: JNCC (2014) Status of UK priority species. Available at: jncc.defra.gov.uk/page-4238
- 8: Aichi biodiversity target 11 under the Convention on Biological Diversity. Available at: cbd.int/sp/targets
- 9: Jones HP, et al. (2008) Severity of the effects of invasive rats on seabirds: A global review. *Conservation Biology* 22: 16–26.
- 10: Courchamp F, et al. (2003) Mammal invaders on islands: impact, control and control impact. *Biological Reviews* 78: 347–383.
- 11: Heaney V (2015) *The status of seabirds breeding in the Isles of Scilly*. Available at: ios-seabirds.org.uk (project publications section)
- 12: Oppel S, et al. (2011) Eradication of invasive mammals on islands inhabited by humans and domestic animals. *Conservation Biology* 25: 232–240.
- 13: Bryce RO, et al. (2011) Turning back the tide of American mink invasion at an unprecedented scale through community participation and adaptive management. *Biological Conservation* 144: 575–583.
- 14: Strachan C, et al. (2000) *Preliminary report on the changes in the water vole population of Britain, as shown by the national surveys of 1989–1990 and 1996–1998*. The Vincent Wildlife Trust, Ledbury.
- 15: Strachan C, et al. (1998) The rapid impact of resident American mink on water voles: case studies in lowland England. *Symposia of the Zoological Society of London* 71: 339–357.
- 16: Reynolds J, et al. (2009) *Mink Raft Guidelines v 2.3*. Game and Wildlife Conservation Trust, Fordingbridge.
- 17: Strachan R, et al. (2011) *Water Vole Conservation Handbook*. Wild CRU.
- 18: Suffolk Wildlife Trust (2015) *Water voles*. Available at: suffolkwildlifetrust.org/water-vole
- 19: Natural England (2010) *England's Peatlands: Carbon storage and greenhouse gases*. Available at: publications.naturalengland.org.uk/publication/30021
- 20: Grayson R, et al. (2012) A GIS based MCE model for identifying water colour generation potential in UK upland drinking water supply catchments. *Journal of Hydrology* 420: 37–45.
- 21: Hiley JR, et al. (2013) Protected areas act as establishment centres for species colonizing the UK. *Proceedings of the Royal Society B: Biological Sciences* 280: 1760–1767.
- 22: Gillingham PK, et al. (2015) The effectiveness of protected areas in the conservation of species with changing geographical ranges. *Biological Journal of the Linnean Society* 115 (3 Special Issue: Fifty years of the Biological Records Centre): 707–717.
- 23: Vickery JA, et al. (2009) Arable field margins managed for biodiversity conservation: A review of food resource provision for farmland birds. *Agriculture, Ecosystems & Environment* 133: 1–13.
- 24: Setchfield RP, et al. (2012) An agri-environment option boosts productivity of Corn Buntings *Emberiza calandra* in the UK. *Ibis* 154: 235–247.
- 25: Stevens DK and Bradbury RB (2006) Effects of the Arable Stewardship Pilot Scheme on breeding birds at field and farm-scales. *Agriculture, ecosystems & environment* 112: 283–290.
- 26: Baker DJ, et al. (2012) Landscape-scale responses of birds to agri-environment management: a test of the English Environmental Stewardship scheme. *Journal of Applied Ecology* 49: 871–882.
- 27: Bright JA, et al. Higher-tier agri-environment scheme enhances breeding densities of some priority farmland birds in England. *Agriculture, Ecosystems & Environment* 203: 69–79.
- 28: Butler J, et al. (2015) Recording ancient trees. *British Wildlife* 26: 398–405.
- 29: Morris P (1966) The hedgehog in London. *The London Naturalist* 45: 43–49.
- 30: Hof AR and Bright PW (2009) The value of green-spaces in built-up areas for western hedgehogs. *Lutra* 52: 69–82.
- 31: Hof AR (2009) *A Study of the Current Status of the Hedgehog (Erinaceus europaeus), and its Decline in Great Britain Since 1960*. University of London, Royal Holloway.
- 32: Hedgehog street. Available at: hedgehogstreet.org
- 33: *Hedgehog Improvement areas*. Available online at: helpforhedgehogs.co.uk
- 34: Newson SE, et al. (2014) Bat-monitoring: a novel approach. *British Wildlife* 25: 264–269.
- 35: Newson SE, et al. (2015) A novel citizen approach for large-scale standardised monitoring of bat activity and distribution, evaluated in eastern England. *Biological Conservation* 191: 38–49.

Evening light in the New Forest



Acknowledgements

The monitoring and research that underpins this report, and our wider knowledge of the state of nature in the UK, its four constituent countries and its Crown Dependencies and Overseas Territories, is conducted by a wide variety of organisations and thousands of individuals. We do not have space here to recognise their contributions individually, but offer our collected thanks to them all.

Conservationists and scientists from the State of Nature partners and other organisations have provided data, analyses, case studies and guidance, and have given their time to review drafts during the production of *State of Nature 2016: England*. In particular, we wish to thank Tom Lancaster, Edward Lawrance, Jaclyn Pearson, Nick Phillips and Pat Thompson. We would also like to thank all the photographers for the use of their images.

We are grateful to the many charitable trusts, grant-giving bodies, companies and private individuals that provide vital funding towards the monitoring of wildlife in England. Additionally, government agencies conduct or support much of the recording, data collation, analysis and reporting of the state of the UK's wildlife that has made this report possible. In particular, the Joint Nature Conservation Committee, Defra and Natural England make significant contributions to the provision of monitoring across the separate parts of the UK. Other English, national and local government bodies also do much to support the recording of wildlife and habitats, as do a wide variety of non-governmental organisations not represented within the State of Nature partnership.

Finally, we wish to thank the thousands of dedicated volunteer recorders who collect much of the data upon which our knowledge of the state of nature is based. Many are supporters of the organisations within the State of Nature partnership and contribute to systematic monitoring and recording schemes. Without their efforts, our knowledge of the health of English nature would be just a fraction of what it is. We hope we can continue to work together with these volunteers to improve our knowledge, and thus provide an increasingly robust basis for informing future conservation efforts. Additionally, we would like to thank all of the volunteers who are involved in the many conservation projects underway around England to address the issues facing our wildlife. Without them, the challenge would be much greater.

This report should be cited as:

Hayhow DB, Burns F, Eaton MA, Bacon L, Al-Fulajj N, Brereton T, Brookman E, Burke O, Butler J, Davis J, De Massimi S, Gambling P, Lewis S, Macadam CR, Matthews F, Meredith C, Newson SE, Noble DG, O'Hara D, Pearson J, Stevenson K, Tansley D, Winder F, Wynde RM and Gregory RD (2016) *State of Nature 2016: England*. The State of Nature partnership.

The *State of Nature 2016: England* report is a collaboration between the conservation and research organisations listed below:

