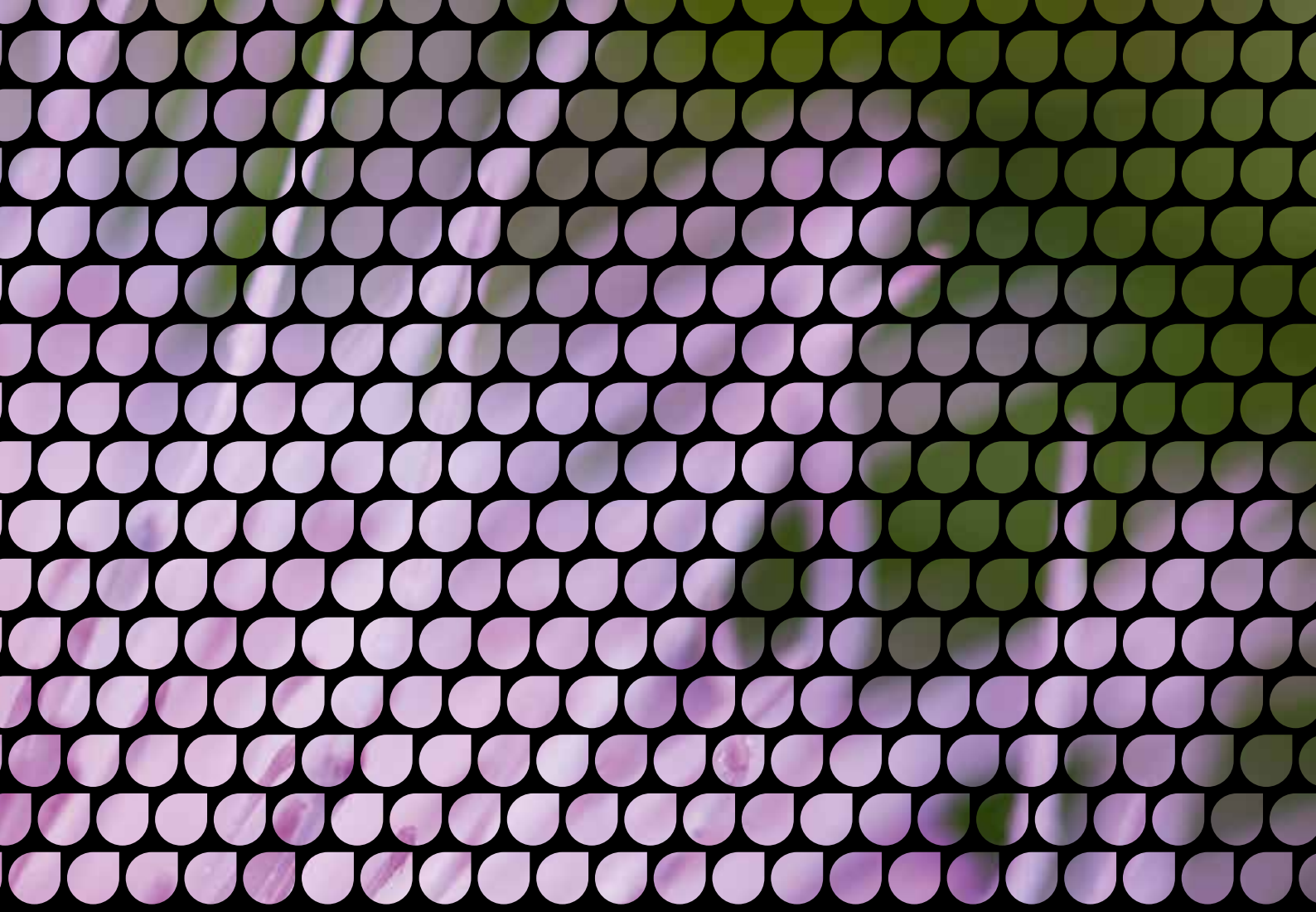
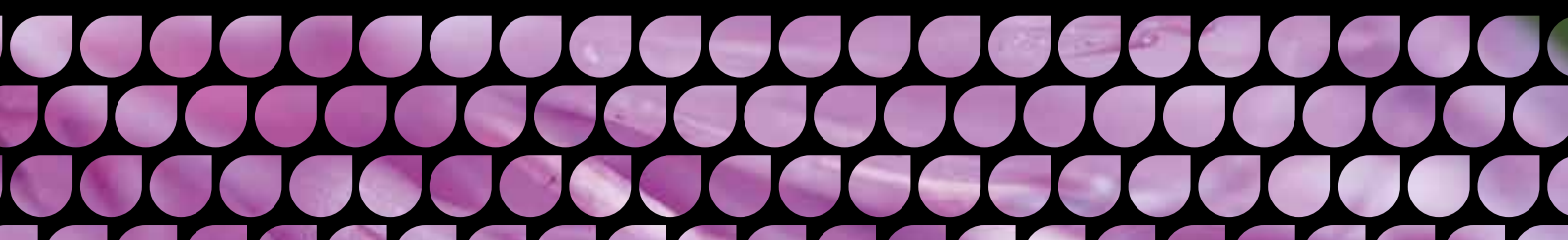


# State of Nature 2016
## Scotland

state of nature



Scotland holds many of the wildest landscapes in the British Isles. From the surrounding seascapes and offshore islands, past sweeps of rocky cliffs, through glens, on to moorland and up to our islands' highest mountains, we encounter diverse habitats and some of the UK's most celebrated species.

Scotland's spectacular wildlife ranges from the minute complexity of montane lichens to the wide-ranging white-tailed eagle. The total number of species in Scotland is estimated to be about 46,000[1,2] and includes internationally important assemblages in the marine and terrestrial environment: bryophytes and fungi, seals, dolphins, breeding seabirds and wintering waterbirds.

The apparent wildness of many Scottish regions cannot fully mask the changes that have occurred over time, and the fact that many of these landscapes are intensively managed by humans. Because around 80% of Scotland's population lives in or close to urban centres, most people do not experience the full diversity of Scotland's nature in their everyday lives.

**Why is Scottish nature changing?**

Land-use change has been particularly dramatic over the last 50 years in Scotland, through both the intensification and the abandonment of management, and this continues to have a huge impact on native species and habitats[3]. Historic and ongoing land management practices across large areas of the Scottish Highlands, including grazing, burning, drainage and predator control, have had an impact on wildlife.

Climate change and human activities are having a particular impact on internationally important marine habitats and species, resulting in declines and alterations to species' distributions and community composition.

The intensification of food and timber production has not only transformed large areas of land, but continues to fragment and isolate remaining areas of semi-natural habitat. Intensification of a kind also occurs on some sporting estates where managers aim to maximise numbers of quarry animals, such as game birds and deer, sometimes at the expense of the mosaic of wildlife-rich habitats. Once largely forested, Scotland is now one of the most heavily deforested countries in Europe[4].

Compounding this, grazing by high densities of deer and sheep reduces the quality of the native woodland that remains, and its ability to support the species and communities reliant on it. In contrast, the abandonment of low intensity, mixed grazing systems has resulted in changes to the structure and composition of habitats important for a range of butterflies, breeding waders and wild flowers.

**What can we do?**

Well-planned, targeted and adequately resourced conservation action can turn around the fortunes of our wildlife. *State of Nature 2016: Scotland* takes you on a trip around eight main habitats of Scotland, highlighting some of the pressures on wildlife and giving numerous examples of how governments, non-governmental organisations (NGOs), the private sector and the public are working together to bring back nature.

The importance of nature in Scotland is apparent, not just in terms of natural and cultural wealth but also the economic benefits it brings: 14% of jobs are supported by the natural environment[5]. Despite this, systematic monitoring of changes in Scotland's natural environment has only been undertaken relatively recently and only for a small proportion of species. The three taxonomic groups we report on in detail here – vascular plants, birds and butterflies – include species for which we have sufficient robust information on population or distribution trends.

- ***Over the long term, 54% of vascular plant species declined and 46% increased. This pattern was unchanged over the short term.***
- ***39% of butterfly species declined and 61% increased over the long term. Over the short term, 26% of species declined and 74% increased.***
- ***Over the long term, 44% of bird species declined and 56% increased. Over short term, 54% declined and 46% increased.***
- ***Of the nearly 6,000 species known to occur in Scotland that have been assessed using modern Red List criteria, 520 (9%) are at risk of extinction from Great Britain.***
- ***It is largely thanks to the efforts of dedicated volunteers that we are able to show these measures for the first time in* State of Nature 2016: Scotland.**

# 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 Scotland, 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: Scotland* report represents a step forward in our ability to report on Scotland'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 Scottish measures, presented alongside existing national biodiversity indicators and alongside UK metrics, improve our understanding of how Scotland'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 centuries[6]. BII values below 90% indicate that ecosystems may have fallen below the point at which they can reliably meet society's needs. Thus the value for Scotland – 81.3% – gives great cause for concern. Of the 218 countries for which BII values have been calculated, Scotland is ranked 36th from the bottom. In other words, we are in the lowest fifth of all the countries analysed.

This measure 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 measure 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 rather than a Scottish scale. Nonetheless, there is strong evidence demonstrating widespread impacts on Scottish habitats, for example:

- Commercial afforestation and drainage resulted in the loss of 44% of Scotland's blanket peat bog between the 1940s and the 1980s; the rate of loss of lowland mires was similar.
- Although grasslands cover around one-quarter of Scotland, after decades of human intervention less than 1% of this is semi-natural.
- Between the 1940s and 1980s, the area of broadleaved and mixed woodland fell by 23% and 37% respectively, and native Caledonian pine forests now cover less than 90,000 hectares – just over 6% of the original area. Where forest cover has increased, it has been in the form of commercial conifer plantations, often of non-native species.

Hence, while *State of Nature 2016: Scotland* 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.

**Native Caledonian pine forest now covers just 6% of its original area**

Mark Hamblin (rspb-images.com)

# Key findings

We show trends in Scottish 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 1,079 terrestrial and freshwater species (2.4% of the total in Scotland). 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

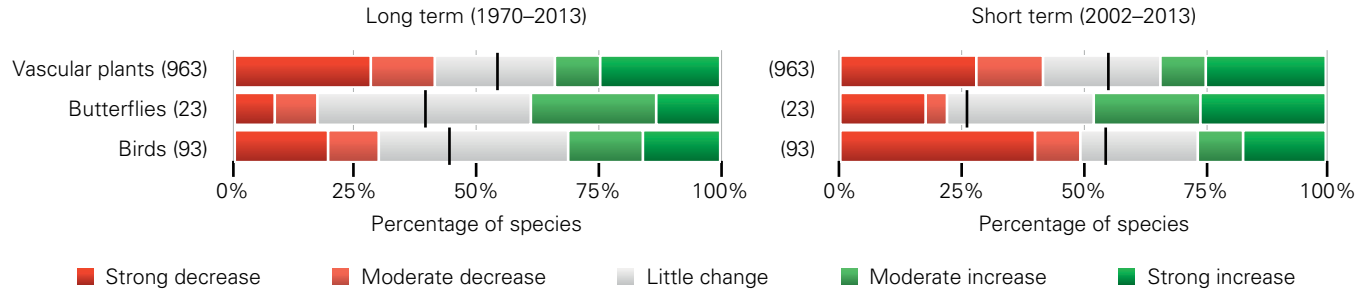



**Figure 1**

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 that occur in Scotland across three taxonomic groups: vascular plants, butterflies and birds. Marine species are assessed at a UK level and are not included in the metrics presented here.

- Over the long term, 54% of vascular plant species declined and 46% increased. Among these, 42% showed strong or moderate declines, 24% showed little change, and 34% showed strong or moderate increases. Over the short term, this pattern was unchanged.

- 39% of butterfly species declined over the long term and 61% increased. Among these, 17% showed strong or moderate declines, 44% showed little change, and 39% showed strong or moderate increases. Over the short term, 26% of species declined and 74% increased. Among these, 22% showed strong or moderate declines, 29% showed little change, and 49% showed strong or moderate increases.

- Over the long term, 44% of bird species declined and 56% increased. Among these, 30% showed strong or moderate declines, 39% showed little change, and 31% showed strong or moderate increases. Over the short term, 54% of bird species declined and 46% increased. Among these, 49% showed strong or moderate decreases, 24% showed little change and 27% showed strong or moderate increases.

Laurie Campbell (rspb-images.com)

**Sphagnum mosses**

# Scottish Red List analysis

Red Lists attempt to identify species at risk of extinction, using a standardised approach that allows for comparison across species and geographic regions.

We were able to analyse 22 Red Lists for groups of plants, invertebrates, fungi and lichens to identify the species that occur in Scotland. Birds were assessed using different criteria[6] (see page 6). Of the 7,964 terrestrial and freshwater species that have been assessed in Great Britain using modern IUCN Red List criteria, 75% are found in Scotland, and the breakdown by broad taxonomic group is shown below.

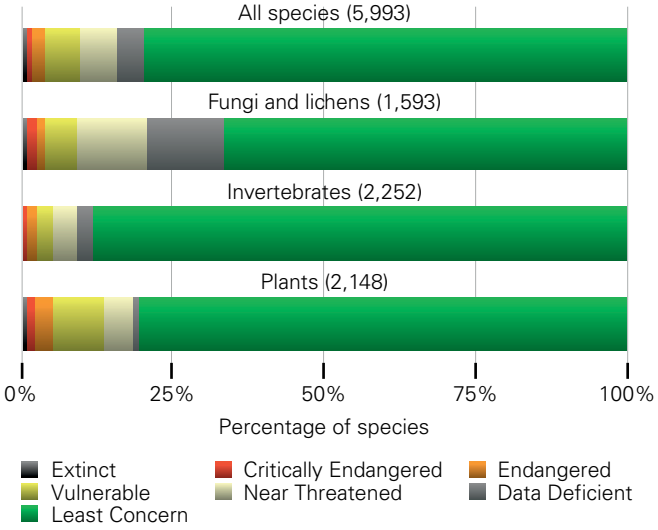



**Figure 2**

The percentage of species that occur in Scotland in each risk category, based on the likelihood of extinction from Great Britain, by broad taxonomic group. 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 species found in Scotland, 520 (9%) are classified as being at risk of extinction from Great Britain. This includes 8% of fungi and lichens, 5% of invertebrates and 13% of plants.


**Azure hawker dragonfly**

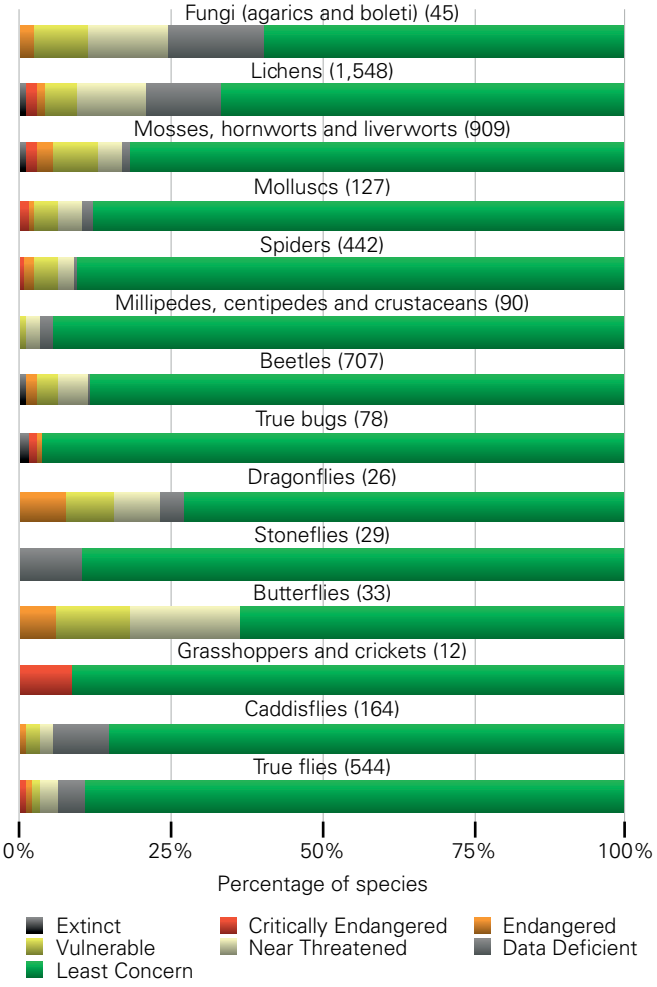



**Figure 3**

The percentage of species that occur in Scotland in each risk category by broad species grouping, based on the likelihood of extinction from Great Britain.

- Looking at Red Lists for species groups that occur in Scotland shows that 18% of butterflies, 15% of dragonflies and 12% of mosses, hornworts and liverworts are classified as being at risk of extinction from Great Britain.
- Some groups are less well recorded than others, with 15% of fungi (agarics and boleti) and 12% of lichens classified as Data Deficient, meaning they cannot be classified in terms of risk of extinction.

Puffins have moved on to the Red List

David Kjaer (rspb-images.com)

# Birds of conservation concern in Scotland

The recent UK *Birds of Conservation Concern 4* assessment[7] uses different criteria from IUCN Red Lists, assessing each species that breeds or overwinters in the UK against a set of objective criteria.

These criteria include historical decline, trends in population and range, population size, localisation and international importance, as well as global and European status. Species are placed on the Green, Amber or Red List, indicating an increasing level of conservation concern.

244 species were assigned to one of the three lists by the UK assessment. Of these, 218 (89%) are found in Scotland, with many having a significant proportion or indeed all of their population in Scotland in summer and/or winter.

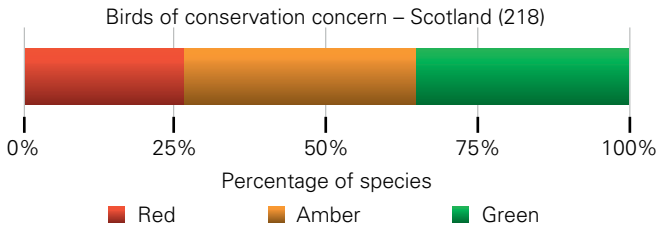



**Figure 4**

The percentage of species occurring in Scotland placed on the Green, Amber and Red Lists – indicating an increasing level of conservation concern.

- Of the 218 species assessed that occur within Scotland, 59 (27%) were red-listed as being of the highest conservation concern (although this is not comparable with IUCN Red Listing). A further 84 (39%) were amber-listed.

- Between *Birds of Conservation Concern* assessments in 2009 and 2015, the number of red-listed birds in Scotland grew by 14. Most notably, upland species such as the curlew and dotterel, and seabirds such as the kittiwake and puffin, have been red-listed. Furthermore, two species found in Scotland, the wryneck and Temminck's stint, have ceased breeding in the UK.

# Scottish biodiversity indicators

Biodiversity indicators are tools for summarising and communicating broad trends in groups of species. In Scotland, Scottish Natural Heritage (SNH) and other government bodies use data from well-monitored groups, such as birds and butterflies, to annually update national indicators. The data come from national monitoring schemes and the indicators are often used as a proxy for the overall state of biodiversity.

Scotland's Wild Bird Indicator is split into broad groups, presenting the average population trend for terrestrial breeding birds, wintering waterbirds and breeding seabirds.

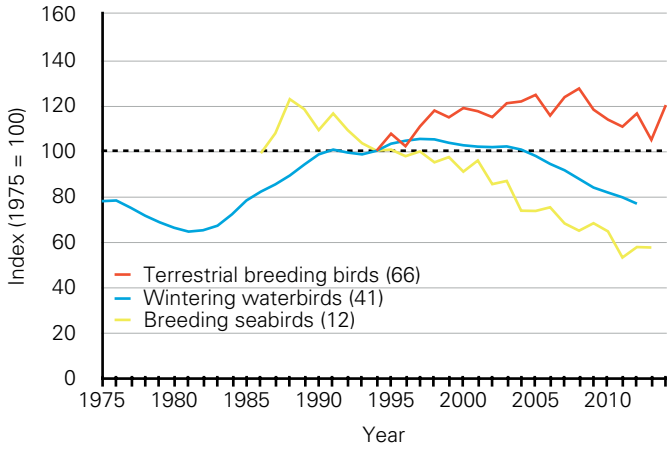



**Figure 5**

The Wild Bird Indicators for Scotland[8], showing the change in abundance for 66 terrestrial breeding birds from 1994–2014; 41 wintering waterbirds from 1975–2013; and 12 breeding seabirds from 1986–2013.

- The indicator for terrestrial breeding birds increased steadily up to the mid-2000s, but has declined since. Within the indicator, woodland birds (including blackcaps and great spotted woodpeckers) increased by 63%, while upland birds (including dotterels and curlews) declined by 19%.
- Scotland's wetlands and coasts are important for wintering waterbirds, many of which are long-distance migrants arriving from breeding grounds in the high Arctic. The indicator has declined since a peak in the late 1990s, but while goose populations have more than trebled, wader populations have declined by 50%.
- Internationally important numbers of seabirds breed in Scotland, providing an important proxy for the state of the marine environment. Since annual monitoring began in 1986 the Seabird Indicator has declined by 38%.

In Scotland, butterflies are monitored through the Butterfly Monitoring Scheme (UKBMS). Volunteers walk fixed route transects weekly, from April to September each year. The indicator describes trends for 20 of the 34 regularly occurring butterfly species in Scotland at 395 sample locations.

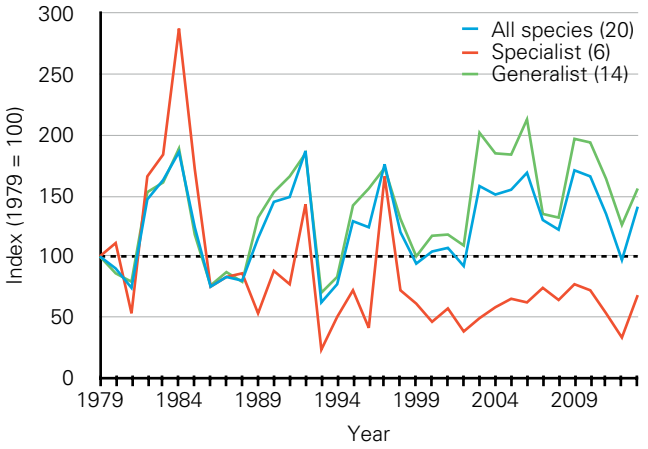



**Figure 6**

The Butterfly Indicators for Scotland[9], showing the change in abundance for 20 of the 34 regularly occurring specialist and generalist butterfly species in Scotland, from 1979–2013.

- Overall, the indicator for all butterfly species in Scotland is up by 41%.
- Generalist butterfly species that use different habitat types have fared better than butterflies with specialised habitat needs. The indicator for generalist species has increased by 56% since 1979, whereas the indicator for specialist species declined by 32% in that period.

# 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 Scotland and the rest of the UK. Here we present a summary of the UK findings to add further context to the Scotland-specific results in the rest of the 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.

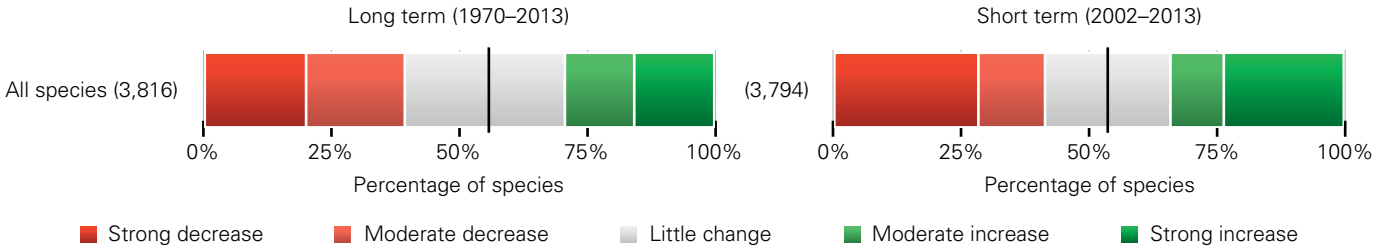



**Figure 7**

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.

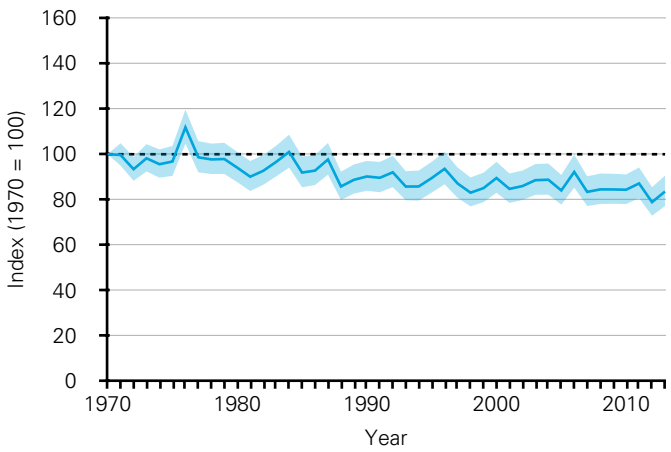



**Figure 8**

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.

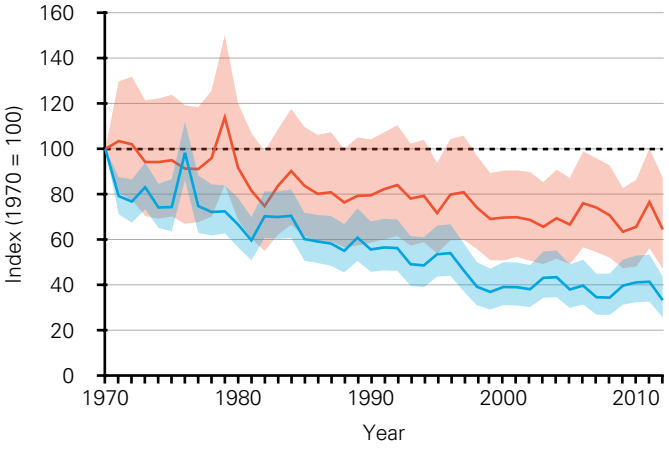



**Figure 9**

The UK Priority Species Indicator shows the Abundance Index (blue) for 213 priority species, and the Occupancy Index (red) for 111 priority species[10]. The shaded areas show the 95% confidence intervals.

- The official UK Priority Species Indicator reports on the trends of the UK's highest conservation priorities[10]. 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%.

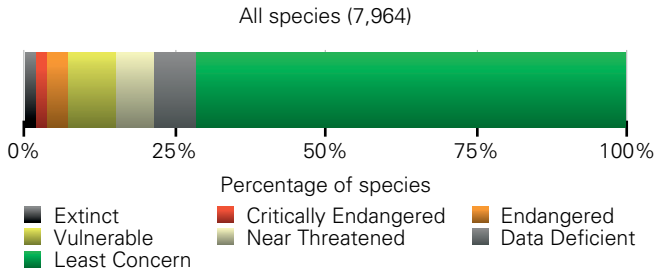



**Figure 10**

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.

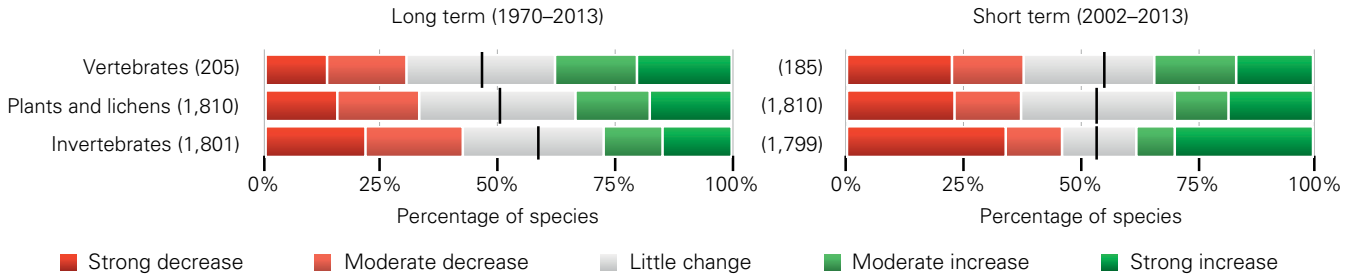




**Figure 11**

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.


Machair in bloom

Niall Benvie (rspb-images.com)

# How are we helping nature in Scotland?

Across the UK, the net loss of biodiversity described in the first *State of Nature* report appears to be ongoing, with no statistically significant difference between our long and short-term measures. However in the next section of this report we present case studies showing how government, NGOs, the private sector and the public have worked together to benefit nature in Scotland. A body of well-implemented, evidence-based public policies that balances regulation and incentives would serve to strengthen these actions.

**Green networks**

The importance of high nature value farming and crofting practices in delivering specific requirements to wildlife is recognised in our case studies. In addition, increasing understanding of the need for bigger and better wildlife sites that function as a network, has led to conservationists collaborating with a range of landowners on large-scale projects.

Such projects include looking at ways the surrounding landscape, including intensive farming systems, can be adapted to help support wildlife; for example by creating features such as corridors or stepping stones. These green networks will also provide and connect spaces for people and nature through and beyond our urban areas.

By diversifying and re-imagining the management of Scotland's varied habitats – uplands, native woodlands and our surrounding seas – new combinations of economically and environmentally sustainable management approaches will be possible, supporting and enhancing the full variety of Scottish wildlife.

**Ecosystem services**

Improving the delivery of ecosystem services is an excellent justification for conserving wildlife, and should be another tool in the defence of nature. However, focusing on species and habitats solely for the economic benefits, or other demonstrable benefits for humans, risks failing to recognise the intrinsic value that nature has in and of itself.

With climate change as a backdrop to environmental change, optimising the status of our wildlife now will improve resilience to future pressures. With clarity of vision, political will and the right support and guidance, the State of Nature partners are confident that Scotland could emerge from these globally challenging times as a leader in the protection, management and enjoyment of the natural environment.

# Marine

Scotland's seas, which make up around 61% of the UK's total marine area, are highly dynamic and varied, and support a diverse range of habitats and species. A network of Marine Protected Areas is being developed in Scottish waters, which aims to protect, and where necessary restore, the areas of our seas that are most important for biodiversity and contribute to the recovery of the wider marine ecosystem. While affording protection to vitally important areas, the network is only partially implemented at present, with gaps in coverage, including for seabirds and marine mammals, as well as basking sharks, sea trout, spiny lobsters, and east coast reef sites.

The marine environment faces major challenges from climate change, the direct and indirect impacts of fishing, development pressure and pollution. Invasive non-native species on islands also have profound effects on marine species, in particular seabirds, as explained below.

Case study

## Past, present and future island restoration projects in Scotland

*The UK is made up of almost 10,000 islands, the majority of them uninhabited by people but home to abundant and diverse native wildlife. In particular, globally significant populations of many seabird species are found here, including 80% of the world's population of Manx shearwaters and 60% of the great skuas[11].*

*Unfortunately, many islands are also home to other, more recent arrivals – invasive non-native species (INNS) such as predatory brown rats and American mink.*

*Island restoration through the eradication of INNS has great potential in the UK, and particularly Scotland, which has over 90% of the UK's islands. A recent prioritisation exercise, led by the RSPB, assessed UK islands according to the potential conservation benefits of INNS eradication using existing methods[12].*

*Nineteen of the twenty highest ranked islands are in Scotland, illustrating the huge potential of island restoration in conserving Scottish nature.*

*Of the 18 island rat eradication attempts so far carried out in the UK, ten have been in Scotland, including the UK's first recorded rat eradication attempt on Ailsa Craig in 1923. Scotland also accounts for the largest island so far successfully cleared of rats in the UK; at 1,300 hectares Canna (and Sanday) is three times larger than the next largest island. The most recent project in Scotland began on the remote Shiant Isles over the winter of 2015/16.*

*Seabirds and other species have responded positively following most of these eradication projects, although not on all islands. Removing predation pressure alone, while highly beneficial, cannot always restore populations threatened by other factors such as food shortages. Future island restoration projects would benefit from wider initiatives to tackle other pressures on marine wildlife. Ongoing monitoring is an essential part of all eradication projects, both to check for the recurrence of rodents, and also to monitor the ecological responses to their removal.*

*The RSPB has developed a best practice toolkit for UK island rodent eradication to ensure future projects are carried out using proven and effective methods, thus maximising both their chances of success and their conservation benefits. This will give confidence in tackling difficult projects in the future, including larger, more remote and rugged islands – the kind that are abundant in Scotland.*

***Karen Varnham**, RSPB*

Ed Marshall (rspb-images.com)

**Scotland's breeding seabirds, such as these Manx shearwaters, are of international importance**

# Upland

Upland habitats in Scotland include grass and rush pastures, woodland and lochs, extensive areas of open moorland and blanket bog, and higher altitude montane heath, as well as areas under permanent snow cover. These habitats and the species that inhabit them face numerous threats, such as inappropriate afforestation, grazing and burning, climate change, wildlife crime and increasing pressure from renewable energy developments including hydroelectric power systems and onshore wind farms.

As well as the Arctic-alpine species that have their British strongholds in the Scottish uplands, many species that were once more widespread in the lowlands now find their main refuges in the uplands. This further highlights their huge cultural and ecological value.

Case study

## Restoring blanket bogs in the Scottish uplands

*The UK's blanket bogs provide a range of important ecosystem services, such as storing carbon and providing drinking water, and notable areas of this habitat can be found in Scotland. Some areas of blanket bog have been, and continue to be, degraded by inappropriate grazing, drainage, peat cutting, burning, afforestation and wind farms, which could threaten their ability to act as an effective carbon store and to mitigate climate change[13].*

*The planting of commercial conifer plantations has had a major impact on blanket bogs. The Flow Country of northern Scotland is a globally important example, where this open landscape is now fragmented by commercial conifer plantations, as a result of one of the most controversial European land-use transformations of the late 20th century[14,15]. Much of the remaining open bog is now designated for its conservation value, including for its globally unique assemblage of habitats and breeding birds, including greenshanks, dunlins and golden plovers.*

*The impacts of afforestation on peatland habitats can be profound: the water table may be lowered when the land is drained during planting, and the water balance is disturbed by the growing trees. Shading from trees may also have a negative impact on the peat-forming Sphagnum mosses, potentially inhibiting peat formation[16].*

*Declines in bird populations have also been detected. The most obvious likely cause of this is direct habitat loss through the replacement of bog with plantations. Afforestation can also reduce bird populations on remaining open ground through "edge effects" from adjacent woodland. These effects include increases in avian and mammalian predators[17,18]; potential habitat changes resulting from changes in hydrology, or grazing and burning practices[19,20]; and behavioural avoidance of trees by breeding birds, as they are associated with an increased risk of predation[21,22,23].*

*Measures to restore blanket bog include felling trees and, where feasible, removing them from the site, and blocking the main drainage ditches to restore the high water table. Trials are underway to assess the effectiveness of these restoration methods. These trials monitor a range of responses, including soil moisture levels, water quality, greenhouse gas fluxes, vegetation, invertebrates and birds.*

*Restoring functioning blanket bog is a long-term process and results to date are preliminary. However, the oldest restoration areas show that water levels can be successfully restored across large areas, which is associated with habitat recovery, at least in the flatter areas which retain moisture more easily. However, some areas, such as those on steeper ground or on top of furrows that were ploughed to increase drainage, are recovering more slowly. These areas may also require further management, such as targeted blocking of the furrows or re-profiling, and this forms the subject of the latest trials.*


**Scotland's blanket bogs provide important habitat for golden plovers**

***Ben Darvill**, BTO*
***David Douglas**, RSPB*

**Forsinard Flows**

David Tipling (rspb-images.com)

# Woodland

Scotland supports some of the most important native woodland habitats in the UK. Around 1% of the country is covered by native woodlands, including lowland broadleaved woodland, the rare western Atlantic woodland, upland birch or oak woods and the iconic Caledonian pine forests of the Highlands. The remaining woodland cover in Scotland is made up of commercial plantations. Native woodlands are threatened by over-grazing, commercial afforestation of existing woodland sites and invasive non-native species such as rhododendron. This invasive plant alters the structure of the habitat and prevents natural regeneration from occurring, affecting the ground flora and eliminating rare and delicate mosses, liverworts and lichens, for which Scotland is a globally important area.

Case study

## Tackling damage caused by deer

*The Ardvar woodlands Special Area of Conservation (SAC) in Sutherland is part of Scotland's remnant ancient Atlantic oak and hazel woodland. This type of woodland, rich in bryophytes and lichens, and influenced by the Atlantic climate of western Scotland, is very restricted in distribution. Site condition monitoring at this internationally important site has shown that recruitment of new trees is seriously affected by deer browsing, as in other woodlands[24,25].*

*In 2004, the site's condition was assessed as "unfavourable" and in 2009, in an attempt to address the damage, a voluntary deer management agreement was negotiated between two of the three landowners. Habitat monitoring was established and deer cull targets set and achieved. Despite this, tree seedlings were still being damaged and the woodland was still subject to deer-browsing for eight months of the year, including winter, when most tree damage occurs.*

*If this continues, the species composition of the woodland is likely to change, with birch and willow increasing and hazel decreasing, which may reduce the diversity of lichens supported.*

*Two woodland grant schemes have been in place across the area since 2000, and these have shown that fencing and planting in combination has led to quite rapid establishment of new trees and subsequent natural regeneration.*

*There are current proposals for additional areas of the site to be fenced to exclude deer. However, the ongoing conflict between the conservation objectives and the aspirations of sporting estates in the area means that the prospects for the unfenced woodland areas remain in question.*

*This site highlights the challenge of managing designated sites under current legislation – the Deer (Scotland) Act 1996 – and raises some fundamental questions. Undoubtedly, traditional deer stalking brings in jobs and money to the local economy – but at what price? Wild deer are an integral part of Scotland's natural heritage and light grazing by deer can be beneficial, but sustainable management is required to maintain deer populations to levels the land can sustain.*

*Deer management in Scotland is under considerable scrutiny and the new Land Reform (Scotland) Act 2016 contains several provisions to increase transparency in deer management. Scottish Ministers have commissioned Scottish Natural Heritage to review "the effectiveness of deer management in protecting the public interest, with a specific focus on the impact on natural heritage" and this will be reported in autumn 2016.*

***Mike Daniels,** John Muir Trust*

Laurie Campbell (rspb-images.com)

**Excessive grazing by deer can seriously affect the condition of woodlands**

# Farmland

Much of the farmed land in Scotland was traditionally worked at a very low intensity, usually through mixed livestock grazing, with some areas more suited to arable. However, parts of the lowlands have become increasingly intensively managed, and many farmland birds and other wildlife have been lost as a result.

The High Nature Value (HNV) farming and crofting of agriculturally marginal lands in the Highlands, islands and uplands of Scotland is increasingly difficult to sustain economically and socially. However, the sensitive grazing regimes and low-intensity arable production involved are hugely valuable for a whole suite of wildlife, and subsidies directed to HNV farming systems deliver tangible environmental benefits from public investment. These benefits are often delivered through conservation organisations working together with landowners to maintain HNV farming at a landscape scale, and enable wildlife populations to thrive. The work of Butterfly Conservation in Argyll is one such example.

Case study

## Delivering advice to benefit marsh fritillaries in Scotland

*The marsh fritillary butterfly has suffered dramatic declines across Europe and has become extinct over a large part of its former range in England, Wales and Northern Ireland. Despite conservation efforts, the butterfly still declined in distribution in the UK by 22% between 2005 and 2014[26]; declines in abundance at monitored sites have been even steeper, at 73% between 1983 and 2004[27].*

*These severe declines are primarily due to the fragmentation of suitable sites through inappropriate management, resulting in the isolation of existing colonies[28]. The widespread declines of the marsh fritillary have increased the importance of the populations in Scotland, where it has a restricted distribution centred on Argyll and the neighbouring islands.*

*The fortunes of marsh fritillaries are closely linked to traditional agriculture. These butterflies require light grazing, ideally by cattle, to maintain their habitat in suitable condition[29]. Such a regime is also beneficial to a wide range of other wildlife, particularly other invertebrates, plants and birds, and is indicative of High Nature Value farming[29]. Successful action for marsh fritillaries therefore requires positive engagement with landowners and land managers, and is best undertaken at a landscape scale[28].*

*However, due to the varied and non-uniform nature of Scottish marsh fritillary sites, a standard grazing prescription that fits all sites is not feasible. Advice, therefore, has to be site-specific. Thanks to funding and guidance from a steering group, Butterfly Conservation Scotland was able to advise farmers and their land agents on how to help marsh fritillaries, allowing them to gain entry into Rural Priorities, Scotland's agri-environment scheme at the time. The initial success of the first few applications quickly bred further interest, and agents, landowners and managers were soon actively seeking site assessments for marsh fritillaries. This also resulted in the discovery of several previously unknown colonies.*

Peter Eeles

**The marsh fritillary has become extinct over much of its former range**

*In total, management advice to assist entry into agri-environment schemes was given for over 200 sites across 20 broad fritillary populations. Monitoring of such initiatives is critical. In the absence of funding for that monitoring, local volunteers are monitoring the recovery of the marsh fritillary within the larger project area, to complement the implementation of measures by land managers.*

*The success of delivering this advice has been down to the co-operation and goodwill of the site landowners and managers and their agents, and their willingness to work together. As a result, the project has become a blueprint for delivering management advice for threatened species across Scotland.*

***Tom Prescott***
*Butterfly Conservation*

# Grassland and heathland

Scotland's grasslands encompass a wide variety of habitats and locations, and are home to some of the country's rarest species. From the flower-rich upland hay meadows of the Highlands, to the dune grasslands of the coast, Scotland boasts some of the UK's best preserved grassland habitats. Scotland is particularly famed for its coastal grasslands, known as machair, where low-intensity management means that species such as the corncrake, Irish lady's-tresses orchid and great yellow bumblebee can still be found.

Case study

## Thurso: Gateway to the great yellow bumblebee

*The disappearance of more than 98% of the UK's flower-rich meadows in the last century resulted in massive declines in some bumblebee species[30]. Two species have become extinct since the 1930s, and some once-widespread species are now restricted to pockets of suitable habitat, such as the open grasslands around the coasts of Scotland. One of these species is the great yellow bumblebee, which the Bumblebee Conservation Trust (BBCT) is working to help in their Thurso: Gateway to the great yellow bumblebee project.*

*Focusing on Thurso, but working throughout Caithness and other areas within the species' range, the project aims to engage with communities and farmers to help provide more habitat for this and other bee species. Other partners such as the University of Highlands and Islands, Forestry Commission Scotland and Learning Through Landscapes will also be getting involved and doing their bit to help raise the profile of this species, as well as carrying out practical conservation work to help populations.*

*Flower-rich machair grassland is one of the most important habitats for the great yellow bumblebee, but it is vulnerable to inappropriate grazing and erosion. Therefore the project is working with crofters who make their living on the machair, to explore ways in which this essential habitat can be protected and improved, while remaining a useful agricultural resource for the crofters.*

*To get more communities involved, there are courses in wild flower seed collection, meadow creation, gardening for bees and even scything, to help coastal communities manage their own local flower-rich areas. One of the initiatives for primary-school children is the use of "propagation stations" – places where they can learn how to grow bee-friendly plants to be used in gardens and conservation projects.*

*The project also aims to get more people "BeeWalking". This is the BBCT's main citizen science survey, asking volunteers to record the bees they see, and this project will train dozens of new survey volunteers who will ultimately help us better understand populations of the great yellow bumblebee.*

***Katy Malone***
*Bumblebee Conservation Trust*

Mike Edwards (rspb-images.com)

**Flower-rich machair grassland is an important habitat for great yellow bumblebees**

# Freshwater and wetlands

There is a diverse range of freshwater habitats in Scotland, including lochs, mires and flushes in uplands; and peatlands, rivers, streams, fens, marshes, reedbeds and raised bogs in the lowlands. Water quality and the manipulation of waterways are significant pressures, affecting all of Scotland's freshwater, and other major pressures include the exploitation of various species through commercial fisheries, and illegal collection. This can affect a species directly, or indirectly through the spread of parasites, such as fish lice, or fungal diseases.

Climate change also presents significant threats to freshwater systems in montane areas, an example of which is highlighted here. To improve the resilience of these systems to climate change, good quality habitat is required in the mountains for threatened insects and other freshwater life.

Case study

## Is the upland summer mayfly in hot water?

*One major threat to Scotland's freshwater ecosystems is climate change, which is driving a rise in water temperatures. As a result, Arctic-alpine species are finding themselves increasingly pushed "uphill" into diminishing areas of habitat.*

*Most recent climate change predictions say that water temperatures will continue to rise, and this will inevitably have an impact on freshwater invertebrate populations. As the majority of species have relatively short life cycles and are able to move between sites quite easily, they are likely to be one of the first groups to show the impact of a changing climate. Cold-loving species are likely to retreat northwards and uphill, while warm-loving species will increase their range[31].*

*The upland summer mayfly is the only predominantly montane mayfly species in the UK, and as such is restricted to cold water streams. In the UK it has been found mostly above 300 metres, although in the north of Scotland it has also been found at lower altitudes.*

*However, a recent study[32] has shown that it is now absent at many of these low level sites and there is some evidence that it is being pushed further upstream as water temperatures rise. Further research into the optimal flow dynamics and habitat features that make the best sites for this mayfly is being pursued.*

*European research using climate change models has shown that the geographical range of this species is likely to contract. By 2080, it is predicted that the upland summer mayfly will be restricted to the Alps, Scandinavia and parts of the Scottish Highlands, such as the Cairngorms[33]. This is an example of a trend that is predicted for many montane species.*

***Craig Macadam***
*Buglife*

Duncan Mcewan (naturepl.com)

**The range of the upland summer mayfly is likely to contract in response to climate change**

# Urban

Our urban wildlife is under constant pressure from development and changes to building practices, especially where the value of green space and other space for wildlife is not properly recognised in planning decisions. It is also apparent that without the integration of green networks and other measures to provide space for wildlife, urban areas can pose increasingly difficult barriers to the movement and dispersal of insects and other wildlife. The increasingly urbanised human population is also suffering as a result of disconnection from nature, which has negative effects on health and well-being[34].

There are initiatives underway across the country to promote a greater understanding and appreciation of wildlife in the urban environment, its value to humans and how it can be improved, including this one from Buglife.

Case study

## Get Britain Buzzing

*Our pollinating insects have declined significantly as a result of environmental factors such as habitat loss, the use of pesticides and the decreased connectivity of nectar and pollen resources[35]. Buglife's Get Britain Buzzing campaign aims to highlight the crisis facing pollinators and other wildlife, while transforming mown grassland in urban parks and along road verges into colourful wild flower meadows through the B-lines and Buzzing conservation projects.*

*The campaign also promotes the installation of living roofs, encourages people to create bee hotels in their gardens and influences policies regarding pesticides that are most harmful to pollinators.*

*In Scotland, Buglife has run Buzzing projects creating flower-rich grassland in Glasgow, Perth, Fife, North Lanarkshire, and along the John Muir Way where a B-line is being mapped. B-Lines are a series of "insect pathways" along which wild flower-rich habitat is restored and created to act as stepping stones. These link existing wildlife areas together, creating a network that weaves across the landscape.*

*Fife's Buzzing is a three year partnership project with Fife Council and is funded by the Heritage Lottery Fund and Fife Environment Trust. The project aims to create up to 12.6 hectares of species-rich grassland at 16 parks across the Kingdom of Fife. This project started in August 2014 and has so far created over five hectares of species-rich grassland at 13 parks across Fife.*

*Over 1,000 people from 18 schools and nine community groups, as well as individual volunteers, have helped with the habitat creation by planting plug plants and native wild flower seeds. These areas are adding colour and life to the parks across Fife for local people and wildlife to use and enjoy.*

*Through these projects, surveys have identified a number of pollinators that are benefitting from the creation of species-rich grassland in our urban parks. These include the solitary bee* Colletes daviesanus*, the drone fly and the red-tailed bumblebee. These grassland areas are also important homes for frogs and toads and, in the east end of Glasgow, water voles.*

***Suzanne Burgess***
*Buglife*


**Over 1,000 people have helped to create habitat for bees across Fife**

# Coastal

The Scottish coastline is probably best known for its rocky shores, islands and sealochs, but it also has dunes, shingle and estuaries of UK and global importance. In the past, Scotland's soft shoreline habitats have been lost because of development or conversion for agricultural use; in some areas, such as the Firth of Forth, 50% of saltmarsh has been lost. Soft coast habitats are under further threat from sea level rise and extreme weather events, a result of the changing climate. Managed realignment of the coast requires strategic planning and adequate funds to create new habitats. The Nigg Bay project, in the Cromarty Firth, was the first example of managed coastal realignment in Scotland, and showed that the technique works and provides a haven for wildlife.

Case study

## Coastal realignment at Nigg Bay

*Climate change is a key threat to our coasts and coastal habitats in the UK. Sea level rise and the increasing frequency and intensity of storms threaten to cause inland flooding, as well as squeezing and damaging important coastal habitats. Despite being under threat itself from the impacts of climate change, saltmarsh actually provides a nature-based solution to these problems. As well as being important for the biodiversity it supports, saltmarsh can store significant amounts of carbon[36] and naturally buffers the coasts against storms and waves[37].*

*Historically, large areas of saltmarsh and other intertidal habitats have been reclaimed in the UK for agriculture and development, leaving the coasts more vulnerable to flooding and erosion. In a familiar story, over 35% of saltmarsh at Nigg Bay in Scotland was lost between 1946 and 1997, and 93 hectares of mudflats were reclaimed for development in the 1970s. In response, the RSPB carried out a pioneering project on its nature reserve at Nigg Bay. The project aimed to recreate intertidal habitats, to address past losses, and also future losses due to sea level rise and other effects of climate change.*

*In February 2003, two 20-metre breaches in the existing sea wall were created to reconnect a 25-hectare field (Meddat Marsh) with the sea for the first time since the 1950s. Fortunately, the original marsh features, including the creek system, were still largely intact, allowing intertidal habitats to redevelop naturally without costly earthworks. Within a year, several key saltmarsh plants and mud-dwelling invertebrates had colonised. By 2011, Meddat Marsh had been completely transformed from rush pasture to a mixture of saltmarsh and intertidal mudflats.*

25 hectares of saltmarsh and intertidal habitats were restored at Nigg Bay

Andy Hay (rspb-images.com)

*Negative impacts have been minimal, and the gains across Meddat Marsh have increased the total saltmarsh in Nigg Bay by about 30%. The project has also created new saltmarsh edge habitat and intertidal mudflats, benefitting wintering waterbirds; 25 species have been recorded using the site since the sea wall was breached. Meddat Marsh is one of the last areas in Nigg Bay to be covered by the incoming tide, and the realignment site therefore provides a valuable extra foraging opportunity. During windy conditions and high spring tides, it has become a refuge for thousands of waders and wildfowl, including internationally important numbers of bar-tailed godwits.*

*More than 13 years on, it is clear that the Nigg Bay project has been a great success, with saltmarsh habitat and key marine invertebrates returning more quickly than expected[38]. The realignment site has become a key area for wintering waterbirds and will increase their resilience to further climate impacts. We hope that these positive results will inspire others to repeat this project's success elsewhere in Scotland, perhaps on a larger scale.*

***Steph Elliott, Chris Bingham and Jim Densham***
*RSPB*

# 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 SCOTLAND?

- We have quantitative assessments of the change in population or distribution in Scotland for 1,079 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 Scottish 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 Scotland or the UK to show the following:

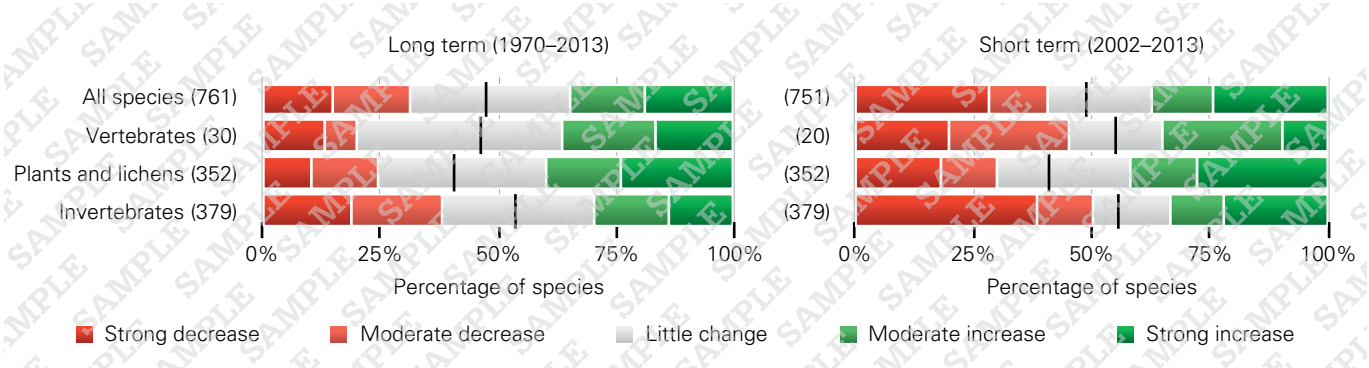
- **Categories of change**
  The percentage of species in each trend category.
- **Change over time**
  The change in the status of species at a UK level, over time, based on abundance and occupancy data.
- **Extinction risk**
  An assessment for each species occurring in Scotland, of the likelihood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



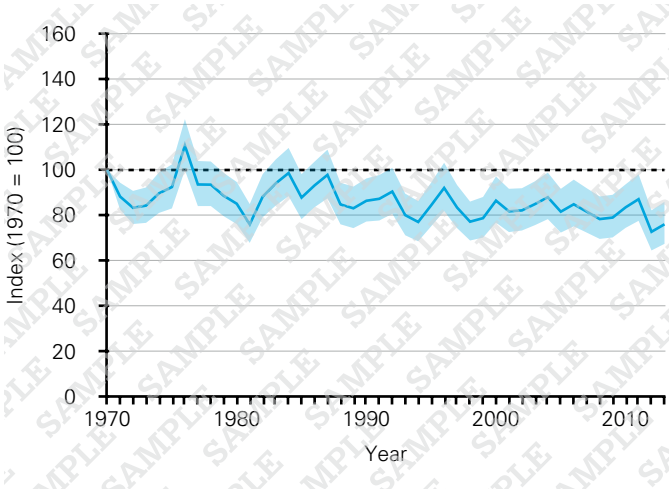

Results reported for each figure include:

- The overall percentage of species that increased and decreased in each time period. The vertical line in 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-km$^2$ 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).



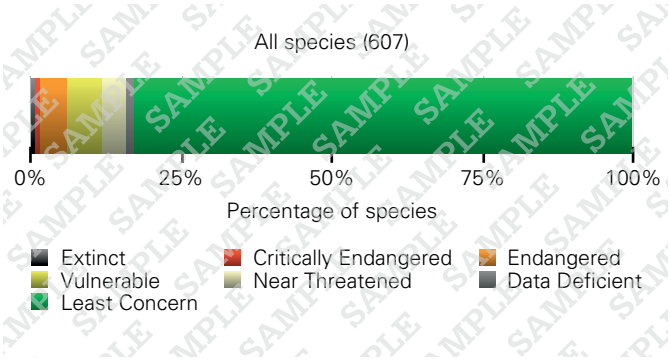

Results reported for each figure include:

- 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.
- At the UK level, 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 interpret existing Great Britain Red Lists, based on species occurring in Scotland 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 considered at risk of extinction from Great Britain is worthy of note.




Results reported for each figure include:

- The overall percentage of species that occur in Scotland 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.

Sue Kennedy (rspb-images.com)

**Seven-spot ladybird**

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Kevin Sawford (rspb-images.com)

**Pine marten**

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

A Focus On Nature
amphibian and reptile conservation
ALERC
A ROCHA
British Lichen Society
BTO Looking out for birds
Butterfly Conservation Scotland
Saving butterflies, moths and our environment
MARINE life
Bat Conservation Trust
Bumblebee Conservation Trust
THE FUNGUS CONSERVATION TRUST
National Forum for Biological Recording
Botanical Society of Britain & Ireland
buglife Scotland
the National Trust for Scotland
Plantlife
BDS British Dragonfly Society
froglife scotland
The Mammal Society
ORCA Looking out for Whales and Dolphins orcaweb.org.uk
CIEEM Chartered Institute of Ecology and Environmental Management
The Conchological Society of Great Britain & Ireland
NBN National Biodiversity Network
WDC WHALE AND DOLPHIN CONSERVATION
Freshwater Habitats Trust
SHARK TRUST
SCOTTISH BADGERS
ROTHAMSTED RESEARCH
WWT
WWF
SAHFOS Continuous Plankton Recorder Survey
CEH Centre for Ecology & Hydrology NATURAL ENVIRONMENT RESEARCH COUNCIL
BRC Biological Records Centre
iSpot ispotnature.org
EARTHWATCH INSTITUTE
WOODLAND TRUST SCOTLAND
Marine Ecosystems Research Programme
The Vincent Wildlife Trust
The University Of Sheffield.
Scottish Wildlife Trust
NATURAL HISTORY MUSEUM
people's trust for endangered species
Bringing the wild back to life
JOHN MUIR TRUST for wild LAND & wild PLACES
marine conservation society
ZSL LET'S WORK FOR WILDLIFE
rspb giving nature a home
Predicts

state of nature
rspb.org.uk/stateofnature

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