

5. Species in the wider countryside: farmland

Type: State indicator

5a. Populations of farmland species



In 2015 the England farmland bird index was less than half its 1970 value. The majority of this decline occurred between the late seventies and early eighties largely due to the impact of rapid changes in farmland management during this period. More recently, since 1990, the decline has slowed; the smoothed index decreased significantly by 7% between 2009 and 2014 (figure 5.1)

Indicator Description

The first part of this indicator shows relative changes in abundance of species in the farmed landscape. Farmland refers to the large proportion of England which is devoted to agriculture and consists of crops and grasslands habitat. Farmland also provides semi-natural habitats such as hedgerows and field margins that provide food and shelter.

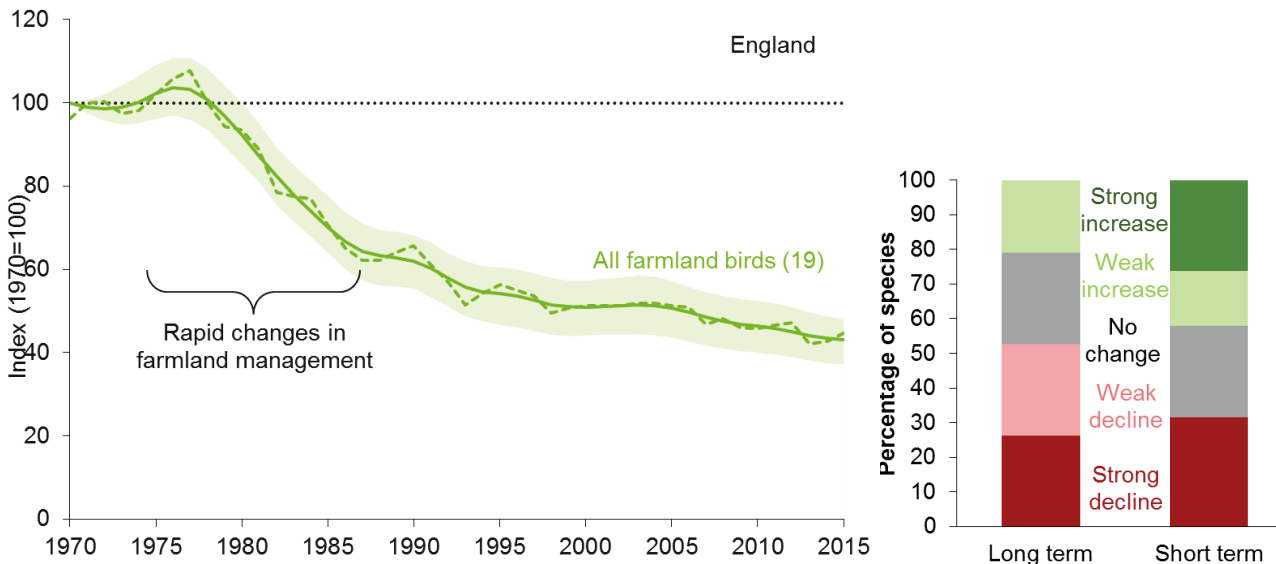


Since 1990 the farmland butterflies index has fallen by 36% (figure 5.2).



Between 1999 and 2015, populations of the bats in the indicator have increased by 32%. In the short term, between 2010 and 2015, the indicator shows no significant change. The bat species vary in their habitat requirements, but all occur in farmland and woodland landscapes and for convenience are presented only in the farmland indicator (figure 5.3).

Figure 5.1: Breeding birds on farmland in England, 1970 to 2015

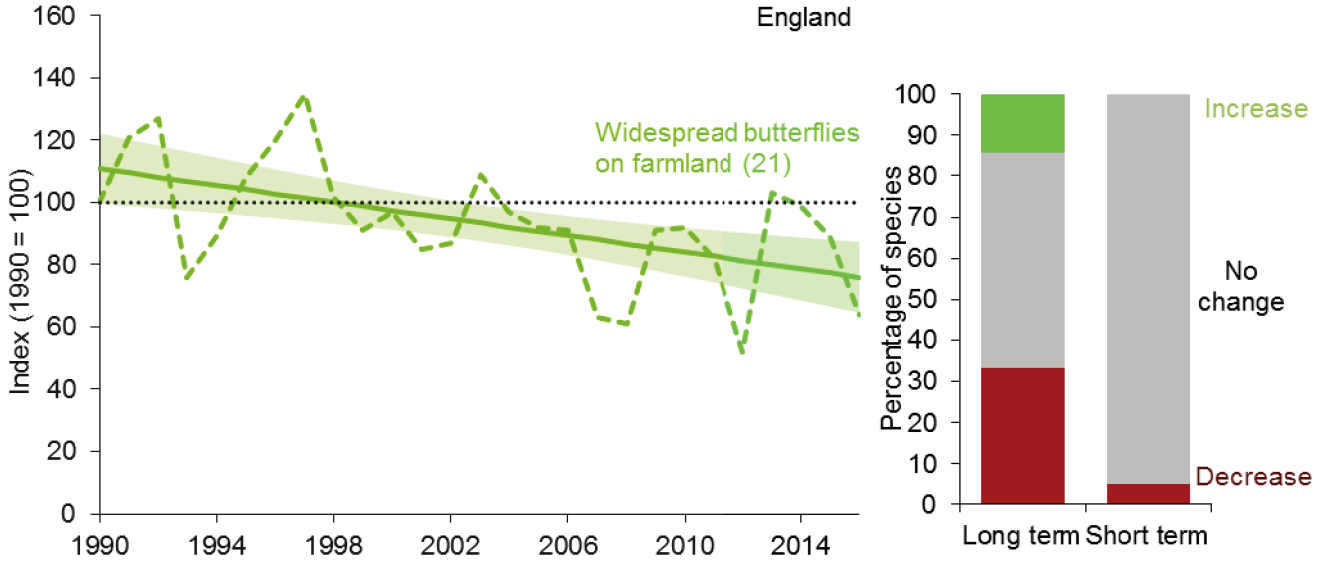


Notes:

1. Figure in brackets shows number of species.
2. Graph shows unsmoothed trend (dashed line) and smoothed trend (solid line) with its 95% confidence interval (shaded).
3. Bar chart shows the percentage of species within the indicator that have increased, decreased or shown no change, based on set thresholds of annual change.

Sources: British Trust for Ornithology, Department for Environment Food and Rural Affairs, Joint Nature Conservation Committee and the Royal Society for the Protections of Birds.

Figure 5.2: Widespread butterflies on farmland in England, 1990 to 2016

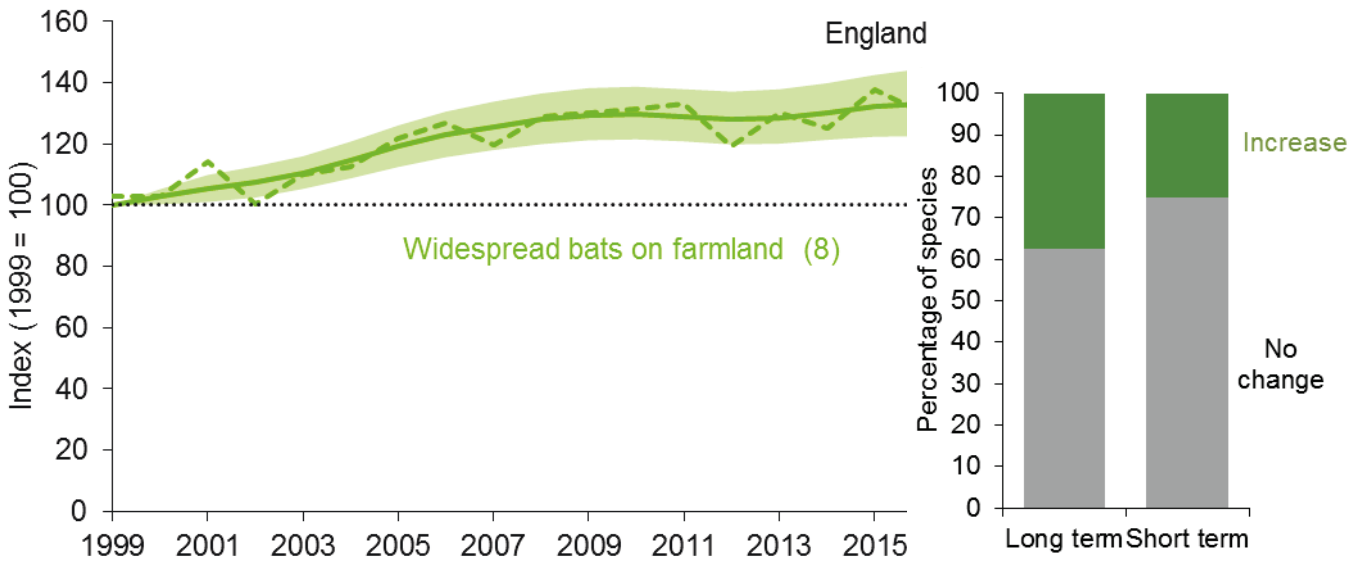


Notes:

1. Figure in brackets shows number of species.
2. Graph shows unsmoothed trend (dashed line) and smoothed trend (solid line) with its 95% confidence interval (shaded).
3. Bar chart shows the percentage of species within the indicator that have shown a statistically significant increase, statistically significant decrease or no change.

Sources: Butterfly Conservation, Centre for Ecology & Hydrology

Figure 5.3: Widespread bats on farmland in England, 1999 to 2016



Notes:

1. The index is a composite of eight species: serotine; Daubenton's bat; Natterer's bat; noctule; common pipistrelle; soprano pipistrelle; brown long-eared bat; and lesser horseshoe bat.
2. Line graph shows the unsmoothed trend (dashed line) and smoothed trend (solid line) with its 95% confidence interval (shaded).
3. Bar chart shows the percentage of species within the indicator that have shown a statistically significant increase, statistically significant decrease or no significant change.

Source: Bat Conservation Trust



The farmland bird index comprises 19 species of bird. The long-term decline of farmland birds in England has been driven mainly by the decline of those species that are restricted to, or highly dependent on, farmland habitats (the 'specialists'). Between 1970 and 2015, the farmland specialists index declined by 71% while farmland generalists increased by 3%. Smoothed trends showed declines, of 72% and 4% respectively (figure 5.4).



Since 1990 the farmland butterflies index has fallen by 36%. These figures demonstrate how numbers fluctuate from year to year, but overall, based on the underlying smoothed trend, the indicator has shown a significant decline since 2008. Species in significant long-term decline on farmland include gatekeeper, small tortoiseshell, wall and white-letter hairstreak. Species that increased over the long term include ringlet and brimstone. 2016 was a particularly bad year for butterflies; short term changes in butterfly populations are affected heavily by weather and although the summer of 2016 was mostly warm and dry in many parts of England, there was a very cold spell in spring following a mild winter, which may have negatively influenced populations.



Between 1999 and 2015, populations of the bats in the indicator have increased by 32%; an assessment of the underlying smoothed trend shows this is a statistically significant increase. In the short term, between 2010 and 2015, the indicator shows no significant change and so is considered to be stable. An increase in the lesser horseshoe bat trend has been sustained throughout the period of the indicator and has been attributed to conservation measures and a series of mild winters that have enhanced winter survival. Assessments are run to the penultimate year of the trend as the most recent smoothed data point (2016) is likely to change as future years of data are added. There was a decrease in the unsmoothed index between 2015 and 2016 but this result should be treated as provisional for the reason outlined above.

These trends reflect relatively recent changes to bat populations. Prior to this there were significant historical declines in bat populations dating back to at least the start of the 20th century.

Indicator assessment

| Assessment of change in abundance and diversity of species in the wider countryside (farmland) | | | |
|--|-----------|------------|------------------|
| | Long term | Short term | Latest year |
| Breeding farmland birds | 1970-2014 | 2009-2014 | No Change (2015) |
| Butterflies of the wider countryside on farmland | 1990-2014 | 2011-2016 | Decreased (2016) |
| Bat populations | 1999-2015 | 2010-2015 | No change (2016) |

Note: To better capture patterns in the data, where possible, long term and short term assessments are made on the basis of smoothed data. Due to differences in the methods used to produce smooth trends for birds, butterflies and bats, long and short term assessments made on smoothed bird trends are made to 2014 and to 2015 for bats, while assessments made on smoothed butterfly data are made to 2016. All latest year assessments are based on unsmoothed data.

5b Farmland plant species richness

An indicator of plant species richness has been published previously within the biodiversity indicators set, based on an analysis of changes in land cover recorded in Countryside Survey – a detailed periodic audit of a statistically representative sample of land across Great Britain. As the latest Countryside Survey data are from 2007, the data previously presented for this indicator are considered too out of date to be fit-for-purpose as a headline measure. In 2014, the UK Biodiversity Indicators Steering Group therefore took the decision to move this data and analysis to the background.

Relevance

Species groups such as bats, birds and butterflies are considered to provide a good indication of the broad state of the environment because they occupy a wide range of habitats and there are long-term data on changes in populations which help in the interpretation of shorter term fluctuations. Butterflies also play a complementary role to birds and bats as an indicator, because they use the landscape at a far finer scale.

The indicator shows progress with commitments to improve the status of our wildlife and habitats. It is relevant to outcomes 1 and 3 in *Biodiversity 2020, the strategy for England's wildlife and ecosystem services* (see annex).

The indicator is also relevant to international goals and targets (see Annex 2).

Background

Farmland birds

The farmland bird measure has been supplied by the Royal Society for the Protection of Birds (RSPB), the British Trust for Ornithology (BTO) and the Joint Nature Conservation Committee (JNCC) and is compiled using data from the Common Bird Census (CBC) and Breeding Bird Survey (BBS). Within the farmland bird measure there are 19 species (Table 5.1). Each species is given equal weighting and the index is the geometric mean of the individual species indices. The assessment of change is based on a statistical test of the underlying trend, using smoothed species trends derived from general additive models, with bootstrapping to generate confidence limits. Further details about species and methods can be found on the British Trust for Ornithology website (see web-links).

Within the farmland bird measure, the decline is generally steeper for specialist bird species – those that are restricted to or very strongly associated with farmland habitats, as opposed to generalists, which are found in a wider range of habitats (Figure 5.4). Changes in farming practices, such as the loss of mixed farming systems, the move from spring to autumn sowing, and increased pesticide use, have been demonstrated to have had adverse impacts on farmland birds such as skylark and grey partridge, although other species such as woodpigeon have benefitted.

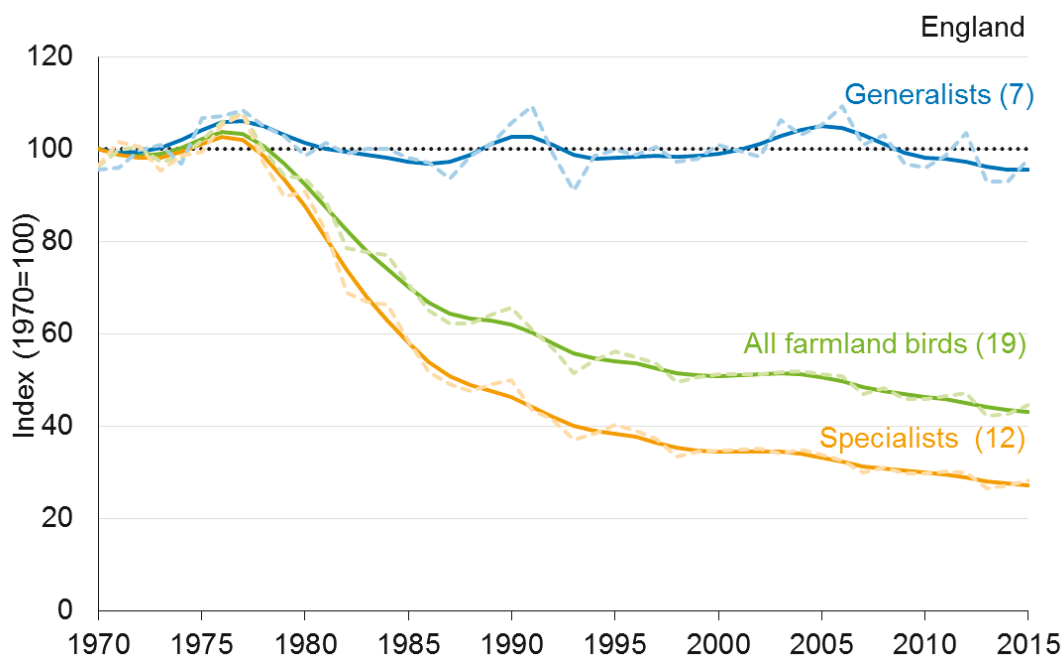
The bar chart provided alongside the headline chart shows the percentage of species within that indicator that have increased, decreased or shown no change. Whether an individual bird species is increasing or decreasing has been decided by its rate of annual change over the time period (long or short) of interest. If the rate of annual change would lead to a population decrease of 50%

(halving), or a population increase of 100% (doubling) or more over 25 years, the species is said to have shown a 'strong decline' or a 'strong increase' respectively. Rates of change less than these but above +33% (increase) or below -25% (decrease) are labelled 'weak'. Asymmetric thresholds are used for declines and increases to represent symmetrical proportional change in an index. These thresholds for decline are based on the rates used in the [Birds of Conservation Concern](#) status assessment for birds in the UK. Note that for most species, particularly over the longer period, the change is statistically significant.

Table 5.1 Bird species included in the farmland bird indicator

| Generalist birds (7) | Specialist birds (12) |
|--|---|
| Greenfinch (<i>Carduelis chloris</i>) | Corn bunting (<i>Emberiza calandra</i>) |
| Jackdaw (<i>Corvus monedula</i>) | Goldfinch (<i>Carduelis carduelis</i>) |
| Kestrel (<i>Falco tinnunculus</i>) | Grey partridge (<i>Perdix perdix</i>) |
| Reed bunting (<i>Emberiza schoeniclus</i>) | Lapwing (<i>Vanellus vanellus</i>) |
| Rook (<i>Corvus frugilegus</i>) | Linnet (<i>Carduelis cannabina</i>) |
| Woodpigeon (<i>Columba palumbus</i>) | Starling (<i>Sturnus vulgaris</i>) |
| Yellow wagtail (<i>Motacilla flava</i>) | Stock dove (<i>Columba oenas</i>) |
| | Skylark (<i>Alauda arvensis</i>) |
| | Tree sparrow (<i>Passer montanus</i>) |
| | Turtle dove (<i>Streptopelia turtur</i>) |
| | Whitethroat (<i>Sylvia communis</i>) |
| | Yellowhammer (<i>Emberiza citronella</i>) |

Figure 5.4: Populations of specialist and generalist farmland birds in England, 1970 to 2015



Notes:

1. Figures in brackets show the number of species.
2. Graph shows unsmoothed trends (dashed lines) and smoothed trends (solid lines).

Source: British Trust for Ornithology, Royal Society for the Protection of Birds, Defra and the Joint Nature Conservation Committee.

Butterflies on farmland

The measures for butterflies on farmland and in woodland are multi-species indices compiled by Butterfly Conservation (BC) and the Centre for Ecology & Hydrology (CEH) from data collated through the UK Butterfly Monitoring Scheme (UKBMS) and the Wider Countryside Butterfly Survey (WCBS), the latter in collaboration with BTO. Populations of individual species within the measure may be increasing or decreasing irrespective of the overall trends. The bar chart provided alongside each headline chart shows the percentage of species within that indicator that have shown a statistically significant increase, a statistically significant decrease or no change.

Within the measure, each species is given equal weight, and the annual figure is the geometric mean of the component species indices for that year. The smoothed trend in the multi-species indicator is assessed by structural time-series analysis. A statistical test is performed using the software TrendSpotter to compare the difference in the smoothed index in the latest year versus other years in the series. The indicators use data from butterfly transect sites on farmland and in woodland from the UKBMS and additionally randomly selected farmland plots from the WCBS. Further details of the methods used to compile the indicators and assess change can be found on the UK BMS website (<http://www.ukbms.org/indicators.aspx>).

Table 5.2 Species used in the England farmland butterfly indicator

| Species | |
|---|--|
| Brimstone (<i>Gonepteryx rhamni</i>) | Peacock (<i>Aglais io</i>) |
| Brown argus (<i>Aricia agestis</i>) | Ringlet (<i>Aphantopus hyperantus</i>) |
| Common blue (<i>Polyommatus icarus</i>) | Small copper (<i>Lycaena phlaeas</i>) |
| Gatekeeper (<i>Pyronia tithonus</i>) | Small heath (<i>Coenonympha pamphilus</i>) |
| Green-veined white (<i>Pieris napi</i>) | Small tortoiseshell (<i>Aglais urticae</i>) |
| Holly blue (<i>Celastrina argiolus</i>) | Small/Essex skipper (<i>Thymelicus sylvestris/lineola</i>) |
| Large skipper (<i>Ochlodes venata</i>) | Small white (<i>Pieris rapae</i>) |
| Large white (<i>Pieris brassicae</i>) | Speckled wood (<i>Pararge aegeria</i>) |
| Marbled white (<i>Melannargia galathea</i>) | Wall (<i>Lasiommata megera</i>) |
| Meadow brown (<i>Maniola jurtina</i>) | White-letter hairstreak (<i>Satyrrium w-album</i>) |
| Orange-tip (<i>Anthocharis cardamines</i>) | |

Bats

The bats measure has been compiled by the Bat Conservation Trust (BCT) using data collected annually from the UK-wide National Bat Monitoring Programme (NBMP). This delivers trends for 11 of the UK's 17 resident bat species, and has deployed a network of over 4,000 volunteers (over 3,000 in England) to record observations at 6,122 sites (4,279 in England).

The indicator is a composite index which combines population trend data for eight species. To generate the overall composite bat indicator, each of the eight species has been given equal weighting, and the annual index figure is the geometric mean in that year. Populations of individual species within the measure may be increasing or decreasing irrespective of the overall trends. The bar chart provided alongside each headline chart shows the percentage of species within that indicator that have shown a statistically significant increase, a statistically significant decrease or no significant change.

Surveys for the bat species in the indicator include summer roost counts, counts at hibernation sites and visual and/or acoustic observations made along predetermined transects within randomly selected 1km survey grids or along 1km sections of waterway. Most species are surveyed by two different survey methods, both of which are included in the index apart from summer roost count data for common and soprano pipistrelle. Pipistrelle species' frequent 'roost switching' can cause a negative bias in trends calculated from summer roost counts, so these data are omitted. The predominant habitat types represented in the combined dataset are woodland (broadleaf and conifer), farmland (arable and grassland), urban and waterway (rivers, streams and canals). They are currently presented within the farmland indicator.

For each species, Generalised Additive Modelling (GAM) is used to calculate the trends in numbers over time. The models include terms for factors that can influence the apparent population means e.g. bat acoustic detector model, temperature, so their effect can be taken into account. The GAM models produce smoothed trends with confidence intervals which are the basis of the indicator assessment. The survey methods and statistical analysis used by the NBMP to produce individual species trends are described in Barlow *et al.* (2015).

Bats experienced major declines throughout Western Europe during the latter half of the 20th century, which have been attributed to agricultural intensification, habitat and roost loss, deliberate killing, remedial timber treatment and insecticide poisoning, and declines of their insect prey. However bats were relatively understudied in the UK during the period of greatest population loss, and the supporting evidence, synthesised in Haysom *et al.* (2010), is fragmented. Evidence includes:

- reports of the loss of large colonies of several species from traditional roosting sites;
- a questionnaire survey documenting roost loss, declines in abundance at roosts, and deliberate killing (Racey and Stebbings 1972);
- range contractions of lesser horseshoe bat (*Rhinolophus hipposideros*); and
- a small number of published population trends (e.g. Ransome 1989, Guest *et al.* 2002).

In response to these declines, large-scale national monitoring was put in place so that future changes could be detected. Bats have benefited from strict legal protection, direct conservation action and public education (Mitchell-Jones 1993, Haysom *et al.* 2010), but remain vulnerable to pressures such as landscape change, climate change, development and emerging threats such as new building practices, wind turbines, and light pollution (Haysom *et al.* 2010, Kunz *et al.* 2007, Rebelo *et al.* 2010, Stone *et al.* 2009, 2012).

Table 5.3 Species in the bat indicator

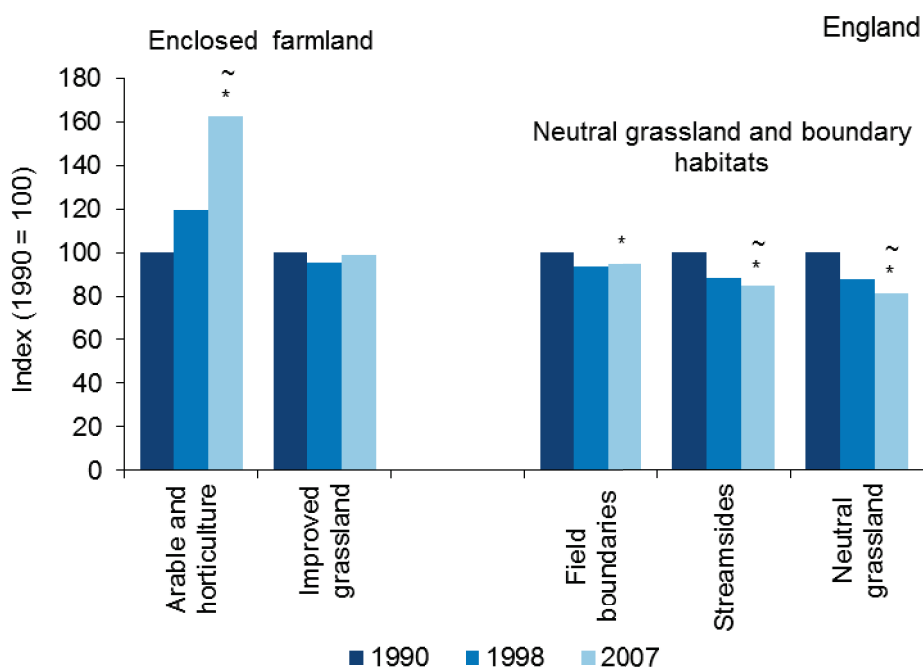
| Species |
|--|
| Daubenton's bat (<i>Myotis daubentonii</i>) |
| Natterer's bat (<i>Myotis nattereri</i>) |
| Lesser horseshoe bat (<i>Rhinolophus hipposideros</i>) |
| Noctule (<i>Nyctalus noctula</i>) |
| Serotine (<i>Eptesicus serotinus</i>) |
| Common pipistrelle (<i>Pipistrellus pipistrellus</i>) |
| Soprano pipistrelle (<i>Pipistrellus pygmaeus</i>) |
| Brown long-eared bat (<i>Plecotus auritus</i>) |

Plants in the wider countryside

Until 2013 this indicator was based on an analysis of the change in plant species richness in the wider countryside. The start point of the data series was 1990, but it has not been possible to update the indicator since 2007. As the data has not been updated for a number of years and future opportunities to update the data in a consistent way are unlikely, the decision was taken by UK BISG to reclassify this indicator as ‘under development’ and look at new options for a headline measure, whilst retaining the previous data and analysis as background information. Key messages from the previous indicator update are presented here.

Within enclosed farmland, there was a significant increase in plant species richness in *arable and horticultural land* in both the longer term (1990–2007) and shorter term (1998–2007). There was little or no overall change in species richness in *improved grassland* between 1990 and 2007. Within neutral grassland and boundary habitats, there was a significant decrease in plant species richness in all three habitats in the longer term, as well as a significant decrease in species richness in *stream sides* and *neutral grassland* in the shorter term.

Figure 5.6: Plant species richness in the wider countryside 1990 to 2007: enclosed farmland, neutral grassland and boundary habitats



Notes: 1. * A statistically significant change between 1990 and 2007. 2. ~ A statistically significant change between 1998 and 2007.

Source: Countryside Survey, Centre for Ecology & Hydrology.

Data for plants in the wider countryside are taken from the Countryside Survey. This takes a random sample of vegetation plots located in arable and horticultural fields, agricultural grasslands, woodlands and associated boundary habitats in Great Britain.

The indicator compares species richness per plot for plots surveyed in 1990, 1998 and 2007. For each broad habitat type, the data are converted to an index (1990 values are set at 100) to compensate for the difference in plot size and species richness between habitats. As a result of agricultural intensification over many years (use of herbicides, artificial fertilizers and cropping and land management practices), arable fields and improved grassland already had low plant diversity in 1990. There is some evidence that arable set-aside schemes in England contributed to a slight increase in diversity by 2007.

Web links

| Organisation | Subject |
|---|---|
| Bat Conservation Trust | The National Bat Monitoring Programme |
| British Trust for Ornithology (BTO) | Volunteer-led surveys |
| Centre for Ecology & Hydrology | Countryside survey |
| Defra | Populations of wild birds |
| Joint Nature Conservation Committee | Tracking Mammals Partnership |
| Butterfly Conservation | The State of UK butterflies 2011 |
| UK Butterfly Monitoring Scheme | Butterflies as indicators |
| British Trust for Ornithology (BTO), Royal Society for the Protection of Birds (RSPB) and Defra | Technical background - birds |
| Butterfly Conservation and Centre for Ecology & Hydrology | Technical document - butterflies |

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Last updated: August 2017

Latest data available: 5a farmland birds, bats and butterflies – 2015; 5b farmland plant species richness – no update.