5. Species in the wider countryside: farmland

Type: State indicator

Indicator short description

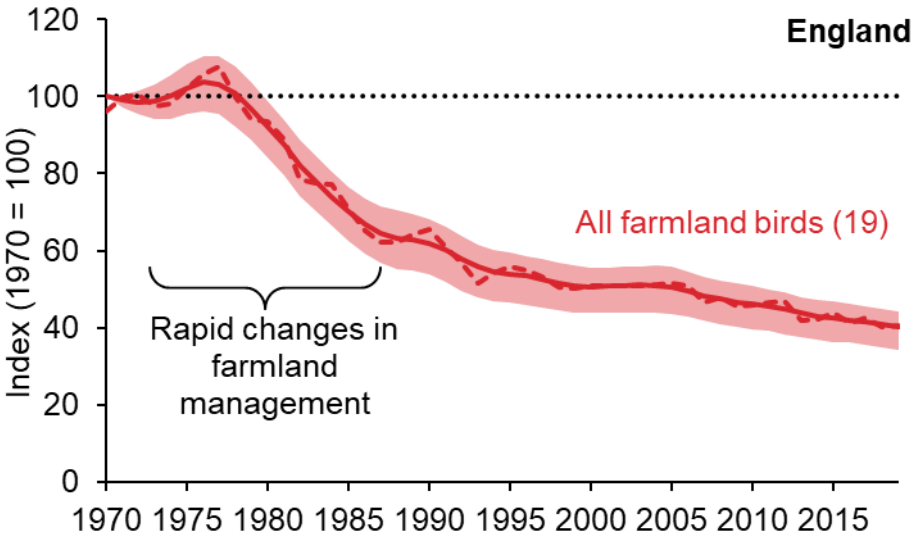
The first part of this indicator shows relative changes in abundance of species in the farmed landscape. Farmland refers to the large proportion of England which is devoted to agriculture and consists of crops or grasslands for grazing. Farmland also provides semi-natural habitats such as hedgerows and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

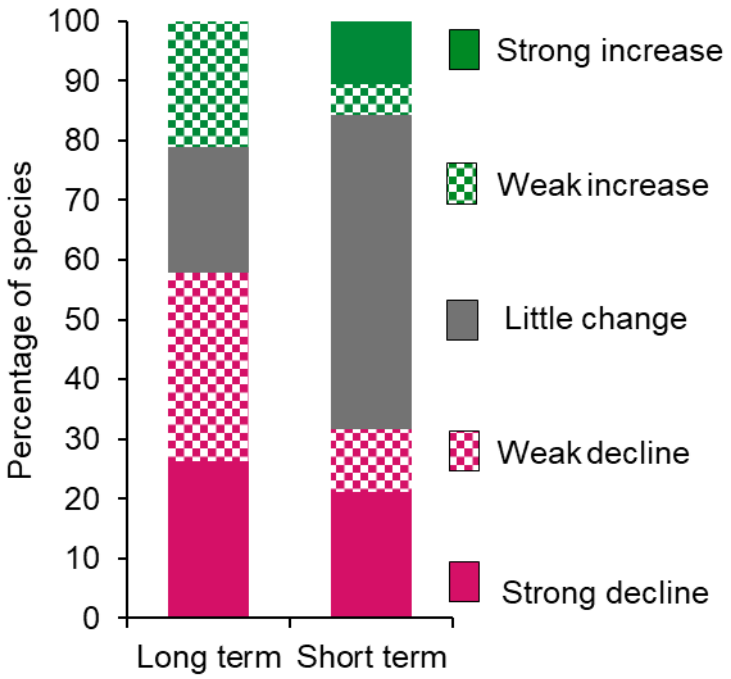
5a. Populations of farmland species

Birds (National Statistics)

In 2019 the England farmland bird index was 42% of its 1970 value (Figure 5.1). The majority of this decline occurred between the late 1970s and early 1980s and was largely due to the negative impact of rapid changes in many farmland management practices during this period. The decline has continued at a slower rate more recently; the smoothed index decreased significantly by 6% between 2013 and 2018.

Figure 5.1: Breeding birds on farmland in England, 1970 to 2019





Notes:

1. This indicator is taken from the Defra National Statistics publication 'Wild bird populations in England'.
2. The line graph shows the unsmoothed trend (dashed line) and the smoothed trend (solid line) together with its 95% confidence interval (shaded).
3. The figure in brackets shows the number of species in the index.
4. The bar chart shows the percentage of species within the indicator that have increased, decreased or shown little change, based on set thresholds of annual change.

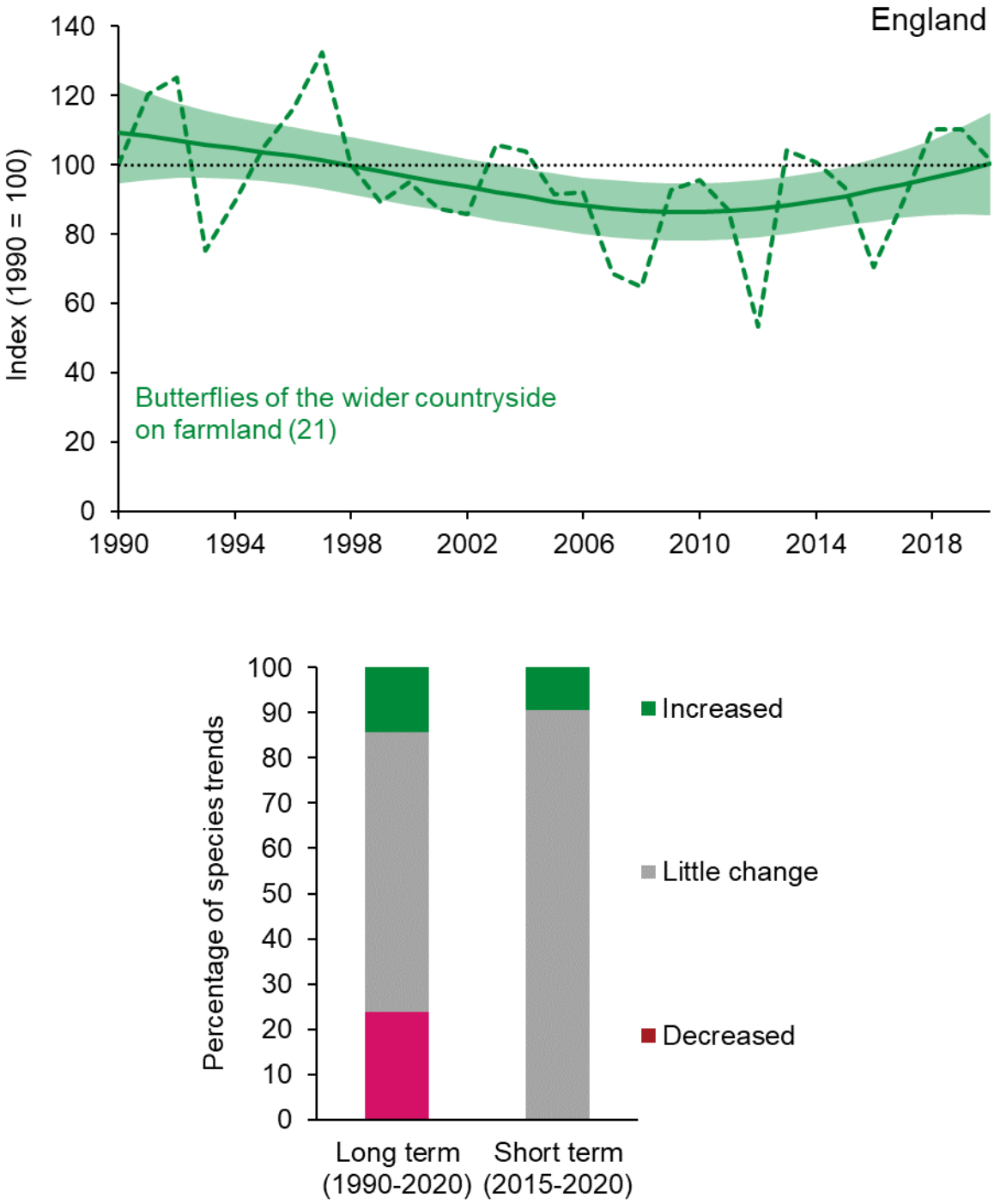
Source: British Trust for Ornithology, Defra, Joint Nature Conservation Committee, Royal Society for the Protections of Birds.

Butterflies

The England farmland butterfly index shows very little overall change (1% higher in 2020 than in 1990) and assessment of the long-term smoothed trend shows no significant change (Figure 5.2). Although the index has shown some recovery since it reached an all-time low in 2012, the short-term assessment of the smoothed trend also shows no significant change.

Large fluctuations in numbers between years are typical features of butterfly populations, principally in response to weather conditions. Despite the sunniest spring on record, 2020 was only an average year for butterflies across England with more than half of all species (31 from 55, or 56%) decreasing in annual abundance.

Figure 5.2: Butterflies of the wider countryside on farmland in England, 1990 to 2020



Notes:

1. The line graph shows the unsmoothed trend (dashed line) and the smoothed trend (solid line) together with its 95% confidence interval (shaded).
2. The figure in brackets shows the number of species trends in the index.
3. This indicator includes individual measures for 22 species of butterflies, the farmland index, however, only includes 21 trends. This is because an aggregate trend is used for small skipper (*Thymelicus lineola*) and Essex skipper (*Thymelicus sylvestris*); these 2 species have been combined due to historical difficulties with distinguishing between them in the field.

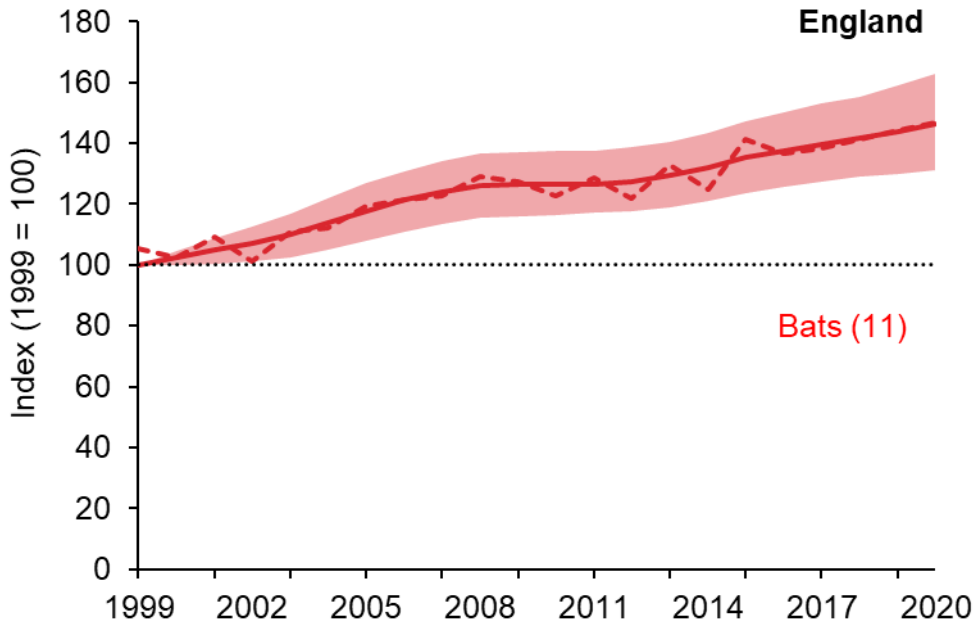
4. The bar chart shows the percentage of species trends within the indicator that have shown a statistically significant increase, a statistically significant decrease or no statistically significant change (little change).
5. Since 2017, an improved analysis method has been used to derive the species indices and in 2020, improvements were made to better account for the colonisation of sites (see 'Background' section for further information). Therefore, the charts presented here are not directly comparable to those presented in releases prior to 2020.

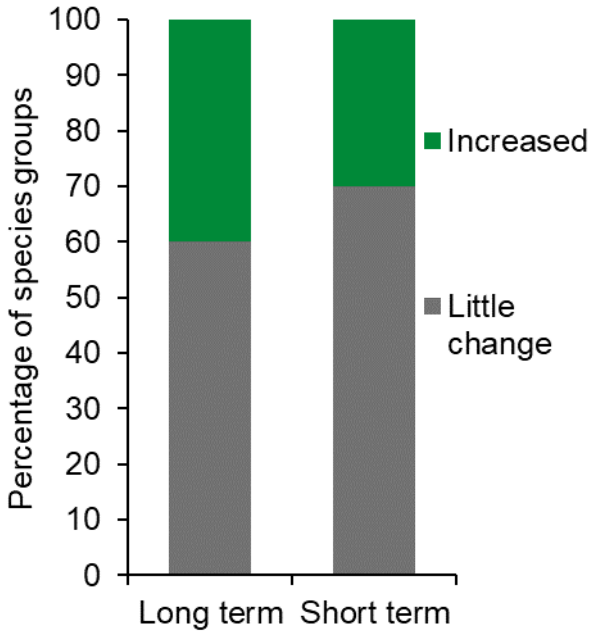
Source: Butterfly Conservation, British Trust for Ornithology, Defra, Joint Nature Conservation Committee, UK Centre for Ecology & Hydrology.

Bats

Since 1999, the unsmoothed England bat index has increased by 40% (Figure 5.3). This is likely due at least in part to the introduction of strict legal protection and a milder climate over this period. In the short term, between 2014 and 2019, assessment of the smoothed trend indicates that the bat index has increased by 9.1%. The bat species within this index vary in their habitat requirements, but all occur in farmland and woodland landscapes. For convenience, they are only presented here in the farmland indicator.

Figure 5.3: Widespread bats in England, 1999 to 2020





Notes:

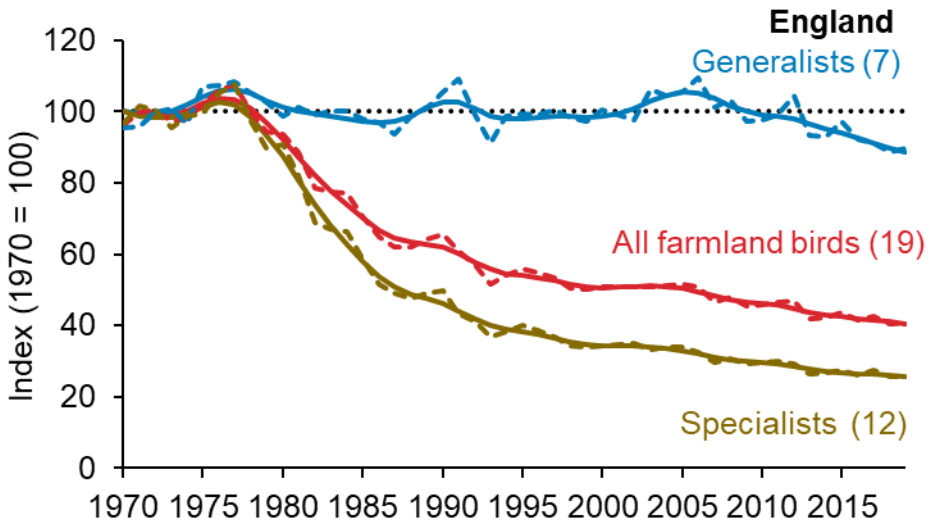
1. The line graph shows the unsmoothed trend (dashed line) and the smoothed trend (solid line) together with its 95% confidence interval (shaded).
2. The figure in brackets shows the number of species in the index.
3. This indicator includes individual measures for 11 species of bats, the index, however, only includes 10 trends. This is because an aggregate trend is used for the whiskered bat and Brandt's bat; these 2 species have been combined due to difficulties distinguishing between them in the field.
4. The bar chart shows the percentage of species groups within the indicator that have increased, decreased or shown little change.

Source: Bat Conservation Trust.

Birds

The long-term decline of the farmland bird indicator for 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 2019, the farmland specialists index declined by 73%; farmland generalists (covering those species which are found in a wider range of habitats) also declined by 6%. The smoothed trend shows a significant decline of 74% for specialists and a (non-significant) 10% decline for generalists (Figure 5.4).

Figure 5.4: Specialist and generalist farmland birds in England, 1970 to 2019



Notes:

1. The line graph shows the unsmoothed trends (dashed lines) and the smoothed trends (solid lines).
2. The figures in brackets show the number of species in each index.

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

Changes in farming practices, such as the loss of mixed farming systems, the move from spring to autumn sowing of arable crops, and increased pesticide use, have been demonstrated to have had adverse impacts on farmland birds such as skylark and grey partridge. Five farmland specialists (turtle dove, tree sparrow, grey partridge, corn bunting and starling) have declined by in excess of 80% relative to 1970 levels. By contrast, 2 other farmland specialists (stock dove and goldfinch) have more than doubled over the same period, illustrating how responses to pressures varies between species. For example, other generalist farmland species may have benefitted from increases in crops such as oilseed rape.

Butterflies

The unsmoothed trend in Figure 5.2 demonstrates how butterfly numbers fluctuate considerably year-on-year, but overall, the England farmland butterfly index shows very little change (1% higher in 2020 than in 1990), and although analysis of the underlying smoothed trend also shows no significant long-term or short-term change, individual species of butterfly fare differently over these 2 time periods. Some species on farmland show a significant long-term decline including small tortoiseshell; wall; gatekeeper; Essex/small skipper; and large skipper. None decreased significantly over the short term (since 2015). Three species on farmland, the ringlet; brimstone; and speckled wood increased significantly over the long term and show little short-term change. Small heath and small copper have increased significantly since 2015.

Bats

The long-term increase in the England bat index is primarily driven by large, statistically significant increases in the trends of; greater horseshoe bat, lesser horseshoe bat and common pipistrelle and between 1999 and 2019, the combined survey trend for these species increased by 153%, 122% and 102% respectively. One other species showed a weaker increase over the same period, and the remaining 6 species groups showed no

significant change. In the short term, between 2014 and 2019, 3 species have increased significantly, and 7 species groups showed no significant change. No species show a decline in either the long or short term, however it is not possible to produce separate trends for whiskered bat and Brandt's bat as they cannot be reliably distinguished between in the field. It is therefore possible that an increase in one species could mask a decline in the other. It is also important to note that England's rarer and more specialised bat species are not included in the index due to difficulties monitoring these species. The bat index and long-term assessment reflect changes in bat populations since 1999. It is generally considered that prior to this there were major declines in bat populations throughout Western Europe during the 20th century.

Indicator assessment

Assessment of change in abundance of species in the wider countryside (farmland)

Breeding birds on farmland (National Statistics): Long term (1970 to 2018): Deteriorating; Short term (2013 to 2018): Deteriorating; Latest year (2019): No change.

Butterflies of the wider countryside on farmland: Long term (1990 to 2020): Little change; Short term (2015 to 2020): Little change; Latest year (2020): Decreased.

Bat populations: Long term (1999 to 2019): Improving; Short term (2014 to 2019): Improving; Latest year (2020): Increased.

Note: To better capture patterns in the data, where possible, long-term and short-term assessments are made on the basis of smoothed data, with analysis of the underlying trends being performed by the data providers. Due to differences in the methods used to produce smooth trends for birds, butterflies and bats, the long-term and short-term assessments are made to 2018 for the bird index, 2019 for the bat index and 2020 for the butterfly index. All latest year assessments are based on unsmoothed data to the latest year available.

5b. Abundance of farmland plant species

Experimental statistic: The UK biodiversity indicators project team would welcome feedback on the novel methods used in the development of this indicator.

Indicator short description

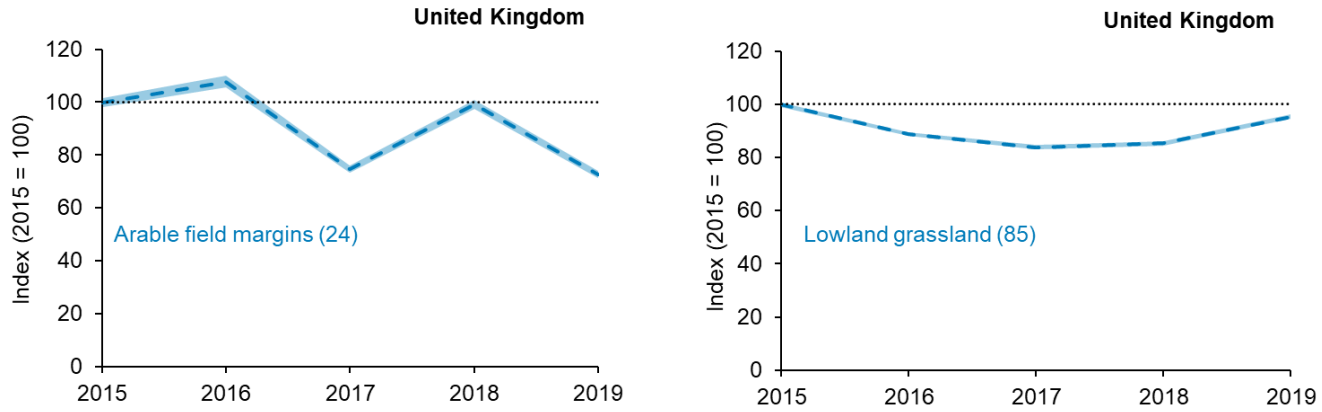
The second part of this indicator measures, in small plots, change in the abundance of plant species considered indicative of good habitat condition on UK farmland, using modelled abundance data from the National Plant Monitoring Scheme (NPMS). Plant populations form the environment in which most other species exist, as well as providing numerous ecosystem services. Drivers of change are well-understood for many UK habitats.

This indicator has not been updated for the 2021 publication. The COVID-19 pandemic in 2020 meant it was necessary to pause collection of the NPMS data for the health and safety of survey volunteers. This was in line with the government guidance and restrictions and lockdowns were implemented in all UK countries. When restrictions were lifted in 2020, some data was collected, but in insufficient quantity to update the indicator. This will not affect the long-term monitoring of the NPMS and we plan to update the indicator for the next publication.

In 2019, average indicator plant abundance for the 2 broad farmland habitat types included within this UK indicator remain below the 2015 level (Figure 5.5).

Arable field margins, while fluctuating annually, shows an overall decline of 27% between 2015 and 2019; and lowland grassland shows a decline followed by a gradual rise to 95% of the baseline level.

Figure 5.5: Abundance of plant species in 2 broad UK farmland habitat types, 2015 to 2019



Notes:

1. The line graphs show the unsmoothed trends (dashed line); the variation around the lines shown (the shaded area) is the standard deviation of 1,000 simulated trend indices calculated according to the method of Soldaat *et al*. (2017).
2. Abundance is measured by the percentage area covered by a species within a plot.
3. The figures in brackets indicate the number of species or species aggregates included in the composite index for that particular habitat type.

Source: Botanical Society of Britain and Ireland, Joint Nature Conservation Committee, National Plant Monitoring Scheme, Plantlife, UK Centre for Ecology & Hydrology.

The National Plant Monitoring Scheme (NPMS) was designed to monitor UK habitats of conservation importance. This is achieved through the establishment of small plots in areas of habitats targeted by the scheme. The abundances of plant species, measured as the percentage area covered by a species within a plot, are recorded each year. Surveyors record from different lists of indicator species depending on their level of experience and the habitat within which a plot is located. Both the placement of plots, and the selection of one-kilometre national grid squares within which the plots are located, are subject to statistical methodologies designed to minimise bias (Pescott *et al.*, 2019a).

The design of the NPMS included the definition of a set of 11 broad habitat types, within which 28 finer habitat types are nested. These fine-scale habitats are linked to existing classifications such as the British National Vegetation Classification. Surveyors can choose, based on their knowledge of a habitat, whether to record a plot at the broader or finer level. The current indicator summarises species' percentage cover (abundance) data at the broad habitat level. This is done using a model that is able to account for both the range of percentage covers that a species may exhibit in a habitat when present, and the fact that species may often be absent from any given plot (Pescott *et al.*, 2019b). Such data are often described as "zero-inflated". This model is applied across years for each species/habitat combination, and the indicators presented here for each broad habitat are the result of combining the resulting species/habitat time trends across the relevant set of NPMS habitat indicator species. The 2 broad UK farmland habitat measures presented in this indicator (arable field margins and lowland grassland) are a subset of those for which the largest numbers of NPMS plots currently exist. See the technical background document for more detail.

As this is an experimental statistic it has not been assessed.

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 respond rapidly to changes in environmental conditions and habitat management, are representative of many other insects, in that they utilise areas with abundant plant food resources and play a complementary role to birds and bats as an indicator, because they use the landscape at a far finer spatial scale.

Plants are a large part of the fundamental fabric of which habitats are made and directly indicate changes to environmental conditions and habitat management. Plants provide essential habitats and food for wildlife, and essential ecosystem services for humans, such as reduced erosion, nutrient cycling, oxygen production, and climate regulation.

These indicators show progress towards commitments to improve the status of our wildlife and habitats. They are relevant to outcomes 1 and 3 in *Biodiversity 2020, A strategy for England's wildlife and ecosystem services* (see Annex A). The indicators are also relevant to international goals and targets (see Annex B of the aforementioned publication).

Background

Farmland birds

The farmland bird measure has been supplied by the British Trust for Ornithology (BTO), the Royal Society for the Protection of Birds (RSPB) and JNCC and is compiled using data from the Common Bird Census (CBC) and Breeding Bird Survey (BBS). Within the farmland bird measure there are trends for 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 BTO website (see web-links).

Table 5.1: Species included in the farmland bird indicator

Generalist birds (7 species)

Greenfinch (*Chloris chloris*); jackdaw (*Corvus monedula*); kestrel (*Falco tinnunculus*); reed bunting (*Emberiza schoeniclus*); rook (*Corvus frugilegus*); woodpigeon (*Columba palumbus*); yellow wagtail (*Motacilla flava*).

Specialist birds (12 species)

Corn bunting (*Emberiza calandra*); goldfinch (*Carduelis carduelis*); grey partridge (*Perdix perdix*); lapwing (*Vanellus vanellus*); linnet (*Carduelis cannabina*); starling (*Sturnus vulgaris*); stock dove (*Columba oenas*); skylark (*Alauda arvensis*); tree sparrow (*Passer montanus*); turtle dove (*Streptopelia turtur*); whitethroat (*Sylvia communis*); yellowhammer (*Emberiza citrinella*).

Composite indicators can mask a lot of variation among the species within them. The bar chart provided alongside the headline chart (Figure 5.1), shows the percentage of species within the indicator that have increased, decreased or shown little change. Whether an individual bird species is defined as 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 an equivalent 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.

Butterflies on farmland

The farmland butterfly indicator is a multi-species index compiled by Butterfly Conservation (BC) and the UK Centre for Ecology & Hydrology (UKCEH) from data collated through the UK Butterfly Monitoring Scheme (UKBMS) including the Wider Countryside Butterfly Survey (WCBS). The indicator includes 22 species of butterflies associated with farmland; however, the farmland measure only includes trends for 21 species because an aggregate trend is used for small skipper (*Thymelicus lineola*) and Essex skipper (*Thymelicus sylvestris*). These 2 species have been combined due to historical difficulties with distinguishing between them in the field (Table 5.2).

Table 5.2: Species included in the England farmland butterfly indicator

Butterflies (21 species)

Brimstone (*Gonepteryx rhamni*); brown argus (*Aricia agestis*); common blue (*Polyommatus icarus*); gatekeeper (*Pyronia tithonus*); green-veined white (*Pieris napi*); holly blue (*Celastrina argiolus*); large skipper (*Ochlodes venata*); large white (*Pieris brassicae*); marbled white (*Melannargia galathea*); meadow brown (*Maniola jurtina*); orange-tip (*Anthocharis cardamines*); peacock (*Aglais io*); ringlet (*Aphantopus hyperantus*); small copper (*Lycaena phlaeas*); small heath (*Coenonympha pamphilus*); small tortoiseshell (*Aglais urticae*); small/Essex skipper (*Thymelicus sylvestris/lineola);* small white (*Pieris rapae*); speckled wood (*Pararge aegeria*); wall (*Lasiommata megera*); white-letter hairstreak (*Satyrium w-album*)

The year-to-year fluctuations in butterfly numbers are often linked to natural environmental variation, especially weather conditions. Therefore, in order to identify underlying patterns in population trends, the assessment of change is based on smoothed indices. 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. Within the measures, each species is given equal weight, and the annual figure is the geometric mean of the component species indices for that year.

Populations of individual species within the measure may be increasing or decreasing irrespective of the overall trends. The bar chart provided alongside the headline trend chart (Figure 5.2), shows the percentage of species within the indicator that have shown a statistically significant increase, a statistically significant decrease or shown no statistically significant change (little change). A table summarising the estimated long-term and short-term changes for each species together with an assessment of the individual species trends can be found in the statistical data set ‘trends in populations of selected butterfly species, 1990 to 2020’.

In 2017, the method for compiling species annual indices was improved. Indices are now calculated for species using the Generalised Abundance Index (GAI) method developed by Dennis *et al.* in 2016 with an additional modification that the data from each site in each

year are weighted in the final stage relative to the proportion of the species flight period surveyed that year for that site. This weighting is necessary as the GAI extrapolates from observed data to estimate the total count across the season, accounting for gaps in the recording, and ensures that the observed data have a stronger effect upon the final indices than the extrapolated data.

The improved method uses butterfly count data collected at UKBMS butterfly transect sites on farmland and in woodland together with additional data from randomly selected 1 km squares of the WCBS primarily comprised of farmland and woodland (totalling 3,274 farmland and 2,339 woodland sample locations across England). All butterfly counts in a season are used to estimate the seasonal pattern of butterfly counts for that year, using a concentrated likelihood method (see Dennis *et al.* (2016)); the resulting indices and species trends are similar to those generated through analysis methods used prior to 2017.

In 2020, further methodological improvements were made to better model trends for species that have expanded in range and colonised new sites (UKBMS transects and WCBS squares) by adding pre-colonisation zero abundance counts for species at sites they have colonised, where the site was being monitored prior to colonisation. At the time, the effect of these changes was most notable for species such as Essex/small skipper and purple hairstreak, where there was a slight reduction in their population indices for the earlier years relative to the latter years.

As there are delays in data submission, data for previous years are also updated retrospectively. This means that the species indices for individual years may vary from previous publications.

Further details of the methods used can be found on the UKBMS website and in the Technical background document for this indicator.

Bats

The England bat index is compiled by the Bat Conservation Trust using data collected annually from the National Bat Monitoring Programme (NBMP). The NBMP has deployed over 4,700 volunteers (3,624 in England) to record observations of bats at 7,095 sites (4,981 in England). Surveys of bat species include summer roost counts, counts at hibernation sites and visual and/or acoustic observations made along predetermined transects. Most species are surveyed by 2 different methods, both of which are included in the index apart from summer roost count data for common and soprano pipistrelle. Frequent 'roost switching' by these 2 species of bats can cause a negative bias in trends calculated from summer roost counts, so these data are omitted (Dambly *et al.* 2020).

Since 2018, 3 additional species have been included in this indicator and the entire time series in the accompanying dataset was updated to reflect these changes. Although the indicator now includes 11 of the 17 species of breeding bats present in England, the farmland bat index only includes 10 trends. This is because an aggregate trend is used for whiskered bat and Brandt's bat; these 2 species have been combined due to difficulties distinguishing between them in the field (Table 5.3).

Table 5.3: Species included in the bat indicator

Bats (11 species)

Daubenton's bat (*Myotis daubentonii*); Natterer's bat (*Myotis nattereri*); whiskered/Brandt's bat (*Myotis mystacinus/Myotis brandtii*); lesser horseshoe bat (*Rhinolophus hipposideros*); greater horseshoe bat (*Rhinolophus ferrumequinum);* noctule (*Nyctalus noctula*); serotine

(*Eptesicus serotinus*); common pipistrelle (*Pipistrellus pipistrellus*); soprano pipistrelle (*Pipistrellus pygmaeus*); brown long-eared bat (*Plecotus auritus*).

For each bat species included in the index, Generalised Additive Modelling (GAM) is used to calculate the trends in numbers over time (Fewster *et al.*, 2000). The models include terms for factors that can influence the apparent population means (for example, the bat detector model and temperature), so their effect can be taken into account. The GAM models produce smoothed trends which are more robust against random variation between years. For easier interpretation the means are then converted to an index that is set to 100 for the selected baseline year of data. The species indices are revised when new data become available or when improved modelling methods are developed, and applied retrospectively to data from earlier years. As such, indices published in previous years are not strictly comparable to the current index. To generate the composite bat indicator and confidence intervals, each species has been given equal weighting, and the annual index figure is the geometric mean in that year (Figure 5.3). Confidence intervals are relatively wide due to the high variability inherent in bat monitoring data and the rarity of several species. Long and short-term assessments are run to the penultimate year of the trend as the most recent year's smoothed data point is likely to change as future years of data are added. The latest-year change is therefore based on unsmoothed data. The survey methods and statistical analysis used by the NBMP to produce individual species trends are described in Barlow *et al.* (2015).

Bat populations are believed to have undergone major declines throughout Western Europe during the 20th century, which have been attributed to persecution, agricultural intensification, habitat and roost loss, remedial timber treatment and declines of their insect prey. Evidence of these declines (synthesised in Haysom *et al*., 2010) is fragmented as during this period few data were collected in a systematic way. Evidence includes:

- Well documented range contractions of greater horseshoe bat and lesser horseshoe bat across Great Britain and Europe.
- Reports of the loss of large colonies of several species from traditional roosting sites.
- Reductions in the number of known maternity colonies across Great Britain.
- A small number of published population trends (for example, Ransome, 1989; Guest *et al*., 2002).

The bat index suggests that more recently some English bat populations are beginning to recover. The greatest weight of evidence suggests that 2 factors have had a positive impact on bat populations: a reduction in human disturbance since the introduction of strict legal protection and a milder climate, (Burns *et al.,* 2016), in particular over winter and spring, which has been shown to benefit horseshoe bat species (Battersby, 2005; Froidevaux *et al*., 2017; Schofield, 2008). The impact of climate change on other UK bat species is less clear. Bats have also benefited from 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 (Browning *et al.,* 2021; Haysom *et al*., 2010; Kunz *et al.*, 2007; Rebelo *et al.*, 2010; Stone *et al.*, 2009, 2012).

Farmland plants

The creation of the NPMS allowed for the creation of annual trends in the abundance of plants in habitats of conservation importance. Following 5 years of development, the scheme was launched by a partnership consisting of the Botanical Society of Britain and Ireland (BSBI), JNCC, Plantlife, and UKCEH in 2015. This indicator uses a subset of the species selected by the NPMS as indicative of good condition in those habitat types

considered to be of most importance for the conservation of UK biodiversity – see the technical background document for a full list of species included. These species are monitored in small sample plots (between 25 and 100 square metres in area) according to a methodology that was designed to minimise biases in data collection. Results for the UK arable field margins and lowland grassland habitats are presented here in the farmland plant species abundance indicator.

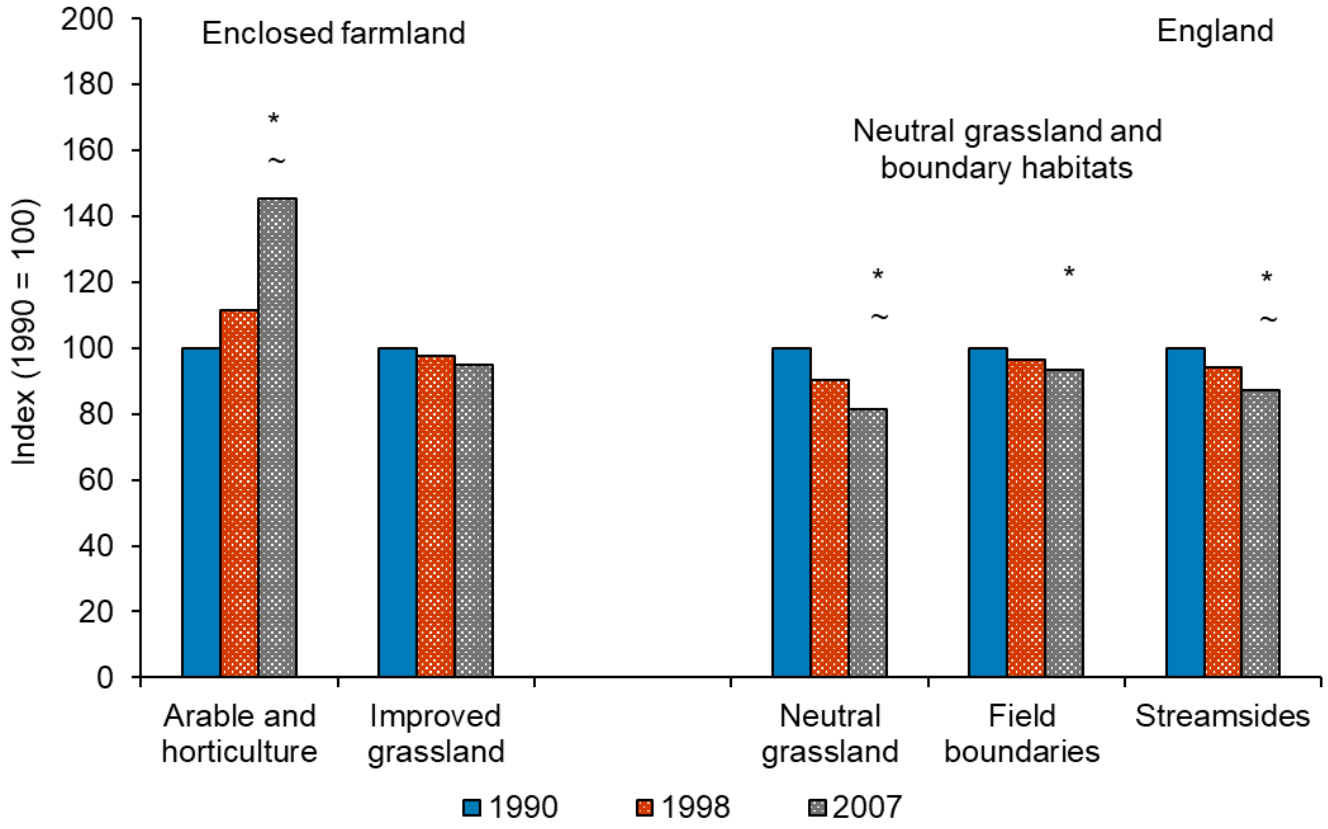
Since 2018, UKCEH, with input from all partners, have been developing a method of using NPMS data to indicate annual changes in habitat condition. The method is based on a hierarchical model, formulated in a Bayesian framework, that integrates information on a species' abundance and occupancy; the occupancy estimates also take advantage of the fact that most plots are surveyed twice a year, allowing adjustments for false negatives (that is, species that are overlooked during surveys). Simulation tests and applications to real data indicate that the method is robust and produces ecologically sensible metrics.

The one-kilometre squares of the NPMS were selected according to a weighted-random algorithm designed to introduce a known bias towards semi-natural habitats. However, within this design, a sampling bias exists in that, in common with other UK structured monitoring schemes based on volunteer participation, squares located within lowland areas are more likely to be sampled. Further work will focus on additional adjustment for bias (Pescott *et al.*, 2019b).

Until 2013, this indicator was based on analysis of the change in plant species richness in the wider countryside. Data were taken from the UK Countryside Survey. This survey provides a random sample of vegetation plots located in arable and horticultural fields, agricultural grasslands, woodlands and associated boundary habitats in Great Britain. Key messages from the previous indicator are presented here; although now archived, the indicator can be viewed in full on the archived version of the JNCC website.

The indicator shows the number of different plant species per standard unit area (species richness) in enclosed farmland and in neutral grassland and boundary habitats. Within enclosed farmland, there was a significant increase in plant species richness in *arable and horticultural land* in both the longer term (1990 to 2007) and shorter term (1998 to 2007) but 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 longer-term decrease in plant species richness in all 3 habitats, as well as a significant shorter-term decrease in species richness in *stream sides* and *neutral grassland* habitats (Figure 5.6).

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



Notes:

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

Source: Countryside Survey, UK Centre for Ecology & Hydrology.

Web links for further information

Bat Conservation Trust: The National Bat Monitoring Programme

Botanical Society of Britain & Ireland: Home page

British Trust for Ornithology: Methods | BTO - British Trust for Ornithology

British Trust for Ornithology: Potential volunteering for surveys

British Trust for Ornithology: BTO - Bird Trends

British Trust for Ornithology, Royal Society for the Protection of Birds and Defra: Technical background document - birds

Butterfly Conservation: The state of Britain's butterflies

Butterfly Conservation and UK Centre for Ecology & Hydrology: Technical background document - butterflies

Countryside Survey: Home page

Defra: Butterflies in England: species of the wider countryside on farmland and in woodland

Defra: Wild bird populations in England

Defra and UK Centre for Ecology & Hydrology: Technical background document - plants

Joint Nature Conservation Committee: Tracking Mammals Partnership

Joint Nature Conservation Committee: Home page

National Plant Monitoring Scheme: Home page

Plantlife: Home page

UK Butterfly Monitoring Scheme: Butterflies as indicators

UK Centre for Ecology & Hydrology: Home page

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5b Abundance of farmland plant species – 2019