21 June 2018

Butterflies in the wider countryside: England, 1990 to 2017

Since 1990, the farmland butterfly index has fallen by 27%, reaching a historical low in 2012, with the unsmoothed trend then showing some recovery to 2017.

Over the same period, the woodland butterfly index has fallen by 58%, also reaching a historical low in 2012 and then showing some recovery.

Large fluctuations in numbers between years are typical features of butterfly populations, principally in response to weather conditions. 2017 was a relatively bad year for butterflies; the fourth worst in the 42-year series and it was likely due to periods of poor weather during the spring and summer months.

The statistical assessment of change is made on an analysis of the underlying smoothed trends. Since 1990, the long-term trend is downward for both farmland and woodland species. However, since 2012 the farmland index continues to show a significant decline whereas the trend for woodland species is unchanged.

Butterflies on farmland

Species fare differently within the overall declining long-term trend (Figure 1). Species in significant long-term decline on farmland include gatekeeper, large skipper, small copper, small tortoiseshell, small white, wall and white-letter hairstreak. All of these, however, were assessed as showing no significant change over the short term since 2012. One species, the ringlet, increased over the long term but also showed no short-term change.

Figure 1: Widespread butterflies on farmland in England, 1990 to 2017
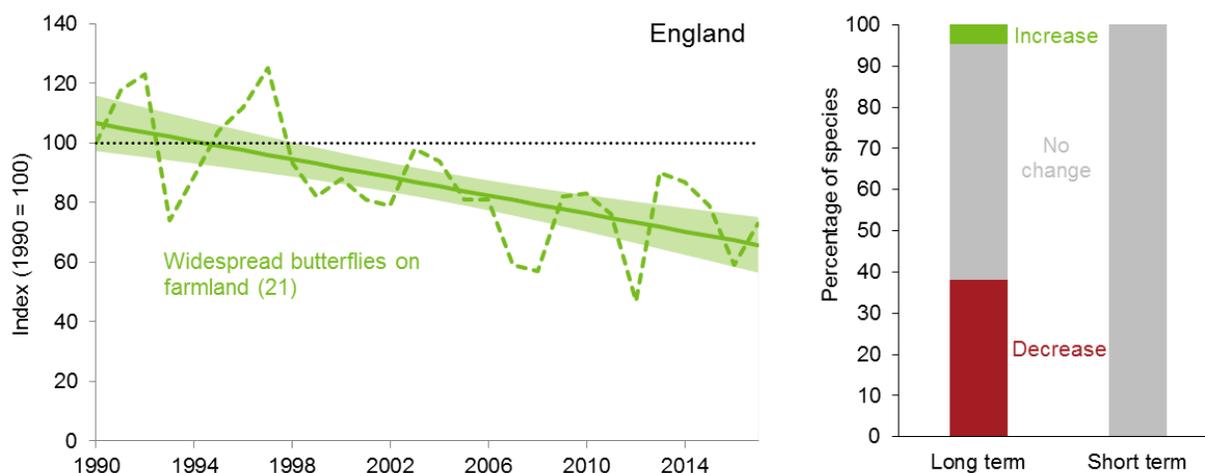
Notes:

1. The figure in brackets shows the number of species in the index.
2. The graph shows the unsmoothed trend (dashed line) and the smoothed trend (solid line) together with its 95% confidence interval (shaded).
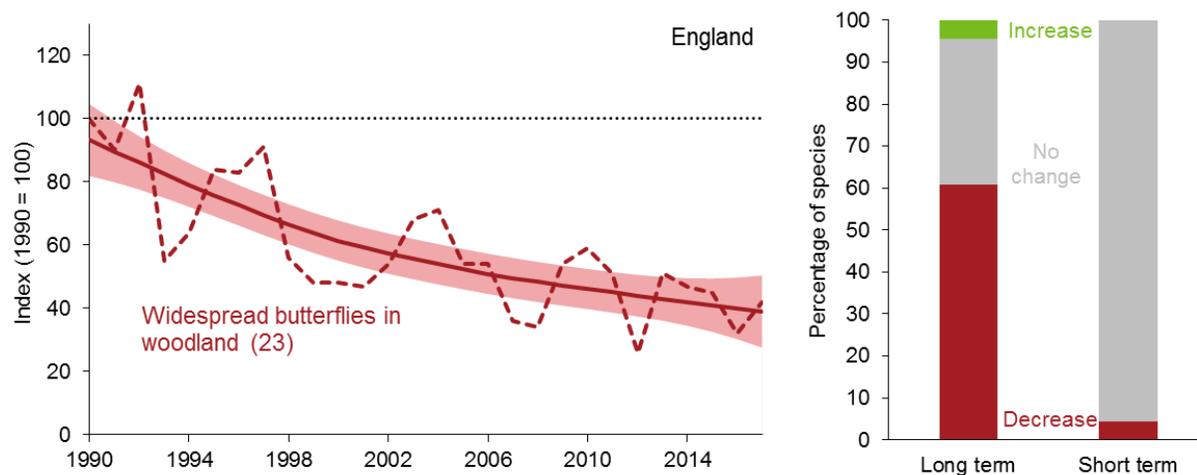3. The bar chart shows the percentage of species within the indicator that have shown a statistically significant increase, statistically significant decrease or no statistically significant change.
4. In 2017, an improved analysis method has been used to derive the species indices (see 'Background' section for further information).
5. The graph is not directly comparable to previous versions of this publication. Improvements in the modelling technique have allowed the inclusion of more data, resulting in slight alternations in the trends for individual species.

Source: Butterfly Conservation, Centre for Ecology & Hydrology, Defra, Joint Nature Conservation Committee.

Butterflies in woodland

The long-term decline of woodland butterflies (Figure 2) is thought to be due to a lack of woodland management and loss of open spaces in woods. Species in long-term decline in woodland include brown argus, common blue, gatekeeper, meadow brown, peacock, purple hairstreak, small copper, small heath, small tortoiseshell, wall and white-letter hairstreak, with the wall undergoing a significant decline in the short term. Ringlet displayed the same trends in woodland as in farmland, increasing significantly over the long term, but showing no significant change since 2012.

Figure 2: Widespread butterflies in woodland in England, 1990 to 2017

Notes:

1. The figure in brackets shows the number of species in the index.
2. This indicator includes individual measures for 24 species of butterflies, the wider countryside index, however, only includes 23 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 them in the field.
3. The graph shows the unsmoothed trend (dashed line) and the smoothed trend (solid line) together with its 95% confidence interval (shaded).
4. The bar chart shows the percentage of species within the indicator that have shown a statistically significant increase, statistically significant decrease or no statistically significant change.
5. In 2017, an improved analysis method has been used to derive the species indices (see 'Background' section for further information).
6. The graph is not directly comparable to previous versions of this publication. Improvements in the modelling technique have allowed the inclusion of more data, resulting in slight alternations in the trends for individual species.

Source: Butterfly Conservation, Centre for Ecology & Hydrology, Defra, Joint Nature Conservation Committee.

Assessment of change in butterfly populations			
	Long term	**Short term**	**Latest year**
Butterflies of the wider countryside on farmland	⊗ 1990–2017	⊗ 2012–2017	Increased (2017)
Butterflies of the wider countryside in woodland	⊗ 1990–2017	≈ 2012–2017	Increased (2017)

The traffic lights are determined by comparing the value of the measure in the base/start year with the value in the end year of the period over which change is to be assessed.

✓	Improving	✗	Deteriorating
≈	Little or no overall change	•••	Insufficient or no comparable data

Long and short-term assessments are based on smoothed data, with the analysis of the underlying trend undertaken by the data providers. Latest-year changes are based on unsmoothed data.

Background

This indicator is comprised of 2 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) including the Wider Countryside Butterfly Survey (WCBS). The indicator includes individual measures for 21 species of butterflies associated with farmland and 24 species associated with woodland. The woodland measure, however, only includes 23 trends 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 them in the field.

The year-to-year fluctuations of butterflies are often linked to natural environmental variation, especially weather conditions; therefore, 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. 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.

Populations of individual species within the measures may be increasing or decreasing irrespective of the overall trends. The bar chart provided alongside each habitat trend graph shows the percentage of species within that indicator that have shown a statistically significant increase, a statistically significant decrease or no statistically significant change. A list of the species included in each index can be found below. A more detailed table summarising the estimated long-term and short-term changes for each species together with an assessment of whether the individual species trends are increasing or decreasing can be found in the accompanying Datasheet.

The method for compiling species annual indices was improved in 2017. Indices are calculated for species using the Generalised Abundance Index (GAI) method developed in 2016 (Dennis *et al.* (2016) BIOMETRICS: DOI: 10.1111/biom.12506) with an additional modification that the data from each site in each year is 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 new method uses data from butterfly transect sites on farmland and in woodland from UKBMS sites and additionally randomly selected farmland plots from the WCBS. The method uses all butterfly counts in a season to estimate the seasonal pattern of butterfly counts for that year, using a concentrated likelihood method; the resulting indices and species trends are similar to those generated through previous analysis methods.

Since 2015, the site index only data has been incorporated into the models; these data are most prevalent in earlier years and thus the graphs are slightly different to those previously presented. As there are delays in data submission, data for previous years are also updated retrospectively; in 2017 extra data were added for 2015 and 2016, for example. 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; in the Technical background document for this indicator; and in the UKBMS data capture, processing, validation and reporting summary document.

Species included in the farmland indicator (21):

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*)

Species included in the woodland indicator (23):

brimstone	(*Gonepteryx rhamni*)
brown argus	(*Aricia agestis*)
comma	(*Polygonia* c-album)
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*)
purple Hairstreak	(*Neozephyrus quercus*)
ringlet	(*Aphantopus hyperantus*)
small copper	(*Lycaena phlaeas*)
small heath	(*Coenonympha pamphilus*)
small tortoiseshell	(*Aglais urticae*)
small white	(*Pieris rapae*)
small/Essex skipper	(*Thymelicus sylvestris/lineola*)
speckled wood	(*Pararge aegeria*)
wall	(*Lasiommata megera*)
white-letter hairstreak	(*Satyrium w-album*)

Web links

England farmland species indicators	England biodiversity Indicators
England woodland species indicators	
Butterfly Conservation	The state of Britain's butterflies
UK Butterfly Monitoring Scheme	Butterflies as indicators

Next publication date: Summer 2019