D1. Biodiversity and ecosystem services

D1c. Status of pollinating insects

Type: State / Benefit indicator

Summary

There was an overall decrease in the pollinators indicator from 1987 onwards. In 2014, the indicator had declined by 13% compared to the value in 1980. The long-term trend was assessed as a decline.

Between 2009 and 2014 the indicator fell further before recovering slightly, declining by 1% overall, and is assessed as stable.

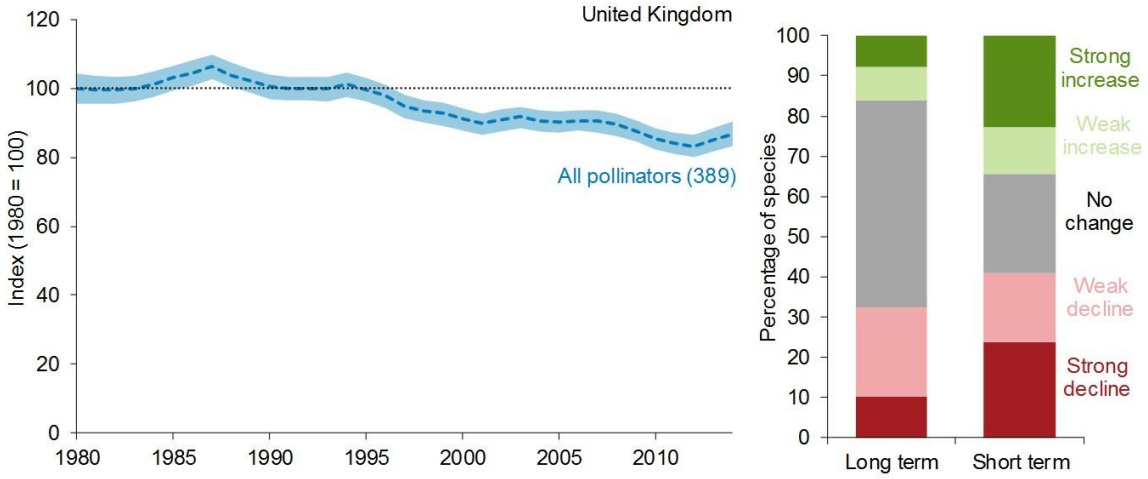
Indicator Description

The indicator illustrates changes in pollinator distribution (bees and hoverflies) in the UK. The indicator is based on 389 species (147 species of bee and 242 species of hoverfly) of pollinator, and measures change in the number of 1km grid squares across the UK in which they were recorded in any given year – this is referred to as the 'occupancy index'. Many insect species are involved in pollination but bees and hoverflies are known to be important and are presented here as an indicator of overall pollinator trend.

Between 1980 and 2014, 16% of pollinator species became more widespread (8% showed a strong increase), and 32% became less widespread (10% showed a strong decrease). The ratio between increasing and decreasing species was more balanced between 2009 and 2014, with 34% of species increasing and 41% of species decreasing.

As individual pollinator species become more or less widespread, the communities in any given area become more or less diverse, and this may have implications for pollination as more diverse communities are, in broad terms, more effective in pollinating a wide range of crops and wild flowers. Despite the inter-annual variation, the overall trend for pollinators remains downward. This indicator is not directly comparable with the previous publication as the Bayesian modelling methods have been improved, which has allowed a further 176 species (42 wild bees and 134 hoverfly species) to be included, thereby increasing the taxonomic scope of the indicator.

Figure D1ci. Change in the distribution of UK pollinators, 1980 to 2014.



Notes:

1. Based on a total of 389 pollinators, comprising 147 wild bee species and 242 hoverfly species.

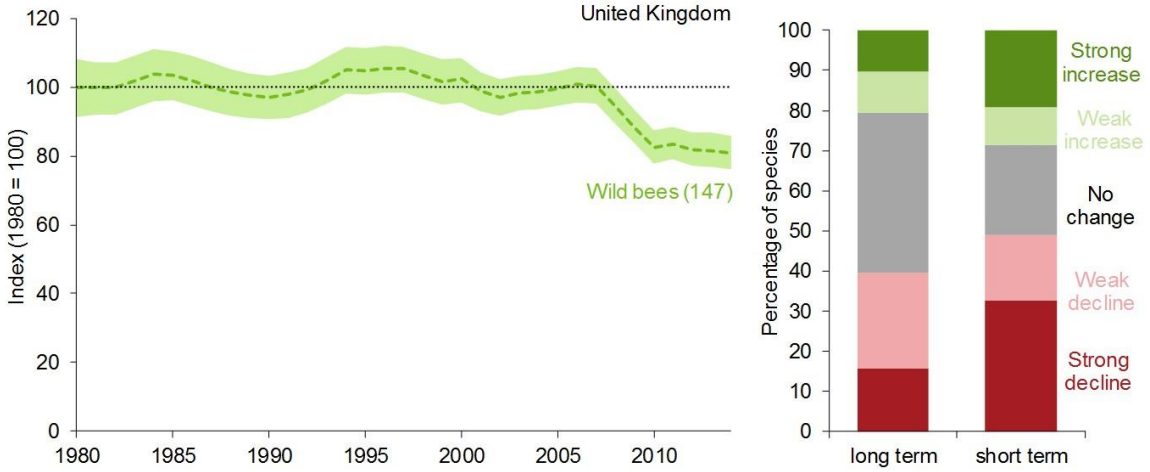
2. Graph shows the unsmoothed composite indicator trend with variation around the line (shaded) within which we can be 90% confident that the true value lies (credible interval).
3. Bar chart shows the percentage of species within the indicator that have increased, decreased or shown no change in occupancy, based on set thresholds of change.

Source: Bees, Wasps & Ants Recording Society; Hoverfly Recording Scheme; Biological Records Centre (supported by Centre for Ecology & Hydrology and Joint Nature Conservation Committee).

Assessment of change in the distribution of pollinators in the UK			
	Long term	**Short term**	**Latest year**
Distribution of UK pollinators	1980–2014	2009–2014	Increased (2014)

The indicator occupancy index was also produced for the bee (Figure D1cii) and hoverfly (Figure D1ciii) species separately. The bee index was relatively stable up to 2007, before undergoing a sharp decline until 2010 when it stabilized. In 2014, the bee index had declined to 81 per cent of the value in 1980. A larger proportion of bee species had decreased than increased over both the long- and short-term, from 1980 to 2014 39% decreased and 20% increased. From 2009 to 2014 49% decreased and 29% increased.

Figure D1cii. Change in the distribution of wild bee species in the UK, 1980 to 2014.



Notes:

1. Based on 147 wild bee species.
2. Graph shows the unsmoothed composite indicator trend with variation around the line (shaded) within which we can be 90% confident that the true value lies (credible interval).
3. Bar chart shows the percentage of species within the indicator that have increased, decreased or shown no change in occupancy, based on set thresholds of change.

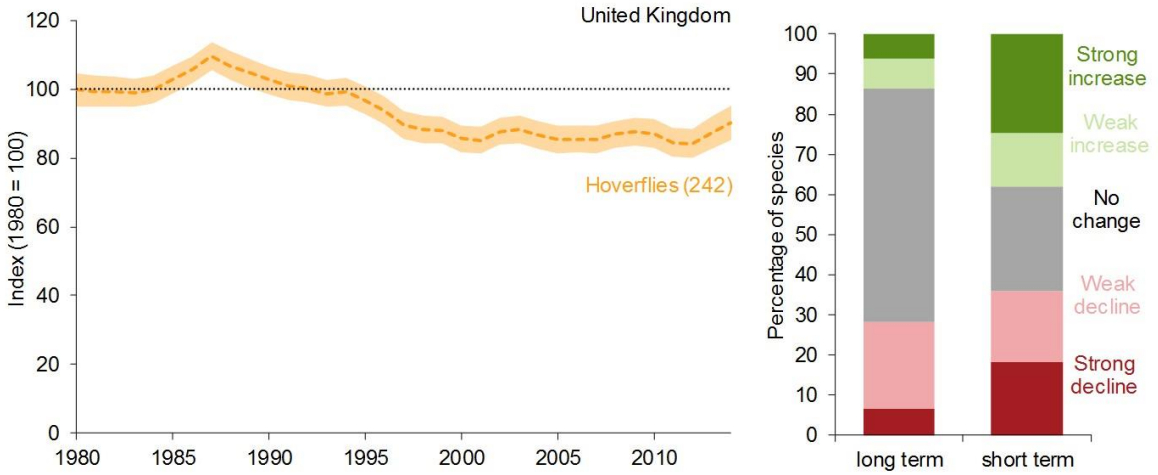
Source: Bees, Wasps & Ants Recording Society; Hoverfly Recording Scheme; Biological Records Centre (supported by Centre for Ecology & Hydrology and Joint Nature Conservation Committee).

There was a noticeable decline in bees from 2007-2010. Loss of foraging habitat is understood to be a major driver of change in bee distribution (Vanbergen *et al,* 2014). Pesticide use has been shown to have an effect on bee behaviour and survival (Stanley *et al*., 2015). However, weather effects, particularly wet periods in the spring and summer are

likely to have had an impact too. Further research would help to better understand the relative importance of these potential drivers of change.

In contrast to the bees, the hoverfly index (Figure D1ciii) shows a gradual decline between 1987 and 2001. In 2001, the composite index was approximately 85% of the value in 1980. Between 2001 and 2014, the hoverfly index has remained stable, with a slight increase in the final two years. In 2014 the index was at 90% of the value in 1980. A greater proportion of hoverflies have declined in occupancy over the long-term than have increased (28% and 14% respectively). However, the balance of increasing and decreasing species was more even in the short-term, with 36% and 38% of species decreasing and increasing respectively, and with an overall increase over the last three years. It is not clear why hoverflies show a different trend to bees, although difference in the life cycle will mean they respond differently to weather events and habitat change.

Figure D1ciii. Change in the distribution of hoverfly species in the UK, 1980 to 2014.



Notes:

1. Based on 242 hoverfly species.
2. Graph shows the unsmoothed composite indicator trend with variation around the line (shaded) within which we can be 90% confident that the true value lies (credible interval).
3. Bar chart shows the percentage of species within the indicator that have increased, decreased or shown no change in occupancy, based on set thresholds of change.

Source: Bees, Wasps & Ants Recording Society; Hoverfly Recording Scheme; Biological Records Centre (supported by Centre for Ecology & Hydrology and Joint Nature Conservation Committee).

Relevance

Nature is essential for human health and well-being. Pollination is an important ecosystem service that benefits agricultural and horticultural production, and is essential for sustaining wild flowers. Bees and hoverflies are also popular insects and people enjoy seeing them in the towns, cities and the wider countryside. Insect pollination depends on the abundance, distribution and diversity of pollinators. Knowledge of the population dynamics and distribution of those species that provide the service, the pollinators helps us assess the risk to these values. Many wild bees and other insect pollinators have become less widespread, particularly those species associated with semi-natural habitats. At the same time, a smaller number of pollinating insects have become more widespread. This may have implications for the pollination service they provide to crops and wild flowers and is an area of active research (Potts *et al.* 2010; Garratt *et al.* 2014).

Background

Occupancy of pollinators refers to the overall area where each species is found and does not refer directly to their abundance. The reduction in the index shows that overall pollinators are becoming more restricted in their distributions so that on average in any one place the diversity of pollinator species found is reduced.

The indicator is the average trend across all 389 species included in the analysis. Individual species within the indicator will have different time-series trends (i.e. some may be increasing while others may show stronger declines). The shaded region on Figure D1ci is the 90% credible interval of the annual occupancy estimates and represents the statistical uncertainty surrounding the annual occupancy estimates. Credible intervals are similar to the confidence intervals used in parametric statistics, but are the appropriate metric to use with Bayesian statistics. Estimates will be revised as new data become available.

The Bayesian occupancy approach is an established analytical approach that enables an estimation of species occurrence even though the data utilized in this indicator were collected without a standardized survey design (van Strien *et al.*, 2013; Isaac *et al.*, 2014). For each species, records were extracted at the 1km grid cell scale with day precision, and an annual time-series of the proportion of sites occupied was calculated. Each species-specific time-series was scaled so the first value in 1980 was set to 100. The annual index (the pollinator occupancy indicator) was estimated as the arithmetic mean of the scaled species-specific occupancy estimates. Each species was given equal weighting within the indicator. Uncertainty in the species-specific annual occupancy estimates is represented by the 90% credible intervals. See the technical report for further detail on production of the indicator.

As species become more or less widespread, individual grid squares will have richer (more species) or poorer (fewer species) pollinator communities; pollination services are generally likely to be higher where the pollinator community is richer (Vanbergen *et al.*, 2013). The area occupied does not necessarily relate to pollinator abundance, as a species with one individual in each of 10 grid squares would receive the same occupancy score as a species with 100 individuals in each of the same grid squares, although generally, species with greater occupancy are likely to be more abundant. National level data on changes in abundance of pollinators is not currently available.

The short-term trends tend to have a fewer species falling into the “stable” category than the long-term trends. This is likely a result of the high level of short-term variation in invertebrate populations. The species-specific trends were calculated as the mean percentage change in occupancy per year, therefore across a 34 year period, the influence of short-term variation on the trend is reduced compared to its influence on a shorter period.

Goals and targets

Aichi Targets for which this is a primary indicator

Strategic Goal D. Enhance the benefits to all from biodiversity and ecosystems.

Target 14: By 2020, ecosystems that provide essential services, including services related to water, and contribute to health, livelihoods and well-being, are restored and safeguarded, taking into account the needs of women, indigenous and local communities, and the poor and vulnerable.

Aichi Targets for which this is a relevant indicator

Strategic Goal B. Reduce the direct pressures on biodiversity and promote sustainable use.

Target 7: By 2020 areas under agriculture, aquaculture and forestry are managed sustainably, ensuring conservation of biodiversity.

Strategic Goal D. Enhance the benefits to all from biodiversity and ecosystems.

Target 15: By 2020, ecosystem resilience and the contribution of biodiversity to carbon stocks has been enhanced, through conservation and restoration, including restoration of at least 15 per cent of degraded ecosystems, thereby contributing to climate change mitigation and adaptation and to combating desertification.

Web links for further information

Reference	Title	Website
Bees, Wasps & Ants Recording Society	BWARS homepage	http://www.bwars.com/
Hoverfly Recording Scheme	HRS homepage	http://hoverfly.org.uk/portal.php
Centre for Ecology & Hydrology	Biological Records Centre homepage	http://www.brc.ac.uk/
Department for Food, Environment & Rural Affairs	The National Pollinator Strategy: for bees and other pollinators in England	https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/370199/pb14221-national-pollinator-strategy.pdf

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Full details of this indicator, including a datasheet and technical documentation are available at: http://jncc.defra.gov.uk/page-6851**.**

Last updated: August 2017

Latest data: 2014