D1c Pollinating Insects

This Evidence Statement should be read in conjunction with the *Summary of Evidence* document (Annex 3). Assertions in bold text have been assigned a confidence rating following assessment by a panel of independent experts (see main report for details).

A. Background, structure and statistical issues/biases

- This indicator had a major overhaul in the 2015 version (published on 19 January 2016, after the evidence base was gathered). Where possible, the evidence statement has been written to reflect these changes.
- This indicator describes trends in the distribution of 105 wild bee and 108 hoverfly species from 1980-2010. This includes all species in these taxa for which reliable trends could be estimated. Species receive equal weighting, regardless of the pollination services they provide. The 2014 version included 216 bees but no hoverflies.
- Trends for all species were derived from opportunistic records from the Bees, Wasps and Ants Recording Scheme (BWARS) and Hoverfly Recording Scheme (HRS). Species indices are derived from statistical models that have been shown to be robust to several sources of bias in opportunistic data (Bayesian Occupancy-Detection models)[i]. Species index values are expressed as the odds of the average 1km^2 grid cell being occupied. The composite indicator is the arithmetic mean of the individual species indices for that year[ii]. Credible intervals in the headline indicator fully accounts for uncertainty in the species index values, resulting in much uncertainty than is generated by methods used by other indicators. The indicator is assessed in unsmoothed form.
- Most of the BWARS data are drawn from England, with a strong southerly bias[ii]. Wales and Scotland contribute a small number of sites each[iii]. The data are extremely biased with respect to landcover types[ii], reflecting preferences by volunteers to visit semi-natural habitats. The indicator does not make a statistical correction for the location of sample locations. The HRS data probably show similar statistical properties[iv]. The indicator does not make a statistical correction for the location of sample locations.

B. Representation

1. **This indicator is the average change in distribution, primarily on semi-natural habitats in southern England, of about half of bee and hoverfly species in the UK** [High], although data from other regions also contribute information. It does not represent changes in abundance of species on the indicator, nor does it represent changes in species richness of sites on which they occur. Many other insects visit flowers (notably butterflies and Tachinid flies)[v], although the majority of pollination is thought to be delivered by a few common species[vi].

C. The Trend

2. The headline indicator declined by 32% between 1980-2010[vii]. **There is strong evidence for a long-term negative decline in the average distribution of insect pollinators** [High].
3. Half (110/213) of species in the indicator declined by at least 1% per year in the long-term and 57 increased at a similar rate[viii]. Declining species changed more on average than increasing ones, suggesting substantial losses among some species. Bee species in the 2014 version of this indicator showed a substantial variation in the trends of species that contribute to it[ix]. **There is good evidence for substantial decreases among many bee and hoverfly species; a few species are increasing** [High].
4. Hoverfly species declined steadily over the three decades, but losses among bees are concentrated in the last five years[vii]. The headline indicator continued to decline over the period 2005-2010[vii], but most of the losses in this period are concentrated in bees. **There is some evidence for a sharp decline in bee distributions since 2005, but hoverflies appear to be increasing** [Medium].
5. **There is no evidence about whether trends vary systematically within the UK** [Medium].

D. Wider Application

6. Wild bee and hoverfly species are believed to be the most important pollinators of insect-pollinated crops in the UK, so the negative trend in the indicator implies a potential reduction in pollination services. The indicator reflects trends in the distribution of pollinator species - not in the abundance of individual populations nor visitation rates to flowers - hence the connection to delivery of pollination service is indirect. The indicator may provide more information about the potential species redundancy of pollination service providing species, but there remains limited knowledge about which bee species are most important for maintaining pollination services. However, **indicator D1c is the best and most direct metric currently available for assessing overall changes in the level of insect pollination services** [Medium].
7. Similarly, given a lack of suitable pollinator abundance data, the **trend in indicator D1c can be used as a direct measure of progress towards Aichi of target 14** [High] (the provision of pollination services). This indicator is also indirectly relevant to the assessment of progress towards target 7 (sustainable land management) and target 15 (the resilience of ecosystems), although other indicators are more directly relevant[x].

*E. Drivers of change**

8. *Agricultural intensification and increasing farm area are both implicated as having a negative impact on the abundance and distribution of wild bees, although there is substantial uncertainty about these effects. **The available evidence suggests that agricultural intensification and expansion are the most important factors contributing to the decline in pollinating insects**[xi] [High].
9. ***Available evidence, though limited, shows **there has been a mixture of positive and negative impacts of urbanisation on bees**[xii] [High].
10. ***There is moderate evidence that wild bees, especially bumblebees, have benefitted from agri-environment schemes and increased management of semi-natural habitats** [Medium] (largely heathland and grasslands)[xiii].
11. ***There is substantial uncertainty about the impacts of climate change on wild bees** [High], with both positive and negative impacts reported[xiv].

*The evidence base underpinning these statements was collated for bees only. The 2015 version also includes hoverflies.

Endnotes refer to the "Technical Report – Summary of Evidence" document, unless otherwise stated

[i] http://jncc.defra.gov.uk/Docs/UKBI2015_TechBG_C4b-D1c_Bayesian_Final.docx
[ii] Figure 2.3
[iii] Table 2.3
[iv] Isaac & Pocock (2015) *Biol J Linn Soc* 115, 522-531
[v] Kleijn *et al* 2009. *Proc Biol Sci* 276**,** 903–9
[vi] Rader *et al.* 2015. *PNAS* 113, 201517092
[vii] http://jncc.defra.gov.uk/page-6851
[viii] http://jncc.defra.gov.uk/docs/UKBI2015_DS_D1c_Final.xlsx
[ix] Section 2.1.5, table 2.1
[x] http://jncc.defra.gov.uk/page-6121
[xi] Sections 3.2.11.1.2, 3.2.11.3.2.
[xii] Sections 3.2.11.1.2, 3.2.11.3.2
[xiii] Sections 3.2.11.1.5, 3.2.11.1.6, 1, 3.2.11.3.6
[xiv] Section 3.2.11.1.7