

What is causing the decline in pollinating insects?

Some groups of pollinating insects, such as bees, have declined and research has revealed a range of different factors that appear to be involved.



Photo by Claire Carvell

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The Living With Environmental Change Partnership brings together 22 public sector organisations that fund, carry out and use environmental research and observations. They include the UK research councils, government departments with environmental responsibilities, devolved administrations and government agencies. The private sector is represented by a Business Advisory Board.

Insect pollinator numbers are affected by many different environmental and socio-economic factors but attributing long term change in pollinator numbers to one or more of these is difficult. Scientists are beginning to understand how these different factors interact with each other, and which are more important for particular insect groups, but there is no single, simple explanation for pollinator decline.

Why are insect pollinators important?

Bees, flies, wasps, beetles, butterflies and moths are part of a nation's biodiversity and natural capital. They have intrinsic value and provide environmental and economic benefits because:

- Over three-quarters of wild flowering plant species in temperate regions need pollination by animals like insects to develop their fruits and seeds fully. This is important for the long-term survival of wild plant populations and provides food for birds and mammals.
- Pollinators improve or stabilize the yield of three-quarters of all crop types globally; these pollinated crops represent around one third of global crop production by volume.
- Many fruit, vegetable, oil, seed and nut crops that provide vital nutrients for human diets worldwide, including more than 90% of our vitamin C, are pollinated by insects.
- The cultivated area of pollinator-dependent crops has risen, raising worldwide demand for insect pollination services three-fold since the 1960s. Globally the crop production attributable to insect pollination was valued at US \$215 billion in 2005.
- Honeybees, but also bumblebees and solitary bees, are managed and traded commercially for their pollination service. Wild pollinators are at least as important as managed pollinators in providing these benefits.

What is happening to pollinators?

Pollinators are declining in Britain and in many regions of the world:

- Declines may be measured by counting the change in the number of pollinator species present (number of species), the number of places where each species is found (species range) or the number of individual insects of each species (population size).
- In Britain since the 1950s there is evidence of decreases in range (more species have reduced their ranges than increased) and number of species (more places have lost species than gained) of bumblebees, solitary bees, butterflies and moths. Hoverfly ranges and species numbers seem to have declined less. A recent analysis suggests that overall declines in the number of bumblebee species have slowed since the 1980s.
- Structured, volunteer recording schemes provide strong evidence that population sizes of butterflies and moths in Britain are declining overall. The lack of a similar recording approach for wild bees and hoverflies makes it harder to know whether their population sizes are also declining.
- In England the number of managed honeybee hives fell by about 50% between 1985 and 2005. Since 2007 an upsurge in the popularity of beekeeping has increased the number of hives again, but every year many honeybee colonies are lost.

What are the main pressures on pollinators?

Many environmental changes can reduce pollinators' access to essential resources such as food, nest sites and overwintering sites, or directly affect pollinator health:

- Loss of wild habitats, changes in crops being grown, exposure to chemical pesticides, climate change, disease, changes to the plant community, and economic or cultural changes affecting keeping of honeybees can all contribute.
- Loss of flower-rich habitats such as hay meadows, rough grassland, woodland and hedgerows is often considered to be the main driver of changes in wild pollinator communities during the late 20th century. This particularly affects species with specialized ecological requirements.
- Intensive farming, with simplified crop rotations in large fields, high herbicide and fertilizer use and high livestock densities can have a negative impact on pollinators, due to the loss of flowers and nesting areas. Flowering crops (eg orchards, oilseed rape) do not compensate because they only provide transient nectar and pollen sources.
- Insecticides have been shown to affect the health and behaviour of honeybee and bumblebee colonies in laboratory and small-scale outdoor experiments, even at levels that don't kill the bees. However, the actual levels of insecticide that pollinators encounter in the real environment are difficult to assess accurately.
- Wild insects and plants are already changing their distributions on a large scale in response to climate change. This may disrupt pollination if important pollinators become desynchronized with the plants they pollinate.
- Pests and pathogens dominate explanations of managed honeybee loss. Honeybees are afflicted by the varroa mite, many viruses, fungi and bacteria. Pathogens are also an important mortality factors for wild bees, and there is increasing evidence that they can spread from managed honeybee to wild bee populations.

Can researchers identify a single cause of pollinator decline?

There is no single, overriding cause of decline in pollinating insects:

- The balance of pressures varies between different pollinator groups. For example, wild pollinators, especially butterflies and specialized bee species, are probably more affected by habitat loss and climate change. Managed honey bees are more affected by disease. Both groups are also threatened by loss of flowers and agricultural pesticides.
- The relative power of the different pressures to change pollinator populations is not thoroughly known for any pollinator group. This is because most studies have been limited in the scope of species (eg honeybees or bumblebees) or combinations of pressures (eg pesticides and pathogens) that have been considered.
- Nonetheless, it is likely that in the real world many of the different pressures combine or interact, leading to an increase in the overall threat to pollinators.

What are the implications for decision makers?

- Securing the value of pollinators to society requires simultaneous action in several different policy areas, including agriculture, biodiversity conservation, land use planning, pesticide regulation, bee health and climate change. We require an overall strategy that draws upon relevant government and other stakeholders to generate solutions to better support pollinator biodiversity and health.
- Creating or restoring flower-rich and semi-wild habitat will enhance pollinator abundance, health and diversity, and may also reduce the combined impacts of other threats (eg agri-chemicals, climate change and pathogens) on pollinators. We can achieve this by incentivizing uptake by farmers of agri-environment schemes that support pollinators and more effective targeting of these schemes in the landscape.
- Citizens can be encouraged to plant wild flowers to help pollinators. Publicly owned spaces (eg parks, road and rail corridors) can be adapted to provide pollinator habitat, perhaps by less intensive management, which could also save money.
- Surveillance of beekeeping operations should continue to help reduce disease impacts on managed pollinators but also be expanded to evaluate the risk of disease spread between managed and wild pollinator populations.
- Policy makers should review the risk to both managed and wild pollinators from the importation for pollination services of managed bees and their associated pathogens.
- Standardized monitoring of wild bees and hoverflies is urgently needed, so we understand better whether their numbers are changing, how changes in pollinator populations are related to different environmental pressures, or how changes affect pollination services across Britain.
- Pesticide risk assessments need to take account of subtle (eg behavioural) effects on honeybees and other pollinator species (eg bumblebees and solitary bees), as these effects are probably interacting with other environmental pressures to affect pollinators.

Further information

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Useful resources:

The Insect Pollinators Initiative (IPI) website contains information about [pollinators and the research projects](http://www.insectpollinatorsinitiative.net) www.insectpollinatorsinitiative.net
The IPI Agriland project is looking at what affects pollinator communities in British agricultural landscapes: www.agriland.leeds.ac.uk/
The IPI Urban Pollinators project is researching insect pollinators in British urban habitats: www.bristol.ac.uk/biology/research/ecological/community/pollinators/
The IPI Emergent Diseases project is researching the impacts of disease on honeybees and bumblebees: <https://wiki.ceh.ac.uk/download/attachments/162464353/Flyer%20Paxton.pdf?version=1&modificationDate=1346164180000&api=v2>
The BeeBase website <https://secure.fera.defra.gov.uk/beebase/> and the British Beekeepers Association www.bbka.org.uk/ provide information for beekeepers on honeybee health and management

Defra is launching a National Pollinators Strategy for England. This will provide a central source of guidance on how to help pollinators in farmed and urban environments.

The Welsh Action Plan for Pollinators wales.gov.uk/topics/environmentcountryside/consmanagement/conservationbiodiversity/action-plan-for-pollinators/?lang=en

The Bumblebee Conservation Trust website has information about how to help British bumblebees, including opportunities to get involved in monitoring www.bumblebeeconservation.org

The Campaign for the Farmed Environment has pollinators as a campaign theme: www.cfeonline.org.uk/campaign-themes/pollinators/

Vanbergen, A. J., and the Insect Pollinators Initiative. 2013. Threats to an ecosystem service: pressures on pollinators. *Frontiers in Ecology and the Environment* 11:251-259. Download at: www.insectpollinatorsinitiative.net

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Download from publications page at www.insectpollinatorsinitiative.net

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