4 Services provided by nature

4.1 This section provides evidence about the different services provided by nature. Specific services may be of interest to different policy makers and practitioners, so you may choose to focus just on those. Alternatively, you may be interested in overarching themes such as economic competitiveness, so **Chapter 2** and **Chapter 3** may be useful in identifying how the environment contributes to those themes.

4.2 It is important to note that not all services provided by nature are included here. The ones chosen are the ones which on the basis of current evidence are most important in the context of environmental projects. The ones selected are also those for which we have available scientific and economic evidence.

4j Pollination

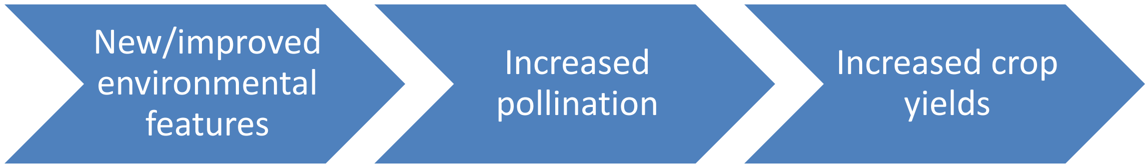
Pollination services provided by the natural environment are critical to the survival of a range of wild plants, and the yield of many commercial crops.

Introduction

4.57 Pollination services are provided by a variety of species such as bees, butterflies and hoverflies. Natural pollinators need to be considered as distinct from managed pollinators such as commercially produced bumblebees and honey bees. Commercial pollinators are now considered to be essential to the production of tomato, seed and strawberry crops in glasshouses, and can be very significant for soft fruit produced in poly-tunnels (strawberry, raspberry, blackberry and blueberry). Natural pollinator species still play an important role in the production of unprotected crops, particularly for crops such as oil seed rape, beans and open field soft and tree fruit. They are also vital for the reproduction of many wild plant species and the habitats these plants support.

4.58 While the use of commercial factory-reared bumblebees has risen significantly over the last 20 years, and these insects are now used to pollinate open, unprotected crops in many countries, this has corresponded with a well-documented decline in wild pollinators since the 1960s (Breeze, Bailey et al. 2011). A reduction in natural pollination can lead to increased input costs for farmers, who will need to purchase commercially reared pollinators or employ commercial crop pollination services to maintain yields. This has implications for UK food security and affordability.

Theory of change



Can the benefit be quantified?

4.59 The benefit of pollination can be quantified using field experiments. This benefit cannot be easily generalised however, as it is likely to be affected by the specific pollinator and plant species involved, weather conditions and other factors such as disease. In contrast to the use of commercial pollinators, where the use of a set number of hives can be shown to increase yields, and thus profits, by specific amounts, the benefits of natural pollinators are harder to quantify.

How strong is the evidence?

4.60 Robust, quantified evidence of this benefit exists, although it is limited and specific to particular situations.

Evidence

4.61 For a comprehensive review of the evidence of the contribution of insect pollination, see Vanbergen, Heard et al. (2014), Status and value of pollinators and pollination services, Report to the Department for Environment, Food and Rural Affairs, March 2014.

- Breeze, Roberts et al. (2012) note evidence that insect pollination is important to maintaining the genetic diversity of plants and the spread of rare habitats. Insect pollination also contributes to wider biodiversity through the provision of insect pollinated plants which in turn provide food, shelter and other resources to animals.

- Honeybees are effective pollinators of most crops, however other species can be more effective with specific plants. Honeybees, for instance, are ineffective at pollinating tomatoes which require buzz-pollination (vibration of the flowers to release pollen) by bumblebees (Delaplane and Mayer 2000).
- On oilseed rape, solitary bees were found to be significantly more efficient at transferring pollen, with 71 per cent of visits to a flower resulting in pollen transfer to the stigma. By comparison, 35 per cent of bumblebee, and 34 per cent of honeybee visits resulted in pollen transfer. However, visits by honeybees tended to be more frequent than other bees when in the vicinity of hives or large areas of alternative foraging habitat (Woodcock, Edwards et al. 2013).
- Fruit set refers to the transition of flower to fruit, and is highly related to final crop yield. In cherry orchards in Germany, fruit set was found to be highly correlated with wild bee visitation (largely solitary bees), but not with honeybee visitation. This was thought to be due to the greater pollination efficiency of solitary bees. When the proportion of high diversity habitats for wild bees within 1 km of the orchard increased from 20 to 50 per cent, this led to an increase in fruit set by 150 per cent (Holzschuh, Dudenhoffer et al. 2012)[112].
- 848,946 hectares of crops in the UK are pollinated by insects, with an estimated market value of £1057.8 million. This represents 19.3 per cent of total UK farm gate value. The area of insect-pollinated crops has been growing steadily since 1984, particularly due to rises in the crop area of oilseed rape and field beans (Breeze, Bailey et al. 2011)[113].
- Garratt, Breeze et al. (2014) conducted field experiments on apple orchards in Kent, UK, and found that insect pollination of both Gala and Cox apples resulted in greater yields than wind pollination alone. This was estimated to be worth an additional £11,900 in output per hectare for Cox and £14,800 per hectare for Gala apples, compared with wind pollination[114].
- A study in Canada found that there was a strong relationship between seed set (determining crop yield) in oilseed rape fields, and the abundance of bees. Fields with moderate to high bee abundance had close to maximum yields. Bee abundance was found to increase with the presence of uncultivated land around the fields. Total crop profits were maximised when 30 percent of the landscape was uncultivated (Morandin and Winston 2006)[115].

References

Breeze, T., A. Bailey, et al. 2011. "Pollination services in the UK: How important are honeybees?" Agriculture, Ecosystems and Environment **142**: 137-143.

Breeze, T., S. Roberts, et al. 2012. The decline of England's bees: policy review and recommendations. Report to Friends of the Earth. Reading, University of Reading.

Delaplane, K. and D. Mayer. 2000. Crop Pollination by Bees. Wallingford, CABI Publishing.

Garratt, M., T. Breeze, et al. 2014. "Avoiding a bad apple: Insect pollination enhances fruit quality and economic value." Agriculture, Ecosystems and Environment **184**: 34-40.

[112] This result is specific to cherry production. Other plants have flowers with different shapes and nectar availability, which influences the species of bee that will pollinate them effectively.

[113] Farm gate value refers to the price of produce when it is sold from the farm. Output is valued at 2007 farm gate prices, and should be taken as an upper estimate because where the particular crop cultivar was not specified in production figures, it was assumed to be insect-pollinated. The value presented should not be interpreted as the value that might be lost if insect pollination ceased, as some production would still occur in the absence of insect pollination (due to wind pollination, for instance).

[114] Output is valued at 2013 farm gate prices, and takes into account changes in both quantity and quality of apples produced. The value is likely to overstate pollination benefits, as increases in other inputs may also achieve an increase in yields.

[115] This study did not include harvesting and transport costs in the analysis. These may be higher with greater yields and more uncultivated areas.

Holzschuh, A., J.-H. Dudenhoffer, et al. 2012. "Landscapes with wild bee habitats enhance pollination, fruit set and yield of sweet cherry." Biological Conservation **153**: 101-107.

Morandin, L. and M. Winston. 2006. "Pollinators provide economic incentive to preserve natural land in agroecosystems." Agriculture, Ecosystems and Environment **116**: 289-292.

Vanbergen, A., M. Heard et al. 2014. Status and value of pollinators and pollination services. Report to Department of Environment Food and Rural Affairs, London, Defra.

Woodcock, B., M. Edwards, et al. 2013. "Crop flower visitation by honeybees, bumblebees and solitary bees: Behavioural differences and diversity responses to landscape." Agriculture, Ecosystems and Environment **171**: 1-8.