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# Bumblebees and the Importance of Pollination

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## Summary


- **Bumblebees are a crucial insect group for pollination of vegetables, fruit, oilseeds, legumes and fodder crops. Maintaining healthy bumblebee populations means that bees and other pollinators can quickly respond to the presence of mass flowering crops.**
- **In the UK there have been major declines in most social bumblebee species over the past 70 years, and two national extinctions. Over a third of social bumblebees are UK Biodiversity Action Plan priority species.**
- **Farmers can play a key role in supporting bees through provision of nectar, pollen sources and bumblebee nest habitats. A habitat providing continuity and diversity of flowers is required from April to September.**
- **Bumblebees respond very quickly to improvement in food sources. Pollen sources are particularly important.**
- **The common bumblebee species tend to be more important for pollination of crops and wildflowers by virtue of their abundance. They represent a guild of short, medium and long-tongued bumblebees. Therefore, they help support very diverse habitats and between them pollinate a wide range of crops.**
- **Helping bumblebees will help a wide range of other invertebrates including honeybees, solitary bees, butterflies and other beneficial insects such as hoverflies, ladybirds and ground beetles**
- **Integrating profitable farming and bumblebee conservation will improve the public perception of farming and provide public good.**


## Introduction

In the UK there are 24 species of bumblebee representing ~10% of the world's bumblebees. In Scotland there are currently 19 species.

There have been declines in both actual numbers and of species of bumblebees. The decline is mainly due to the loss of flower rich habitats as bumblebees exclusively depend on pollen and nectar as food sources. In addition traditionally managed hay fields and clover leys which were once common are now a much rarer sight.

This technical note explains the importance of bumblebees, their requirements and how farmers can help support bees.

*White tailed Bumblebee © H Bibby*

*Common Carder Bee © H Bibby*

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## The Importance of Bumblebees

*Red Tailed Bumblebee © H Bibby*

We need a range of different pollinators because flowers come in a variety of shapes and sizes and are adapted to different pollinators. The open flowers of oilseed rape are easily accessed by a wide variety of pollinators, and visitors include hoverflies, honeybees, and solitary bees. In comparison, field beans have complex flowers with nectar hidden deep inside where only long-tongued pollinators, such as the Garden bumblebee, can access. Consequently long-tongued pollinators are more effective pollinators of field beans. Promoting pollinator diversity not only ensures pollination in a wider range of plant species (i.e. both wild and crop plants) but can also stabilise pollination in adverse weather conditions. For example, bumblebees will continue to forage in conditions too adverse for honeybees.

*Honey bees at hive © H Bibby*

It cannot be denied that the honey bee is a great pollinating machine when it comes to agriculture. Their large perennial colonies can be moved to wherever they are needed and they can communicate direction and distance from the hive to nectar sources. However bumblebees are 'keystone pollinators' and along with honeybees they are essential to farmers in order to pollinate crops, fruits and wild flowers.

Solitary bees (80 species in Scotland) can also be important pollinators and although they tend to have short flight seasons, many different species are found from April to September.

The key message is that we need healthy populations of all of our wild bees and other pollinators. They are important in their own right as well as providing valuable 'insurance' against problems with managed bees.

## Lifecycle and requirements

Bumblebees have a one year life cycle and live in colonies comprising of a queen and up to 200 workers. Nests are founded in spring by a queen, who mated the previous autumn and hibernated over winter. The queens can be seen as early as February, but most are seen from late March into May.

In spring the queen must first feed to restore body condition after hibernation. Once a suitable nest site is found, pollen is collected and formed into a clump. Into this the first batch of eggs is laid, which become the first brood of workers. The queen also creates her own honey pot to ensure that she can effectively forage, and incubate these eggs at around 30°C.

Successive batches of workers are reared and take on foraging and nest maintenance duties, before males and daughter queens are reared in summer. At the end of the summer the whole colony dies apart from the new mated queens, which hibernate.

Throughout the colony's life there is a need for continuous availability of suitable flowers from which pollen and nectar can be collected. A diversity of flowers helps provide this continuity and also support different species. For example short-tongued bumblebees are important for strawberries and oilseed rape, but long-tongued bumblebees are needed for peas and beans. Hardy northern species are active for longer in the season, work longer hours and forage in colder weather than honeybees.

Pollen is essential because of its protein component. Crucially, pollen, typically that with a high protein content, is collected from a narrower range of flowers than nectar. These flowers are therefore particularly vital for bumblebees. In honeybees, pollen is also important, but abundant nectar sources are required to ensure harvestable quantities of honey.

It has been suggested that only one in five hibernating queens successfully establish a nest the following spring. Therefore each nest must, on average, rear at least five new daughter queens to keep numbers stable. Lack of flowers, compounded by bad weather conditions, can cause colonies to fail before this stage.

Bumblebees will often fly 1km (and probably up to 2km) from the nest to locate and forage from suitable flower-rich patches. However, unlike honeybees, bumblebees have only small honey stores, which can quickly become exhausted if flowers are scarce and/or weather is very wet. Therefore, a diversity of flower species is needed both for ensuring continuity from April to September, meeting demand at critical periods in spring and summer, and also supporting different bumblebee species.

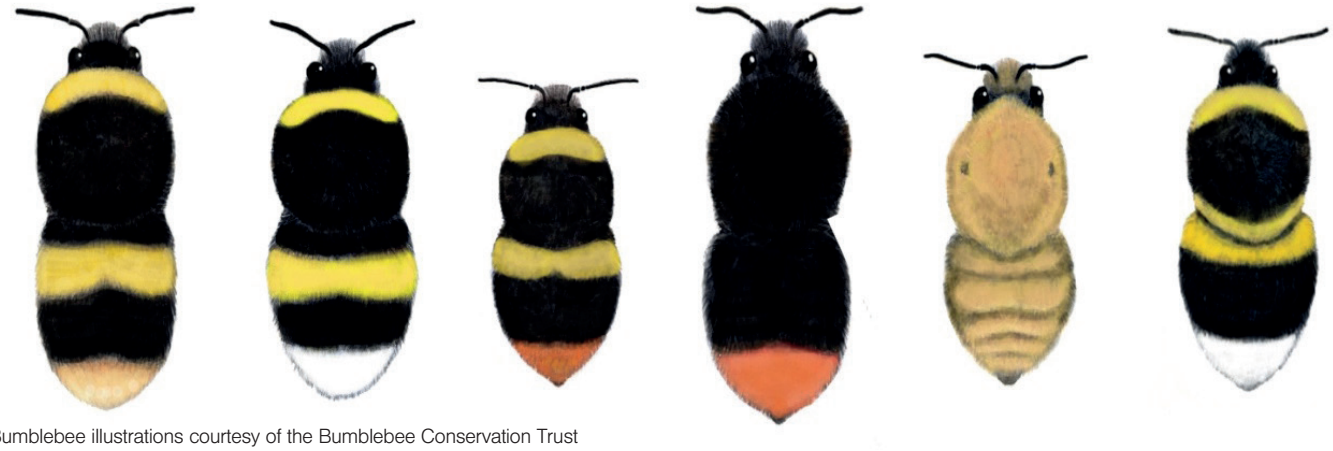
*Species Rich Grassland ©H Bibby*

## Bumblebee Species

The common bumblebee species tend to be more important for pollination of crops and wildflowers by virtue of their abundance. They represent a guild of short, medium and long-tongued bumblebees. Therefore, they help support very diverse habitats and between them pollinate a wide range of crops.

The six bumblebee species common in most of Scotland are in the table on the next page:

| SHORT | MEDIUM | LONG |
|---|---|---|



Bumblebee illustrations courtesy of the Bumblebee Conservation Trust

**"The Big Six" bumblebees (queen illustrated)**. From left to right: buff-tailed, white-tailed, early, red-tailed, common carder and garden bumblebee. Short-tongued bumblebees are valuable pollinators of oilseed rape, while long-tongued species are better for legumes and red clover. Soft fruits and top fruits are visited by all species, particularly Short-tongued. Commercial bumblebees are varieties of the Buff-tailed bumblebee, of which the native, 'buff-tailed' form is now available.

Our rarest bumblebees tend to be long-tongued grassland species that emerge late in spring. For these, legumes are particularly important, especially red clover, with common knapweed heavily used later in the season.

The great yellow bumblebee is now confined to Argyll (Coll & Tiree), the Western Isles, Highland (north coast of Sutherland and north east Caithness) and Orkney.

The moss carder bee is associated with uplands and its flower-rich grasslands. The mainland form is very similar to the common carder bee and is found in uplands and associated species-rich grasslands. It is rare in southern Scotland but is found in Orkney. The islands of the Inner Hebrides, Western Isles and Shetland support a distinctive form that again is found on uplands and grasslands, and can be particularly abundant on machair.

The red-shanked carder bee is now resident only in Argyll (Coll and Tiree), though it has been recorded elsewhere in the past. It is similar to the red-tailed bumblebee. It is widespread but not common in England and Wales, mainly in the south.

Upland bumblebee species are heavily dependent on heathers and related species, including blaeberry. An abundance of these upland flowers close to species-rich grasslands or flower-rich woodlands is ideal for these species.

## What key pollinators need

**Bumblebees**

- Nesting sites
  - Abandoned rodent burrows, grassy tussocks, rough ground, woodland edges, long-term fallow
- Hibernation sites for queens

**Solitary bees**

- Nesting sites
  - Bare ground
  - Gaps in brickwork, stone walls
  - Hollow plant stems (e.g. reeds

**Hoverflies**

- Larvae resources
  - Dead wood, stagnant water, cow dung, invertebrate prey such as aphids

**All pollinators need a range of flowering plants to provide a stable supply of nectar (to provide energy) and pollen (tp provide protein - key for reproduction).**

Bumblebee illustrations courtesy of the Bumblebee Conservation Trust

## Requirements of Bumblebees

Bumblebees have three main requirements:

1. A supply of food (pollen and nectar) throughout the season from April through September. Nectar is needed for energy but pollen is particularly vital as a source of protein for developing larvae.
2. A suitable nesting site. Different bumblebees have different requirements. Most species nest underground or in cavities (even in bird boxes). They often make use of an old mouse nest or vole run. The exception among common species is the common carder bee that nests on the surface of the ground in tussocky grass (or even in the base of garden plants).
3. Suitable safe places for the queens to hibernate. This is usually underground. After mating, the daughter queens tend to dig into loose soil and establish a chamber within which they hibernate. Some species typically use woodlands. Other hibernation sites include banks or ditch sides, or within dead wood.

## What can Farmers do For Bumblebees?

The best way to support bumblebees in a farming landscape is to have a number of flower-rich areas within commuting distances of tussocky grassland which supports bumblebee nests. Patches can be large, for example cut or grazed species-rich grassland, or clover leys where flowers are available for bees. There are also 'edge' habitats such as grass margins, hedges, dykes and ditches, and seed mixes that contain suitable pollen and nectar sources.

To attract bumblebees to nest on the farm there needs to be a combination of early pollen and nectar close enough to areas with possible nest sites. Farm gardens themselves are often very useful, and two of the most important sources of food for queens in spring are the catkins of pussy (goat) willow (*Salix caprea*), and blossom of wild cherry (*Prunus avium*), both often present on farms.

The queens need to find a suitable nest site close to reliable early sources of pollen and nectar. Grass margins, ditches, dykes, hedgerows and woodland edge provide habitats for small mammals and therefore bumblebees, though gardens tend to have the highest densities of bumblebee nests.

Once queens have established a nest, they require other flowers to be present to support colony growth and nest success. Note; There is often a 'lull' in bee activity in late spring while most queens are incubating. It takes four weeks for the first workers to emerge from the nest and from then the colony builds up slowly. Summer is the period of peak demand, linked to the rearing of new daughter queens.

**Early season flowers**

- Pussy (goat) willow
- Wild cherry
- White deadnettle
- Blaeberry
- Bird's-foot trefoil
- Red campion
- Bugle

**Mid-season and Peak season flowers**

- White and red clover
- Bush, kidney and tufted vetches
- Meadow vetchling
- Yellow rattle
- Foxglove
- Raspberry and bramble
- Heathers and heaths
- Common knapweed
- Devil's-bit scabious

## Management of Species Rich Grasslands

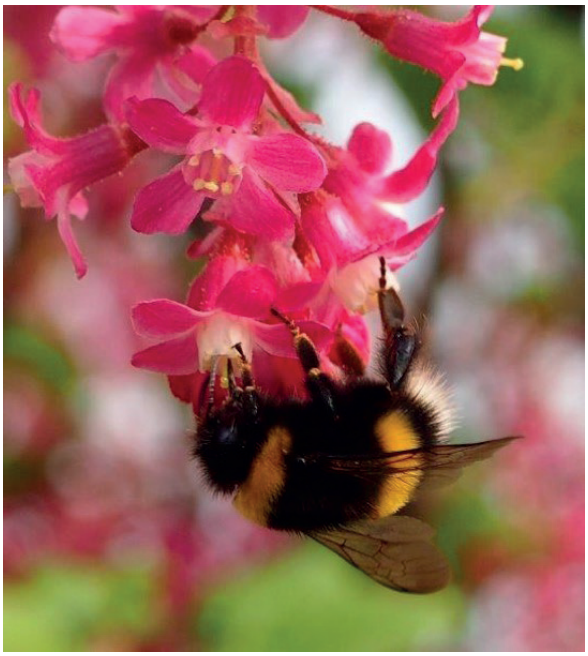
The best option for bumblebees is the management of existing and created species rich grasslands as these are permanent swards with long term benefit.

For maximum benefit to bumblebees, it is recommended to manage species rich grasslands so that flowers are still available for foraging bees until the end of August. This also means that many flowers that have finished flowering can successfully set seed and regenerate.

Most new queen larvae will have been fed enough pollen by early or mid August. However, nectar is still required for workers to maintain conditions to ensure that these new queens develop successfully and 'fledge'. Also, late pollen sources may help feed the critical few percent of new queens needed to maintain populations.

For management of the great yellow bumblebee (SAF, UKBAP), moss carder bee (UKBAP) and red-shanked carder bee (UKBAP) it is recommended that any grazing plan includes a commitment to removing stock from the site between 15 April and 1 September. Additionally, where possible, stands of common knapweed, still flowering should be protected from grazing stock to provide a food source for late reared queen larvae and until the queens go into hibernation.

***Common Carder Bee ©H Bibby***



***White tailed Bumble bee © H Bibby***

## Creation of Species Rich Grasslands

A suggested seed mix is given below for those wishing to benefit bumblebee species in Scotland.

| Flowers | |
|---|---|
| Red Clover | 2% |
| Meadow buttercup | 2% |
| Common Knapweed | 1.50% |
| Ribwort plantain | 1.50% |
| Tufted Vetch | 1.50% |
| White Clover | 1% |
| Self Heal | 2% |
| Bird's foot trefoil | 1% |
| Yarrow | 1% |
| Lady's bedstraw | 0.70% |
| Yellow rattle | 0.50% |
| Common sorrel | 0.20% |
| Meadow vetchling | 0.05% |
| **Grasses** | |
| Festuca rubra ssp. rubra (Strong creeping red fescue) | 35% |
| Poa pratensis (Smooth stalked meadow grass) | 31% |
| Cynosurus cristatus (Crested Dog's tail) | 15% |
| Alopecurus pratensis (Meadow foxtail) | 4% |

Unimproved but species poor grassland can be restored or made more flower rich by scarifying and over sowing with wildflower species or pit planting wildflowers into the sward.

*A variety of pollinators on Knapweed ©H Bibby*

## Tree and hedge planting

Planting hedges, trees and shrubs can also be good for bees if the planting is made pollinator friendly by carefully selecting the planting species. Plant pussy willow and wild cherry to mature in gaps in hedges and along water margins, or around woodland edges and in gardens. Hawthorn and blackthorn blossom is also useful in a hedge as a nectar source as well as ivy.

## Grass Margin Management & Creation

Leave areas of rough grass to develop a tussocky structure and provide moss and dead grass as bee nesting material. The presence of mice and voles is also good as their nests can be used by bees the following year. High nest densities are found along hedges, fence lines (grass margins) and woodland edges. However, other nests, albeit at lower densities are also found in open, rough grassland fields.

A long-term grass margin mix enhanced for bumblebees would include red clover, common knapweed and tufted vetch as well as a diversity of other flowering species to support bees and other beneficial insects. Manage by restricting grazing to allow the plants to flower and set seed. Cut or graze back in late summer and remove cuttings every one or two years, otherwise the wildflowers are outcompeted by competitive grasses.

Encourage suitable wildflowers in grass margins, hedge bottoms, water margins, among scrub and in wooded areas.

## Short-term boosts for bumblebees

The following options use agricultural varieties, and are designed to support demand in late spring and summer. They can attract very large numbers of bumblebees. They complement long-term, wildflower rich habitats, but should not be considered in isolation when managing the land with bees in mind.

**1. Enhance Unharvested Crops/Wild bird seed mix**

Sow wild bird seed mix or unharvested crops which can be either a mix of annual crops including at least one cereal and the addition of kale for a two year option.

Such crops can be enhanced to include a small proportion of pollen and nectar sources for bees and other insects. Commonly, phacelia is used (as an annual) and in two year mixes, red clover. Borage is also very good for honeybees and short-tongued bumblebees. Sweet blossom clover and sunflower have also been used

**2. Pollen & Nectar mix**

A 'bumblebee mix' could be used based on agricultural cultivars. Most mixes are designed to help rare bumblebees, and as these tend to be long-tongued, red clover is the main component. Both autumn-sown and spring-sown mixes have been used successfully.

Seed mixes provide a valuable short-term boost of pollen and nectar, and are usually re-sown after three years. Ideally the mixes are cut after flowering and cuttings removed as silage or finely mulched and spread but light grazing can also be used. Nectar rich mixes can also be considered so get advice from your local seed merchant. Ensure all seed is of UK origin and that no invasive species are included.

*Seed mix planted in a sunny sheltered spot ©H Bibby*

## Further Information

Further information on bumblebees and management for bees can be obtained from the following organisations web sites:

SAC Consulting: www.sruc.ac.uk/info/20005/sac_consulting
Bumblebee Conservation Trust (BBCT): www.bumblebeeconservation.org/
Scottish Natural Heritage (SNH): www.nature.scot/

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