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## Managing brownfields for scarce bumblebees

Wildflower-rich brownfields can provide abundant forage for scarce bumblebees, with a diverse flora providing them with nectar and pollen throughout their active periods. The decline of wildflowers in the wider landscape due to habitat loss, fragmentation and agricultural intensification, have made brownfields increasingly important in maintaining populations. To maintain healthy bumblebee populations in many areas, it is essential that a network of wildflower-rich brownfields are maintained.

### Scarce species of bumblebee on brownfields

Shrill carder bee (*Bombus sylvarum*), Red-shanked carder bee (*Bombus ruderarius*), Brown-banded carder bee (*Bombus humilis*), Large garden bumblebee (*Bombus ruderatus*).

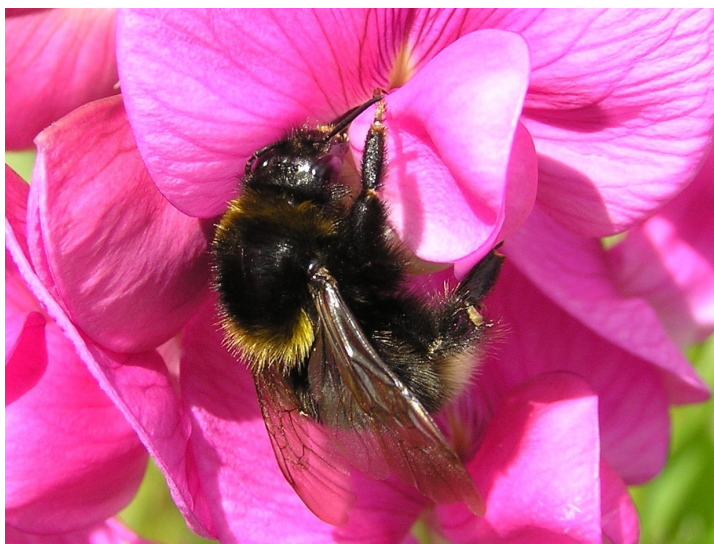
### Species distributions

All four species have undergone significant declines in their range due to the loss of wildflowers in the landscape resulting from habitat loss, habitat fragmentation and agricultural intensification. The Shrill carder bee was once widespread in southern UK but is now restricted to small areas of the South and East of England, and South Wales. The Brown-banded carder bee is now absent from most of its northern range, but is still quite common on the coast of southern England, South Wales and chalk grassland areas of Salisbury Plain. The Large garden bumblebee is found sparingly in South Wales, and

central and southern England, but has disappeared from much of its western and northern range. The Red-shanked carder has always been more common in the south-east of England, which remains the case, but is declining badly in the rest of England, Wales and north-west Scotland.

### Key brownfield habitat features for bumblebees

- Large extensive wildflower resources, notably early successional habitats with plentiful legumes.
- Forage availability throughout the active season, from April until October.
- Long grass areas, tussocks and accumulated leaf litter for nesting carder bees and overwintering queens.
- Rodent burrows to provide nesting and overwintering sites for the Large garden bumblebee.



Large garden bumblebee (*Bombus ruderatus*) © Steven Falk



Brown-banded carder bee (*Bombus humilis*) © Steven Falk



## The importance of brownfields for bumblebees

Scarcer bumblebees require large areas of wildflower-rich vegetation, and like early successional habitats dominated by legumes such as bird's-foot trefoils (*Lotus* spp.) and vetches (*Vicia* spp.). Many brownfields support a rich and varied ruderal wildflower resource linked to their history of disturbance and abandonment, and the presence of low nutrient substrates, which prevent fast growing and more competitive species from dominating. In the absence of competitive species, nectar and pollen-rich wildflowers are allowed to flourish.

A valuable feature of many brownfields results from being close to urban areas and the opportunities for colonisation that disturbance brings. This allows non-native garden escapes and former fodder crops such as Broad-leaved everlasting pea (*Lathyrus latifolius*), Lucerne (*Medicago sativa*) and Goat's rue (*Galega officinalis*) to flourish, providing useful additional forage for scarce bumblebees (Connop *et al.* 2010; Harvey 2000 & 2001).

Scarce bumblebees benefit from brownfields often being free of management for many years or only managed sporadically. An absence of grassland management can ensure that flowers are available throughout the year from April until October. In the wider landscape, wildlife-rich sites are often subject to cutting or grazing during this time, removing forage and increasing the dependency of bumblebees on unmanaged brownfields. Early season nectar and pollen sources are especially important for queens when they are stocking cells in new nests. Throughout the rest of the flight season, workers require nectar and pollen in even greater quantities for feeding grubs that will become new workers, queens and males.

The absence of grassland management on many brownfields also provides ideal nesting and overwintering spots for



Non-native Broad-leaved everlasting pea © Steven Falk

queens. In the wider landscape, intense grassland management prevents long, tussocky swards from growing and developing the thick layer of leaf litter which make ideal nesting sites for carder bees. Intense management also makes sites less attractive to small mammals, whose disused burrows are used by nesting Large garden bumblebees and most of the commoner bumblebees.

## Key forage species for scarce bumblebees

Bumblebee foraging activity will vary according to the type of habitat being used, reflecting differences in forage plants that predominate habitats such as coastal grazing marsh, chalk grassland or brownfields.

Queens emerging from hibernation in spring tend to rely heavily on willows (*Salix* spp.), White dead nettle (*Lamium album*), dandelions (*Taraxacum officinale* agg.), Ground ivy (*Glechoma hederacea*), early clovers (*Trifolium* spp.), vetches such as Kidney vetch (*Anthyllis vulneraria*), and Broad-leaved everlasting pea. New summer queens will often forage on late

### Valuable brownfield forage plant flowering periods

Bird's-foot trefoils (*Lotus* spp.) **Jun- Sep**

Black horehound (*Ballota nigra*) **Jun- Oct**

Brambles (*Rubus fruticosus* agg.) **May- Sep**

Bristly oxtongue (*Helminthotheca echinoides*) **Jun- Oct**

Clovers (*Trifolium* spp.) **May- Sep**

Common fleabane (*Pulicaria dysenterica*) **Aug- Sep**

Goat's rue (*Galega officinalis*) **Jun- Jul**

Ground ivy (*Glechoma hederacea*) **Mar- May**

Hogweed (*Heracleum sphondylium*) **Jun-Sep**

Knapweeds (*Centaurea* spp.) **Jun- Sep**

Medicks (*Medicago* spp.) **Jun- Sep**

Peas & Vetchlings (*Lathyrus* spp.) **Apr- Sep**

Ragworts (*Senecio* spp.) **Jun- Oct**

Red bartsia (*Odontites vernus*) **Jun- Aug**

Thistles (*Cirsium* spp. & *Carduus* spp.) **May- Oct**

Toadflaxes (*Linaria* spp.) **Jun- Oct**

Vetches (*Vicia* spp.) **May- Sep**

Viper's bugloss (*Echium vulgare*) **Jun- Sep**

Weld (*Reseda luteola*) **Jun- Sep**

White dead nettle (*Lamium album*) **May- Dec**

Wild teasel (*Dipsacus fullonum*) **Jul- Aug**

Willows (*Salix* spp.) **Mar- May**

clovers, thistles (*Cirsium* spp. and *Carduus* spp.), Wild teasel (*Dipsacus fullonum*) and bird's-foot trefoils.

Workers and males will use a wider range of forage, including clovers, thistles, bird's-foot trefoils, Broad-leaved everlasting pea, knapweeds (*Centaurea* spp.), brambles (*Rubus fruticosus* agg.), Red bartsia (*Odontites vernus*) and Black horehound (*Ballota nigra*).

### Bumblebee metapopulations

Scarce bumblebees tend to develop metapopulations, which are groups of small but linked populations using patches of suitable habitat scattered across the landscape. Natural cycles of local extinction are balanced by re-colonisation from nearby sites, allowing their survival across the landscape. Where there is progressive loss of suitable habitat, remnant sites become fragmented and their bee populations isolated. As sites become more isolated, it is more difficult for suitable habitat to be colonised, with progressive local extinctions leading to their declines across the landscape and the potential loss of entire metapopulations.

Some nationally important metapopulations of Shrill and Brown-banded carder bees rely heavily on landscapes containing brownfields alongside coastal grazing marsh and semi-natural grasslands. Scarcer bumblebees ideally require in the region of 10-20km<sup>2</sup> of habitat mosaics which include large, dense stands of forage (Edwards, 1998). However, flower-rich habitats of this nature are increasingly uncommon in the wider countryside. This has made large areas of high quality brownfield habitat increasingly important for scarce bumblebees.

### Threats to bumblebee populations on brownfields

The ongoing loss of brownfields to redevelopment is having a significant impact on bumblebee populations which are already in decline.

Inappropriate management of brownfields such as tidying up for public access can result in the loss of forage and nesting sites. Conversely, a long-term absence of management on a brownfield can lead to scrub encroachment and the eventual loss of open habitat.

### Creating & managing habitat for scarce bumblebees

Although an absence of management is often a key factor in the high biodiversity of brownfields, management will eventually be necessary to retain that wildlife value. Without management, brownfield sites will eventually revert to dense scrub and secondary woodland that has limited value for bumblebees.

A number of habitat creation and management methods can be used to enhance brownfields for bumblebees. Any work should be undertaken on a small proportion of a site in any one year, as managing large swathes of a site in a single fashion can lead to the loss of habitat diversity. It is also important that if the ultimate aim of management is to enhance the floral resource of a site, that a detailed knowledge of the flora is first acquired. It is important that availability of forage throughout the active season is considered and that areas of existing high interest are kept safe from interference. Methods to enhance brownfield habitats for bumblebees include:

- Rotational disturbance in scattered areas around a site to help encourage a successional mosaic with a diverse flora. Creating newly disturbed areas every few years will ensure a continuity of colonisation opportunities for many of the ruderal flower species favoured by bumblebees. Disturbance can be small scale and undertaken manually with hand tools or with machinery such as an excavator to scrape off larger areas of material and vegetation, overturn soil or simply be driven around and churn up soils. Disturbance is best undertaken during winter so that foraging is not disrupted. Consider both disturbing new areas and re-visiting previously disturbed areas to encourage a successional mosaic.



Diverse forage including both native and exotic species © Jamie Robins



Red-shanked carder bee (*Bombus ruderals*) © Steven Falk



- Diversifying topography can be extremely useful in enhancing the wildflower resource of brownfields. Using machinery to create a network of scrapes and using the arisings to create mounds will vary the topography, soil conditions and hydrology, creating a range of microclimates for different plant species to colonise.
- The addition of substrates such as industrial spoil, sand or calcareous aggregates will enhance the floral resource by creating different soil conditions and bare substrates for characteristic plant communities to develop.
- Rotational scrub and bramble clearance can help restore open habitats on sites where an absence of management has led to scrubbing over. Stumps should be treated after cutting and any humic layer or leaf litter scraped off to provide bare conditions for ruderal plants to colonise. Previously cleared areas are best managed by regularly pulling young saplings to slow succession.
- Topsoil stripping can be labour intensive but can help restore areas of bare low nutrient substrate. Machinery such as an excavator can achieve this more rapidly. Consider stripping new areas every few years or so and leaving previously stripped areas to develop, to encourage a successional mosaic which will be more likely to provide diverse forage.
- Enhancing species-poor grasslands with a select number of key forage species can be an effective way of increasing forage availability, so long as selected species can tolerate tall grasses. In these cases, a sward can be enhanced by using hand tools to create localised patches of disturbance, with a pinch of the desired seed dropped on to the bare



Shrill carder bee (*Bombus sylvarum*) on Narrow-leaved ragwort © Steven Falk

earth. Suitable species include Broad-leaved everlasting pea, Wild teasel, thistles, Hogweed (*Heracleum sphondylium*), Wild parsnip (*Pastinaca sativa*) and knapweeds.

- Creating wildflower-rich areas by preparing a larger seed bed and sowing seed can be considered where there is only limited floral diversity across a site. Wildflower enhancement should target low nutrient areas which are less likely to be dominated by coarse grasses. Creating suitable ground for sowing seed may require initial cutting, followed by herbicide spraying and a two week waiting period. Harrowing or other methods of disturbance can then remove overlying vegetation and create disturbed ground for seeds. Sowing seed can be done simply by broadcasting or using machinery for larger areas. Seed sowing times will vary by species, with some requiring an autumn sowing to overwinter in the soil.
- Cutting and grazing by livestock are best avoided on brownfields. However, if used on larger sites it must be carefully considered so as not to interfere with flower availability. Management should be avoided between April and October, and arisings from any cutting should be removed to actively lower nutrient status. Management should be restricted to a proportion of a site, to ensure a strong resource of unmanaged grasslands is always present to provide nesting habitat for carder bees. Large garden bumblebees are also likely to benefit from unmanaged areas, which are more likely to attract the small mammals that create their nesting sites.
- Any rabbit grazing and burrowing should be retained, as it helps maintain herb-rich short swards and encourage patches of valuable Gorse scrub and tall herb species such as thistles and Weld (*Reseda luteola*). Rabbit burrowing and latrine activity also create localised disturbance and variation in nutrient enrichment.
- Recreational use should be encouraged as walking and cycling create localised areas of disturbance.

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