

# The Short-haired bumblebee reintroduction project

10 year report  
by Nikki Gammans



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# Ten years of the Short-haired bumblebee reintroduction project: a landscape-scale approach to conservation

## Executive summary

Towards the end of the last century, in 1988, the Short-haired bumblebee (*Bombus subterraneus*) was seen for the last time in Britain, on the Dungeness peninsula in Kent. Two decades later, in 2009, the newly-formed Bumblebee Conservation Trust joined the RSPB, Hymettus, and Natural England in an ambitious plan to carry out the first bumblebee reintroduction in history, and reintroduce the Short-haired bumblebee to Dungeness. Ten years on, the project has been garlanded with awards and is the Trust's longest-running conservation project.

It was originally planned to reintroduce Short-haired bumblebees from the New Zealand population – these are the descendants of British queens shipped across the globe more than a century ago – but this eventually proved impossible. Instead, between 2012 and 2016 more than 200 Short-haired bumblebee queens were collected from the strongest population in western Europe (around Skåne, in southern Sweden), and released onto the RSPB reserve at Dungeness.

The releases were only ever the tip of a very large iceberg, however. The precise reason for the species' extinction isn't known for sure, but decreasing areas of suitable habitat – and increasing distances between bumblebee-friendly patches – was thought to have played a major role. Therefore, before any foreign trips, the project's first aim was to create as much bumblebee-friendly habitat as possible, tailored to the long-tongued Short-haired bumblebee. Dungeness was a great starting point as it was already a flower-rich area, but bumblebees need a lot of flowers!

Initially the project aimed to create 100 hectares – equivalent to 100 football pitches – of flowers by the time the first Swedish bees were released. Ten years on almost 25 times that area – 2,460 hectares – receive advice from the project.

As well as the sheer quantity of flowers, much of the work has focused on extending the flowering season, to make sure queens emerging from their winter dormancy have food as close at hand as possible, and tweaking the types of flower present to make the mix as suitable for long-tongued bees as possible. To help with this, staff and volunteers have collected data throughout the project on the flowers visited by different bumblebee species. This has meant that more of the favoured flowers have been planted, and has generated a treasure trove of data to guide future bumblebee conservation projects, and the Trust is currently working on analysis of this.

Audacious projects are catnip for the media, and the project has been featured widely in the national and local press, and on radio and TV. Project staff have also done a huge amount of direct outreach – through talks, guided walks, and so on more than 30,000 people have heard about the project in person, as well as millions more through the media. But while support of any kind is great – and the project is supported from as far afield as Australia and the USA – buy-in from the local community is key for any conservation project.

The local community in the project area, from Dymchurch and Ashford to the High Weald, have been fantastic throughout. Across the region they bought in to the project's aims from the start and donated their money, time, and land. Almost 100 landowners are involved – from local councils to rare-breeds centres, farmers to the RSPB – and the volunteer team has grown from six to 45, from as far afield as Surrey and north Kent. They spend around 3,000 hours per year planting flowers, managing stands at village fetes, counting bumblebees, raising money, surveying wild plants, amongst much else besides. The project simply wouldn't function without them.

The Swedish queens were seen for 1-2 days post-release every year, and seemed to be foraging successfully. Possible workers were seen in the first couple of years, but the species is very similar to the Garden and Ruderal bumblebees and it wasn't possible to unequivocally confirm the species from any of the photos taken. After this, the project began to use non-lethal sampling and DNA analysis of all possible sightings, but in spite of a huge surveying effort there have been no confirmed sightings of the species. Regrettably, the most likely conclusion is that the reintroduction has not succeeded, although monitoring will continue.

Despite this, the project as a whole has done a huge amount of good, in the project area and beyond. As a flagship project for insect conservation it has inspired people across the country to look beyond the over-promoted vertebrates for their wildlife interest. As a conservation project it has massively helped at least three rare bumblebee species: the Brown-banded carder bee, Moss carder bee & Ruderal bumblebees (*Bombus humilis*, *B. muscorum*, & *B. ruderatus*) have all become much more abundant in the project area, including returning to areas where they had not been recorded for up to 25 years.

In particular, the project area is now almost certainly the best place in the country for the Ruderal bumblebee, a species which at one time looked to be following the Short-haired bumblebee towards extinction. On nature reserves which have worked with the project bumblebees have increased up to eightfold: on farmed areas (where work has generally been less intensive) bumblebees are up threefold.

The Short-haired bumblebee may still be extinct in the UK. But the future of our 24 remaining species is more secure because of a decade's work by the Short-haired bumblebee reintroduction project.



## Background and aims

The Short-haired bumblebee reintroduction project was formed in 2009 by Natural England, the RSPB, Hymettus and the Bumblebee Conservation Trust with the central aim of attempting to reintroduce the Short-haired bumblebee (*Bombus subterraneus*) to the UK. This species was the second bumblebee to go extinct in the UK during the 20<sup>th</sup> century: it was last seen in the UK in 1988 at Dungeness, and was declared nationally extinct in 2000. However, populations were still extant in continental Europe and New Zealand.

The project was finalised with four overall aims:

1. Attempt to reintroduce *Bombus subterraneus*, the Short-haired bumblebee, into the UK and improve rare bumblebee diversity and abundance.
2. Maintain long-term monitoring of the creation and longevity of suitable bumblebee habitat across the project area.
3. Maintain a high public profile.
4. Have a sustained and appropriate volunteer group.

This report outlines what has been achieved over the last ten years of the project.



Perennial wildflower meadow created by the project on a smallholding in Kent.

## **Aim 1: Attempt to reintroduce *Bombus subterraneus*, the Short-haired bumblebee, into the UK and improve rare bumblebee diversity and abundance**

### **Queen collection for reintroduction**

When the project began in 2009, New Zealand was considered the most suitable source of Short-haired bumblebee (*Bombus subterraneus*) queens for a reintroduction into the UK. This is because the *B. subterraneus* population in New Zealand are direct descendants of the now-extinct UK population, having been introduced to the islands in the late 19<sup>th</sup> century by the New Zealand Acclimatisation Society.



Fig. 1.1: Queen Short-haired bumblebee, *Bombus subterraneus*, foraging on Red Clover in New Zealand

In the first two years of the project, attempts were made to rear colonies of *B. subterraneus* in New Zealand, in order to produce fresh queens to reintroduce back to the UK. Unfortunately, the captive rearing was not successful for a variety of reasons. This included a low abundance of wild queens, lack of successful egg-laying by queens in captivity, inexperience of rearers with this species, and the difficulty of seasonality between the UK and New Zealand for transport of queens to the UK (the populations being six months out of sync).

The New Zealand population has also gone through a genetic bottleneck (it is now thought that only two queens founded the population), therefore genetic diversity is low. This reduces the population's ability to react to change, such as the attempted switch from southern to northern hemisphere seasons, and also to respond to diseases, which are widespread in European bumblebees but are not found in New Zealand. Therefore it was decided to use a European population as the source for queens for the reintroduction. Only two countries in Europe have a stable or growing population of *B. subterraneus* - Estonia and Sweden.



Southern Sweden was selected as the project's source population because local recorders have a good understanding of the location of the species, the region has a similar seasonal pattern to the UK, and genetic analysis revealed that this population was a close match for museum specimens of the extinct UK population (now more so than New Zealand due to the inbreeding of the latter population).

In 2011 an initial field survey and queen collection was carried out in Sweden, and two *B. subterraneus* collection transects were established in the south and west of Skåne, Southern Sweden. The transects were 30km long and 30km apart from each other in order to collect over a large area and minimise disease and parasite presence, as well as reducing the chance of collecting highly related queens and thus improving genetic diversity of the eventual UK population. A maximum number of collected queens (100 per year for five years) was agreed with the Swedish authorities, after consultation with bumblebee experts in order to minimise the effect of removing this number of individuals.

All queens caught were quarantined before any UK release, which involved screening for a range of parasites and diseases. Only uninfected individuals were cleared for release into the UK. Disease screening and then subsequent quarantine was conducted by Prof Mark Brown, his PhD students Gemma Baron and Catherine Jones, and laboratory technicians from Royal Holloway University. To minimise the number of diseased queens brought back to the UK to enter quarantine, Catherine Jones was employed by the project from 2014-16 to come to Sweden to screen faecal samples from queens for the parasite *Crithidia* spp. Any queens infected were re-released, and new queens collected as replacements.

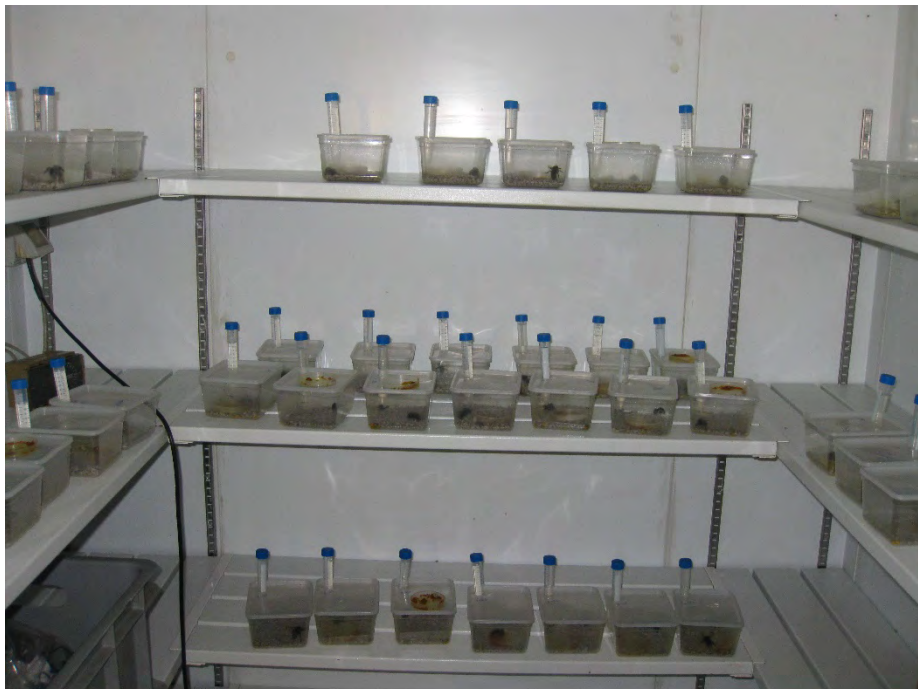


Fig. 1.2: Quarantine of Swedish short-haired bumblebee queens *B. subterraneus* in 2012 at Royal Holloway University of London

Queen collections for the reintroduction began in 2012. Each year the project manager and ten volunteers went to Sweden as soon as the air temperature reached

16-18°C, the temperature *B. subterraneus* queens begin to emerge from their winter dormancy. Collecting trips were timed to fall at the start of the queen emergence period in order to minimise the risk of collecting queens which had already begun building a nest. This was both to avoid leaving early nests without queens, and because queens which have already established a nest will generally not do so again.

Collected queens were stored in a fridge (simulating winter dormancy, keeping the queens calm, and reducing their need to feed). When either five collection days had passed or 100 queens had been collected, all collected queens were brought to the UK. They were quarantined for two weeks in the labs at Royal Holloway University before the healthy queens were released at RSPB Dungeness. Between 2012 and 2016, 415 queens were imported from the Swedish population, and of these 204 cleared quarantine and were released.



Fig. 1.3: Project manager Nikki Gammans releasing a queen Short-haired bumblebee at RSPB Dungeness during the 2016 release event.

Data from the quarantine and disease screenings was used for a 2017 paper in the scientific journal *Ecohealth*, entitled 'Bringing back a healthy buzz? Invertebrate parasites and reintroductions: a case study in bumblebees'<sup>1</sup>. The paper used the *B. subterraneus* reintroduction as a case study for management of parasites and diseases in invertebrate reintroduction projects.

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<sup>1</sup> Brown, M.J.F., Sainsbury, A.W., Vaughan-Higgins, R.J. *et al.* Bringing Back a Healthy Buzz? Invertebrate Parasites and Reintroductions: A Case Study in Bumblebees. *EcoHealth* **14**, 74–83 (2017)  
doi:10.1007/s10393-015-1093-5



## Bumblebee surveying

Once the first short-haired bumblebee queens were released, staff and volunteers put a huge amount of time and effort into searching for them. Sightings of queens would indicate that released individuals had survived, and queens carrying pollen would suggest nesting attempts. Worker bees would show that nest founding had been successful, and males and new queens in late summer would be proof that the nests had produced new reproductive individuals. From 2013, sightings of newly emerged queens in spring, before that years' release of Swedish queens, would prove that nests had successfully produced new reproductive individuals, which had in turn successfully mated and survived through the winter. To have the best chance of finding the bumblebees, three main survey types were used.

## Transects

Transects (fixed routes walked on a monthly basis from March to October) were set up from the beginning of the project as part of the Bumblebee Conservation Trust's BeeWalk bumblebee-monitoring scheme ([www.beewalk.org.uk](http://www.beewalk.org.uk)). These had the aim of standardising the monitoring of all bumblebee species in the project area so that population changes could be measured, both of existing species and, it was hoped, of the reintroduced, *B. subterraneus*. Transects were established at sites where it was thought *B. subterraneus* may appear but also in areas where habitat improvements were being made or were beginning, as well as at existing high-quality sites known as controls (such as at SSSIs where no improvements could be made or where Natural England advisors had already been advising for a long period of time). This allowed the project to monitor any potential changes in bumblebee abundance and diversity, and link them to improvements in habitat quality.

Between 2009 and 2019, the Short-haired bumblebee reintroduction project set up 26 BeeWalk transects and another 23 were established between 2017 and 2019 by the Green Lanes project, within the overall Short-haired bumblebee reintroduction project area (Figs 1.4 and 1.5) (see section 2 for an explanation of the Green Lanes project).

These transects have been walked by trained volunteers, with assistance from the project manager or Green Lanes trainee.

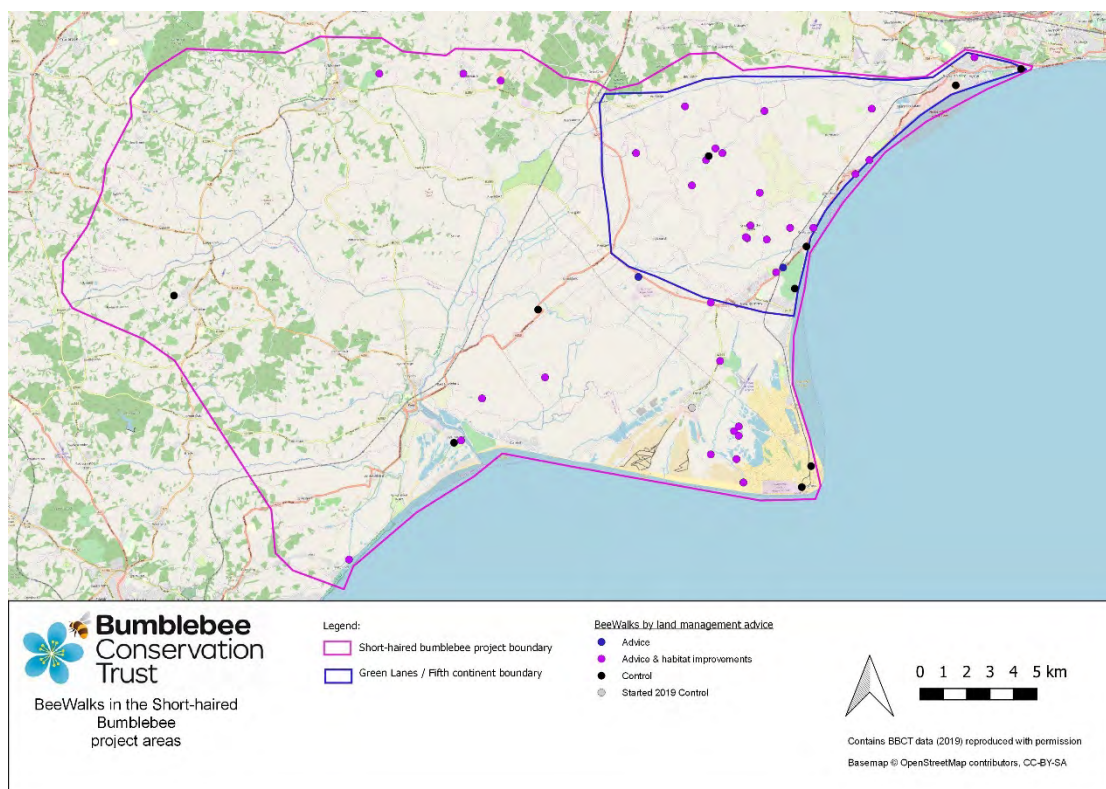


Fig. 1.4: The location of the 49 BeeWalk transects established by the Short-haired bumblebee and Green Lanes projects. Transects are colour-coded according to the type of habitat intervention at each site.

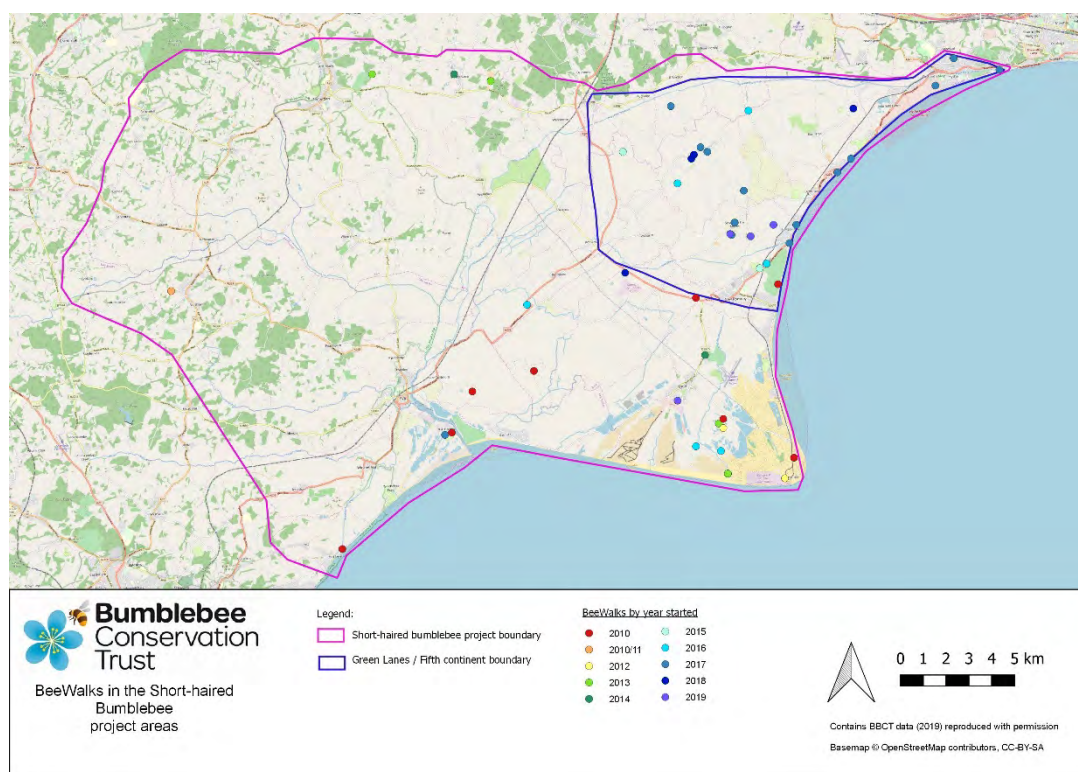


Fig. 1.5: The location of the 49 BeeWalk transects established by the Short-haired bumblebee and Green Lanes projects, colour-coded by start date.

## Targeted surveying

While transects provide a standardised, comparable method of data collection, they are not the best way to fully survey a site, particularly for species only present in small numbers. To fill in the gaps, the project conceived the idea of bumblebee blitz days, where staff and project volunteers intensively survey flower-rich areas.

For these events, volunteers are placed in groups of 2-3, mixing experienced and new volunteers, and these groups survey a particular area, recording all the bumblebee species present, and which flowers they were visiting. At the start of the project these blitz days were held every six weeks, becoming more frequent as the volunteer base grew. From 2016 they have been fortnightly events from March to October, with between eight and 22 volunteers participating in each blitz.

The bumblebee species present have also been recorded on separate site visits to farms and other project landowners by the project manager and other Trust staff and volunteers, especially where transects had not been organised. All bumblebee data has been entered into a database by volunteer Geoff Allen on an annual basis.

## Findings

A great success of the project has been the increase of rare bumblebee species. This is demonstrated most impressively by the up to eightfold increase in abundance of the Ruderal bumblebee *B. ruderatus* and the Brown-banded carder bumblebee *B. humilis* where the project has worked with landowners. Other rare species such as the Moss carder bumblebee *B. muscorum* and Red-shanked carder bumblebee *B. ruderarius* have also increased in number and the Shrill carder *B. sylvarum* was found in the area for the first time in several years, although the population now appears to have gone extinct.

Many of these species have now been recorded in areas where they had not previously been recorded for up to 25 years. Undoubtedly much of this is due to the massively increased search effort from the project's monitoring work, but it is likely to also partly be the result of habitat interventions made by the project to improve forage for rare bumblebees by increasing flower species diversity and abundance, seasonal forage, and the amount of bumblebee-friendly land on a landscape scale.



Fig. 1.6: Male Ruderal bumblebee *B. ruderatus* foraging on Black Horehound. A species which has increased across the project area

During the release years (2012-2016), the Swedish queens were seen on multiple occasions at the release site, for up to three days post-release. It was hoped that their absence thereafter was because they had dispersed across the Dungeness reserve, a large and flower-rich area where small numbers of a species could easily be missed, even by targeted searches. This supposition was backed up by the patchy nature of records of other rare bumblebee species known to be established on the reserve.

Worker bumblebees which appeared to be *B. subterraneus* were also seen during the release years. These were photographed *in situ* and agreed as workers of *B. subterraneus* by experts in Sweden and the UK who were familiar with the species. In 2016, in order to confirm these sightings, and to find out how many nests were present, tarsal clips were taken from 16 putative workers, including some which had been confirmed as far as was possible from photographs, and their DNA analysed. Unfortunately, these proved to be an unusual form of the Garden bumblebee, *B. hortorum*, and not *B. subterraneus*. This threw the previous photographic records into doubt, and it remains uncertain whether the workers previously recorded were indeed *B. subterraneus*. Since 2016 all putative *B. subterraneus* have undergone DNA barcoding to confirm their identity, but none have been confirmed as that species.

Therefore, there is as yet no evidence that the reintroduction part of the project has been successful. This comes with caveats: the reintroduction site is large and it is difficult to survey some areas within it, and there are numerous examples of bumblebee populations being overlooked, sometimes for long periods. However, the most likely conclusion is that the reintroduction of *B. subterraneus* has not succeeded. There are a number of potential reasons for this:

- Collected queens will have emerged from their winter dormancy in Sweden, only to be returned to it when stored in a fridge during collection and then quarantine, for at least two and up to three weeks. This may have disrupted the collected queens' development and shortened their lifespan or otherwise decreased their fitness.
- Delayed release (late May-early June) post-quarantine may have meant that prime nesting spots were already occupied by other bumblebee species, leaving *B. subterraneus* queens to attempt to nest in suboptimal sites.
- The total number of queens released over 5 years was low – the maximum number of queens which could be collected was 100 per year, and after disease screening and quarantine the actual number released each year on average was only 40. This may simply not have been a large enough number to establish a colony: nest establishment is a very difficult time for all bumblebee species and there is a high loss rate at this stage.
- A critical factor may have been missing from the release area, such as pollen of a particular type at a particular time. Although the project carried out exhaustive literature searches and worked with multiple experts who are familiar with the species in a British and European context, knowledge of the species is not complete.



The project believes it tried everything possible to try and reintroduce this species to the UK.

## Bumblebee forage preference analysis

As all bumblebee species and flower visitations were recorded on surveys, we now have excellent data on forage selection. This has been categorised into several groups: all bumblebee species, rare species, long tongued species, and each species individually. For each bumblebee species the forage preferences have also been broken down by month and by forage period - early (April-May), mid (June-July), and late season (August-September).

A selection of these graphs are shown in Figs 1.7-1.10. All the data analysed to date has been on flower visitation collected by the Short-haired bumblebee reintroduction project, but it is intended that the data from the Green Lanes project, and flower survey data will be added so that a greater degree of visitation preference can be inferred. This analysis will be published in order to provide vital information to inform land management for rare bumblebees, by suggesting the best flower species to help increase the length of the forage season, or simply make the area more bumblebee-friendly.

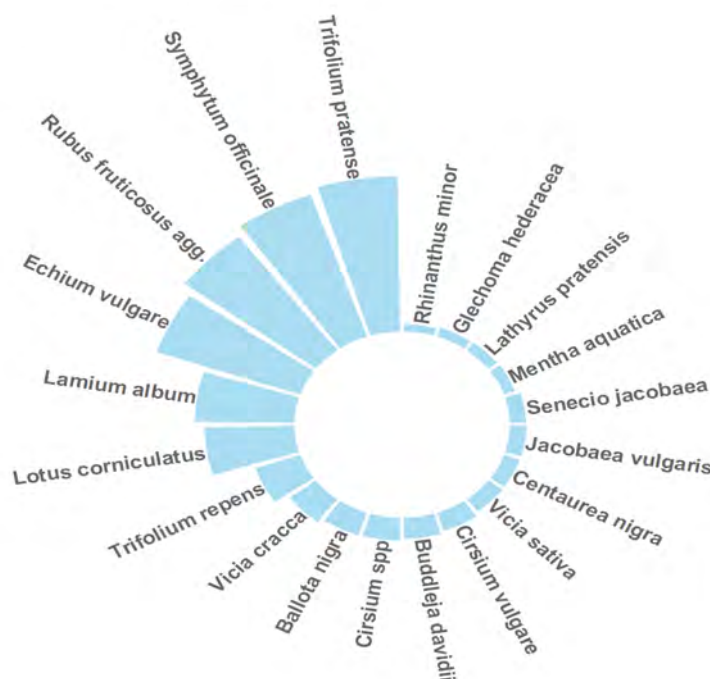


Fig. 1.7: The top 20 flower forage species visited by all bumblebee species recorded by the Short-haired bumblebee reintroduction project. These are not standardised by flower abundance.

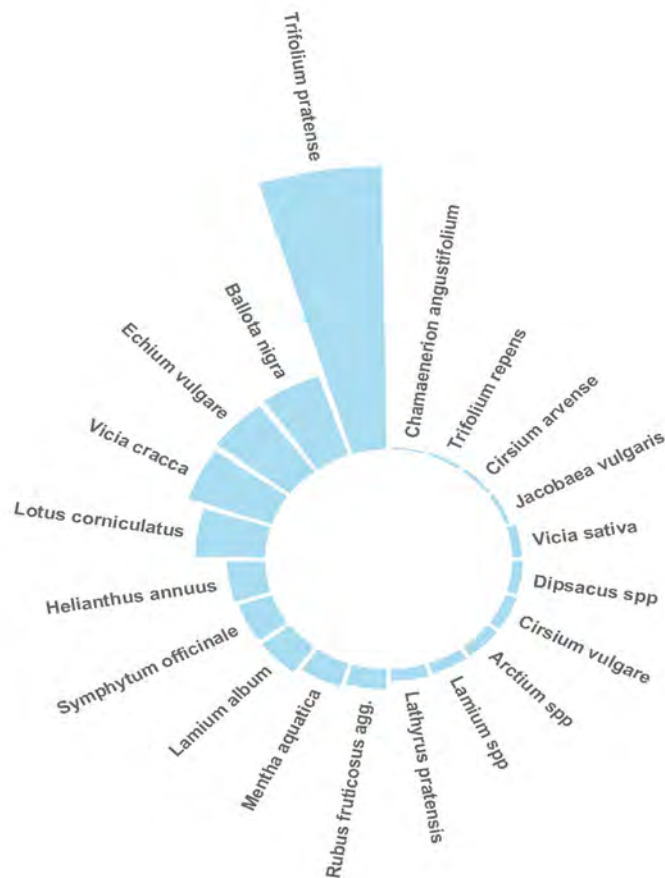


Fig. 1.8: The top twenty flower forage species visited by rare (UK S41/BAP) bumblebees recorded by the Short-haired bumblebee reintroduction project. These are not standardised by flower abundance.

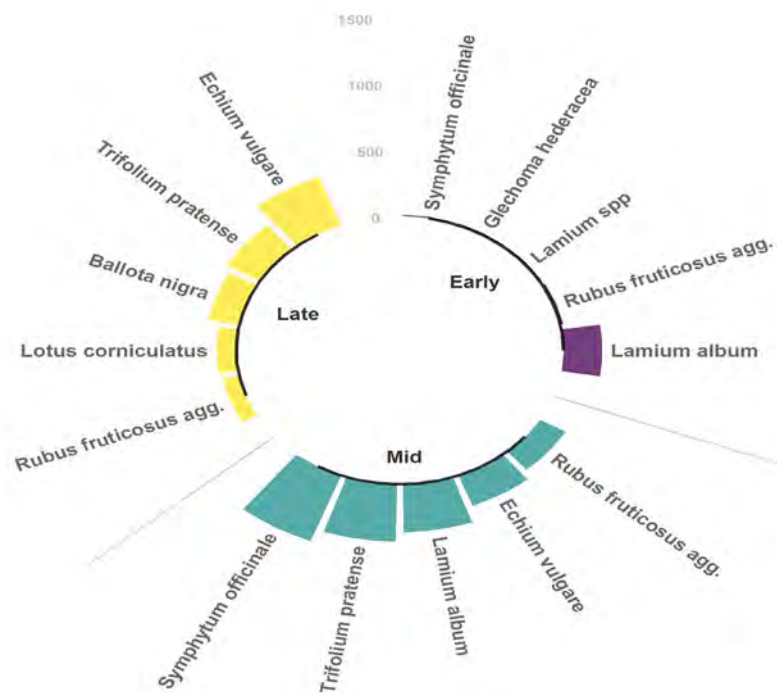


Fig. 1.9: The top five flower species visited by long-tongued bumblebee species during each season: early (April-May), mid (June-July), and late (August-September). These are not standardised by flower abundance.



Fig. 1.10: The top five flower species visited by the Ruderal bumblebee, *Bombus ruderatus*, during each month across the life of the project. These are not standardised by flower abundance.

## Aim 2: Maintain long-term monitoring of the creation and longevity of suitable habitat across the project area

When the project began in 2009 it was with the aim of working on 100 hectares within 10km of the release site at RSPB Dungeness.

Farmers were contacted through introductions by our project partners Natural England, direct contact, and through invitations to annual bumblebee farm day demonstration events hosted at farms we were already working with. Smallholders and other landowners (such as golf courses or the Environment Agency) were approached through networking at meetings, attending outreach events, or direct contact.

The project provided bespoke advice on creating, maintaining, managing, and restoring flower-rich habitat. Bumblebees forage differently depending on their tongue length: *Bombus subterraneus* has a long-tongue, so management interventions have particularly focused on providing forage for rare long-tongued bumblebee species. This has been a two-way process, as ideas were adapted to individual circumstances. For example, a good relationship has evolved with RSPB Dungeness around discussions of rotating livestock, timing of grazing, and hay cuts.



Fig. 2.1: Craggs Large Field at RSPB Dungeness, where the Short-haired Bumblebee Project and RSPB are working in partnership to improve floristic diversity and seasonal length on the reserve's wild flower meadows

The aim of working with farmers and landowners is to create a greater diversity and abundance of (ideally native) flower-rich patches over a wide area, making the whole landscape better for bumblebees. In particular, this has involved improving the seasonal forage available for rare bumblebee species. This seasonal forage is split into three time periods - early (April-May), mid (June-July), and late (August-September). At a landscape scale, forage is particularly lacking in the early and late periods which are crucial for queen survival and development. The project has provided advice, and in some cases also extra support and resources, for habitat improvements in the form of project volunteers and staff.





Fig. 2.2: Wild flower meadow created under a wind turbine by the project volunteers

Some areas (listed as ‘control’ sites) didn’t need any extra work (e.g. where the Natural England advisor had a long-standing relationship with an area and work had already been done, or the area was a well-managed SSSI such as the Dungeness estate).

During the first three years, as the project focused on sites within a 10-15km radius from RSPB Dungeness, most work was with farmers and landowners from the south and west of Romney Marsh (particularly around East Sussex, moving as far as the border with the High Weald).

As the project developed during 2012-2016, it expanded towards the central and northern areas bordering Ashford. Between, 2017-2019 the development of the Fifth Continent’s Green Lanes for Bumblebees project extended work further to the east as far as Hythe (Figs 2.3, 2.4, 2.7, & 2.8).

### **Green Lanes traineeship (part of the Fifth Continent Project)**

The Green Lanes for Bumblebees project is part of the Kent Wildlife Trust’s Fifth Continent project, focused on providing bumblebee habitat along road verges, along with outreach and monitoring of both habitat and bumblebees.

The Short-haired Bumblebee Project manager worked with Kent Wildlife Trust to develop the project, and the Heritage Lottery Fund (now National Lottery Heritage Fund) funded the new project in 2016. For each of the three years 2017-2019 the project has supervised a trainee for 6 months of the year focusing on the area of East Romney Marsh (Figs 2.3, 2.4, 2.8 & 2.9).

The two projects are closely linked, with similar aims and methodology. The Green Lanes project area also lies entirely within the Short-haired bumblebee reintroduction project area and consequently for the purpose of statistical analysis of habitat advice

and bumblebee records we have combined both projects in order to have a greater sample size.

## Farmers

A total of 50 farmers have worked with the projects to date - 36 in the Short-haired Bumblebee Project, and 14 in the Green Lanes project area (where some of the farmers were already engaged with the Short-haired Bumblebee Project, but are now grouped in Green Lanes). BeeWalks, bumblebee blitz days and ad hoc surveys and wild flower surveys have been undertaken at farms, and advice given on seed mixes, sowing times, grazing regimes, hay cutting, etc. This advice is written up into a report format for the farmer. All farms that have engaged with the Project have been offered bespoke advice tailored to the farm, with frequent repeat visits if necessary, to build a rapport and to advise over the long-term.

Overall, the Green Lanes project has provided direct habitat management advice to 164.85ha, and the Short-haired Bumblebee Project on another 1,483.41ha. The project has developed an excellent working relationship with local farmers and this engagement has proved to be one of the most successful parts of the project.

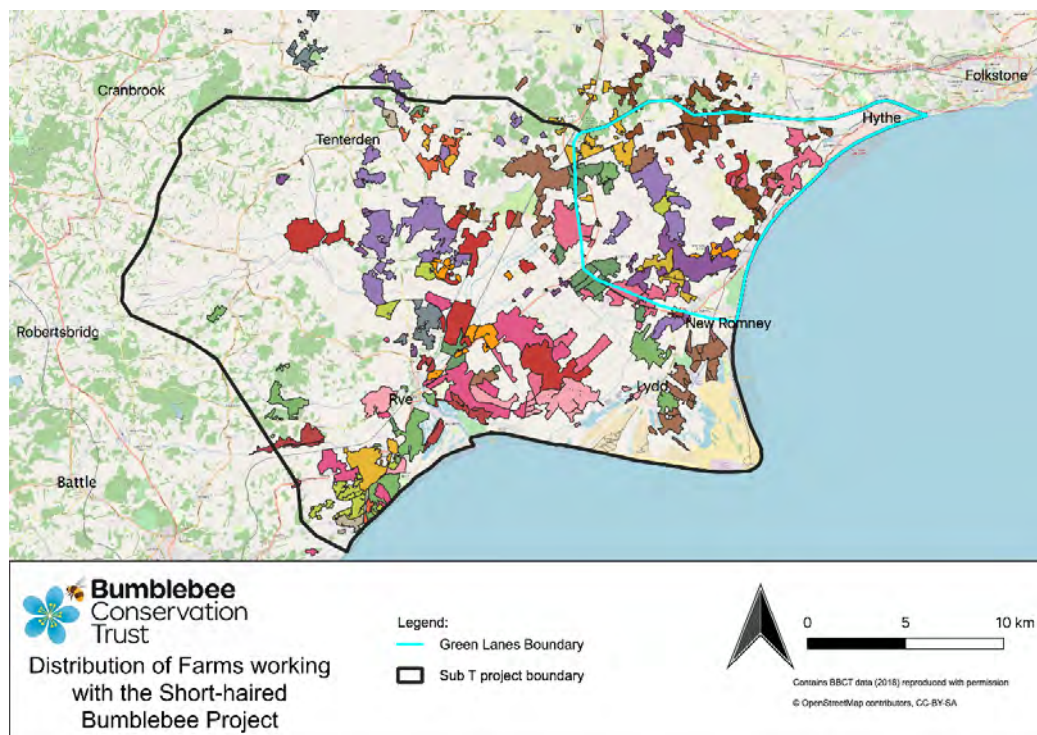


Fig. 2.3: Location and total area of farmland which have received advice from the Short-haired bumblebee and Green Lanes projects, 2009-2019.



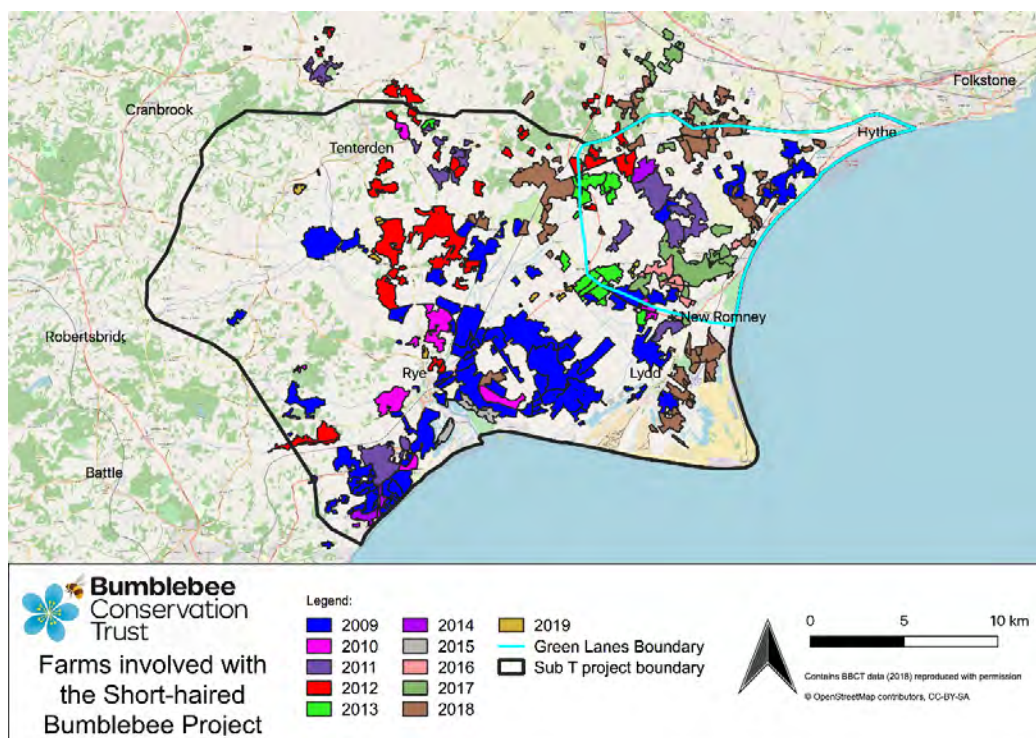


Fig. 2.5: Farm locations across the Short-haired bumblebee reintroduction project area, coloured by the years each became involved with the project.



Fig. 2.6: Landowners at a bumblebee farm day event held at Bosney Farm, Iden, East Sussex, during 2011, demonstrating the project's habitat management interventions.





Fig. 2.7: Pollen and nectar strip at Brissenden farm St. Michaels, Kent, during summer 2013.

## Non-farming landowners

Help and advice has been given to a total of 45 other landowners, 27 in the Short-haired bumblebee reintroduction project and 18 in Green Lanes (some landowners were previously worked with under Short-haired bumblebee but for ease are now grouped under Green Lanes), Figs 2.8 & 2.9. Both projects have limited financial resources, equipment and time, so work has been focused in areas that can be managed long term by the land owner or by project volunteers.

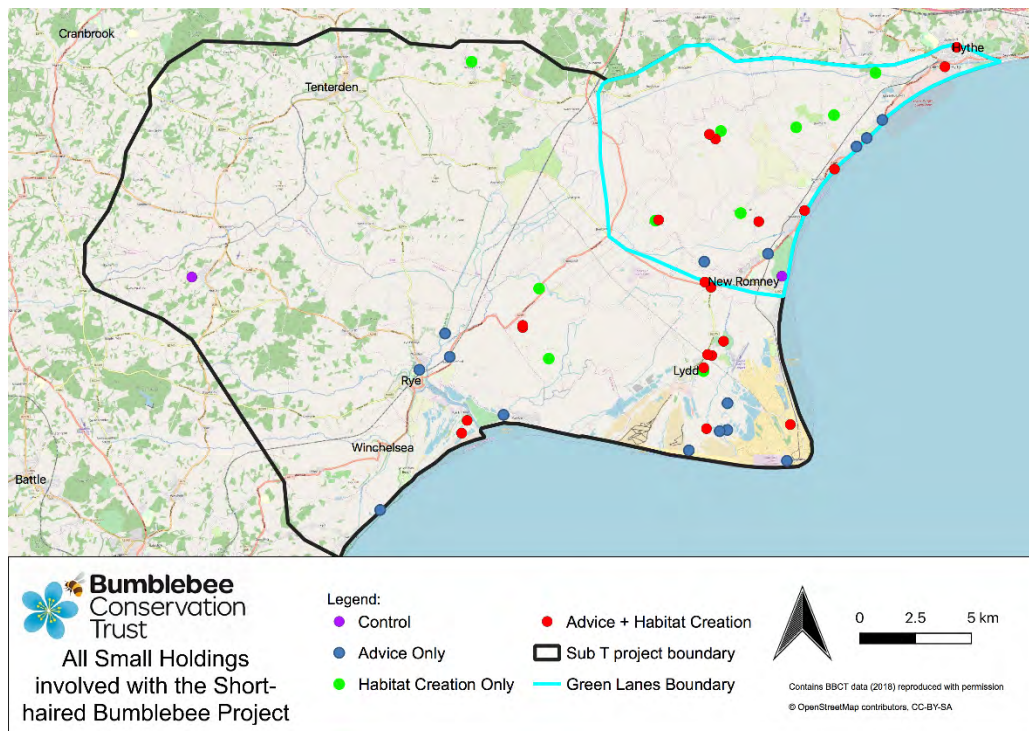


Fig. 2.8: Point locations of all non-farm landowners who have worked with the Short-haired bumblebee and Green Lanes projects, and the type of work carried out on each.



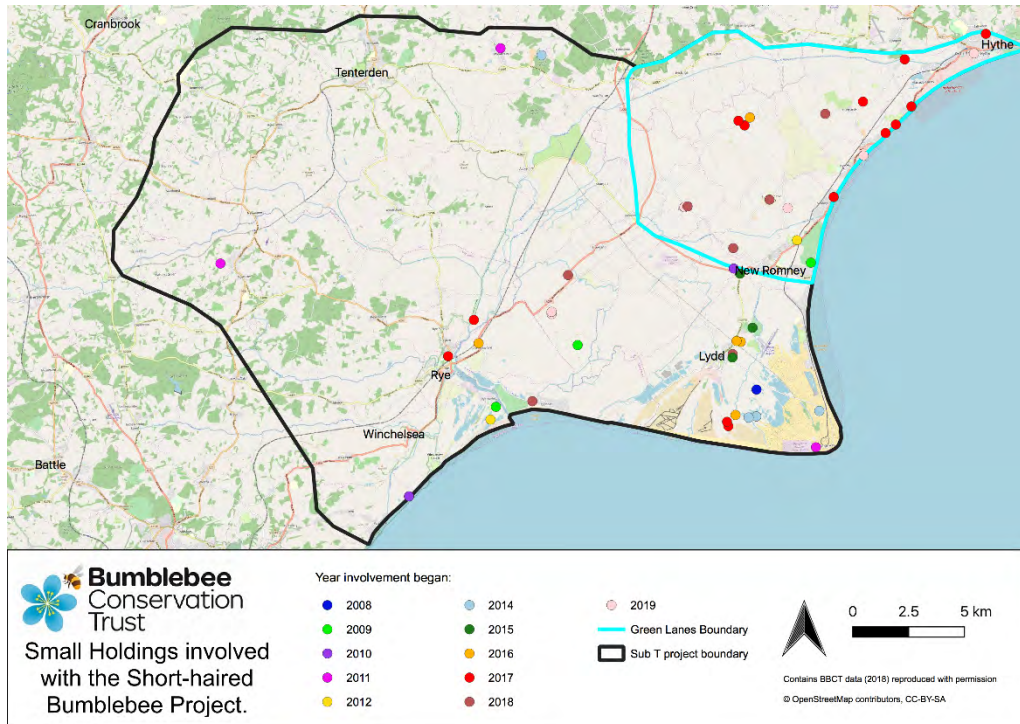


Fig. 2.9: Point locations of all non-farm landowners who have worked with the Short-Haired bumblebee and Green Lanes projects, categorised by the year each began working with the projects.

In many cases, landowners have ‘donated’ a piece of land for the Project to manage, and the Project has created and implemented a management plan for the area.

Various methods of habitat creation have taken place at several of the sites, including planting Russian Comfrey *Symphytum x uplandicum* (a plant that is sterile and non-spreading but will provide nectar and pollen for long-tongued bees, kindly donated by Frank and Peggy Wood), sowing perennial and annual seed mixes, creation of herb gardens, and planting plugs of Common Mallow *Malva sylvestris*, Ground Ivy *Glechoma hederacea* and White Dead-nettle *Lamium album*, amongst many others. Such planting aims to increase floristic diversity and extend the seasonal forage length.

This planting has been carried out through volunteer work parties and corporate charity days by staff from Credit Suisse (repeat visits), SAGA (repeat visits), EDF, & Balfour Beatty. To date the Short-haired bumblebee reintroduction project has given habitat management advice for 447.6ha of non-farm habitat, and the Green Lanes project for 214.56ha and 36km of B roads.



Fig. 2.10: Credit Suisse staff attending a corporate charity day, spreading green hay at a smallholding near Lydd, Kent.

Since 2017 the Green Lanes Project has worked with Folkestone and Hythe Council, and Kent County Council on improving the cutting regime along the verges of 36 km of B-roads in Romney Marsh. Habitat creation is ongoing along a 10km stretch of these highways. We believe this is the longest continuous B-road habitat improvement to be worked on in the UK. In total, across the farmed and non-farmed areas receiving advice from the Short-haired bumblebee (1,483.41ha + 447.6ha) and Green Lanes (164.85ha+ 214.56ha) projects we have advised on, improved the management of, restored and recreated approximately 2,459.61ha of bumblebee-friendly habitat.

### Statistical analysis

The Bumblebee Conservation Trust's Data Monitoring Officer Dr Mia Derhé is currently analysing data collected by the project to examine which habitat improvements have made the biggest improvements for bumblebees.

Analysis is ongoing, but a Generalised Linear Mixed-Effect Model (GLMM) has been used to investigate the effect of the project's habitat interventions, both overall and split across reserve designation status. This analysis uses data from the entire Short-haired bumblebee reintroduction project area (including Green Lanes data) to compare bumblebee numbers on sites before and after interventions were implemented, with a particular focus on rare bumblebees. The analysis is ongoing and will be published as a scientific paper, but the preliminary results demonstrates that rare bumblebees do increase as a result of the project's interventions ( $\chi^2=15.204$ ,  $p < 0.01$ , Fig 2.11).

Changes to the management of land were correlated with increases in rare bumblebee abundance which were almost eightfold on nature reserves (where management has generally taken place over a greater area & timescale), and approximately threefold away from reserves (Fig 2.11). These results are

preliminary, there is a sizeable error component, and correlation does not equal causation, but these findings are promising nonetheless.

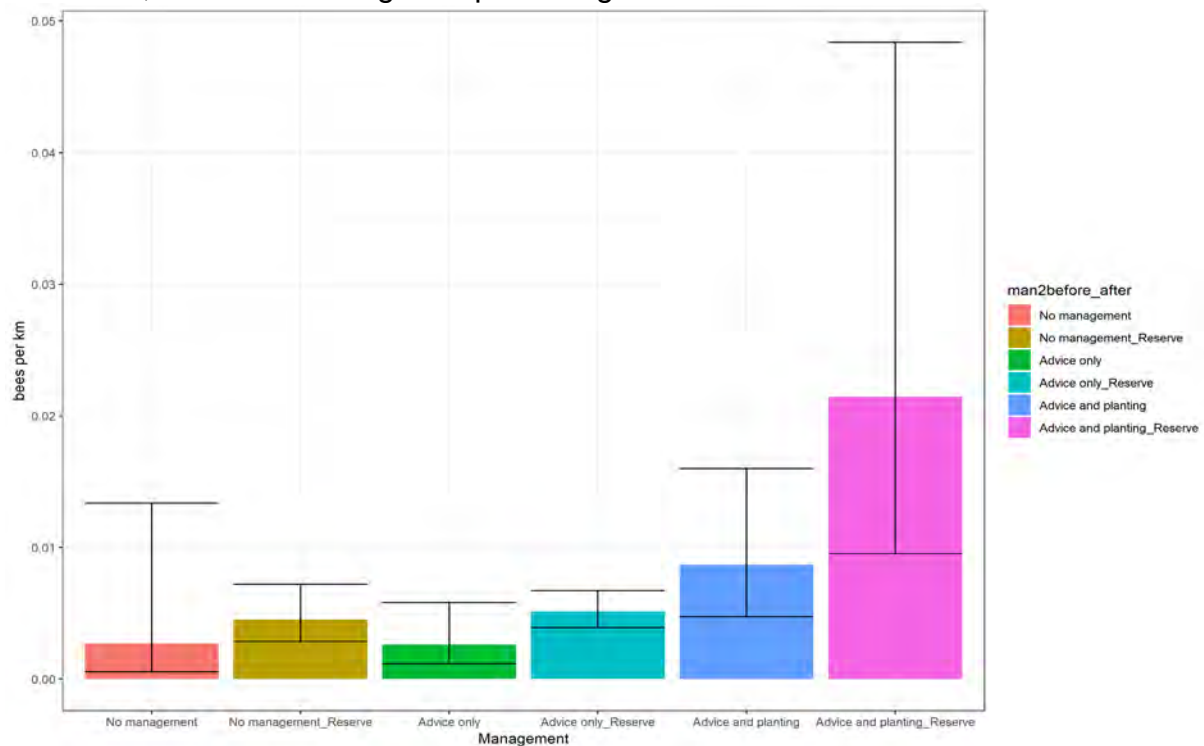


Fig. 2.11: Generalised Linear Mixed-effect Model results demonstrating the difference in abundance of rare bumblebees (NERC act Section 41 species) within the Short-haired bumblebee reintroduction project area, categorised by the type of habitat improvement works undertaken. Abundance is bees recorded per kilometre of transect walk undertaken.

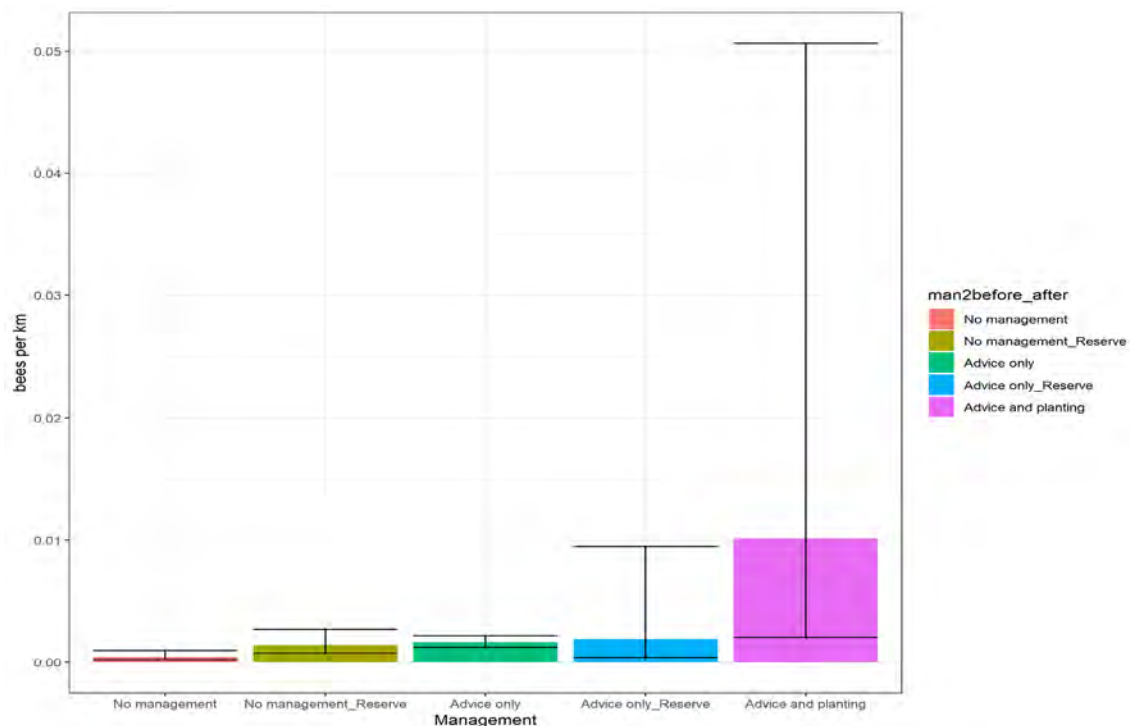


Fig. 2.12: Generalised Linear Mixed-effect Model demonstrating the difference in abundance of a rare bumblebee (Ruderal bumblebee, *Bombus ruderatus*) within the Short-haired bumblebee reintroduction project area, categorised by the type of habitat improvement works undertaken. Abundance is bees recorded per kilometre of transect walk undertaken.

The three rare bumblebee species most frequently encountered in the project area, the Brown-banded carder bumblebee *B. humilis*, Moss carder bumblebee *B. muscorum*, and Ruderal bumblebee *B. ruderatus*, all show a trend towards increased abundance in areas where the project has carried out habitat advice and planting. The Ruderal bumblebee shows the most significant change ( $\chi^2=19.822$ ,  $p<0.001$ , Fig 2.12).

If these results hold true as the analysis progresses, it would suggest that the project's habitat advice and additional planting is successful, demonstrating that habitat improvements are making a positive difference for rare bumblebee species. More widely, they would support the wider use of these techniques across the country to help to conserve rare bumblebee species.

## Testimonials

Simon Wright, Lamb Farm, East Sussex:

*'I have listened to advice given by the Short-haired bumblebee reintroduction project over several years. No longer do I just accept we have bees on the farm, but I have taken an active role in encouraging their numbers by simply tweaking my farming system to deliver the habitat bees require. It has been rewarding to see the population of bees grow over the years.'*

David Harrison, Little Omenden Farm, Kent:

*'We really value the Short-haired bumblebee reintroduction project's input and advice, and the encouragement that you and your colleagues show. This leads us to think that we are going in the right direction for wildlife and a sustainable and resilient farming system.'*

Liz Davis, Brodnyx small holding, Kent:

*'Thank you for the management plan - it's marvellous and a real help. I was heartened and excited to hear what you said about the field and also about what you observed there. I've been using it today to order native wild flower seeds and will sow some and bring others on in seed trays. Thank you for donating the comfrey rhizomes I have and planted them out and they are now thriving.'*

Ben Hay, small holder, East Sussex:

*'I joined BBCT thanks to being invited to a recent excellent Farm Day organised by Nikki Gammans near Winchelsea. Involved with nature conservation all my life, I know the vital importance of having good constructive relations with farmers. Nikki is doing a grand job down here. May your whole team's efforts for bumblebees continue to flourish.'*



## Aim 3: Maintain a high public profile

An important aim of the project has been to spread awareness of bumblebee declines, their conservation, ecology and most importantly, how people can help.

### Public events

Over the past decade the project has organised or participated in a broad range of events and activities, and between 2009 and 2019 the project directly engaged with over 30,500 people. Public events have been divided into six main categories: talks, identification days, guided walks (separate from bumblebee surveys), stalls at events, fundraisers, and educational events for students (Fig. 3.1). Bumblebee identification courses are run at beginner and intermediate levels. These are carried out by the Project Manager with the help of volunteers, both for the project and also for other organisations in the local area such as U3A's and Kent Wildlife Trust.

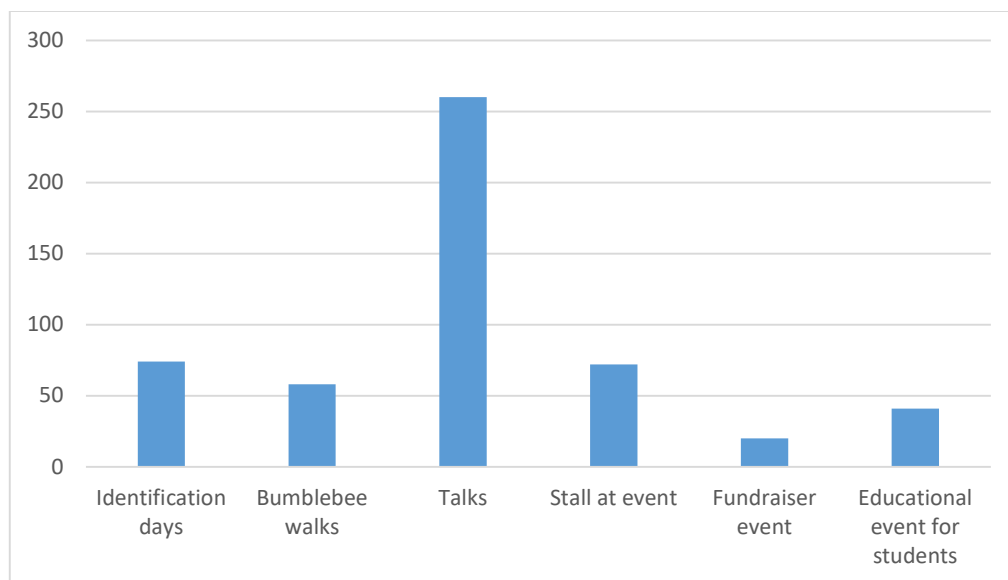


Fig. 3.1: Total number of outreach events undertaken by the project 2009-2019.



Fig. 3.2: A guided bumblebee walk led by the Project Manager for the Forest Row Natural History Group during 2014.

During the spring and summer months the project led a number of guided walks each year. These usually took place at the RSPB's Dungeness reserve, the core project area, and serve to showcase the diversity and abundance of bumblebees on the reserve. Walks are also offered on other sites, usually as a follow-up to talks or training events.

From the start of the project, talks have been the most numerous outreach activity (Fig. 3.1), with more than 250 given to local groups including the Women's Institute, U3A, and beekeeping groups. Many of these have been repeat bookings, paying tribute both to the Project Manager's delivery and the community engagement with the project.

The project has been invited to events such as the South of England Show, Kent County Show and Local Village fetes. The project has also undertaken events for fundraising purposes such as bumblebee garden parties, sponsored walks and yearly quizzes. Since 2015, the project has on average raised £7,500 per year from fundraising and outreach events.



Fig. 3.3: Volunteers Anita and Geoff staffing the project stand at the South of England show, 2018.

## Education

Another important part of our outreach programme has been providing educational talks and activities to Primary and Secondary Schools (assemblies and individual classes ages 5-16), Agricultural Colleges (HND conservation management students) and universities. On average four educational events have been run each year.



Fig. 3.4: School assembly on bees given by the project manager, Kent

## Social media

Alongside the existing project website<sup>2</sup>, the project joined the social media channels Twitter<sup>3</sup> and Facebook<sup>4</sup> in 2012. These have used these to highlight our work, share photos and identifications, raise awareness of bumblebee conservation, advertise events and recruit volunteers. There has been a steady rise in followers since the pages were started (Fig 3.5), and the project attracts many followers from outside of the UK.

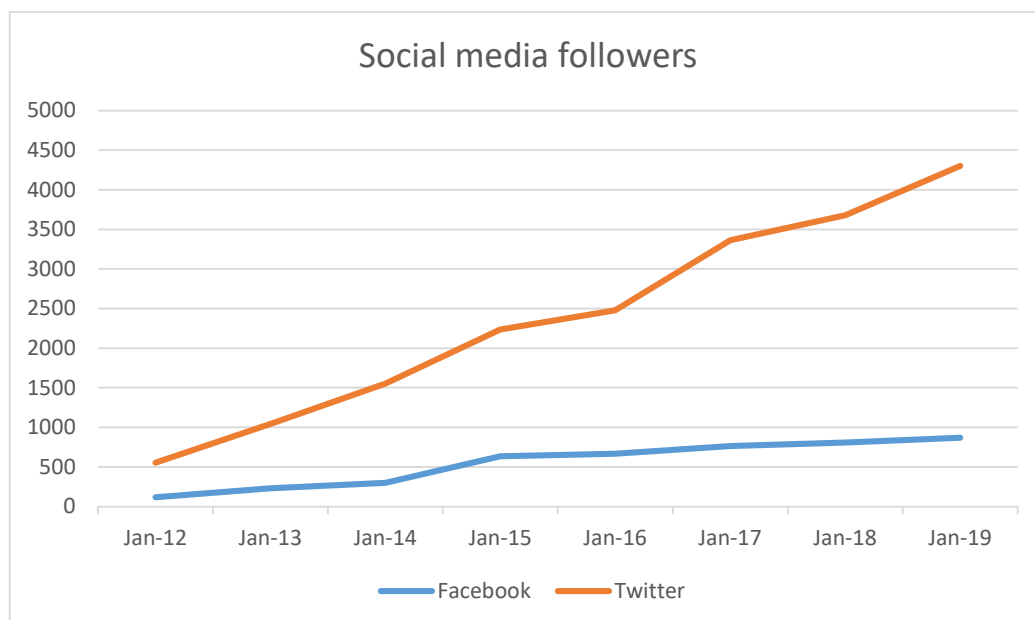


Fig. 3.5: Social media followers of the project pages since 2012 on Facebook and Twitter

<sup>2</sup> <https://www.bumblebeeconservation.org/short-haired-bumblebee-reintroduction-project/>, formerly [www.bumblebeereintroduction.org](http://www.bumblebeereintroduction.org)

<sup>3</sup> <https://twitter.com/nikkigammans>

<sup>4</sup> <https://www.facebook.com/groups/191913424256503/>

## Broadcast & Published Media

In most years since the inception of the project the partnership has issued press releases highlighting important project milestones. These have included the start of the project, the five releases of *B. subterraneus* queens, recording of rare bumblebees, and highlights of the project's work with landowners and farmers.

The work of the project has been covered on national and regional television and radio in the UK, including BBC Radios 2 and 4, Countryfile, and BBC Breakfast. Most of the UK national newspapers have featured articles on the project, most frequently during the years when the queen bees were released (2012-2016). The project has also written or been interviewed for a range of magazines including British Wildlife, National Geographic Kids, Countryfile magazine, BBC Wildlife Magazine, Beecraft, Nature's Home and Buzzword. Further afield, it has also featured on Swedish, American, Australian and New Zealand media.

## Testimonials

Paddock Wood U3A, Talk

*'Many thanks for your excellent talk last week. I have had great feedback from members who clearly enjoyed learning about the project.'*

Lyminge Garden Club, Walk and talk

*'Thank you so much for such a brilliant walk and talk today. I think you can gather from the general enthusiasm that it was very much enjoyed by all. It was fun trying to identify the bees and we are all now more bee aware.'*

Attendee, bumblebee beginners' ID event

*'Thank you so much for the course you delivered on Saturday, my mum and I left completely inspired. We both studied zoology at university and so already had an interest, but it was just amazing to listen to all the information.'*

Transition Hythe, talk

*'Just wanted to say many thanks for the excellent talk last night as part of the Hythe Festival. Thank you again for your time and effort into presenting the fascinating and compelling story of bee life, and in particular the Short-haired Bumblebee Project.'*



## Aim 4: Have a sustained and appropriate volunteer group

From the start this was a very ambitious project, and it was clear that in order to achieve its objectives a large amount of volunteer help would be needed. In particular, for the project to be successful and to leave a legacy, it was essential to have support from both the local and wider community.

### Volunteer Recruitment

Recruitment of volunteers was mainly achieved by outreach activities. As the project continued, some volunteers recruited their family members, friends and neighbours. The full range of outreach activities undertaken can be seen in section three.

In 2009 the project began with six volunteers. Over the course of the project, this has risen to 45 in 2019, with a steady influx of new volunteers each year (Fig. 4.1), indicating the ongoing support for the project from the local community.

Volunteer recruitment increased with the project's involvement in the Green Lanes section of the Kent Wildlife Trust's Fifth Continent project from 2017-2019. This took place within a subset of the Short-haired bumblebee reintroduction project area, with a trainee working under the guidance of the Project Manager during the summer of each year. Due to the close working relationship between the two separate projects, existing volunteers and new recruits often work on both projects. This enables existing volunteers to experience new sites as they develop, and new recruits can see established sites.

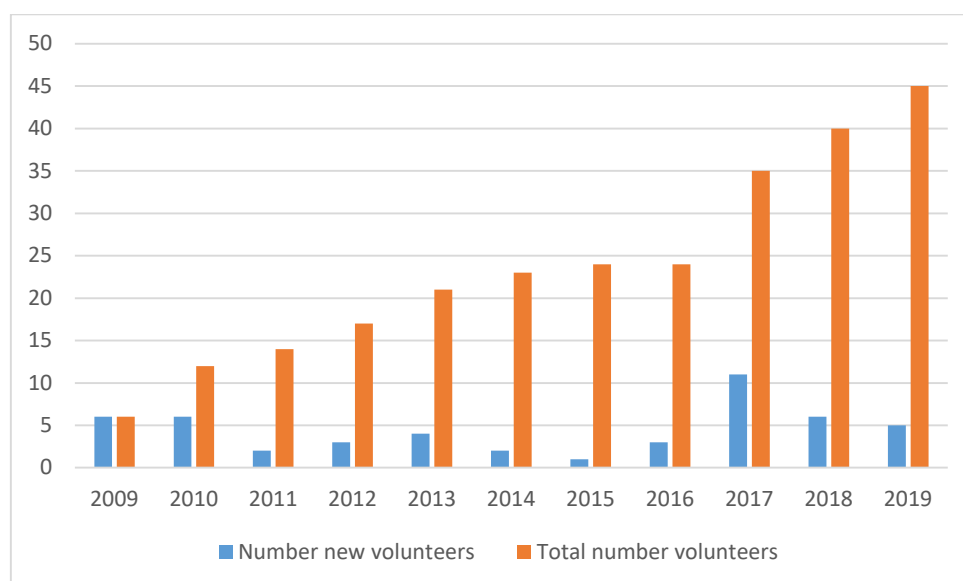


Fig. 4.1: Annual volunteer numbers on the Short-haired Bumblebee Project: total active volunteers and the number of newly-recruited volunteers per year.

### Volunteer Training

As the project has grown over time, volunteers have been trained in several different aspects of the work, particularly identification of bumblebees and wild flowers, but also the use of power tools and more. These upskilled volunteers have been able to lead tasks by themselves, taking ownership of particular aspects of the work and thus also freeing up the Project Manager's time. As the project progressed five volunteers also took over the running of different aspects of volunteer co-ordination

such as habitat management, pollen collection for queens in quarantine, data entry and outreach events.



Fig. 4.2: Volunteers at a wildflower and bumblebee blitz, Corkwood farm 2019

### Volunteer activities

By far the most popular activity for volunteers has been bumblebee surveys, followed by habitat management and events (Fig 4.3).

Between 2012-2016 ten volunteers each year were invited to go to Sweden to help with the collection of emerging *B. subterraneus* queens for the reintroduction aspect of the project. Without their help the project would not have been able to collect the number of queens needed.

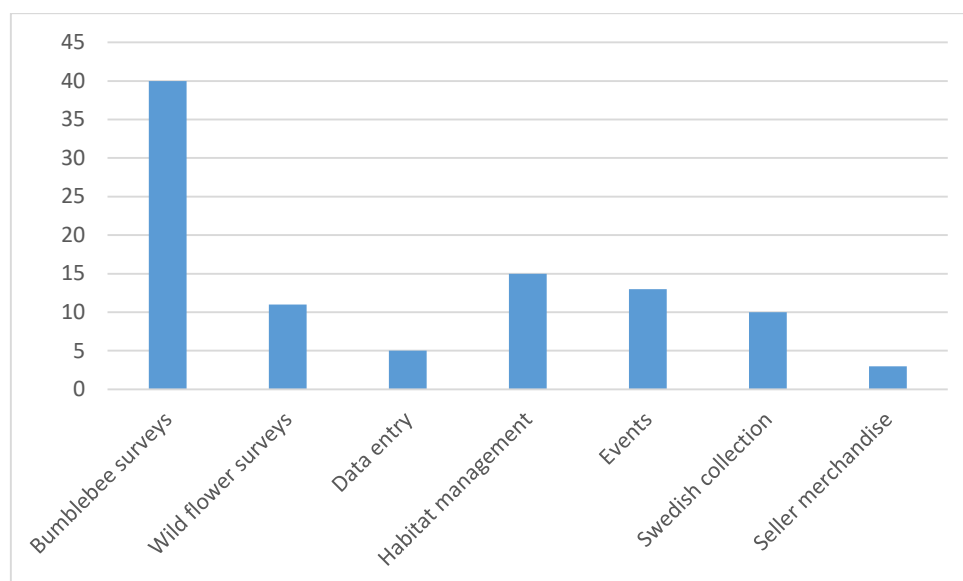


Fig. 4.3: Total number of volunteers who take part in each activity type. Volunteers are able to take part in as many of the categories as they choose, so some individuals appear in multiple columns.



Fig. 4.4: Swedish queen collection volunteers, 2015

Volunteer hours have been consistently high throughout the project, which is a testament to the dedication of our volunteers. During 2012-16 annual volunteer hours were boosted considerably by time donated by the ten volunteers who participated in the collection trips to Sweden (as each volunteer day was classed as 24 hours): annual volunteer hours for each of these five years exceeded 3,000. Figs 4.5 & 4.6 show 2015 and 2018 as an example of a reintroduction and surveying year respectively. Total annual volunteer hours in the surveying years 2017-19 declined slightly overall, but a greatly increased commitment to bee walks and bumblebee blitz events saw the time spent on bumblebee surveys almost treble.

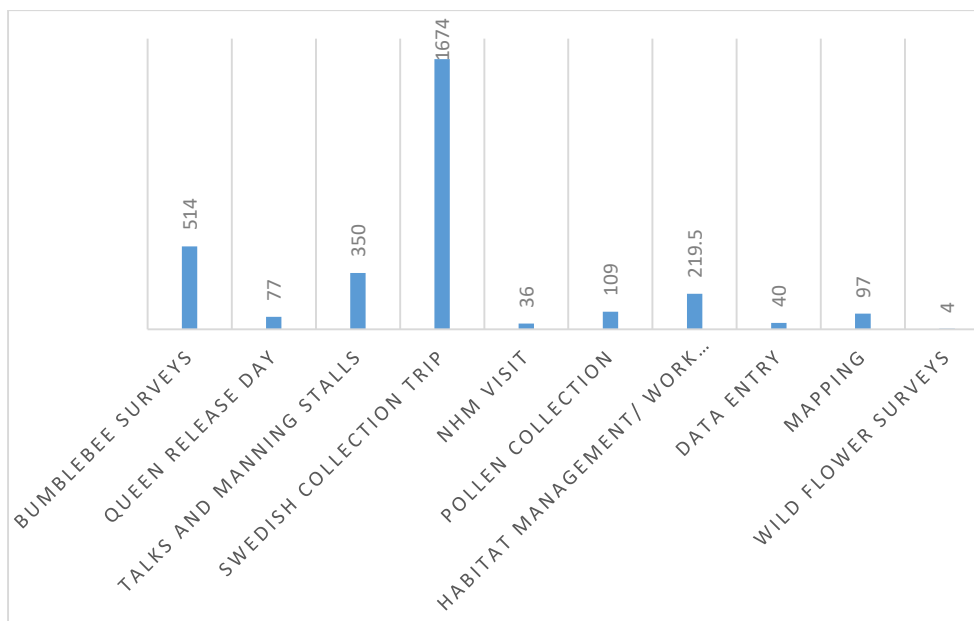


Fig. 4.5: The number of volunteer hours in each activity in 2015. A total of 3120.5 hours were donated by 24 volunteers in 2015, of which more than half was contributed by the collection trip to Sweden.



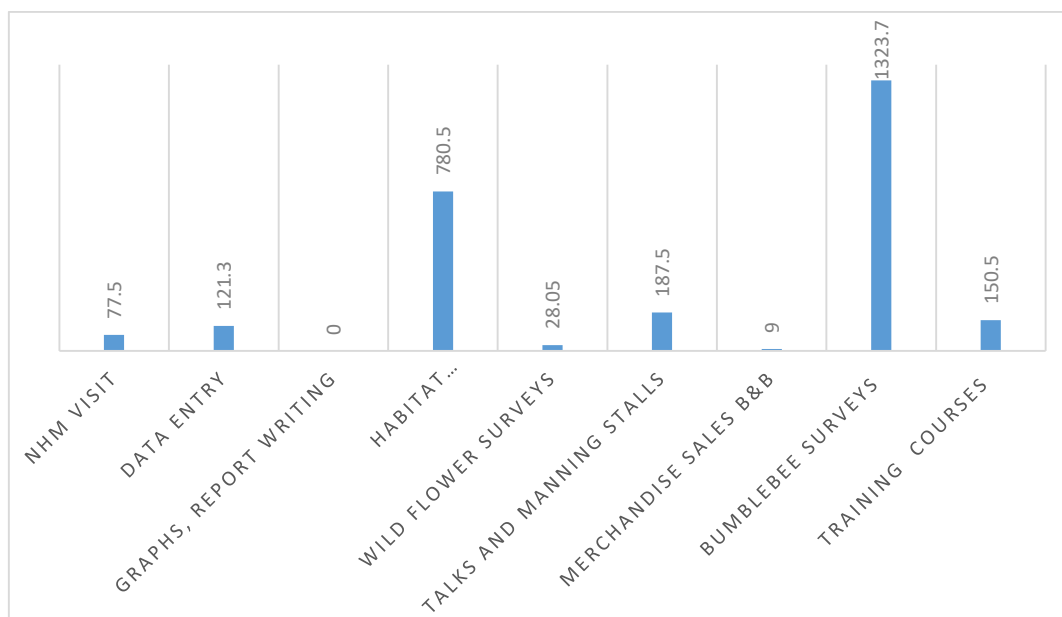


Fig. 4.6: The number of volunteer hours in each activity in 2018. A total of 2678.05 hours were donated by 45 volunteers during 2018, with time spent in Sweden replaced by an increased emphasis on surveying and habitat work.

## Student placements

The high public profile of the project has meant that there have been multiple requests from university and A-level students keen to carry out their own research on the project, and these requests have been fulfilled where possible.

In 2015 and 2018 two Bournemouth University students, Jordan Connor and Becca Messenger, joined us for their seven-week work placements. In 2016 two undergraduate students from Canterbury Christ Church and Harper Adams Universities, Peter Pike and Jake Jones<sup>5</sup>, undertook their dissertation projects with the project. They investigated nectar and pollen production from wild versus cultivar red clover and bumblebee forage plant selection respectively, with the results used to guide project work in future years.

In 2017 A-level student Tadd Seymour (nephew of volunteer Sarah Seymour) volunteered for a summer, and in 2019 Poppy Bathurst (daughter of volunteer Anita Bathurst) spent three months volunteering.

The Project Manager has also given advice to students writing coursework, completed interviews and has been filmed for student projects. Due to the project's diverse activities students are able to engage in a range of activities and get a rounded experience of a long-term conservation project.

<sup>5</sup> See <https://www.bumblebeeconservation.org/our-science-research/>



Fig. 4.7: Canterbury Christ Church University dissertation student Peter Pike measuring sucrose content in wild red clover nectar.

### Volunteer testimonials

Duncan Lawie, volunteer for 10 years

*'The work we have done has been great for the bumblebees of the project area and I get great satisfaction from this. I also enjoy working with Nikki, the summer interns and the other volunteers, and feel like I am doing something for nature; and I delight in being 'in the moment' with the bees, when they are doing their own thing.'*

Roger Thompson, volunteer for 8 years

*'I feel that we are making a difference. The project has vastly increased the awareness of the public for our need to increase habitat to help our invertebrates, through talks to clubs and at shows.'*

Alan Cobb, volunteer for 4 years

*'I very much enjoy coming to Dungeness and meeting up with the other volunteers. There is so much to learn and to do this in the company of other bee enthusiasts is fantastic.'*

Anita Bathurst, volunteer for 3 years

*'The project has a huge impact in the recording of bees in general, the education and interest of the public and a big improvement of pollinator friendly foraging plants and foraging areas.'*

Heather Silk, volunteer for 1 year

*'A lifelong interest in wild flowers led to watching the pollinators, and especially the bumblebees, and I became fascinated by them and wanted to learn more. I have been aware of the project going from strength to strength and wanted to be part of this. It is also based at Dungeness which is one of my favourite areas.'*

David Wilson, volunteer for 7 years

*'The project has achieved considerable environmental benefits to flora and fauna across Romney Marsh, through habitat restoration for key-stone pollinator species. I remember what the first transects were like ten years ago and how many more bumblebees we see today!! It has also championed citizen science and developed a powerful volunteer network which has created a prototype for community conservation engagement across Europe. This is a remarkable achievement. It has also been fun, challenging and rewarding for all concerned! Congratulations!'*

## Acknowledgements

The project manager would like to thank:

Our project partners: Bumblebee Conservation Trust (Ben Darvill, Gill Perkins, Richard Comont); RSPB (Jane Sears, Gareth Brookfield, Craig Edwards, Martin Randall); and Natural England (David Sheppard, Gavin Measures, Jon Curson, Paul Hyde) for their support, encouragement and dedication to the project.

Advisors and steering group members Mark Brown, Dave Goulson, Mike Edwards, Brian Banks and Paul Lee (Hymettus) for their expertise and knowledge on the various aspects of the project development.

Paul Williams for allowing us to view specimens of bumblebees at NHM and for his continued support.

To all the volunteers who have dedicated their time, knowledge and many hours to making this project a success. The aims would not have been achieved without them.

The many students who have completed their work experience or dissertations with the project.

The three Green Lane trainees: Lucy Witter, Lucia Chmurova and Izzy Knight, who have been a great experience and joy to supervise.

Bumblebee Conservation trust staff Mia Derhe for her statistical analysis, Steph Miles for GIS mapping, and Barnaby Smith for publicity. Also to student placement Poppy Bathurst for her GIS mapping used in this report.





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Registered Office: Bumblebee Conservation Trust, Lakeside Centre, Lakeside Country Park,  
Wide Lane, Eastleigh, Hampshire, SO50 6PE  
[www.bumblebeeconservation.org](http://www.bumblebeeconservation.org)

