Fowey Valley Bumblebee Project

Securing wild pollinators for agriculture: testing a new landscape-scale approach to sustainable management.

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Funded by:

The Prince of Wales Charitable Foundation and Kelly's of Cornwall are generously supporting the Bumblebee Conservation Trust project, the Fowey Valley Bumblebee Project. The project is carried out by a part time (0.5 FTE) Project Officer, Dr. Rosalind Shaw, with project partners contributing time and resources.

Background

Pollinators, including bumblebees, are declining worldwide in response to interacting factors relating to agricultural intensification such as habitat loss, habitat fragmentation and pesticides. This multitude of co-acting stressors, rather than a single cause, makes the problem particularly difficult to tackle.

Pollinators are essential for sustainable farming and an estimated 65% of crop production by volume depends on insect pollination and determines both crop quality and quantity.

Farmers are however under considerable economic pressure to increase productivity, often resulting in agricultural intensification and increased cultivation of land previously left out of production. This reduces the availability of suitable habitats for wild pollinators, leaving their populations vulnerable. Together we have tested a new and innovative predictive model, BEE-STEWARD, to test and quantify how targeted changes in land management can increase both resilience in bumblebee populations and how this impacts farm productivity.

Key recommendations and next steps

BEE-STEWARD simulations should be run periodically, when contemplating big changes to land management

It is best run by a trusted advisor, with experience of using it.

Bringing in upland, horticultural crop and urban green habitats would allow the model to be used in more contexts including by developers, but would require additional investment.

Summary of achievements

Testing the model – we surveyed bumblebees in six areas across the upper Fowey Valley over 3 years. We have compared this to the number of bumblebees predicted by BEE-STEWARD model, and they are correlated – this gives us confidence that the model can predict a 'good' landscape for bumblebees. We have submitted this work to a peer-reviewed scientific journal.

Adding new habitats to the model – in collaboration with project partners we decided on the most important new habitats to add to the model and have carried out flower surveys resulting in 9 new habitats added. We added another 5 habitats or management types from existing information.

Adding more flower species to the model – BEE-STEWARD assesses a habitat and landscape based on the pollen and nectar supplied by flowers in that landscape at different times of year – we gathered information on another 34 plant species and created a bespoke database to store the data in making it easier to access for farmers and land managers.

Improving the BEE-STEWARD model – working with the model developers we have created a new version of BEE-STEWARDv2.0, bringing together new habitats, flowers and increased landscape scale functionality, helping us understand how land managers can work together for bumblebees. This is freely available online.

Providing information for land farmers and land managers
4 bespoke reports have been created for land managers and a case study on herbal leys created and made freely available.

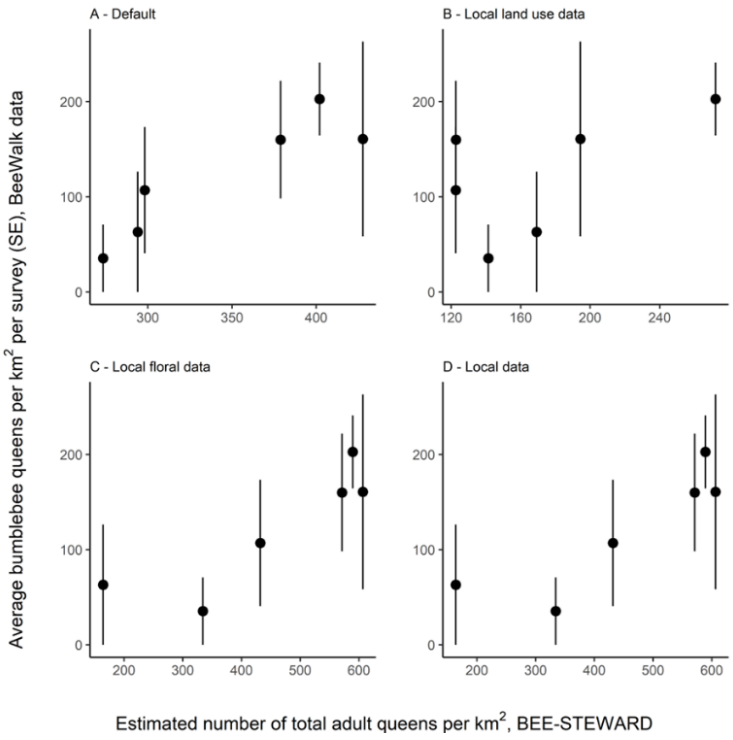
Public engagement and outreach - by giving talks, running bumblebee identification workshops and attending events we have talked to over 860 people about bumblebees!

Project objectives

1. Test the BEE-STEWARD model in agricultural land in Cornwall, UK, and create habitat for bees based on the model's predictions

To test the BEE-STEWARD against real-world bee numbers we collected data on bumblebee numbers on 6 BeeWalks in the Upper Fowey Valley over three years (2019-2021), located on project partners land holdings. We collected data on the land use on in a 1km area around the six BeeWalks.

We ran four modelling scenarios using the BEE-STEWARD default habitat flower data and remote sensed data from freely available sources such as Land Cover Map 2019 (Morton et al. 2020[1]) and compared them to outcomes from using locally collected land use and habitat flower data. This helps us to understand firstly if BEE-STEWARD predictions are correlated with the number of bumblebees seen in the field; and secondly if we need to collect any additional information on local land use or local habitat flower species composition and if this improves how well BEE-STEWARD estimates correlate with the bumblebee numbers seen in the field. The four modelling scenarios we used were A) Default using data from the LCM 2019 and default BEE-STEWARD habitats and flower abundance B) Local land use data with information collected from project partners and default BEE-STEWARD habitats and flower abundance data C) Local floral data using LCM 2019 land use maps and locally collected habitat flower abundance data and D) Local data – using locally collected land use data, additional habitats and locally collected flower abundance data. The result were that scenarios A and C gave BEE-STEWARD estimates of adult buff-tail bumblebee queens which were significantly correlated with the number of adult queens seen on BeeWalks. These were scenarios which used the Land cover map and either the default or locally collected flower abundance data. This was surprising because we thought that scenario D would be the most likely to correlate with field estimates. This may be because increasing the land use complexity on a landscape scale tends to reduce the success of the computer bumblebee populations. The results give us confidence in that we can use BEE-STEWARD to understand the impacts of broad scale land management changes on bumblebee populations without having to collect time consuming field data. The results from this work have been submitted to a scientific journal, PeerJ.



The relationship between the BEE-STEWARD estimates of adult buff-tailed bumblebee queens and the average number of buff-tailed bumblebee queens seen on BeeWalks.

Yellow rattle seedlings (left, with narrow leaves and serrated edges) successfully established in 2022, and site in July 2022

Many project partners are carrying out bumblebee friendly land management as part of their current practice. As part of the project work, locally sourced yellow rattle has been given to two project partners, to boost bumblebee friendly habitat at the centre of the project area. Yellow rattle is establishing well.

[1] Morton, R. D., Marston, C. G., O'Neil, A. W., & Rowland, C. S. (2020). Land Cover Map 2019 (20m classified pixels, GB) [Data set]. NERC Environmental Information Data Centre. https://doi.org/10.5285/643EB5A9-9707-4FBB-AE76-E8E53271D1A0

2. Gather data to refine the model.

The BEE-STEWARD model requires information on the value of different plants for bumblebees (based on the amount of flowers in different habitats). We met with project partners to discuss which habitats they would most like to see implemented in the BEE-STEWARD model. Habitats of interest were those more relevant to more pasture-based systems that we have in the southwest. We collected monthly flower abundance data on the following additional habitats new to BEE-STEWARD: heathland, herbal leys (also known as multispecies leys), permanent pasture, rush pasture, wetland mosaics, wildflower meadows, woodland edges and two agri-environment scheme (AES) options, nectar plots and permanent grassland under reduced inputs. We also searched the scientific literature and have added information on four further AES options – legume rich fallows and leys, margin mixes aimed at wild birds and pollinators, wild bird mixes which are also used as game cover crops and reduced hedge cutting regimes. The new habitats required significant data processing and testing before being ready to be used. These new habitats allow BEE-STEWARD to be used in a wider range of contexts and management scenarios than previously.

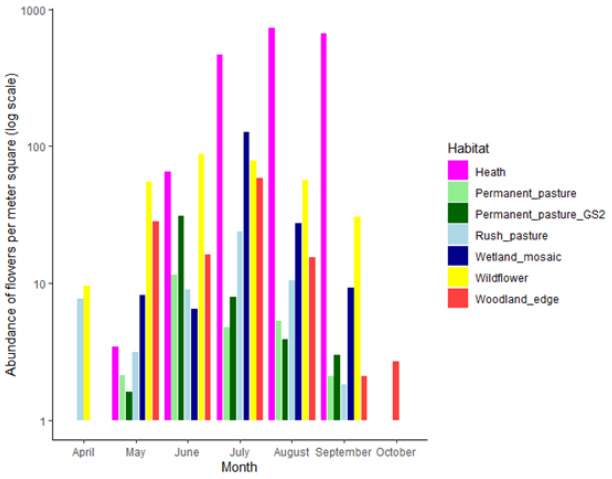


Figure 2 The flower abundance of some new habitats, showing how many resources they provide for bumblebees throughout the summer

We also need to know the nectar and pollen values for more bumblebee-friendly plants so that they could be included in BEE-STEWARD. We searched the literature and worked with a volunteer to create a use-friendly database for storing this information. We have added 34 new plant species to the BEE-Steward model.

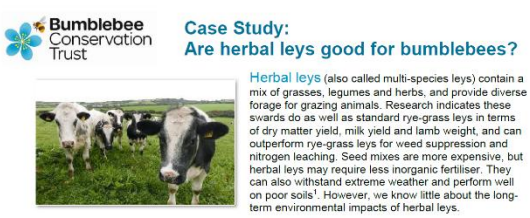
Demonstration landscape scale BEE-STEWARDv2.0, created from the Fowey Valley landscape. Darker areas show places with more visits by bumblebees and lighter areas places where it would be good to have more bumblebee friendly habitat.

In discussion with project partners there was interest in expanding the use of BEESTEWARD from solely being a farm or individual holding level to being used on landscape scale to understand gaps in the wider landscape and if landowners working together might provide better benefits to bumblebees. This required changes to the code of the original model. Working with Dr. Grace Twiston-Davies (University of Exeter and now Wildflower Collective CIC) and Dr. Matthias Becher (RIFCON GmbH), who wrote the original BEE-STEWARD model, we have been able to publish BEE-STEWARDv2.0 which has the option to run BEE-STEWARD on a small landscape and to produce Geographic Information System compatible outputs. Version 2 can now include more AES options, and has been released on the BEE-HAVE website, freely available to download from https://beehave-model.net/download/

3. Provide evidence to farmers of how they can use limited resources to support pollinators through prudent land management decisions without adversely affecting productivity, leading to sustainable farming practices.

BEE-STEWARD reports of the impacts of planned, or previous management changes were carried out for four farms or land holdings in the area, looking at what happens to bumblebees when: intensive grassland is converted to more species rich grassland; flower rich plots area added to arable land used to grow maize, potato and barley affects bumblebee populations and how a standard Countryside Stewardship

Scheme has less impact than a full Natural Capital land management approach. We used BEE-STEWARD to understand the impact of switching from traditional leys to herbal leys on bumblebees and shared this as a case study (https://www.bumblebeeconservation.org/fowey-valley-bumblebee-project/). We have land managers contacting the Bumblebee Conservation Trust wishing to use BEE-STEWARD on their landholdings.



Project publicity and engagement events

Public engagement and outreach was limited to online events in the first year of the project (2020) due to COVID-19. Despite this, during the course of the project, the project officer has attended or supported volunteers in attending the following public engagement and outreach events, reaching a wide variety of audiences –

- 6 talks given to interested groups including gardening groups, volunteers and wildlife groups.
- Beginner bumblebee ID courses (delivered online by Richard Comont, but advertised in the local area)
- Intermediate bumblebee ID courses (delivered online by Richard Comont but advertised in the local area)
- 6 practical field sessions in Cornwall (Richard Comont and Rosalind Shaw) following the online courses to allow people to practice their new knowledge in the field).
- New BeeWalk volunteers trained to carry on with the Fowey Valley Bumblebee Project BeeWalks, and for volunteers to do BeeWalks at the Lost Gardens of Heligan and Woodland Valley Farm Beaver Project.
- 9 public engagement events attended, with posters and information on how to help bumblebees in your garden or on your land, including 5 in urban public open spaces in Cornwall.
- Provided materials for the ‘Bumblebee Hut’ at Duchy of Cornwall Nursery in their ‘Bumblebee Garden’, giving information on how to garden for bumblebees, information posters on bumblebees and materials for a bumblebee-friendly green roof, which we plan to use as case study one established.
- Blog post for Agricology on the project – https://www.agricology.co.uk/field/blog/bringing-buzz-fowey-valley-mixing-bumblebees-and-sustainable-farming
- Article for the Bumblebee Conservation Trust newsletter, Buzzword.
- Advice visit on Bumblebee friendly planting to Lostwithiel Primary School, with free bumblebee friendly plants donated by project partner the Duchy of Cornwall Nursery.
- Conferences presented at included: Bumblebee Working Group, Innovation in Species conservation (a Rethink Nature Scotland event) and Sheepdrove Organic Farm Conference.

Talks and engagement events have meant that we have spoken to around 860 people about the importance of bumblebees.

Financial records

Final financial record will be available in October 2023

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