

Where the bee flies: discovering the hidden ecology of bumblebees in Cornish Gardens

Supervisors

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Project description

Bumblebees are important pollinators and have experienced range declines in the UK over the past 50 years. Recent evidence suggests that garden provide a haven for bumblebees, compared to farmland. This is likely to be because of the diversity and abundance of forage and nest sites available in gardens. However, our understanding bumblebee population dynamics and spatial ecology is still hampered by the difficulty of finding wild bumblebee colonies and quantifying their distribution and reproductive success. The substantial historic gardens in Cornwall (open to the public) provide a hitherto unstudied landscape where the exploration of bumblebee population dynamics is likely to be more feasible: the extraordinarily high abundance of queens in the spring leads us to propose that nest density is likely to be much higher than in most of the UK landscape, and consequently provides the ideal testing ground for new technologies for finding and monitoring colonies.

The Environment and Sustainability Institute, at University of Exeter, has a suite of new technologies including unmanned aerial vehicles (UAVs); thermographic cameras; a harmonic radar to track individual bees and automatic bee hive monitoring devices. In the first year, the student will evaluate for the first time whether some of these instruments can be used to a) track queen bumblebees exploring for nest sites; b) locate wild bumblebee nests to measure development and success; c) monitor colony behaviour and development remotely. This will be done in Cornish Gardens (e.g. National Trust sites) because technique development requires a site where nest density is likely to be *very* high.

Based on results from this initial technology-driven phase, the student will choose which of the following hypotheses to test, replicating across five gardens:

A) Cornish gardens act as a source of bumblebee pollinators for the wider countryside, and foragers from nests within gardens spread into the agricultural landscape. Alternatively, the gardens act as sinks drawing in foragers from nests outside the gardens.

B) A high density of bumblebees in Cornish gardens leads to higher transmission of diseases than in the wider countryside. This would be tested using molecular techniques to identify bumblebee diseases.

C) The high density of forage in spring leads to a large number of nests establishing, but later in the season, there is competition between bumblebees from different nests for forage. Competition within and between bees has rarely been shown, because of the difficulty of measuring fitness effects at colony level.