# Project 1: Impacts of environmental stressors on bumble bee queen movement.

# Project 2: Learning their needs by tracking the bees.

# Project 3: Does soil temperature predict bumble bee queen emergence in spring?

# Project 1: Impacts of environmental stressors on bumble bee queen movement.

## Background

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| Bumble bees are important pollinators for wild flowers and crops. They pollinate flowers while collecting the flower’s pollen and nectar that they collect to feed themselves and their young. While collecting pollen and nectar in agricultural areas, they can become exposed to pesticides sprayed on crops to fend off crop pests. Although the levels of these pesticides that are sprayed on crops are not allowed to reach limits that are lethal to bumble bees, researchers have noted there can be sublethal impacts of these chemicals.  Sublethal impacts do not cause the bees to die, but can still cause harm – for example by limiting learning and memory (*1*, *2*), limiting foraging ability(*3*, *4*), interrupt sleep and circadian rhythms(*5*, *6*), and change flight behaviour(*7*, *8*). Although we know that sublethal impacts do occur, pesticide regulatory agencies are not required to test for these impacts before approving the use of pesticides. | Project1A photo but rounded  Neonicotinoids are one class of pesticides that have become notorious for their impacts to pollinators such as bumble bees. As their negative impacts become widely known, neonicotinoids are becoming increasingly regulated and restricted. This will lead to growers looking for alternative pesticides to protect their crops from pests. Newer classes of pesticides could replace neonicotinoid use but whether these newer classes have sublethal impacts is not known. |

To test for possible sublethal impacts of newer pesticide classes on bumble bee queen movement in spring and late summer using radiotelemetry.

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| We are radio tagging bumble bees to track their movement after being exposed (or not) to different pesticides and comparing their movement behaviour. | Project1B but rounded also |
| Project1C all photos rounded | Their movements are tracked using radio towers set up at our study sites. Using this data, we have compared the flight distance, home range, habitat usage and selection of bumble bee queens. The results are still preliminary, but it unfortunately looks like a newer class of pesticide called diamides are just as harmful as neonicotinoids when we look at their flight behaviour. |

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# Project 2: Learning their needs by tracking the bees.

Bumble bees need at least 3 resources to survive: flowers (their food source), nest sites (to raise their young), and overwintering sites (for queens to hibernate for the winter). However, we know very little about their nesting and overwintering habitat, partly because these sites are so hard to find – they are usually underground!

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| We also know very little about their movement behaviour and habitat selection. For larger animals, it has been easier to track their movements using radio collars or GPS collars that send a signal giving the animal’s location. Until very recently the technology has not existed for researchers to be able to follow smaller animals such as bumble bees. | Project2A |
| Project2B | In this project we tagged spring bumble bee queens and late summer bumble bee queens to learn more about their movement behaviour, habitat selection, and about their nesting and overwintering habitat locations. |

We are still analyzing the data, but it appears late-summer queens often return to the same areas and can be active for up to 50 days. They also may overwinter at the same location with many other queens.

# Project 3: Does soil temperature predict bumble bee queen emergence in spring?

Bumble bee queens hibernate throughout the winter by burying themselves in the ground. In the spring they emerge from their hibernation and begin looking for nest sites. Researchers have noticed that some species tend to wake up from hibernation earlier than others. The timing of when different species wake up from hibernation could be related to soil temperature – perhaps early emerging species hibernate in the top layers of soil which could warm up faster than deeper layers waking them up faster.

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| To test the impact of soil temperature on queen bumble bee emergence timing, we surveyed for bumble bee queens, while simultaneously measuring soil temperature at different depths. | Project3A photo |
| Project3B photo | In our preliminary analyses we found that some species, particularly early emerging species may respond to soil temperature, while later emerging species may respond more to air temperature. |