Restoring declining bumble bee species habitat in Southern Ontario

bookend
broad
significance

Declines in pollinator species are occurring globally which threatens ecosystem function and the agricultural industry. Insects pollinate 80% of all wild plant species and 75% of crop species which contributes $215 billion (USD) worth of food production globally (*1*, *2*). Declines in wild bees have also caused reductions in plant abundance, diversity, and local extinctions of plants that depend on these bees for pollination (*3*). Bumble bees are important wild bees as they can pollinate under cooler temperatures relative to other bees and they have the unique ability to "buzz" pollinate crops and wild plants (*4*). However, certain species of bumble bees are in decline. In North America, some bumble bee species have declined in abundance by up to 96% (*5*), and in Southern Ontario, five species are deemed at-risk of endangerment or extinction without conservation measures. The cause of decline for these species is unknown but evidence suggests that habitat loss, introduced pathogens, and climate change are contributing factors (*6*) with habitat loss identified as the greatest threat in Europe (*7*). A species' habitat is important as it contains the resources necessary for survival and reproduction. Thus, protecting and improving a species' habitat can be an effective strategy for conservation. First, however, the species' habitat must be determined, but this is not well understood for bumble bee species in Southern Ontario. There is a need to develop a conservation strategy for supporting these critically important species because their current habitat requirements are unknown.

too
much
info?

goal and
novelty

The goal of my research is to: "**Identify and restore the habitat for at-risk bumble bee species in Southern Ontario".** This research is novel because it is the first study to quantify the habitat requirements for these declining bumble bee species. I will conduct field surveys to identify site-level habitat variables that are important to bumble bees, such as the composition of floral resources and nesting availability. I will also use GIS (Geographic Information System) and spatial modelling techniques to identify landscape-level habitat variables that are important predictors of recent (within 15 years) at-risk bumble bee occurrences. By comparing site and landscape level habitat variables for bumble bee species I will determine why bumble bees have persisted in some areas, but have disappeared from others and predict new areas where they can be found. Findings from these analyses will be used to 1) identify areas of high quality habitat that should be protected, 2) to identify areas of low quality habitat that could be improved through restoration, and 3) initiate a habitat restoration experiment to improve the low-quality bumble bee habitat and monitor their response to habitat improvements. The restoration experiment will measure changes in at-risk bumble bee occurrences, abundance and the overall diversity of the bumble bee community to the habitat improvements. The variables that will be manipulated to improve habitat quality will be those identified in my study as important habitat determinants for these species. The development of successful restoration techniques to support at-risk bumble bee species can be implemented across Ontario to increase pollinator abundance and richness.

experi
ment
clear

Future management initiatives for bumble bee species across Southern Ontario, and potentially other regions, would benefit from the results of my study as it is the first to identify important habitat variables for declining bumble bee species. Habitat variables that are identified as important should be the focus of future conservation and management projects to help reverse the observed declines for these bumble bees. Given the importance of habitat to any species, identifying, restoring, and protecting the habitat of at-risk bumble bee species is an imperative focus for conserving these vital species and the industries, ecosystems, and plant species that are reliant on them. Improving the habitat for these at-risk species could be an important step at stopping, and hopefully reversing their decline.

1 N Gallai *et al*, *Ecol Econ* 68, (2009) **2** SG Potts *et al*, *TRENDS Ecol Evol* 25, (2010) **3** JC Biesmeijer *et al*, *(80-.).* (2006). **4** D Goulson, *J FOOD Agric Environ* 1, (2003) **5** SA Cameron *et al*, *Proc Natl Acad Sci USA* 108, (2011) **6** SR Colla *et al*, *Biol Conserv* 129, (2006). **7** MJF Brown, RJ Paxton,. *Apidologie* 40, (2009).