# Does Aerial Mosquito Control Spraying Have Any Effects on Wild Bees in Plymouth County, Massachusetts?


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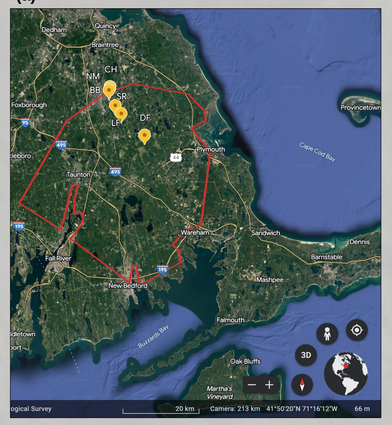
## Introduction

- Risk to pollinators from aerial mosquito control spraying has been a concern for some time due to reports of sumithrin (d-phenothrin) being toxic to honeybees (*Apis mellifera*) (Jackson, et al., 2011; Skyrm & Hotze, 2019).
- Several sites within the Massasoit Community College pollinator study area were included in aerial spraying to control mosquitoes during the years 2019 and 2020.
- The insecticide used, Anvil Ⓡ 10+10 ULV, (a combination of the pyrethroid sumithrin and the synergist piperonyl butoxide) is applied aerially by the state of Massachusetts in low concentrations at night in an attempt to minimize damage to pollinators (BIDLS, 2021).
- Information from the Commonwealth of Massachusetts (BIDLS, 2021) suggests Anvil Ⓡ 10+10 ULV was chosen for its safety profile regarding beneficial insects, but toxicological data (Celona, 2006) suggests that this insecticide may be more toxic to non-mosquito insects than is hoped.
- This study is one of the first to investigate changes in wild bee abundance before and after the aerial spraying of Anvil Ⓡ 10+10 ULV.

## Methods

**(a)**




**(b)**

| Spray Year | Site | Times Sprayed |
|---|---|---|
| 2019 | Beaver Brook | 3 |
| 2019 | Christo's | 3 |
| 2019 | Native Meadow | 3 |
| 2019 | Leland Farm | 3 |
| 2019 | Dunrovin Farm | 3 |
| 2019 | Sachem Rock Farm | 3 |
| 2020 | Beaver Brook | 0 |
| 2020 | Christo's | 0 |
| 2020 | Native Meadow | 0 |
| 2020 | Leland Farm | 1 |
| 2020 | Dunrovin Farm | 1 |
| 2020 | Sachem Rock Farm | 1 |

**Figure 1.** Panel (a): map of six study sites in Southeastern Massachusetts located within the State's aerial mosquito control spray zone for August 2019 (red polygon) (MDAR, 2023). Panel (b): table depicting spray year and frequency for each study site.

- Aerial mosquito control spraying was conducted overnight by the Commonwealth of Massachusetts in early August of 2019 and 2020.
- Pollinator collection via pan traps and sweep nets (Popic, et al., 2013) was performed biweekly at six sites, in early spring to late fall, from 2016-2021, as part of an ongoing monitoring study in
- Plymouth County, Massachusetts.
- Wild bee abundances from spray and non-spray years were compared in early to late August. Sampling dates before and after mosquito spraying were retrospectively analyzed.
- Honeybees (*Apis mellifera*) were excluded from the data due to their domesticated status.
- Statistical analysis was performed using a two-way repeated measures ANOVA.

## Results

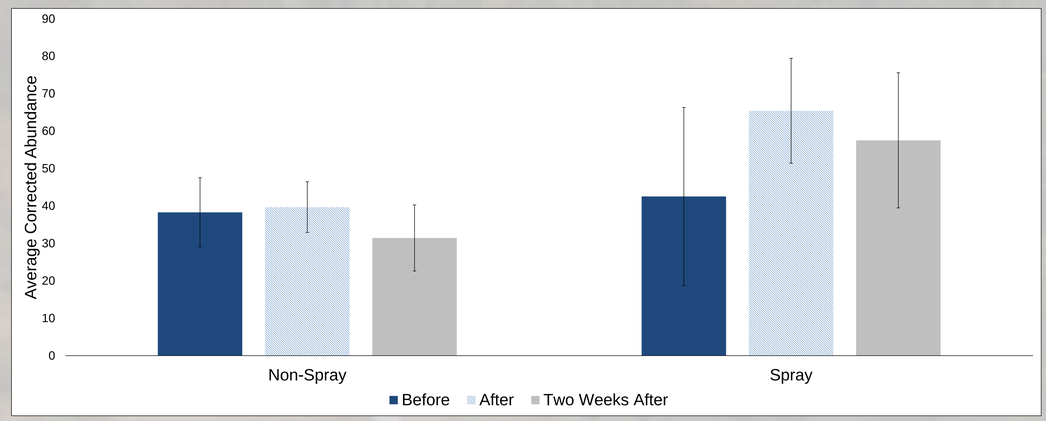



**Figure 2.** Comparison of years when aerial mosquito control spraying occurred to years when it did not. Bars represent average corrected wild bee abundance for one sampling event prior and two sampling events post aerial spraying of Anvil Ⓡ 10+10 ULV. Error bars represent SEM. Honeybees (*Apis mellifera*) were excluded from this analysis.

- There was an increase in bee abundance for both post spraying sampling dates.
- Comparison dates in non-spray years showed a less robust increase in this same time period.
- The increase in bee abundance one sampling date after spraying was followed by a decrease in abundance. The magnitude of change was not observed in non-spray years.

## Discussion & Conclusion

- The rise in wild bee abundance after spray events may or may not be related to pesticide use, but there is no indication of an acute lethal toxicity to wild bees due to aerial mosquito control spraying.
- The observed increase in wild bee abundance after aerial spraying has been reported elsewhere (Chaskopoulou et al., 2014), which could possibly be due to altered behavior resulting in increased capture rate.
- The impact of aerial mosquito control spraying on wild bees is still unknown and additional studies looking at community composition after spray events should be conducted.

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