

Delta Farmland and Wildlife Trust: Grassland Set-Aside Bumblebee Survey

June – September 2025

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Picture 1 An Eastern bumblebee (Bombus impatiens) foraging on vetch with a full pollen basket in a grassland set-aside.

Program Background

Bumblebees play an important role in many British Columbia ecosystems. As one of the most efficient pollinators, they are often found both in agriculture and in the wild. Despite their importance, pollinator populations are still declining due to habitat loss, pesticide use, climate change, and competition with invasive species. There are currently 32 known species of bumblebee found within British Columbia, with several populations in decline or endangered (Cannings, 2011; Williams et al., 2014).

Habitat loss is one of the main drivers of conservation concern for local pollinator species. Delta Farmland and Wildlife Trust (DFWT) aims to improve pollinator habitat in the Fraser River delta by entering into stewardship agreements with farmers to manage farmland as Grassland Set asides (GLSA). Grassland fields are planted to provide essential wildlife habitat in the Fraser River delta. These spaces are planted with diverse flowering resources to support local pollinators in farmland.

The aim of this study was to monitor and identify the abundance and diversity of bumblebees utilizing flowering GLSAs. By conducting point surveys, we were able to determine which species of bumblebee are using GLSAs for foraging and determine which

flowering species were used most abundantly. DFWT hopes to increase the understanding of bumblebee abundance and diversity, especially as these species face a loss of habitat and diverse floral resources.

Survey Methods

Grassland set-asides were selected for the survey if they were planted with a seed mix containing a flowering plant, therefore seven fields were surveyed in Delta, BC. Fields were surveyed three times throughout the summer season from June to September between 10am and 3pm. Surveys were 45 minutes long and conducted within a hectare (~2.5 acre) subdivision of each field. Field surveys were only conducted under suitable weather conditions, when temperatures were above 12 °C, with zero precipitation and wind under 20km/hr, as adverse weather can reduce bee activity.

Surveys were done over a 45-minute time period, with the timer paused during bee capture and processing, to ensure consistent search efforts across all fields. During surveys, bumblebees were captured while visiting floral resources. Captured individuals were temporarily placed in a vial within a cooler to minimize movement, and photographed for subsequent species identification. The species of flower that each bee was caught on was recorded to link bee foraging activity with floral resources. All bumblebees were released back into the GLSA after they were photographed.

Results and Discussion

Throughout the season, a total of seven bumblebee species were observed, with 179 individual bees recorded (Table 1). The Eastern Bumblebee (*Bombus impatiens*), an introduced species in British Columbia, was the most frequently observed, followed by the Red-belted Bumblebee (*Bombus rufocinctus*), Yellow-faced bumblebee (*Bombus vosnesenskii*), California Bumblebee (*Bombus californicus*), Nevada Bumblebee (*Bombus nevadensis*), Fuzzy-horned bumblebee (*Bombus mixtus*), and Yellowish Cuckoo bumblebee (*Bombus flavidus*). Although only seven species were documented during this survey, it is estimated that approximately 15 bumblebee species occur in the Lower Mainland. This estimate is not based on a single confirmed dataset but is supported by regional survey trends and observational records from iNaturalist.

The Eastern Bumblebee was detected in every GLSA survey, and the Red-belted Bumblebee was present in all but one site. Species composition differed in 2025 compared to both 2024 and 2023. Species such as the Two-form Bumblebee (*bombus bifarius*) and Indiscriminate Cuckoo Bumblebee (*bombus insularis*), which were observed in both previous years were absent from the 2025 survey, However, there is currently

insufficient data to determine whether this represents a true declining trend. However, three species were observed which had previously not been recorded, including the Nevada Bumblebee (*bombus nevadensis*), Yellowish Cuckoo Bumblebee (*bombus flavidus*), and California Bumblebee (*bombus californicus*) which is classified as Vulnerable by the IUCN.

Bumblebee activity varied over the summer, with noticeable seasonal trends. July had the highest activity, with an average of 22.3 bees captured per survey followed by September (12), August (9.9), and June (6.3). This trend likely corresponds to the changes in floral availability, as well as the natural life cycle of the bumblebee.

Species richness followed a similar trend. On average, 2.5 species of bumblebee were recorded per survey, ranging from 1.5 - 4. This is a decrease from the 2024 survey which had an average of four species per survey. Richness peaked in July with an average of 3.3 species per survey and by September richness dropped to 1.5, which reflects both the seasonal decline in floral resources and the reduction in activity of native species as the season progressed.

The Eastern Bumblebee (*Bombus impatiens*) became the dominant species caught in August and September (Figure 1). This shift suggests that the Eastern Bumblebee maintains activity later in the season relative to many native species, which begin preparing for winter hibernation.

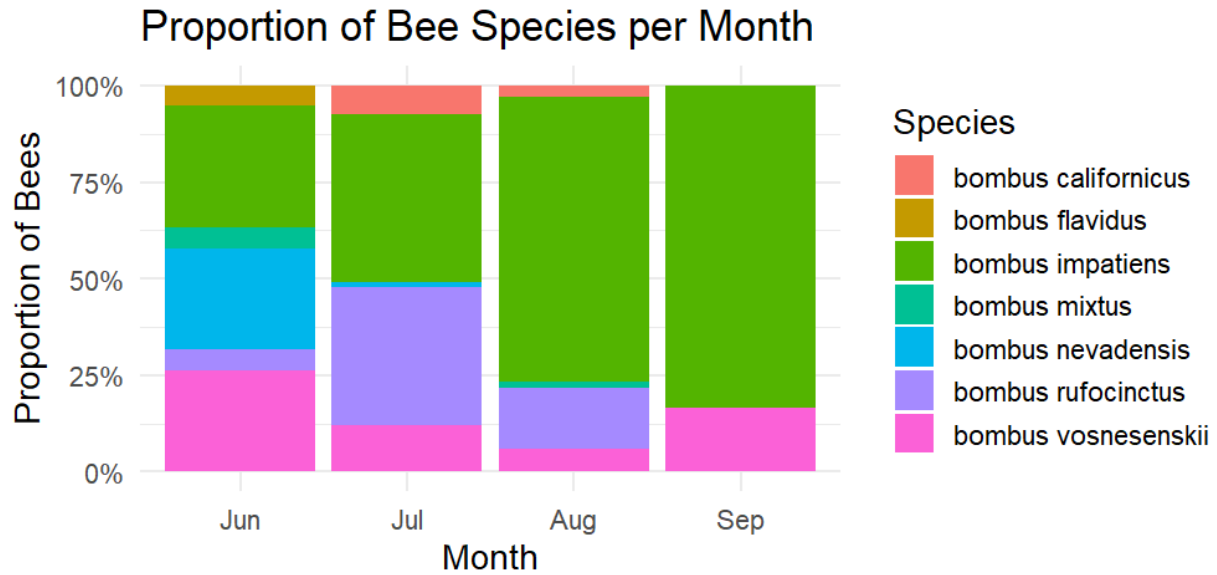


Figure 1 Monthly proportions of bumblebee species (2025) displayed as a stacked bar chart

Overall, clover was the most frequently visited floral resource by bumblebees in the 2025 survey. This was followed by phacelia and sunflowers, which bees were also commonly observed on (Figure 2). In addition to these planted species, several weedy plants, which were not included in the original set-aside seed mix, such as Bull Thistle, Vetch, and Oxeye Daisies. While the planted species provided the majority of foraging resources, the presence of these weedy plants demonstrates that bumblebees also utilize naturally occurring floral resources within set-asides.

Grassland set-asides are often planted with a pollinator mix containing annual flowering plants such as Super Bee Phacelia and Sunflowers. Although both can self-seed, the proportion of plants that re-establish in the second year is much smaller compared to the first year. As a result, species like clover may become the dominant floral species in older set-asides, while many set-asides become grass-dominant with sparser floral resources.

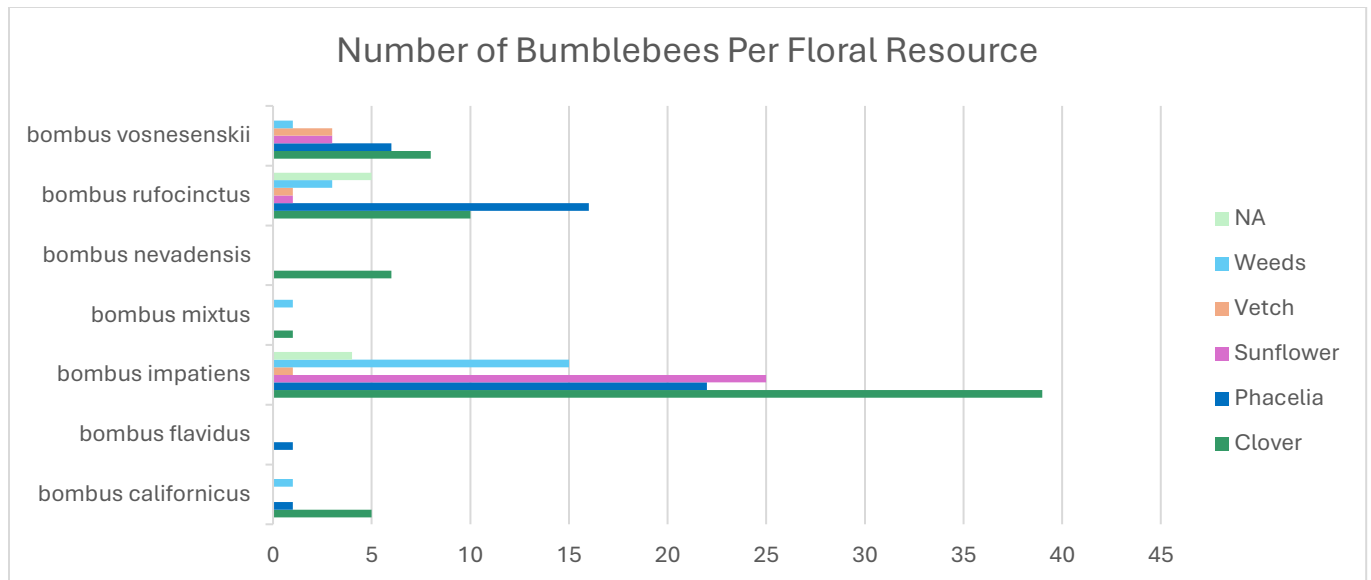


Figure 2 Number of bees of each species recorded on different floral resources (2025).

Bumblebee Trends (2023-2025)

Bumblebee surveys were conducted over multiple grassland set-aside fields over a three-year period (2023 – 2025). Observations were standardized by survey days to account for potential differences in sampling efforts.

The total number of bumblebees observed per survey was highest in 2023, decreasing slightly in 2024 and again in 2025. A one-way Anova revealed that the number of bees observed per survey differed significantly among years ($p=0.02$). A Post-hoc Tukey test indicated that surveys in 2023 had significantly more bees per survey than in 2025 ($p=0.02$), though the difference between 2024 and 2023 was marginally non-significant ($p=0.07$), and no significant difference was detected between 2024 and 2025.

Five fields were repeatedly surveyed throughout multiple survey years. A linear mixed-effects model was used to evaluate changes in species richness over time. Species richness showed a declining trend over time across repeatedly surveyed fields ($\beta = -0.79$ species per year), suggesting a potential reduction in bumblebee diversity, though sample size was limited.

Although the total number of bees decreased over time, the abundance of Eastern bumblebees (*Bombus impatiens*) has increased each year from 67 individuals recorded in 2023, 87 in 2024, and 102 individuals in 2025. Compared to 2023, the Eastern Bumblebee made up a significantly larger proportion of bees surveyed in both 2024 ($p= 0.008$) and 2025 ($p<0.001$). While ANOVA tests showed that the individual counts of the Eastern Bumblebee

did differ significantly, the proportion of total bees represented by this species has increased significantly (Figure 3).

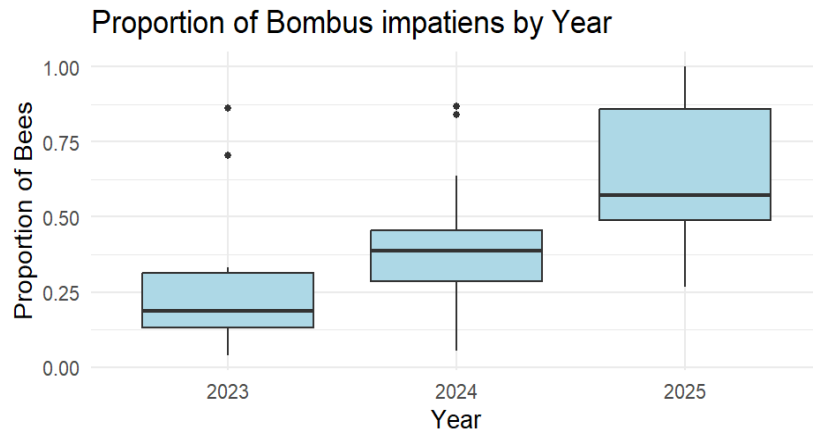


Figure 3 Proportion of Eastern Bumblebees (*Bombus impatiens*) by survey year.

Seasonal patterns were also evident in the presence of the Eastern Bumblebee (Figure 4). A paired T-test demonstrated a significant difference ($p=0.01$) between the proportion of Eastern Bumblebees found in early season surveys, June and July, compared to later season surveys in August and September. Eastern bumblebees may be escaping from greenhouses and establishing overwintering reproductive colonies. At this stage, it is not possible to determine whether the observed increase is due to successful nesting in natural habitats or repeated escapes from greenhouse populations (Knoerr, 2024).

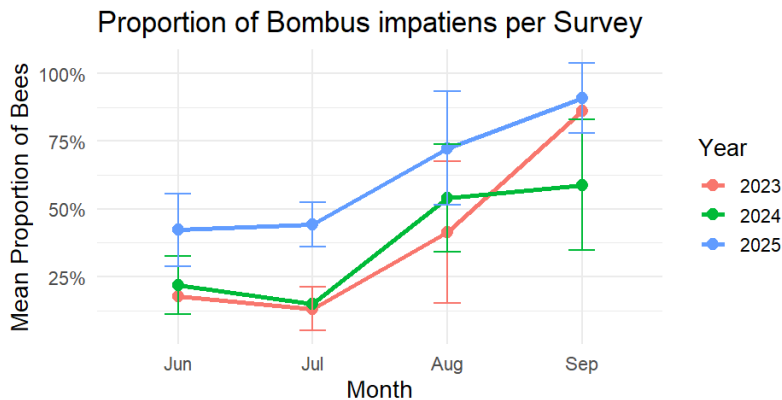


Figure 4 Monthly proportion of Eastern Bumblebee (*B. impatiens*) across 2023–2025.

Preliminary surveys were conducted in April 2026 to determine the presence of Eastern bumblebee queens overwintering on farmland. Within two fields surveyed that were

blooming with a turnip cover crops, the only presence of bumblebees that was recorded was that of the Eastern Bumblebee. A total of four queens were collected, and no other species was observed. This may indicate that Eastern Bumblebee queens are overwintering in the area and have established themselves in the wild.

As an introduced species, the Eastern Bumblebee poses a potential threat to native bumblebee populations. First brought to British Columbia in the early 2000s, Eastern Bumblebees were initially, and continue to be, used for greenhouse pollination due to their efficiency as pollinators. This advantage allows them to outcompete native species for resources. Additionally, the introduction of non-native species carries the risk of spreading diseases to native bumblebees when they escape from greenhouses (Looney, 2019). As the Eastern bumblebee is rapidly spreading through British Columbia, and Washington, many of the greater ecological effects are still unknown (Looney, 2019).

Species richness, measured as the number of species observed per survey, has also been decreasing over the three survey years. An Anova test showed a significant difference among years ($p < 0.001$), and a Post-hoc Tukey test showed that 2025 had significantly lower species richness than in 2023 ($p < 0.001$), and 2024 ($p = 0.0007$), while the difference in richness between 2023 and 2024 was not significant ($p = 0.13$). Mean richness has decreased from 5.1 in 2023, to 4.1 in 2024, and 2.5 in 2025 (Figure 5).

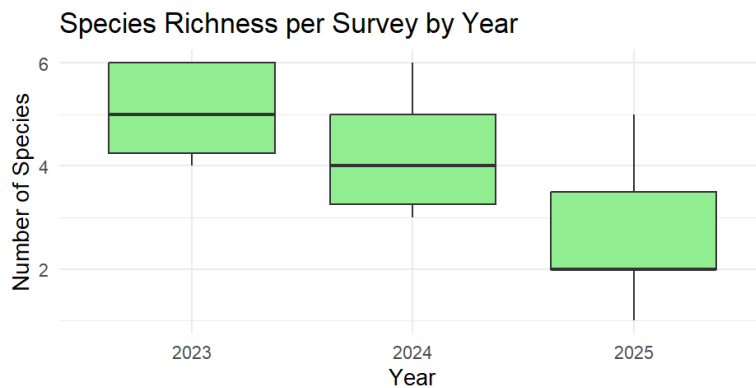


Figure 5 Species richness per survey per year.

Newly planted fields had the highest number of bumblebee observations per survey, while one- and two-year-old fields showed a slight decline, before increasing once more in fields older than four years old (Figure 6). Kruskal-Wallis tests show that observations did significantly differ based on field age (p -value = 0.017), in particular there was a significant difference only between fields that were newly planted and fields that were two years old ($p = 0.01$). Overall, this means that bumblebees are initially attracted to the new floral resources in newly planted set-asides. Though the individual counts decline slightly as fields age, older fields continue to support pollinators.

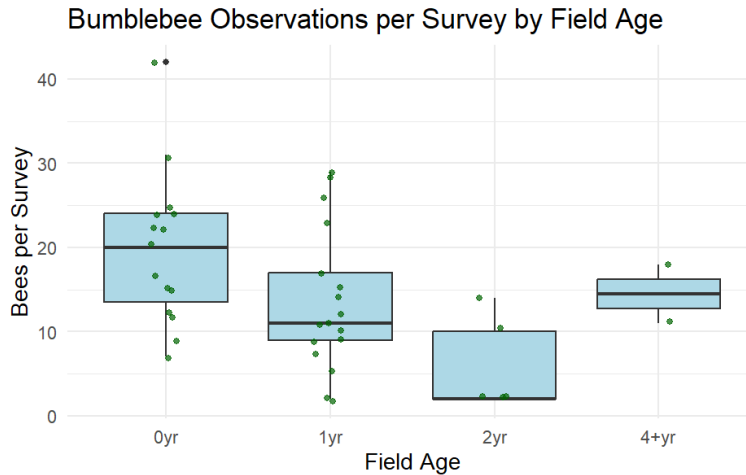


Figure 6 Scatter-box plot showing the number of bumblebees observed per survey by field age (years since planting).

Conclusion

Over the three-year survey period, grassland set-asides in Delta, BC, consistently supported bumblebee populations, though there was a decrease in both bee counts and species richness over time. Newly planted fields attracted the highest number of bees per survey, with a significant decrease observed in two-year-old fields. Despite these changes, fields continued to provide habitat for bumblebees throughout their lifespan, highlighting the effectiveness of GLSAs as pollinator habitat. The introduced Eastern bumblebee (*Bombus impatiens*) increased in proportion each year, particularly throughout the August and September surveys. The Eastern Bumblebees' efficiency could enable it to outcompete native species, posing a risk to native bumblebee populations. Monitoring the spread and ecological impact of this species is important to understanding and protecting native bumblebee communities.

Works Cited

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Knoerr, S. A. (2024). *Grassland set-asides as nesting habitat for bumble bees in agroecosystems* (T). University of British Columbia. Retrieved from <https://open.library.ubc.ca/collections/ubctheses/24/items/1.0447621>

Looney, C., Strange, J. P., Freeman, M., & Jennings, D. (2019). The expanding Pacific Northwest range of *Bombus impatiens* cresson and its establishment in Washington State. *Biological Invasions*, 21(6), 1879–1885. doi:10.1007/s10530-019-01970-6

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Appendix

Species	2023	2024	2025
Eastern Bumblebee (<i>bombus impatiens</i>)	68	83	106
Red-belted Bumblebee (<i>bombus rufocinctus</i>)	49	39	36
Fuzzy-horned Bumblebee (<i>bombus mixtus</i>)	34	18	2
Yellow-faced Bumblebee (<i>bombus vosnesenskii</i>)	34	27	21
Two-form Bumblebee (<i>bombus bifarius</i>)	16	15	0
Indiscriminate Cuckoo Bumblebee (<i>bombus insularis</i>)	15	8	0
Black-tailed Bumblebee (<i>bombus melanopygus</i>)	2	0	0
Nevada Bumblebee (<i>bombus nevadensis</i>)	0	0	6
Yellowish Cuckoo Bumblebee (<i>bombus flavidus</i>)	0	0	1
California Bumblebee (<i>bombus californicus</i>)	0	0	7
Total	218	190	179

Table 1 Breakdown of each bumblebee species and the number of observations per survey year.