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Abstract

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4 1 Introduction

5 2 Methods

6 2.1 Study system

7 Our study took place in the Lower Fraser Valley in southwestern British
8 Columbia, Canada, in an agricultural system dominated by mixed veg-
9 etable, hay, and perennial berry production. From 1984-2018 the Lower
10 Fraser Valley underwent a 13% decrease in forest patch area, mainly result-
11 ing from conversion to urban or agricultural land use (Paul et al., 2020).
12 *decide what else needs to be said in this section later on!*

13 Field surveys were conducted across six replicate landscapes distributed
14 throughout the Lower Fraser Valley. Each landscape encompassed roughly
15 3 sq km of farmland interspersed with rural/suburban residence. Land-
16 scapes were initially chosen to span a gradient of configurational and com-
17 position diversity metrics, including Shannon's diversity, edge density,
18 and the ratio of annual to perennial crop cultivation.

19 Thirty sampling transects (50 meters x 2 meters) were established in each
20 landscape, spaced as evenly as possible based on land-access and the avail-
21 ability of foraging resources on which to observe bees. We did not survey
22 in active crop fields except for high-bush blueberry, which offers floral
23 resources during its spring bloom and can sometimes host other flowers
24 such as clovers (*Trifolium spp.*) and flatweed (*Hypochaeris radicata*) later in

the season. A total of *INSERT TOTAL TRANSECT NUMBER HERE* were surveyed over the course of two years (2022-2023) due to changes in land access within and between years.

2.2 *Bombus* collections and floral surveys

Each landscape was surveyed during 10 sampling rounds in year one (May-August 2022) and 17 sampling rounds in year two (March-August 2023). During each round of sampling, surveys were conducted on *INSERT MEAN PLUS OR MINUS SD OF SAMPLING EFFORT* (mean \pm SE) transects.

Bombus surveys at each transect entailed 5 minutes of active search time (totaling 140 hours in 2022 and *INSERT TOTAL SAMPLING EFFORT 2023* in 2023), during which the stopwatch was paused whenever a foraging bumble bee was sighted. Specimens were captured by netting, placed into sterile 15 mL tubes, and immediately placed on ice before transfer to a -80°C freezer at the end of the day. Surveys were conducted on days when the temperature was above 12°C (10°C for queen surveys) and wind speeds below 2.5 m/s. In 2022, all *Bombus* species were collected; in 2023 only the focal species (*B. mixtus* and *B. impatiens*) were collected.

To assess floral quality, all flowering plants within the transect area were identified to species or genus level. Abundance estimates were given for each species using a log-scale (i.e., 0 = 1-10 inflorescences, 1 = 11-100 inflorescences, 2 = 101-1000 inflorescences, 3 = 1001-10,000 inflorescences, 4

47 = 10,000+ inflorescences). Floral survey data was later filtered to exclude
48 species which bumble bees were never observed visiting (based on over
49 3,400 visitation events in 2022, and 3,500 visitation events in 2023). This
50 filtering step was included to reduce the noise introduced by a variety
51 of herbaceous weeds with flowers too small to attract or support bumble
52 bee foragers, but which were frequently observed on the transects in high
53 abundance.

54 **2.3 Landscape characterization**

55 Land cover maps were developed for each study site based on manual
56 classification of Google Earth satellite imagery (2021) and site visits. Briefly,
57 land cover was classified into 16 categories: annual row crops, blueberry,
58 cranberry, other perennials, polyculture, hay meadows, pasture, fallow,
59 grassy field margins, hedgerows (tree-dominated), hedgerows (blackberry-
60 dominated), forest, wetlands, urban/suburban, roads, and water). These
61 land cover types were chosen based on their hypothesized provisioning
62 of nesting/floral resources and differences in disturbance regimes (see Ta-
63 ble ?? for details). Land cover was mapped at 2-meter resolution in QGIS
64 (QGIS Development Team, 2024).

65 **3 Results**

66 **4 Discussion**

67 **References**

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⁷⁵ **Supporting Information**