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Male *Bombus nevadensis* annually populate a congregation site for 14 years (Hymenoptera: Apidae)

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Abstract. Drones of a North American bumble bee, *Bombus nevadensis*, are known to congregate in small adjacent territories in late summer, within which they scent mark, patrol and perch to encounter passing gynes. Males of several other *Bombus* species are reported to occupy sites for several sequential years, but in northern Utah, one such congregating site was still in use after 14 years. Enduring congregation sites seem likely for other territorial bumble bee species as well.

INTRODUCTION

Male bumble bees employ one of several tactics to encounter and mate with newly-emerged gynes in the late summer and early autumn (O'Neill *et al*., 1991; Goulson *et al*., 2011). Drones of some species aerially throng the nest entrances of conspecific colonies (*e.g*., *Bombus appositus* Cresson; Cane, 2026), competing for access to emerging virgin gynes. Alternatively, drones of other species await virgin gynes by patrolling a long "trap-line" of vegetation that they have marked with pheromone (*e.g*., Svensson, 1979), or "hill topping" (*e.g*., Goulson *et al*., 2011), or defending and scent-marking small territories within which they perch to visually survey for passing gynes (*e.g*., O'Neill *et al*., 1991). Drones of one *Bombus* species employ two of these tactics (Harano *et al*., 2018). These drone congregation areas (DCAs) act like leks except that we do not know if the infrequently arriving gynes are choosing among displaying males, a defining feature of vertebrate leks (Kimsey, 1980; Otis, 2026).

Charles Darwin was apparently the first to report bumble bees annually reoccupying the same DCA. He observed *Bombus hortorum* (Linnaeus) patrolling the same ditches and hedges around his Down House in England for five sequential years (Freeman, 1968). Shorter sequences of 2–3 sequential years are reported for *Bombus* drones reoccupying DCAs (*e.g*., Alcock & Alcock, 1983), including for *Bombus nevadensis nevadensis* Cresson (Alcock & Alcock, 1983; O'Neill *et al*., 1991). Typically, the sequence is ended by the researcher rather than a cessation of use by drones, leaving open the possibility that these DCAs are in fact occupied for more than 2–3 years.

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MATERIAL AND METHODS

Two DCAs of *B. nevadensis* were found along the lower reaches of Logan Canyon in the Bear River mountain range of northern Utah, USA. One site followed the trail up Mill Hollow (41.751° x -111.723°, 1590 m elev.; Fig. 1). The other was 5.5 km distant across Logan Canyon near the bottom of Vault Canyon (41.770° x -111.664°, 1615 m elev.). Drones of *B. nevadensis* were readily distinguished from other local species, particularly *Bombus griseocollis* (De Geer), by a suite of diagnostic morphological features: protuberant convergent eyes, shorter antennal flagellomeres (held straight forward by perched males), and two genital traits (straight penis valves, gonostyli without hooked tips) (Thorp *et al*., 1983). A drone taken at Mill Hollow is vouchered in the National Pollinating Insect Collection of the USDA-ARS at Utah State University, Logan, Utah, USA.



Figures 1–2. Drone congregation areas (DCA) of *Bombus nevadensis* in northern Utah, USA. **1.** Trail passing through the Mill Hollow DCA, observed in use between 2013 and 2026. **2**. Drone atop its perch at the Vault Canyon DCA.

RESULTS

Both the Mill Hollow and Vault Canyon DCAs for *B. nevadensis* were first noticed in 2013. In 2014, the sites were revisited on August 6 and 10. At Vault Canyon, I counted 59 males, 13 of them perched on taller stems of often dead vegetation (Fig. 2; Cane, 2026). On six occasions, males were seen climbing vegetation with their mandibles spread, presumably applying scent marks. These and other behaviors of drone *B. nevadensis* at DCAs conform to an earlier account (O'Neill *et al*., 1991). Upon revisiting the DCA sites in 2018 and again in 2026, drones of *B. nevadensis* were again seen perching and patrolling, albeit in fewer numbers than Vault Canyon in 2014.

Both locations were patches of dry, browned herbaceous vegetation bordered by short-statured (~6–8m tall) groves of the Bigtooth Maple, *Acer grandidentatum* Nutt. In Vault Canyon, these south-facing patches were larger and irregular in shape, but

on the north-facing slope of Mill Hollow, the senescing grasses and forbs bordered a footpath in a band 5–7 m wide that cut through the maple grove. There the DCA was 140 m long, and by 10:00 h, was in dappled shade to full sun. Very few flowers were still blooming within the confines of the DCAs.

DISCUSSION

Annual reuse of the same lek or trysting site has been studied more extensively with several kinds of birds and mammals. Among birds, multiple field studies report a decade or more of annual occupation of leks by manakins and grouse (*e.g.*, Hovi *et al*., 1996; Ryder & Sillett, 2016). For these longer-lived vertebrates, multiple generations overlap at leks, such that young males can search for and join leks at specific locations. This enables persistence or "traditionality" of the leks, a sort of cultural memory not available to short-lived insects. We now know that aerial DCAs of honey bees can be repopulated annually, sometimes for decades (Seeley, 2019), even though honey bee drones cannot benefit from the site memory of an older overlapping generation of experienced males.

In parallel with honey bees, newly-emerged bumble bee drones and virgin queens from multiple nests congregate to seek receptive mates. Darwin was particularly astonished that bumble bee DCAs persisted over the several years that he and his children observed them at his Down House (Freeman, 1968), yet such persistence goes unheralded in the various books about bumble bees. The navigational cues that lead the first young naive drones and gynes of bumble bees to an unpopulated DCA are wholly unknown to us, although they may include some of the same navigational cues apparently employed by congregating honey bee drones (Otis, 2026). Given the paucity of bloom at the two DCAs of *B. nevadensis*, the drones were not gathered there to defend floral resources, consistent with one of the defining characteristics of leks.

Reoccupation of two DCAs by drones of *B. nevadensis* in sequential years for 1, 7, and even 14 or more years indicates that the drones and gynes follow persistent landscape features recognized by multiple individuals of both sexes. The maples bordering both DCAs, although short-statured, are known to live for many decades (Van Auken *et al*., 2017). They provide a suitably persistent landscape edge feature that may help demark these two DCAs, although by themselves they are insufficient. On subsequent days, drones can presumably use the visual landmarks that they learned on the first day to navigate back to their DCA, while later arrivals could follow the pheromonal cues applied by the first congregated drones.

These two DCAs were encountered serendipitously at locations that were relatively convenient to revisit. When I first encountered them, I did not expect their DCAs to persist, but we now know that annual monitoring of *Bombus* DCAs is both warranted and achievable. Indeed, in my experience, DCAs of *B. nevadensis* were much more noticeable than the nests of any bumble bee species. Reminders to annually revisit DCAs can be set using cell phone apps. A voucher male or two should be taken for conclusive identification, and the site's dimensions and habitat traits recorded, as well as notable weather conditions and anomalies. During the season of drone activity, promising neighboring areas/trails can be walked and the presence or absence of drone activity noted.

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