HOW IS NATIVE, CAVITY-NESTING BEE COLONIZATION DRIVEN BY RESOURCE AVAILABILITY & HABITAT COVERAGE WITHIN AN URBAN COLLEGE CAMPUS?

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ABSTRACT

To expand research regarding the influence of urban infrastructure on bee ecology, this study assessed the specific response of native, cavity-nesting bees to varying habitat qualities between three sites at the University of North Texas. Six bee boxes were installed at three sites to gather colonization data, while pollinator-visitation events provided data about floral resource use. Data collection persisted from late-June to late-October, 2024, with sampling occurring from 10:00 a.m. to noon every Friday. The results indicated a preference for *Dianthidium sp*. to colonize habitats with high floral availability, low nesting availability, and high-habitat coverage.

KEY WORDS: Native bees, ecology, conservation, bee boxes, *Dianthidium* genus

The ‘save the bees’ initiative has drawn the public eye toward pollinator conservation, with the prime target of the initiative’s resting upon a non-native species, *Apis mellifera* (western honey bees). While *A. mellifera* pollination efficiency is responsible globally for the high agricultural yield of many crops, this non-native species exhibits detrimental effects on the native bees that utilize the same resources (Klein et al., 2007; Mallinger et al., 2017; Hudewenz & Klein, 2015). Native bees face similar environmental stressors to *A. mellifera*, such as urbanization, habitat fragmentation, climate change, and loss of floral resources, but without substantial attention from the public (Wilson et al., 2017). Recently, there has been an increasingly prevalent shift in ecological research to study native species alongside *A. mellifera* to promote awareness for their conservation, as well as expanding the pre-existing literature that describes their resource and habitat use (Wilson et al., 2017).

"Bee boxes" (also known as bee hotels, nest boxes, or trap nests) are man-made structures built from wood and pithy stems, offering supplemental housing for native, cavity-nesting bees in areas that lack the necessary nesting resources. Anthropogenic materials (metal soda cans, glass, paper straws, and bricks) have also been incorporated into bee-box design, while retail companies like Lowe's and Target sell and distribute them across the United States (Free & Williams, 1970; MacIvor, 2017). Pertinent to such habitation is the way native, cavity-nesting bees are solitary bees that excavate new cavities in wood (or utilize pre-existing cavities) for reproduction, unlike the eusocial *A. mellifera* that creates freestanding hive nests with a queen and many offspring (Michener, 2007). Most bees, including cavity-nesters, exhibit a solitary lifestyle with neither hierarchy nor nestmates, meaning that one non-queen female will provision a nest for her offspring (Michener, 2007). The low quantity of offspring produced by solitary bees is further restricted by the expansion of human urbanization and deforestation, subsequently shrinking the abundance of nesting opportunities due to decreased plant habitat. Creating these boxes for native, cavity-nesting bees has become a popular hobby and conservation strategy for engaging community scientists, academics, and nature enthusiasts. Thus, more research is needed to determine the extent of bee box efficacy in supporting native, cavity-nesting bees as this conservation strategy increases in popularity.

Previous bee-box research can be traced back to the early 20th century use of various materials and experimental methods to evaluate solitary bees alongside their nesting biology (Free & Williams, 1970). Despite earlier research implementing anthropogenic materials (i.e. metal soda cans and glass), later research has suggested that natural materials (i.e. pithy stems and wooden rows) are more efficient at attracting and supporting colonization (MacIvor, 2017).

Moreover, this research has expanded over the decades to include bee boxes' agricultural impact, parasite transmission, introduced- , as opposed to native-bee pollination efficiency, responses to urbanization, and many other variables (Free &

Williams, 1970; MacIvor, 2017; Eeraerts et al., 2022). As suitable plant habitat and nesting opportunities decrease with frequent urbanization, as need arises to study the success of native bees in urban spaces. Urban gardens, suburban towns, and various fragmented habitat patches have been the focus of most pre-existing research, but there is a lack of extensive research regarding the specific influence of college-campus habitat management on differences in bee-box colonization (Hernandez et al., 2009). Several college campuses across the United States (i.e. University of Minnesota at Morris, Cal Poly, and Cornell University) have provided support for developing environmental initiatives that provide habitat for native wildlife (Affordable Schools, 2021). While most bee research occurs in natural or agricultural settings, colleges may shed further insight into the effects of urban infrastructure and environmental initiatives on native-bee colonization (Klein et al., 2007; Mallinger et al., 2017; Hudewenz & Klein, 2015; Free & Williams, 1970; MacIvor, 2017; Eeraerts et al., 2022).

I investigated the impact of habitat qualities on native, cavity-nesting bee colonization via a bee box research study that on the UNT main campus and Discovery Park campus. Three sites of varying habitat qualities (differences in the floral availability, nesting availability, and habitat coverage for each site) were chosen across UNT campus for examination of native bee colonization in man-made bee boxes during the summer and fall of 2024 (Table 1).

Table 1. Habitat qualities for each site, regarding their floral availability, nesting availability, and habitat coverage

Site	Floral availability	Nesting availability	Habitat coverage
Chemistry Building (CB)	High	High	Low
Pollinative Prairie (PP)	High	Low	High
Willis Library (WL)	Low	High	Low

The terms floral availability, nesting availability, and habitat coverage are considered as the presence of floral resources in proximity to each bee box, the presence of nearby nesting opportunities for cavity-nesting bees (such as trees and dead wood), and the area of available habitat in relation to surrounding urban infrastructure, respectively. All three aspects are critical to successful bee colonization: floral resources impact reproduction and development, nesting resources provide shelter for offspring, and habitat coverage dictates the capacity for resources in each area. Two bee boxes were installed at each of the three sites and monitored from late June to the end of October to acquire data about colonization trends. During data collection for all six bee boxes, plant-pollinator relationships were further examined to understand how floral resources are used by native, cavity-nesting bees. Through an assessment of the bee-box colonization factors and plant-pollinator relationships, several questions emerged:

(1) Which native bee species are more likely to colonize the bee boxes?

(2) Are there differences in native bee species colonization across sites?

(3) Which habitat qualities are preferred for native, cavity-nesting bees?

(4) How do native, cavity-nesting bees use floral resources?

Higher bee-box colonization is hypothesized to occur when habitat coverage is lower, since prevalent urbanization makes smaller habitat patches more abundant in the landscape than larger habitat patches. Further, higher bee-box colonization is expected at sites with abundant nesting availability because native, cavity-nesting bees already utilize those resources before bee box installation. Floral resources are critical to reproduction and development, so sites containing a higher abundance of flowers are predicted to be more beneficial for colonization than sites that contain a lower abundance.

MATERIALS & METHODOLOGY

Site Selection

Site locations were selected under the categories ‘high’ or ‘low’ according to an estimated abundance of floral and nesting resource availability, as well as habitat coverage. High-nesting availability was noted as more than five nesting opportunities (one opportunity is the equivalent of one tree or piece of dead wood) near a site, high-floral availability involved more than three individuals of the same species within the confines of the habitat, and high habitat coverage specified an area larger than 50 meters in diameter. Conversely, sites with low-nesting availability included less than five nesting opportunities; low- floral availability denoted one individual of a species; and low-habitat coverage was assigned for an area smaller than 15 meters in diameter. A UNT grounds committee then approved the placement of bee boxes within three sites (WL, CB, and PP) of these various qualities across the UNT main campus and Discovery Park campus within the scope of Denton, Texas (Figure 1).

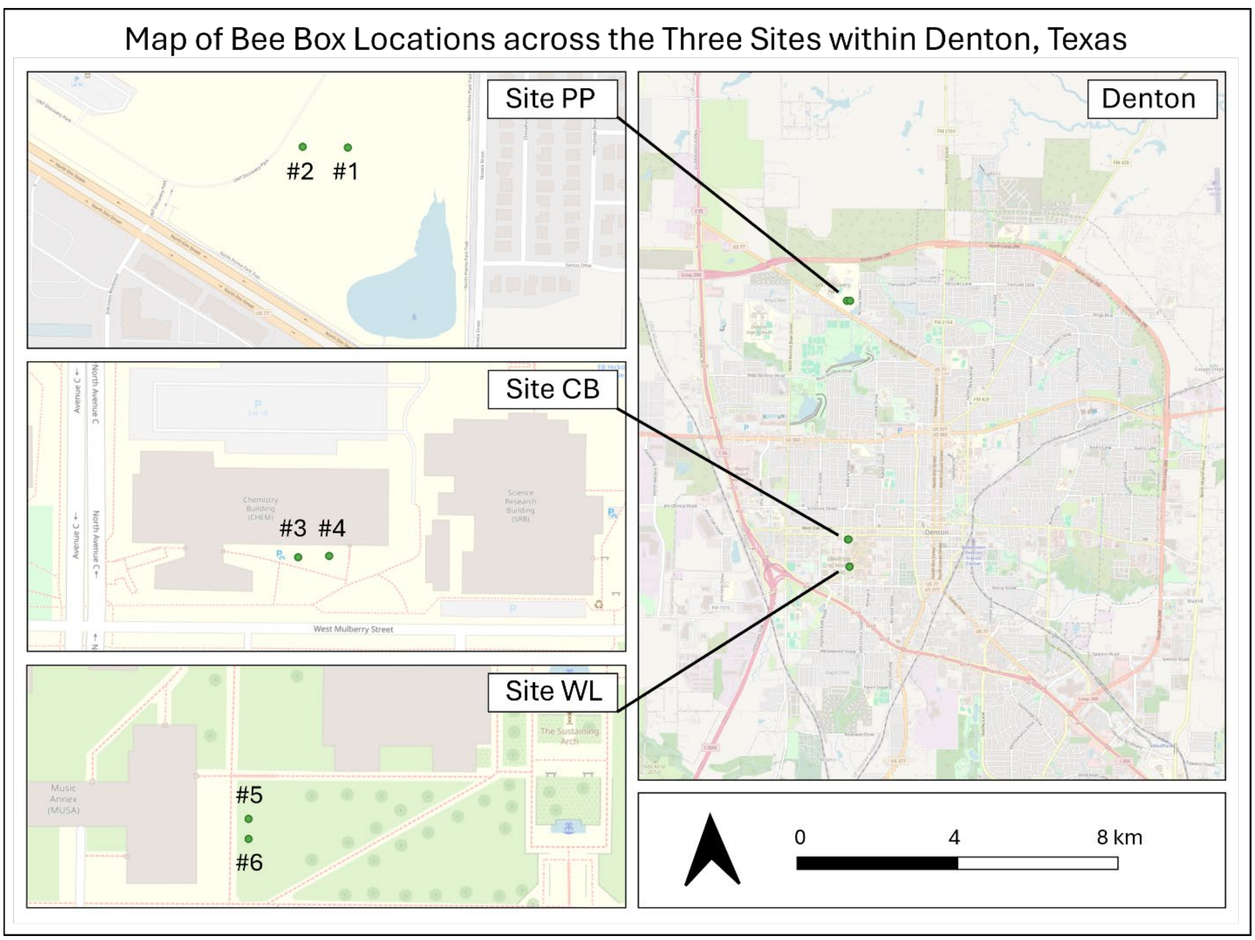

Figure 1. Map visualization of the three UNT campus site locations (with bee boxes numbered at each site) within Denton, Texas; geographical coordinates for bee boxes are as follows: (#1) 33.252, -97.15 (#2) 33.251, -97.15 (#3) 33.214, -97.15 (#4) 33.214, -97.15 (#5) 33.21, -97.149 (#6) 33.209, -97.149

Each site also met the following institutional criteria set by UNT: official approval of location by the committee, lack of harm to UNT affiliates (students, staff, and faculty), and continued supervision by student-led organizations.

Bee Boxes & Installation Materials

Two handmade bee boxes were installed on t-posts within the landscape at each site (Figure 2A). The materials used for the bee boxes were untreated wood, brown wood stain, wood screws, wood glue, wooden separable rows (Meyer Bees, Minooka, IL), and Nectar Fortress ant repellant (Sapphire Labs, Brentwood, CA). Each bee box was 19.7 centimeters (cm) x 18.4 cm x 19.7 cm (overhang measured 25.4 cm in length) with 96 cavities. After assembly, the bee boxes were fitted with a t-post bracket for secure adhesion to each t-post in the event of intense weather (Figure 2).

Figure 2. Images of bee box design (A) adhered to a t-post at site WL, (B) after being painted with wood stain, and (C) in the early phase of construction

Each bee box was positioned on the t-post facing either south or southeast to avoid direct sunlight that may hinder the colonization of the boxes (MacIvor, 2017). Moreover, Nectar Fortress ant repellant was consistently applied to the t-posts later in data collection as *Solenopsis invicta* (fire ants) began to invade the boxes at site WL.

Abiotic Conditions

The data collection period lasted for four months during 2024 in the city of Denton, Texas. Abiotic conditions for temperature (°Celsius), precipitation (inches), humidity (percentage), wind speed (miles per hour), year-to-date growing-degree-days (YTD GDD), and cloudiness were recorded for each sampling period using the Weather Underground (The Weather Company, Brookhaven, GA) and GreenCast (Syngenta, Basel, Switzerland) applications (Table 2).

Table 2. List of the abiotic conditions during data collection (temperature, precipitation, humidity, wind speed, YTD GDD, and cloudiness), with corresponding units in parentheses, including survey absences that are marked in full black shading[1]

Date	**Temperature** (°C)	**Precipitation** (In.)	**Humidity** (%)	**Wind Speed** (MPH)	**YTD GDD**	**Cloudiness**
28-XI-2024	32.2	0.0	58.0	12.8	2734.5	Mostly cloudy
5-XII-2024	27.7	0.0	65.4	9.0	2991.5	Light storm
12-XII-2024	30.3	0.0	55.1	9.8	3220.0	Partly cloudy
19-XII-2024	28.3	0.1	58.3	6.2	3462.0	Partly cloudy
26-XII-2024	25.9	0.0	74.3	5.7	3671.0	Cloudy
2-XIII-2024						
9-XIII-2024	29.1	0.0	64.1	9.2	4186.5	Light storm
16-XIII-2024	33.5	0.0	52.3	9.6	4455.0	Partly cloudy
23-XIII-2024	32.3	0.0	57.7	14.5	4731.0	Fair
30-XIII-2024	28.0	0.0	70.1	6.3	4977.0	Mostly cloudy
6-IX-2024	26.7	0.0	67.9	11.5	5182.0	Partly cloudy

[1] August 2 and October 4 were blacked out for survey absences due to sicknesses that prevented any data collection on those dates.

13-IX-2024	27.5	0.0	57.1	6.2	5347.5	Fair
20-IX-2024	30.4	0.0	56.2	9.3	5579.5	Partly cloudy
27-IX-2024	22.5	0.0	49.5	8.2	5769.5	Fair
4-X-2024	[redacted]					
11-X-2024	26.1	0.0	40.0	10.3	6151.0	Mostly cloudy
18-X-2024	18.4	0.0	44.0	11.8	6283.0	Partly cloudy
25-X-2024	25.6	0.0	57.7	10.3	6443.5	Fair

Experimental Design

The data collection process consisted of weekly sampling periods (15-minute duration at each bee box) that took place from 1000 to 1200 (high bee activity before intense heat) from June 28 to October 25, regardless of weather conditions. An iPhone camera application and iNaturalist application (iNaturalist, San Rafael, CA) were implemented to record visual observations of bees and flowers at each site, as well as to track the rate of bee box colonization (defined as a fully capped cavity without room for additional nesting) over time. Additionally, pollinator-visitation events (when a bee was in contact with the floral reproductive organs for at least five seconds) were noted in the surrounding area when the camera application recorded bee-box activity. Observations and pollinator-visitation events were uploaded to iNaturalist to obtain information about taxonomic identification with assistance from the iNaturalist community and experienced entomologists.

Pollinator Networks

Pollinator networks, depicted as a visual display (grid) with bees as columns (or rows) and visited flowers as the alternate position, are often applied to ecological research to focus on plant-pollinator relationships. The pollinator-visitation events noted during data collection were translated into these networks to further examine how native, cavity-nesting bees use floral resources at each site. In addition, this study did not focus on the frequency of each pollinator-visitation event, but rather the presence of a plant-pollinator relationship. Information from these events was subsequently compiled into a pollinator network with the help of 'bipartite' and 'tidyverse' packages on the R 4.4.1 software version.

RESULTS

Bee Box Colonization

Sites CB and WL had no noteworthy colonization during the data collection period, despite the three unidentified instances of colonization at bee box #3 without visual observation. The only site that had colonization of both bee boxes was site PP with 58.33% occupancy and 22.92% occupancy at bee boxes #1 and #2, respectively. There was an initial period of 25 days without noticeable colonization at either bee box, followed by a steady increase (more pronounced in bee box #1) starting from day 35 and progressing onward (Figure 3).

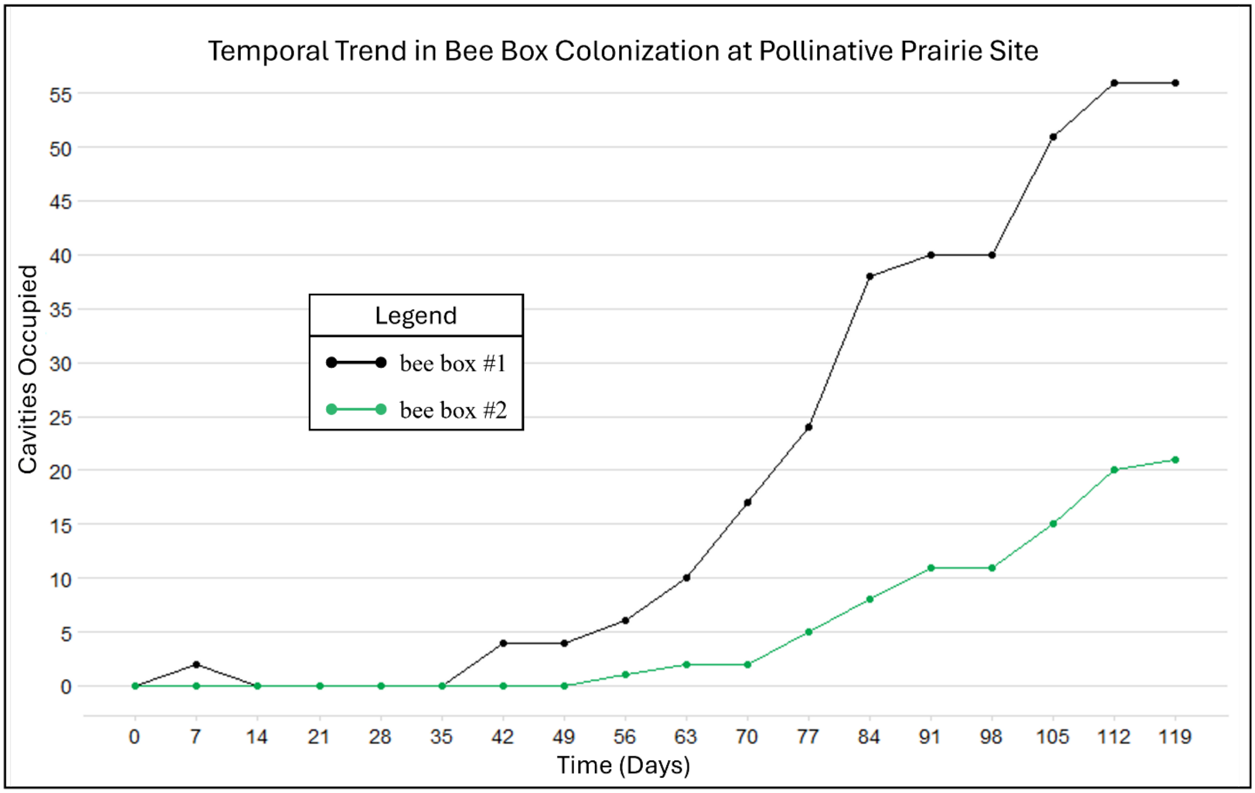

Figure 3. Site PP colonization of bee box #1 and bee box #2 by native, cavity-nesting bees across the total data collection period (in order of daily sampling) to demonstrate the corresponding temporal changes

Two instances of colonization by *Megachile sp*. (leafcutter bees) were recorded for bee box #1 on week three, but these specimens were not found in the following weeks of sampling. The dominant taxon that inhabited both bee boxes at site PP was *Dianthidium sp*. (resin bees) which colonized from August to the end of October (Figure 4).

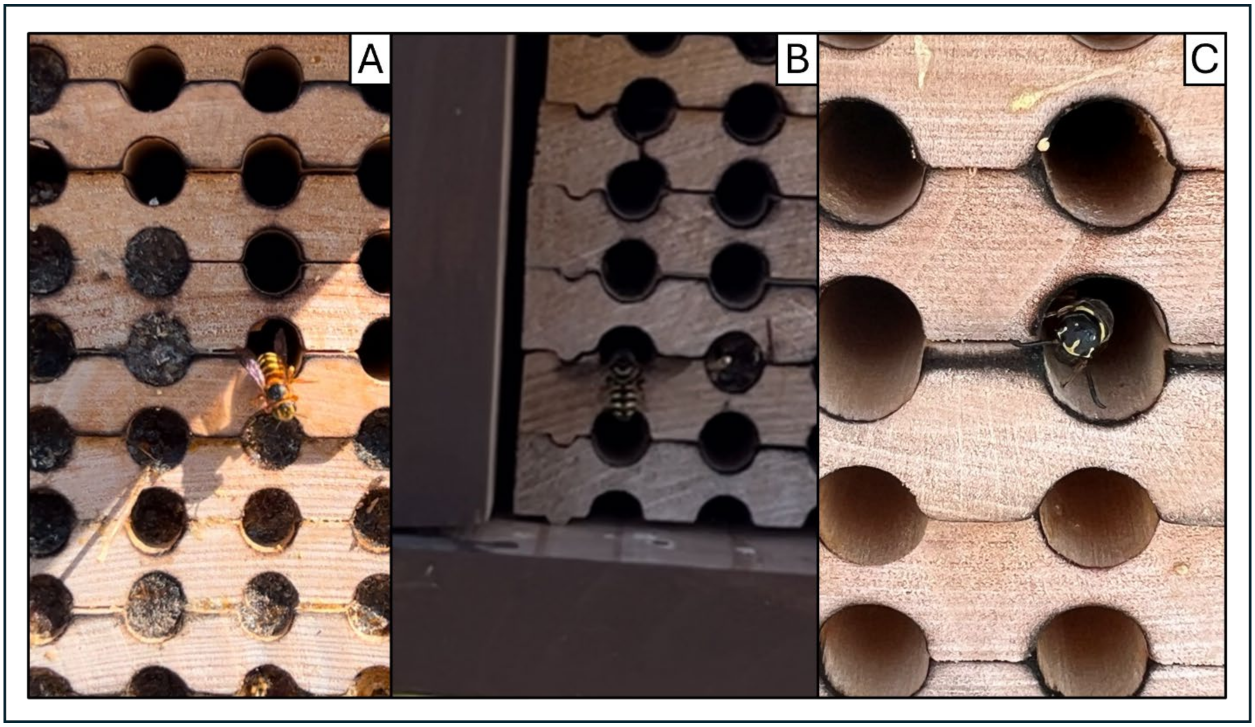

Figure 4. *Dianthidium sp*. observations from different angles: (A) aerial view leaving a cavity, (B) aerial view entering a cavity, and (C) front view leaving a cavity

The taxonomic distinction was identified at the genus level since species identification was not possible with only photos of bee observations on iNaturalist. Other nearby observations identified *D. curvatum* as a possible species, but there was no verification of this taxonomic suggestion by experienced entomologists.

Pollinator Networks

The three sites and their respective pollinator networks displayed variations in the type of bee and flower taxa that inhabited each habitat. Site WL pollinator-visitation events yielded a total of six bee visitors and 14 flowers visited (Figure 5). The most abundant visitor of the site WL network was *A. mellifera*, followed by an unknown bee from the Halictidae family, then a member of the *Megachile* genus (Figure 5). *Helianthus annuus* (common sunflower) and *Nepeta racemosa* (eastern catmint) were the most visited flowers with three visits (Figure 5).

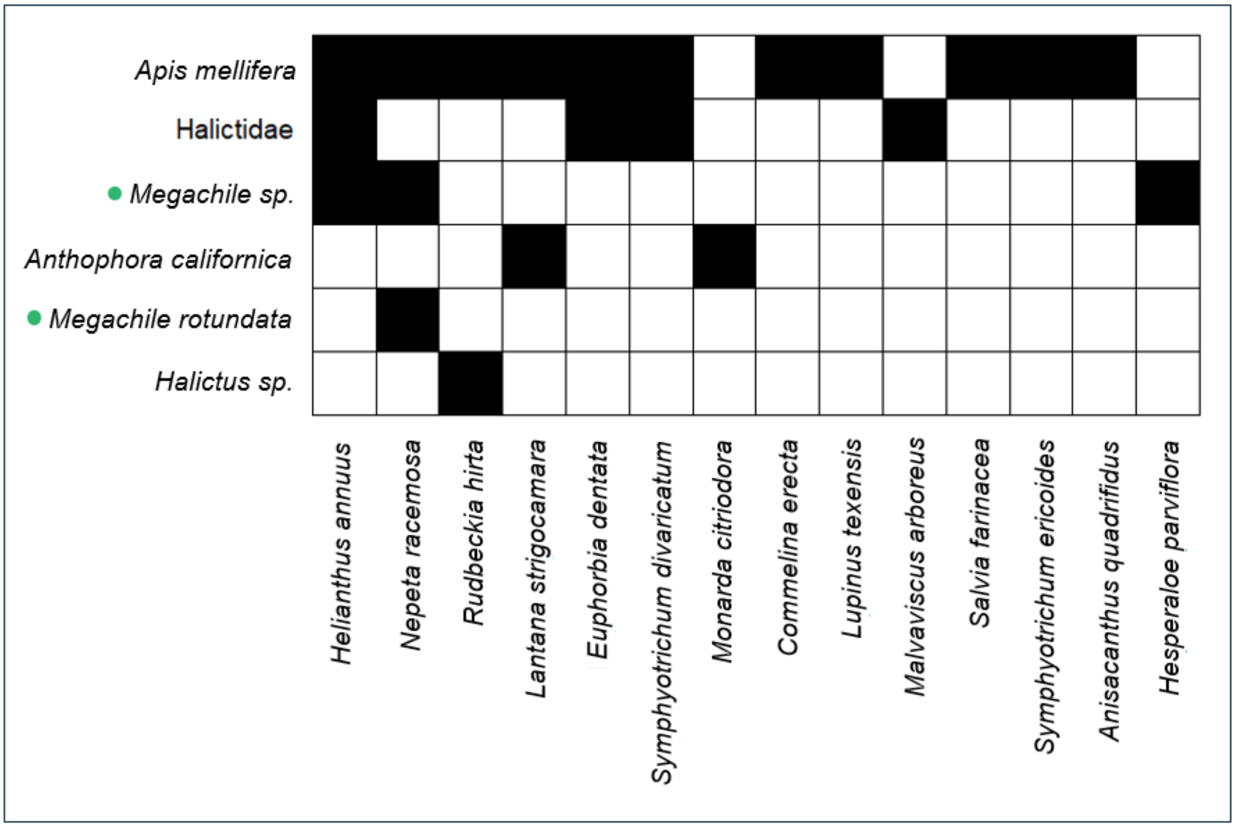

Figure 5. Pollinator network, with cavity-nesting bees marked with a green circle, for site WL during the data collection period

Site CB pollinator-visitation events yielded a total of six bee visitors and 14 flowers visited (Figure 6). The most abundant visitor of the site CB network was *A. mellifera*, and the second most abundant was tied between an unknown bee from the Halictidae family and a member of the *Megachile* genus (Figure 6). *Gaillardia* *pulchella* (firewheel) was the most visited flower with seven visits, followed by *H. annuus* with six visits (Figure 6).

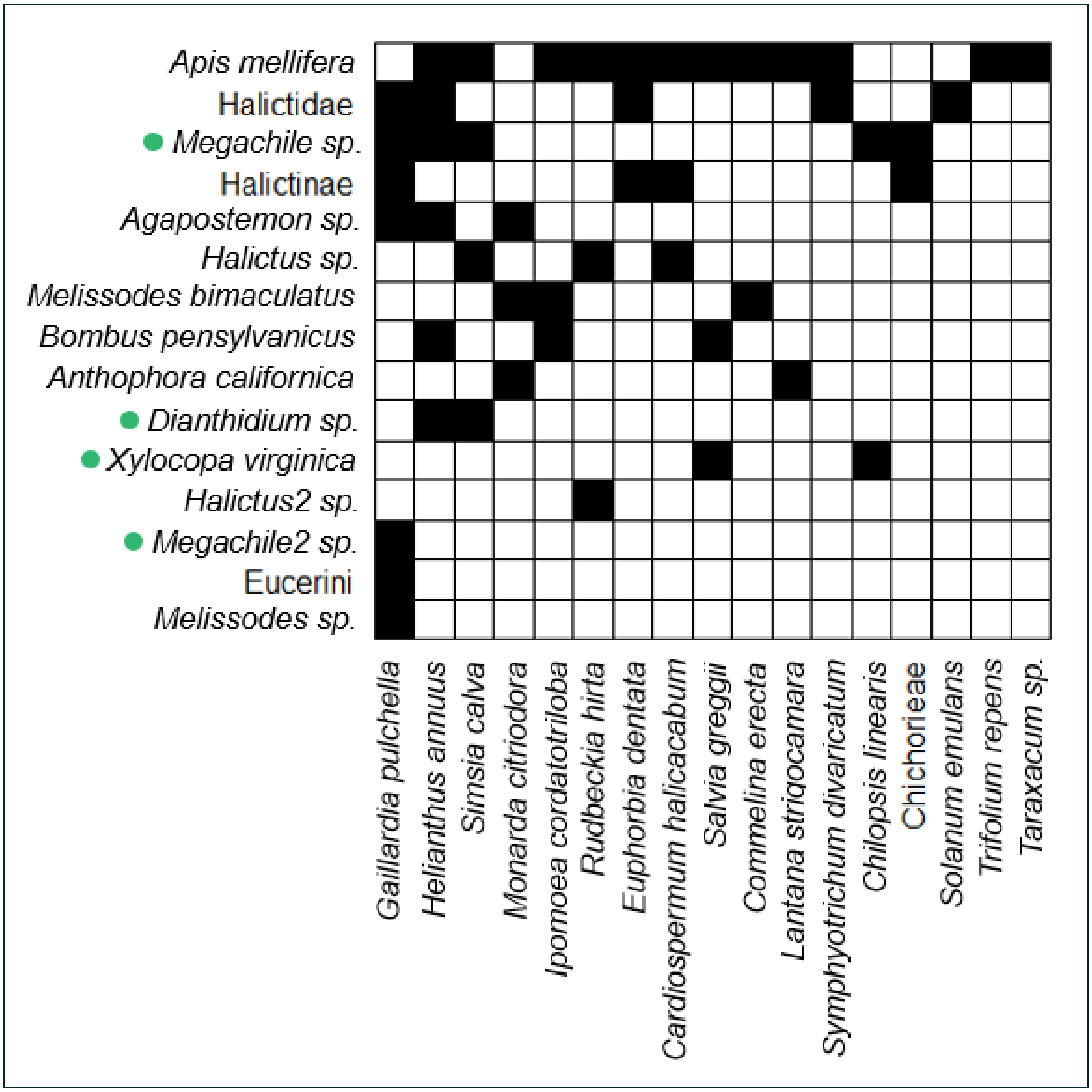

Figure 6. Pollinator network, with cavity-nesting bees marked with a green circle, for site CB during the data collection period

Lastly, site PP yielded pollinator-visitation events that included a total of 12 bee visitors and 10 flowers visited (Figure 7). The most abundant visitor of the site

PP network was *A. mellifera* with six visits, and the second most abundant was one of two *Megachile sp*. that were documented at the site with five visits (Figure 7). *H. annuus* was also the most visited flower, followed by a tie between *G. pulchella* and *Convolvulus arvensis* (field bindweed) (Figure 6).

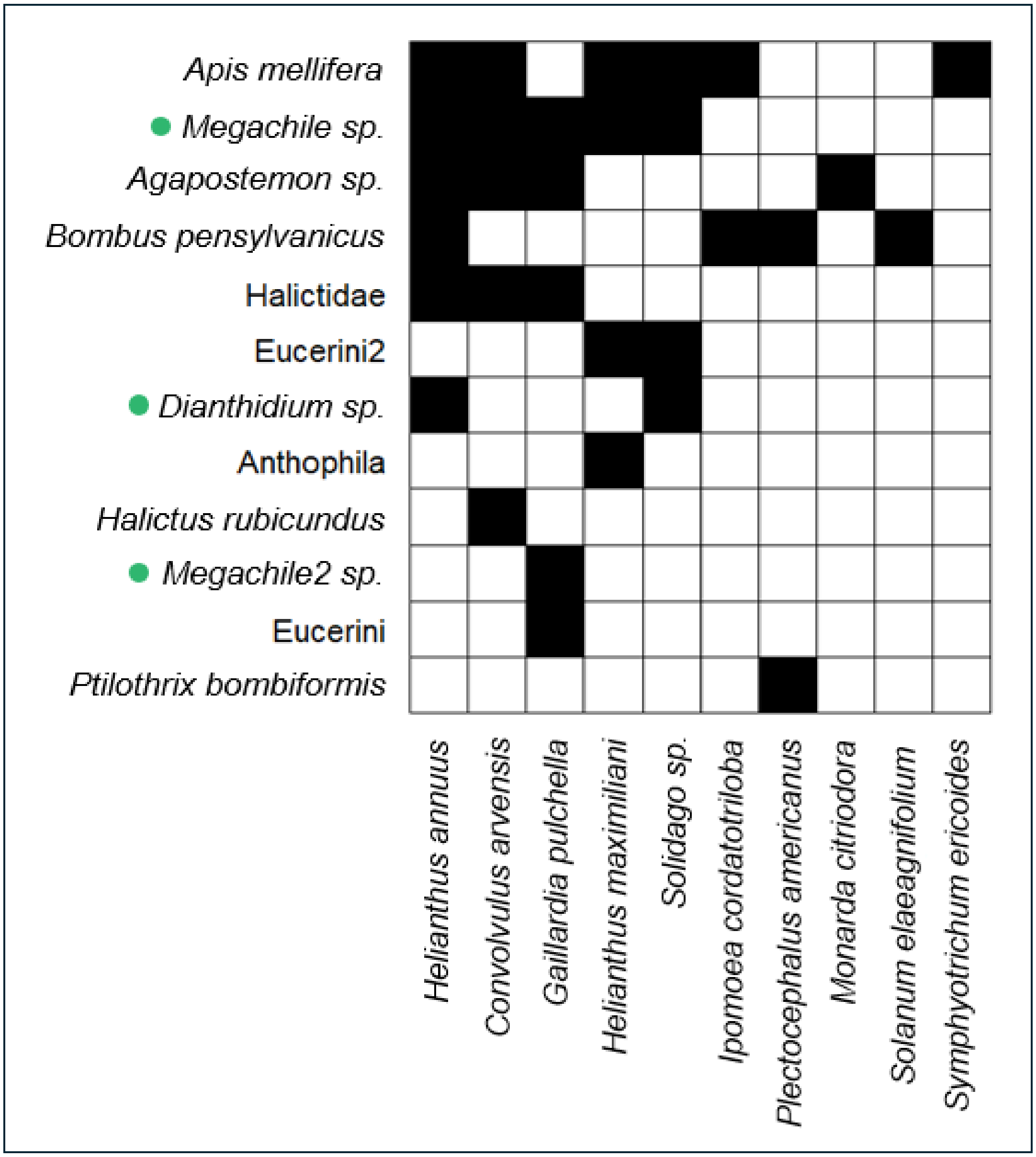

Figure 7. Pollinator network, with cavity-nesting bees marked with a green circle, for site PP during the data collection period

All the bees from this study were narrowed to or past their taxonomic family, except for one bee that remained at the bee epifamily (Anthophila) due to the lack of taxonomic identification from the iNaturalist community and experienced entomologists (Figure 7). There were also two instances of *Megachile sp*. and *Halictus sp*. that displayed visual differences enough to be considered separate without identification to species level (Figure 6; Figure 7).

DISCUSSION

Habitat Preference

The results from the bee boxes support the notion that native, cavity-nesting bees colonize sites with high floral availability, low-nesting availability, and high-habitat coverage. Site PP exhibited the highest overall bee box colonization at 55.33% (bee box #1) and 22.92% (bee box #2), when compared to the lack of colonization at the other two sites. Additionally, there is a slight variation in colonization trends between the bee boxes of site PP that were installed at different distances inside the habitat patch (Figure 3). This revelation could suggest that there are differences in bee box colonization within desirable sites that were not previously considered in addition to underlying factors at sites CB and WL that contained similar taxa without success. The abundance of trees and dead wood at sites WL and CB would predict a higher likelihood for cavity-nesting bees to colonize, even in urban areas, but there was no such pattern detected (Matteson et al., 2008). It is possible that nearby roads (especially road construction) and human foot traffic of UNT affiliates could be a deterrent for native cavity-nesters; however, more experimental research is needed to support both theoretical claims (Wilson et al., 2024; Hernandez et al., 2009).

After an extensive literature search through the Web of Science, Google Scholar, and Willis Library online databases, there were limited publications available for the dominant taxon that colonized both boxes at site PP. One report of *Dianthidium simile*, a taxon from the same genus that nests around the Great Lakes region in Michigan, confirmed that there was nesting activity at bee boxes, shrubs, gravel pits, and sandy dunes (O'Brien, 2007). The few remaining research reports on *Dianthidium sp*. were conducted prior to the 21st century, but this contribution imlies a need for modern research to continue investigating the nesting biology across its native range (O'Brien, 2007). There may also be complexity to *Dianthidium sp*. nesting behavior, since habitat qualities may lead to a preference for cavity-nesting over ground-nesting behavior. *Dianthidium sp*. at site CB were documented on iNaturalist, but there was no bee box colonization over the course of the data-collection period. Alternatively, the *Dianthidium sp*. could have nested in the ground nearby or chosen distant nesting opportunities from that site. Knowing that *D. simile* exhibits both types of nesting behavior, this could represent a trait of the *Dianthidium* genus (O'Brien, 2007). As a result, the data from their temporal colonization trends, nesting substrate, and preferred habitat qualities could benefit from additional research. The other taxon that briefly attempted to colonize the bee boxes at site PP belonged to the *Megachile* genus. These bees occur globally and have abundant information about their nesting biology from previous research (Michener, 2007; Young et al., 2016). *Megachile sp*. nest in hollow stems, pre-existing cavities, and gaps between stones while incorporating leaves or flower petals to line their nests (Young et al., 2016). Both *Dianthidium* and *Megachile* genera fall under the family Megachilidae for their general taxonomy; therefore, nesting characteristics are expected to be similar in both genera (Michener, 2007; O'Brien, 2007). Despite the data, more studies and experiments are encouraged to support a distinction in nesting behavior for individuals of the *Dianthidium* genus regarding colonization of urban spaces.

College campuses like UNT exhibit both urban and green spaces that serve as optimal sites for bee research, considering that urban influences are hardly studied in this group of native bee taxa (Hernandez et al., 2009). Willis Library served as an adequate site due to a previous pollinator project that established wildflowers at the rock wall, where many students pass on their daily commute. The chemistry building habitat patch was a recent initiative, led by members of the UNT grounds team, to restore bits of native pollinator habitat that were previously dominated by *Cynodon dactylon* (bermuda grass). The Pollinative Prairie is a well-known, multi-year prairie restoration project that has been at the forefront of several other ecological initiatives. These three sites were supported by the institution and UNT affiliates, allowing for opportunities to study the impacts of restoration, urbanization, and conservation on native and non-native taxa. The importance of these spaces also extends beyond research opportunities and into outreach potential. As research was conducted, curious students and professors approached with inquiries about the bee-box project. While sites CB and WL lacked bee-box colonization, the engagement with these UNT affiliates was extremely valuable for continuing outreach and education on the importance of protecting native bees.

Pollinator Network Analysis

While colonization data is valuable for understanding nesting availability and habitat coverage, the pollinator-visitation events at each site were investigated further to examine floral availability and native, cavity-nesting bee use of floral resources. *H. annuus* was the most visited flower in all networks with six visitors at site CB, six visitors at site PP, and three visitors at site WL (Figure 5). The second most visited flower of all networks was *G. pulchella* with six visitors at site CB and five visitors at site PP (Figure 5). These two species are native to the United States, but the third most visited species overall, *C. arvensis*, is a non-native species (Figure 5). Concerning the bee-box colonization data, *Dianthidium sp*. was a noted visitor of the two most visited native species (*H. annuus* and *G. pulchella*).

The most abundant pollinator in the networks was the non-native *A. mellifera*, a polylectic (collecting resources from a wide range of flowers) species that was introduced in the Americas during the colonial period (Michener, 2007; Whitfield et al., 2006). Unsurprisingly, the extent of its pollination influence within each pollinator network is the most. *A. mellifera* visited 12/17 flowers of the site CB pollinator network, the site PP pollinator network recorded 6/10 flowers visited, and site WL had 11/14 flower visitations for that pollinator network (Figure 5). For each site, *A. mellifera* contacted the floral reproductive organs of more than half of the flowers included in the networks - the most out of any other bee taxa. The next highest contributor to the pollinator networks was *Megachile sp*. with 5/17 flowers visited at site CB, 5/10 flowers visited at site PP, and 3/14 flowers visited at site WL (Figure 5). This native taxon was common at all three sites, but their visitations were not as widely varied as *A. mellifera*, supporting the notion that a non-native, polylectic bee uses more resources in urban areas than do its native counterparts (Hudewenz & Klein, 2015). Further, the dominant taxon of the bee boxes (*Dianthidium sp*.) exemplifies this pattern through flower visitations at only 2/10 flowers of site PP and 2/17 flowers of site CB (Figure 5). Floral availability at a given site does not guarantee bee box colonization by native, cavity-nesting bees, as seen in the data comparison between site PP and site CB. *Dianthidium sp*. visited flowers at both sites, but there was only colonization at the site PP bee boxes. These bees could be more specialized in their floral resource use, so future research should consider that both 'floral availability' and 'floral resource use' could carry different underlying meanings for bees from different ecological niches. Little is known about where *Dianthidium sp*. fall on this spectrum between specialist and polylectic, providing another opportunity to expand on the finite pre-existing literature. This distinction supports the value of properly defining floral resource use or availability in the context of study subjects, as well as the realm of bee box research and beyond.

Limitations

Impromptu changes and spontaneous difficulties could have contributed to unintentional biases in colonization data as well. An initial survey yielded three locations consisting of sites WL, PP, and the DATCU football stadium rather than site CB. Despite the lack of floral resources at the DATCU site, the project funding allowed for the planting of native vegetation in March 2024 to satisfy the floral-availability requirement. However, the combination of intense summer heat and the absence of irrigation led to an impromptu change in site selection. This site transition from DATCU to CB occurred during nesting season, so native bees may have already colonized nearby cavities prior to bee box installation. For antipredatory measures, two different predators disturbed bee box colonization. Approximately 10 weeks of *S. invicta* invasion at bee boxes #5 and #6, complemented with a lack of colonization, required continuous Nectar Fortress application. There were also several instances of *Phidippus texanus* (jumping spiders) that disturbed two *Megachile sp*. that had briefly inhabited bee box #1 on week three of data collection. All predators were removed, but the lasting effects of predation could be a factor of insufficient bee-box colonization. Another possible source of bias derives from the uniform separable rows, which may have favored colonization of smaller species or increased competition of similarly sized species. Differences in cavity dimensions should be prioritized in future research efforts to accommodate native bee species that vary in body size (MacIvor, 2017). Challenges like these may have been a factor in the absence of colonization at two of the three sites for this study.

Another challenge was the final evaluation of colonized bee boxes, which involved examining every row for mortality (fungal infections, parasitization, and malnourished larvae). However, an issue was encountered with roughly 20 *Polistes* (*Fuscopolistes*) *sp*. (paper wasps) that had colonized bee box #2 between the end of data collection and the final evaluation attempt in February 2025. The *Polistes* (*Fuscopolistes*) *sp*. became agitated when removing the separable rows to record bee mortality, inhibiting data collection for that aspect. Initially, non-bee

Hymenoptera in data collection had been excluded from the results, yet the presence of *Polistes sp*. suggests bee boxes may have the capacity to support other Hymenoptera as well. The last issue was the inability to separate each row due to the strength of the plant resin that *Dianthidium sp*. incorporated in the nest construction. If the biological seal were broken, the overwintering bees would have inadequate protection from weather, predators, and parasites.Thus, the final evaluation was no longer considered for the results of this study so that the native bees could persist without human interference.

Conclusion

Bee box colonization on urban college campuses is an underexplored pathway into the nesting biology of native, cavity-nesting bees, especially under the influence of varying habitat qualities (floral availability, nesting availability, and habitat coverage). This research study sought to identify this gap through an assessment of bee box colonization and pollinator networks at three sites on the UNT campus. The ecological extent of the data provides support for the importance of abundant floral resources and high habitat coverage, complemented with low nesting opportunities, for supporting native, cavity-nesting bee colonization at a given site. Conversely, the dominant taxon of the bee boxes (*Dianthidium sp.*) presents extra complexity to the data that includes the possibility of specialist bees differing in floral resource use than polylectic bees. Future research in this subfield should take into consideration how floral resource use, in addition to the abundance of floral resources, may hinder or encourage the colonization of bee boxes.

Similar studies that delve into the nesting biology of native bees within urban landscapes will continue to add knowledge for ecologists to implement more efficient conservation strategies. As this knowledge becomes more widespread, the public will also begin to synthesize these findings with outreach programs so that others are compelled to continue the cycle of necessary pollinator knowledge. Native bees require a deeper ecological understanding to ensure their future in ecosystems, especially as urban infrastructure and prolific habitat loss become more prevalent worldwide.

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