

A qualitative assessment of wild bee habitat features on  
Boulder County open spaces

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## **Abstract**

This study served in part as a qualitative re-evaluation of riparian bee habitats along the St. Vrain Creek on Boulder County Parks and Open Spaces. To do so, A. Carper revisited 6 previously surveyed properties from 2016, and made observations of previously recorded bee nesting habitats. Given the extent of riparian restoration, changes in both nesting and foraging resources have likely lead to new pollinator habitats, as well as changes to previous nesting resources. Here, I provide notes on the locations of specific habitat features and observations on nesting aggregations at several sites along the St. Vrain Creek. In addition, I have photo-documented and geolocated a handful of specific habitat features of concern for native bees. In addition, I have attached a brief slideshow on the importance of erosional habitats for ground-nesting bees, including photos of habitats, maps, and locations for a handful of specific Boulder County Parks and Open Space properties. In summary, much of the restoration efforts along the St. Vrain are likely to provide good foraging resources for bees, though nesting habitats should not be overlooked, given their importance for certain native species.

## **Introduction**

In 2016, I led a team of students to survey pollinators on Boulder County Parks and Open Spaces along the St. Vrain Creek, in an effort to determine the conservation value of woody debris in riparian areas. In areas where Open Space reported removing woody debris we found 50% less woody debris compared to unmanaged sites and 40% fewer bees overall. We also found a positive relationship between woody debris and bee abundance (manuscript in prep). Where woody debris was abundant, cavity-nesting bees used nest blocks less than when woody debris was scarce, suggesting that wood nesting bees were likely limited by suitable woody

nesting habitat, and in areas where it was available preferred it over artificial nests. Conversely, where wood was lacking, many cavity-nesting bees readily nested in artificial substrates. These results suggested that woody debris and its management can impact pollinator conservation and that changes in nesting habitats can have implications for the entire bee community. Moreover, it suggests that most native bees are also nest-sited limited; that is, local populations likely respond to habitat manipulations that impact nesting habitat.

In addition to the formal surveys, I made a number of observations about important nesting locations, habitats, and other features important for native pollinators. Foremost among these were the availability of erosional habitats where ground-nesting bees were found to nest in abundance. Given that open, bare ground is relatively uncommon in most sites, finding nesting locations of appropriate slope, drainage, and orientation, is likely difficult for most bee species. Some species in particular, rely on specific soils (sandy vs. clay) or formations (as in vertical bank and even sandstone-nesting species) in which to nest. The abundance and distribution of these types of habitats across the landscape should therefore be of concern to land managers interested in native bee conservation.

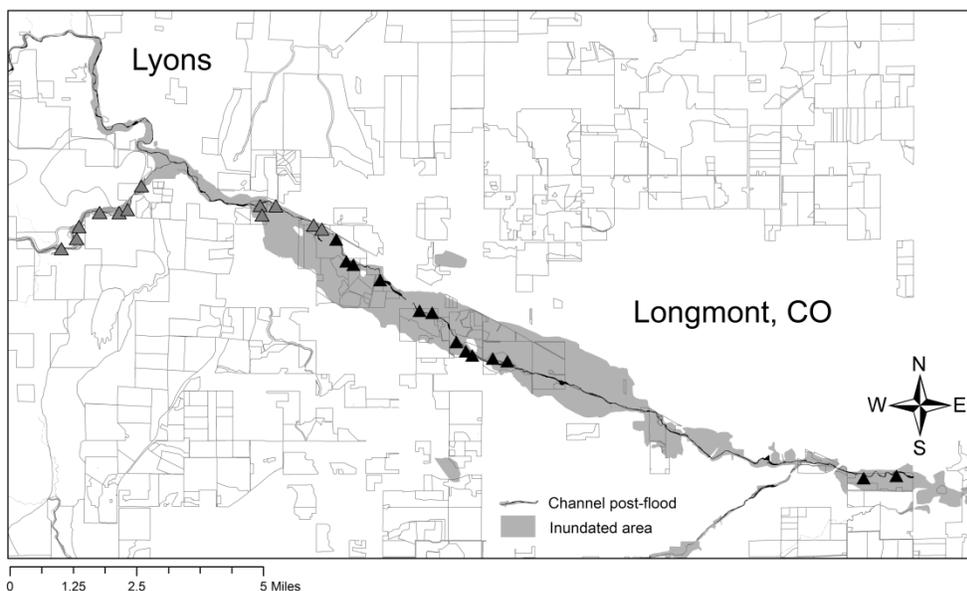
Given the amount of restoration and other habitat changes over the past two years, a reassessment of the features and a more detailed account of their location, availability, and use could prove extremely helpful in future conservation efforts. In 2018, I revisited 12 sites from 5 properties used in our 2016 riparian surveys. I made observations of floral and nesting resources, and qualitative assessment of habitat change related to native bees. While I was unable to revisit all sites, I did document new nesting resources on previously surveyed properties, and made notes of changes in previously recorded habitat features relative to native bee conservation. In this report, I describe the limited site visits I conducted, review the potential habitat features of

importance for wild bees, and explore the implications of such habitat features for pollinator conservation on Boulder County Parks and Open Space properties.

## Methods

I conducted this study along the St. Vrain Creek and in the same properties studied in 2016 (Figure 1, Table 1). Surveying time was extremely limited in 2018 due to my leading several other research projects from VT to CO. This created logistical constraints that when combined with personal time taken for family affairs, made extensive revisits to field sites logistically difficult. I set aside two days to cover as many sites as possible: July 25<sup>th</sup> and September 17<sup>th</sup> 2018. Although brief, these visits were primarily to check specific habitats identified in 2016, qualitatively assess changes in local habitats, and explore potential implications for wild bees.

**Figure 1.** Sampling locations along the St. Vrain Creek in 2016 are marked by black triangles; those revisited in 2018 are indicated with gray triangles, and include sites located on Hall Ranch II, Hall Ranch, Bullock, Wallace, and Western Mobile.



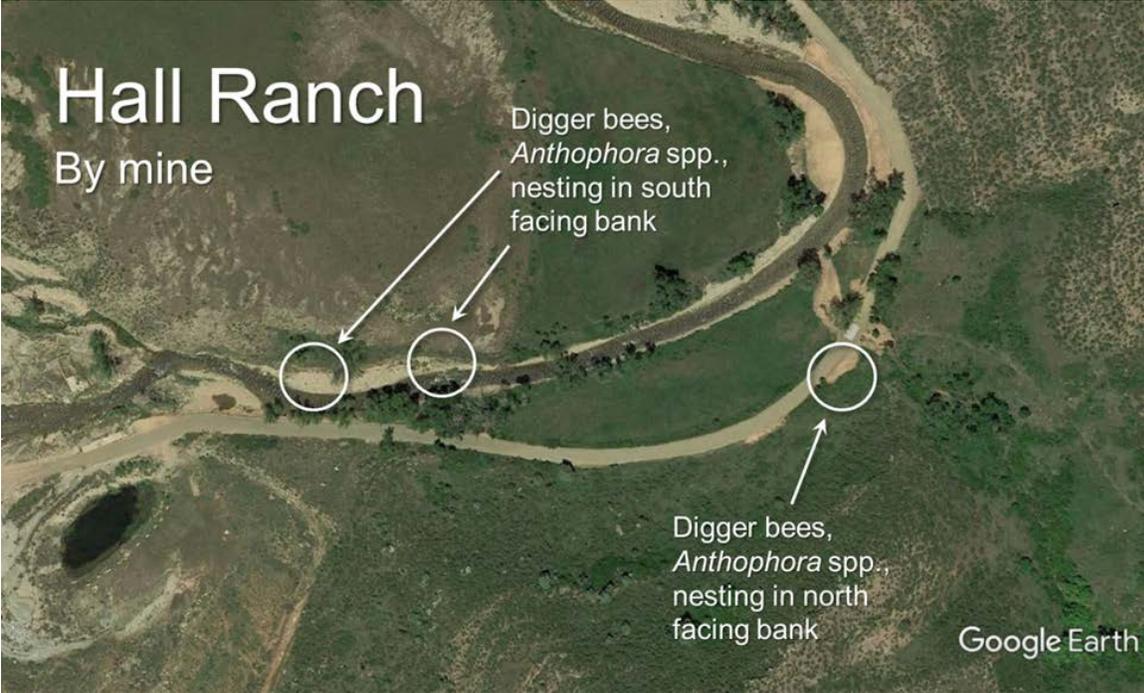
**Table 1.** Locations of 25 sites used to survey for wild bees in 2016. Block # refers to a unique catalogue number for wooden trap nests and the associated Latitude and Longitude represent the center of bee surveys at each site. Those sites highlighted in gray were not revisited in 2018.

<b>Property</b>	<b>Block #</b>	<b>Latitude</b>	<b>Longitude</b>	<b>Elevation (m)</b>
Hall Ranch 2	169013	40.20176	-105.29830	1659
Hall Ranch 2	169014	40.20395	-105.29406	1681
Hall Ranch 2	169015	40.20661	-105.29336	1676
Hall Ranch	169016	40.20964	-105.28753	1665
Hall Ranch	169017	40.20967	-105.28194	1658
Hall Ranch	169018	40.21030	-105.27949	1655
Hall Ranch	169019	40.21549	-105.27551	1645
Bullock	169020	40.21119	-105.24163	1605
Western Mobile	169021	40.20914	-105.24103	1602
Wallace	169022	40.21110	-105.23720	1601
Montgomery	169023	40.20696	-105.22638	1601
Western Mobile	169024	40.20603	-105.22408	1598
Western Mobile	169025	40.20375	-105.21992	1589
Western Mobile	169026	40.19899	-105.21707	1578
Braly	169027	40.19826	-105.21507	1574
Ramey	169028	40.19490	-105.20741	1571
Gage	169029	40.18818	-105.19618	1566
Gage	169030	40.18776	-105.19255	1559
Pella Crossing	169031	40.18138	-105.18568	1552
Pella Crossing	169032	40.17936	-105.18295	1561
Pella Crossing	169033	40.17844	-105.18111	1550
Golden-Fredstrom	169034	40.17778	-105.17530	1537
Golden-Fredstrom	169035	40.17716	-105.17114	1523
Keyes	169036	40.15161	-105.06948	1491
Keyes	169037	40.15209	-105.06012	1488

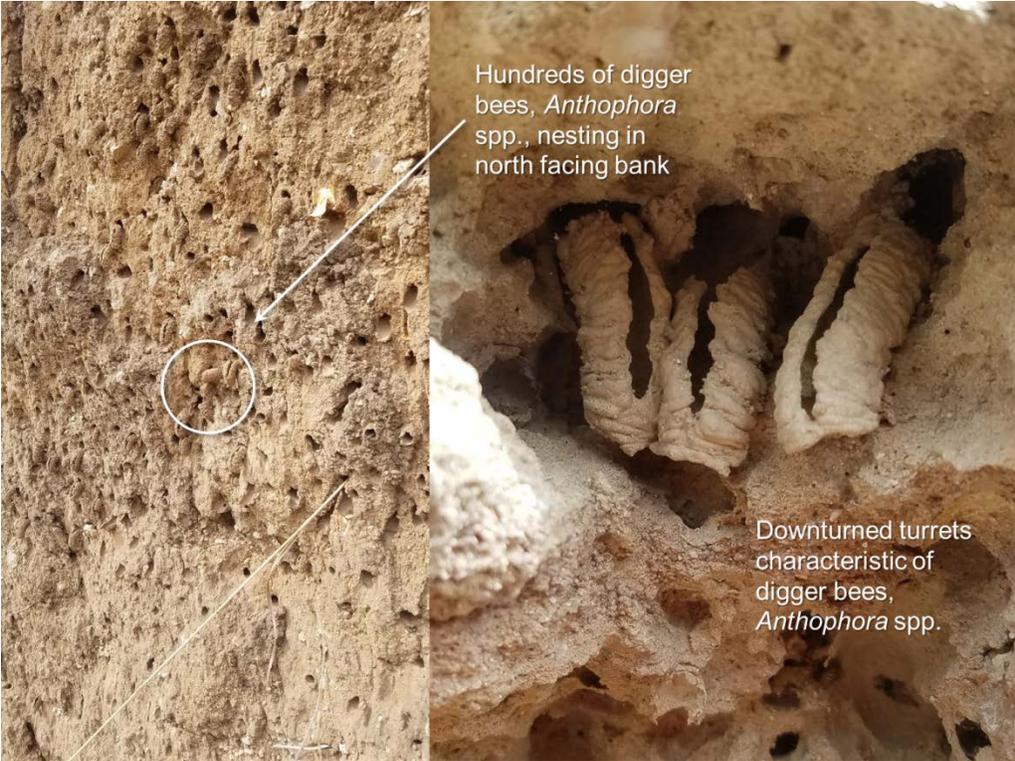
### *Identifying native bee habitats*

I visited each sites for approximately 1 hour, systematically exploring areas with bee nesting habitats and assessing potential changes from 2016. For example, at Hall Ranch, erosion from the northern bank had created a vertical bank nearly two meters in height, facing south, and creating potentially prime nesting habitat for bees (Figure 2). I forded the stream to verify and found several hundred digger bee nests (*Anthophora* spp.). The nests appeared to have been constructed in the 2018 season, given the retention of mud turrets at the nest entrance (Figure 3). Another, even larger erosional bank was found to the west, facing northwest. This bank appeared to be eroding faster, given its proximity to a hillside gully. Still, hundreds of digger bee nests were apparent, especially in recessed areas of the bank, protected from the worst erosion. It should be noted that even though these habitats likely erode quickly, digger bee nests can be quite deep and larvae likely successfully overwinter without being washed away except for in severe erosional events. Moreover, the aggregations may be locally rare, as suggested by the density of the nesting aggregations, and could be some of the best habitat within the foraging ranges of these bees (roughly 2-4 km).

**Figure 2.** Observed aggregations of *Anthophora* spp. nesting at Hall Ranch in 2018.



**Figure 3.** Close up view of digger bee turrets on erosional banks at Hall Ranch.

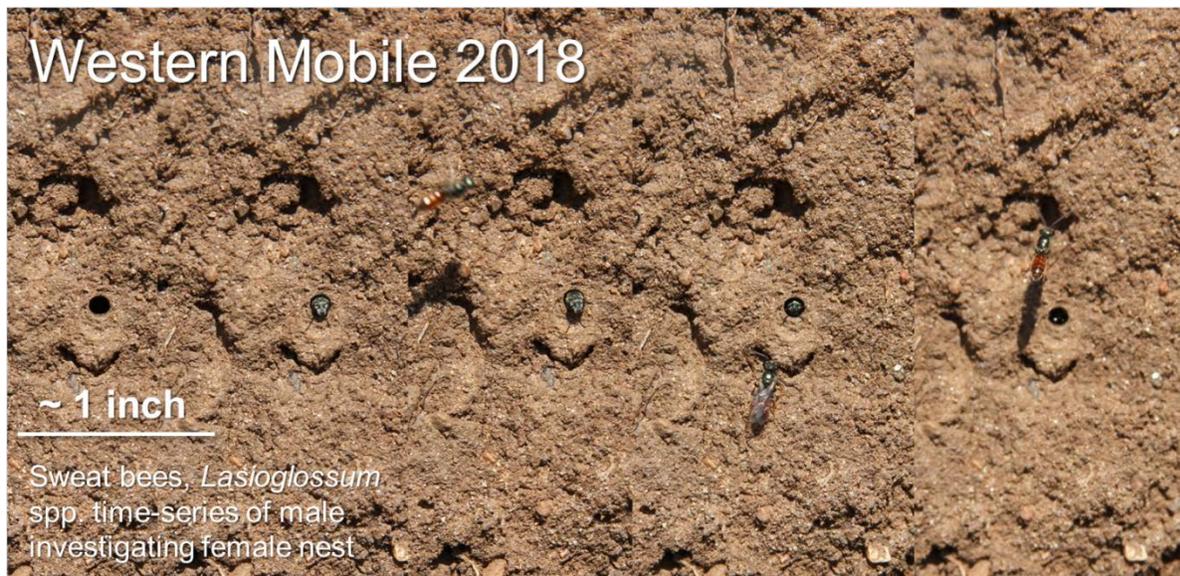


While the stabilization of the banks and restoration at Hall Ranch and Hall Ranch II were extensive, much woody debris remains. However, several large standing dead trees that had high densities of *Osmia ribifloris* and *Osmia lignaria* nests were removed as part of restoration efforts associated with the new bridge construction across the creek, and construction of what appeared to be high flow channels on the south bank of the creek in the bend just southwest of the Bitterbrush Trailhead. These two spots in particular had high abundances of the two native early-season megachilid bees in 2016, likely driven by the combination of large standing dead wood in close proximity to rosaceous shrubs and apple trees along Old St. Vrain Rd. Hopefully, woody residues left in place will create alternative nesting habitats. The restored floodplain should also provide many floral resources as the riparian plant community continues to recover. In general, habitat heterogeneity at Hall Ranch should promote a diversity of bees across the season, including early season specialists of rosaceous shrubs and willows. The amount of decomposing woody debris should be good nest habitat for native bees that nest in decaying wood (e.g., some *Megachile*, *Augochloropsis*, etc.), and a good deal of exposed soil, sand bars, and exposed banks remain for ground nesting bees.

The extent of restoration plantings at Bullock should provide excellent foraging resources for bees there and at Western Mobile. This area had a unique plant assemblage post-flood, with lots of early successional forbs that are typically highly attractive to bees. Sunflowers were still in bloom during my September visit and were still attracting late season sunflowers specialists, including *Megachile*, *Melissodes*, and *Svastra*. There appeared to be a mix of *Helianthus annuus* and *H. petiolaris*, both of which provide good pollen and nectar. Most of Western Mobile remains little restored, with lots of bare ground for ground-nesting bees, in addition to a short (0.5-1m) vertical bank from the initial stream breach. A handful of digger bee nests were

observed there, as well as a relatively large species of *Lasioglossum*, the male of which had an orange metasoma, and was observed inspecting female nests in July (Figure 4). Many other smaller *Lasioglossum* and *Halictus* species were also present.

**Figure 4.** Time-series of a male *Lasioglossum* spp. inspecting the instance to a female's nest on Western Mobile.



Wood-nesting resources are still mostly intact across Bullock, Western Mobile, and Wallace. A good amount of downed woody debris exists. Of note, several large standing dead trees that had extremely high densities of leaf cutter bees (most likely *Megachile rotundata*) naturally fell over the past two years. Interestingly, most of the nesting cavities of those downed sections have become vacant, though many nests remain active in the standing stumps and larger tree sections not in contact with the ground. This could be due to extremely tall grass in mid-summer, obscuring smaller logs that have fallen. It would be interesting to track the succession of bees nesting in such high density trees across their decay stages. To my knowledge this has never been done but could offer interesting insight into wood-nesting bee community dynamics.

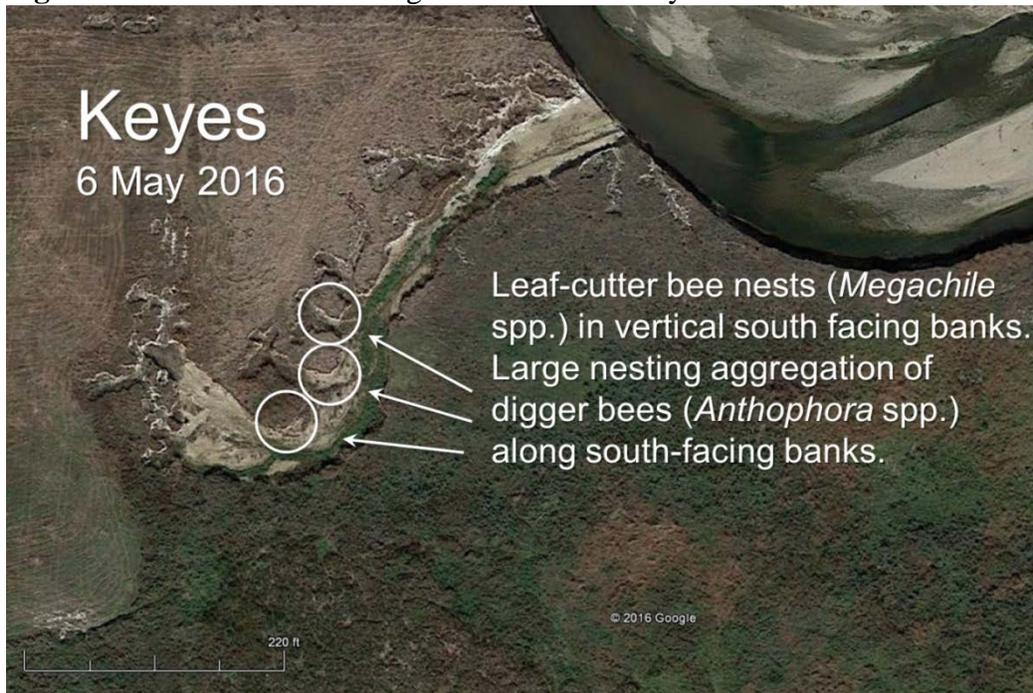
While I was unable to revisit other sites down stream, I would be interested in revisiting some in particular. The lower stretches of Western Mobile (Figure 5) and Keyes (Figure 6) both

harbored nesting aggregations of digger bees, sweat bees, and mining bees. Specifically, it would be helpful to inspect digger bee nesting aggregations to determine which species is nesting there, and get photos or videos of nest construction.

**Figure 5.** Observed bees nesting at Western Mobile in 2016.



**Figure 6.** Observed bees nesting in a head cut at Keyes in 2016.



## *Conclusions*

In summary, Boulder County Parks and Open Space properties along the St. Vrain Creek appear to have good nesting and foraging resources for wild bees there. Moreover, restoration efforts are likely creating additional foraging resources in the long-term, though potentially at the removal of some nesting habitat in the short-term. However, the inclusion of unmanaged areas across multiple sites likely creates protected nesting habitats in the form of undisturbed soil and woody debris. Moreover and in general, I believe that this study has made me increasingly aware of the value of erosional habitats for ground-nesting bees. Some, such as digger bees, are large and with specific nesting requirements, which could make them a taxa of conservation concern. In addition, their fascinating ecology makes them a great target for outreach and education. Toward that goal, I have included a short Power Point slideshow along with this report, to highlight the importance of erosional habitats for bees. Please feel free to explore or distribute to any interested parties.

Link to slideshow (not the embedded video makes it

large): <https://drive.google.com/open?id=15EKf5aJGVjQOOujHskBQzqPzPBIR65RN>

Just the quick video:

<https://drive.google.com/open?id=1YX9Nfn9Z97K1-cyxxpnhgYIZ8-laTIE1>