

# NATIVE SOLITARY BEES:

Kid-friendly bees for schoolyards

Wildlife Austin Program

---



Front Cover: Sweat bee (genus *Agapostemon*) on Purple Coneflower (genus *Echinacea*)  
Photo: John M. Davis, Austin Parks and Recreation Department

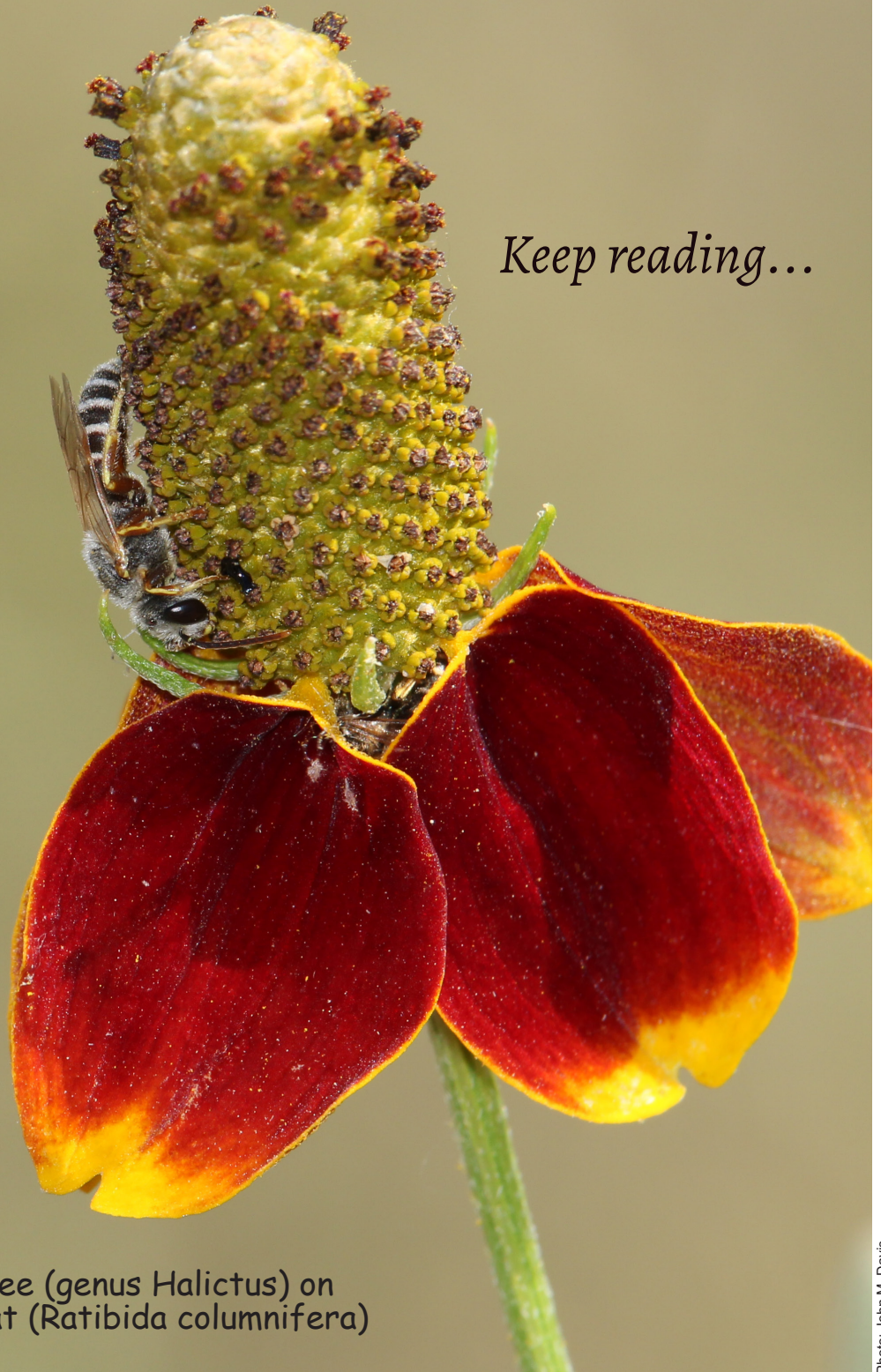
# **CONTENTS**

- 1 NATIVE BEES IN NEED**
- 2 KID-FRIENDLY DEMEANOR**
- 3 POLLINATION POWERHOUSES**
- 4 FASCINATING AND FUN**
- 5 BE A POLLINATOR PROVIDER**
- 8 RESOURCES**
- 9 REFERENCES**



*Do you want to know 4 reasons why native solitary bees are much better than European honey bees for schoolyards?*

*Keep reading...*



Furrow Bee (genus *Halictus*) on  
Mexican Hat (*Ratibida columnifera*)



# NATIVE BEES IN NEED!

## *Texas Native Bees*

Texas is home to an estimated 800+ species of native bees.<sup>1</sup> These include bumblebees, carpenter bees, mason bees, sweat bees, leaf cutter bees and mining bees to name a few. These bees face threats ranging from habitat loss and pesticides to disease and competition from introduced species.<sup>2</sup>

### *What is a “native” species?*

Native species originated here. Due to global travel and commerce, many species have been introduced in Texas where they often negatively impact local species and ecosystems.

## *Introduced Honey Bees*

Though the European honey bee (*Apis mellifera*), introduced to the U.S. in 1622,<sup>3</sup> has been the subject of media concern in recent years, that species is globally common. In fact, it is the most abundant non-native bee on Earth.<sup>2</sup> Therefore, the European honeybee is not in need of conservation. However, native bees are in need of your help!

In just 3 months, a typical honeybee hive robs the landscape of enough resources to produce 110,000 native solitary bee offspring.<sup>4</sup> As of 2022 there are 157,000 managed honey bee hives in Texas.<sup>5</sup> Therefore, honey bee hives cost our state an estimated 17.2 billion native bees each year! European honey bees also help spread pathogens<sup>2,6</sup> and invasive exotic weeds,<sup>7,8</sup> which further degrades habitat for native bees in our parks and nature preserves. Given these factors, it is no surprise that native bee abundance and species richness decline with the introduction of European honey bee hives.<sup>4,9,10</sup> These and other pressures have led to significant population impacts<sup>11</sup> resulting in 116 native bee species being listed in the U.S. as Species of Greatest Conservation Need.<sup>12</sup>



Artwork: John M. Davis



Photo: John M. Davis

Native furrow bees huddling under the only remaining upright prairie coneflower after a wildflower meadow was mowed.

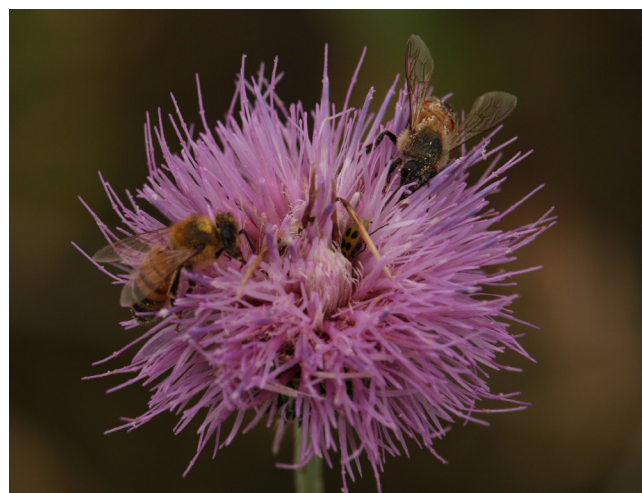


Photo: John M. Davis

The European honey bee is an introduced species that is thriving worldwide, impacting native bees across the globe.

# KID-FRIENDLY DEMEANOR

## *Honey Bee* **RISK**

Honey bees are high risk. Insect venom hypersensitivity exists in 5-7.5% of the population.<sup>13</sup> Therefore, it is critical that educators consider the risk posed by welcoming bees to their site. European honey bees will defend their hive aggressively by deploying hundreds of workers to sting a perceived threat.<sup>14</sup> Even with precautionary measures in place, honey bee hives pose significant risk. Given such defensive behavior, it is difficult to closely observe honey bee behavior without expensive and intricately designed hive structures that allow viewing from the safety of an enclosed and separate space.

*“The majority of solitary bee species are not aggressive and many are stingless.”*

*-Xerces Society for Invertebrate Conservation*

## *Kid-Friendly* **Natives**

Native solitary bees have none of these issues. Since native solitary bees have no hive to defend, the majority are quite docile, and many are stingless.<sup>15</sup> Those that can sting, only do so under extreme duress, such as being pinched or caught between clothing and skin. In such a case, the sting of a solitary bee is much less painful than a honeybee,<sup>16</sup> and the venom is not known to contain allergens that cause anaphylaxis.<sup>17</sup> This docile demeanor greatly minimizes risk and allows kids to closely observe behavior without fear of attack.



Photo: John M. Davis

Native solitary bees have no hive to defend and are not aggressive. This allows children to closely observe nesting behavior without fear of aggression.



# POLLINATOR POWERHOUSES

*One native solitary bee (*Osmia lignaria*) pollinates as much as 300 honey bees!*

Native bees are pollinator powerhouses! Researchers have estimated they are up to 300 times better pollinators than European honey bees.<sup>18,19,20</sup> Native bees visit more flowers per minute than honey bees and their body structure and behavior facilitate greater pollen transfer among flowers. Additionally, native solitary bees remain active under worse weather conditions than do honey bees. All these advantages lead to higher levels of seed set and higher fruit and vegetable yields when native bees do the work.<sup>19,21</sup>



Photo: John M. Davis

A small furrow bee with legs and underside covered with pollen.



Photo: John M. Davis



Photo: John M. Davis

Honey bees (left) carry pollen neatly in pollen baskets (corbicula) on their hind legs, while native bees (right) often have long specialized hairs (scopa) on their legs and abdomen that become packed with pollen. This is one of several factors that make native bees much more effective pollinators.



# FASCINATING AND FUN!

Given the long-standing relationship with local ecosystems, solitary bees provide a better pollination example than European honey bees. About 25–45% of native bees are pollen specialists that feed only on one type of plant.<sup>22</sup> Native solitary bees are highly specialized central place foragers. They only visit flowers and crops within a few hundred meters of their nesting site, with some of the truly tiny species (3 mm or less) only foraging within a 10-meter radius.<sup>2</sup> Compared to honey bees, which can forage over 9 kilometers from their hive,<sup>23</sup> native solitary bees provide a more direct connection between students' actions and the bees that benefit as well as a clearer educational link between the pollinator and the pollinated. Curriculum is available to help educators incorporate native solitary bee ecology into classroom instruction (see the Resources section). The kid-friendly nature of these bees allows for close, personal study of their behavior at the nesting site. Transparent bee trays can be purchased to allow viewing inside of nesting chambers during the season. Bee blocks are designed to be easily disassembled after the season is complete allowing access to developing larvae / pupae. These intimate experiences create a personal connection to native solitary bees not possible with European honey bees.



Transparent nesting trays allow for observation inside the chamber.

Photo: CrownBees.com

*As “central place foragers,” native bees are your personal pollination army!*



Photo: John M. Davis

Tiny bees like this 4mm sweat bee (genus *Lassioglossum*) forage just a few meters from their nest site.



Photo: City of Austin

Central place foraging by native bees creates a direct tie to students' actions.



Photo: CrownBees.com

Nesting blocks are inexpensive and easy to install and maintain.



# BE A POLLINATOR PROVIDER

Creating native habitat on your school grounds is the best way to provide for your pollinator powerhouses. Native bee diversity and abundance increases as the diversity of native habitat increases.<sup>25</sup> Therefore, work with your school administrators to keep or enhance natural areas on campus. Create wildlife-centered native landscapes around buildings and courtyards. A list of local nurseries providing native plants and online companies offering native wildflower seed mixes can be found in the Resources section.

The following active ingredients are neonicotinoids:

- Acetamiprid
- Clothianidin
- Dinotefuran
- Imidacloprid
- Nitenpyram
- Thiacloprid
- Thiamethoxam

Once your school has created pollinator habitat, manage it well to consider the needs of native bees while reducing threats.<sup>24</sup> Avoid pesticides, especially neonicotinoids (“nee-oh-nik-oh-tin-oids”). This category of pesticide acts on the nervous system and is very toxic to invertebrates. This category of pesticide is applied to the soil, absorbed into plant tissues, and kills invertebrates that feed on the plant. See the test box above for more detail on these pesticides. The active ingredient may be sold in products with various brand names.

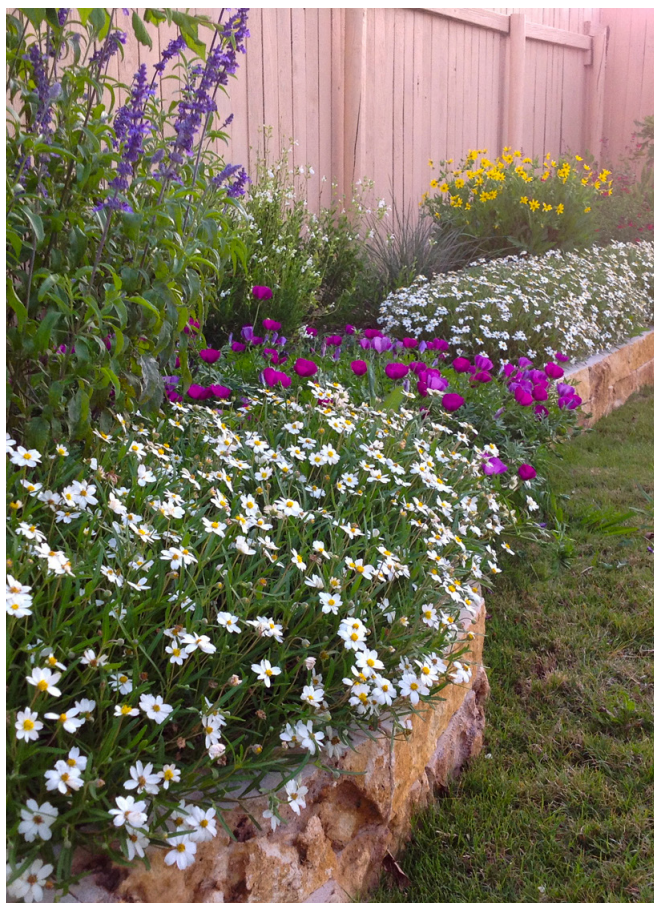


Photo: John M. Davis

Landscaping with a diversity of native plants is a great way to help native bees.



Photo: Texas AgriLife Extension

Insecticides kill insects. Avoid using chemicals that impact pollinators.



## Save the Stems

Leave “dead heads” on wildflowers standing overwinter to feed wildlife and protect bee pupae that may be developing within stems. In Spring, cut back dead flower stalks leaving stem stubble of 8 to 24 inches tall. These cut stems will provide vertical nesting cavities for very small bees to use. New growth will hide last year’s stubble. Repeat the process and allow dead-heads and old stubble to stand over the next winter and trim them in Spring.



Photo: John M. Davis

## Leave the Leaves

Many beneficial insects overwinter in fallen leaves (called “leaf litter”). Some lay eggs on fallen leaves which then become food for the emerging offspring. To provide overwintering habitat for these species, leave fallen leaves on the landscape if possible. If leaves must be removed, relocate them (whole, not shredded) to flower beds or natural areas. Shredded wood mulch is difficult for pollinators to navigate. It is hard for them to bury themselves and reduces access to soil for nesting. Landscape fabric presents the same challenges. A light covering of leaf litter is the best mulch option for overwintering pollinators.



Photo: John M. Davis

## Deploy Dead Wood

Standing snags (dead trees) and decaying logs are important habitat components for native bees. Allow a snag to stand if there is no danger of it falling on a structure, etc. Often, removing limbs and leaving the main trunk standing will reduce stress on the snag and allow it to stand longer. This also reduces the risk of falling limbs. Snags can also be “topped,” or cut off at a height to reduce wind stress or to ensure a structure is not impacted should the snag topple. If a snag must be taken down, cut it into logs that lie against the ground. This material will continue to provide habitat for native bees.



Photo: John M. Davis





Photo: John M. Davis

## Produce Piles

Brush piles and dry-stacked rock walls / piles also provide great overwintering habitat for native bees. Stone may be purchased or gathered on site and stacked to create dry-stack walls or piles to provide crevices for overwintering. Limbs from snags that had to be felled provide the perfect material for brush piles. Place larger limbs on the ground side by side then add smaller limbs perpendicular to the layer below. Continue this pattern for several layers then place the thinnest limbs over the top.

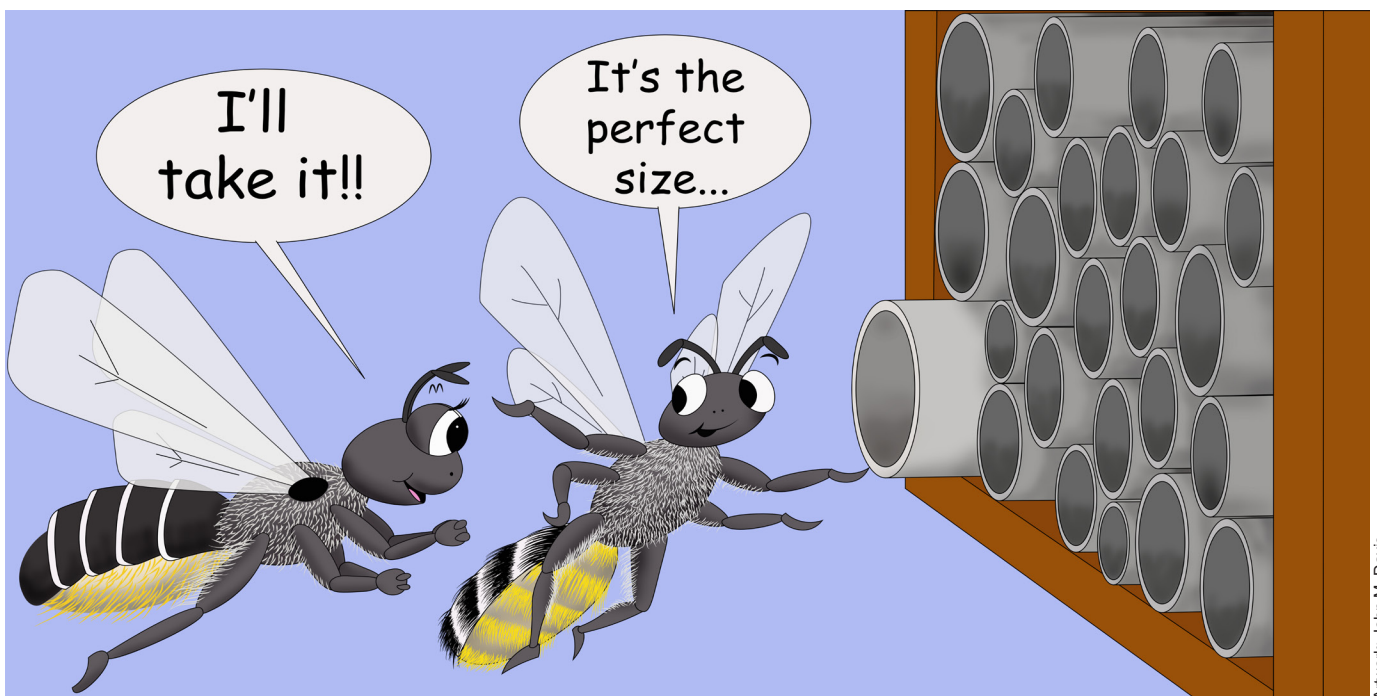
## Supply Structures

Artificial nesting structures are great ways to allow close observation. Unlike honey bee hives, no expert skills or special professional clothing are needed to manage artificial structures for native solitary bees. Managing honey bees requires expensive hives and bee suits, while the typical investment in solitary bees is \$50-\$200. Honey bee hives require year-round maintenance while managing native solitary bees requires 2 hours a year.<sup>19</sup> To keep native bees healthy, simply replace nesting tubes when bee offspring emerge from the previous year's tubes or disassemble the nesting block and clean it to prevent parasites and disease transmission.<sup>19</sup> See the Resources section for tubes.



Photo: John M. Davis

Solitary bee nesting structures can be purchased or made. Just be sure to use tubes or blocks that can be removed and cleaned or replaced after each season.



Artwork: John M. Davis

# RESOURCES

## Videos about native bees:

TX Parks and Wildlife- Honeybees vs. Native Pollinators: <https://youtu.be/btDjodzetNk>  
TX Parks and Wildlife- The Bee Condo: <https://youtu.be/CIVgYqIIPyU>  
TX Parks and Wildlife- Bee Research: <https://youtu.be/EGtvfkGYNx0>  
Xerces Society - N.A. Bee Diversity and ID: [https://youtu.be/\\_sOKGLn304s](https://youtu.be/_sOKGLn304s)  
DW Planet A - Bee Extinction: Why we're saving the wrong bees <https://youtu.be/VSYgDssQUtA>  
Crown Bees - ABCs of Raising Solitary Bees: <https://youtu.be/YrJVeD0kctE>

## Curriculum based on native solitary bees:

Crown Bees - <https://crownbees.com/mason-bee-edu-educator-modules/>

## Bee houses and nesting materials:

<https://crownbees.com/tower-bee-house/>  
<https://crownbees.com/bee-observer-solitary-bee-observation-tray/>  
<https://crownbees.com/nesting-materials/>

## Xerces Society Educational Materials:

Create Habitat for Stem-Nesting Bees - <https://xerces.org/publications/brochures/save-the-stems>  
Nesting & Overwintering Habitat - <https://xerces.org/publications/fact-sheets/nesting-overwintering-habitat>  
Tunnel Nests for Native Bees: Nest Construction and Management (2013) - [https://xerces.org/sites/default/files/2018-05/13-054\\_02\\_XercesSoc\\_Tunnel-Nests-for-Native-Bees\\_web.pdf](https://xerces.org/sites/default/files/2018-05/13-054_02_XercesSoc_Tunnel-Nests-for-Native-Bees_web.pdf)  
Nests for Native Bees (2012) - <https://www.xerces.org/publications/fact-sheets/nests-for-native-bees>

## Seed Mixes (no neonicotinoids):

Bee Happy Mix - [https://www.seedsource.com/catalog/detail.asp?product\\_id=4505](https://www.seedsource.com/catalog/detail.asp?product_id=4505)  
Butterfly Retreat Mix - [https://www.seedsource.com/catalog/detail.asp?product\\_id=4501](https://www.seedsource.com/catalog/detail.asp?product_id=4501)

## iNaturalist (to record bee sightings, get help with identification, etc.):

[https://www.inaturalist.org/users/sign\\_in](https://www.inaturalist.org/users/sign_in)

## Native Plant Nurseries (in the Austin area known to avoid neonicotinoids):

Nursery	Phone	Link	Notes
McIntire's Garden Center	(512) 863-8243	<a href="https://www.mcintiresgarden.com/">https://www.mcintiresgarden.com/</a>	
Papilionem Natives	(512) 300-6443	<a href="https://www.facebook.com/papilionemnatives/">https://www.facebook.com/papilionemnatives/</a>	Appt only / native milkweeds only
Green 'n Growing	(512) 251-3262	<a href="http://www.greenngrowing.com/">http://www.greenngrowing.com/</a>	
Shoal Creek Nursery	(512) 458-5909	<a href="https://shoalcreeknursery.com/">https://shoalcreeknursery.com/</a>	
Barton Springs Nursery	(512) 328-6655	<a href="https://www.bartonspringsnursery.com/">https://www.bartonspringsnursery.com/</a>	
Tillery Street Plant Company	(737) 212-0457	<a href="https://www.tillerystreetplants.com/">https://www.tillerystreetplants.com/</a>	
Far South Nursery	(512) 291-4648	<a href="https://farsouthnursery.com/">https://farsouthnursery.com/</a>	Mostly wholesale; will sell to individuals
Cultivate Holistic	(512) 217-0661	<a href="https://www.cultivateholisticsupply.com/">https://www.cultivateholisticsupply.com/</a>	
Lone Star Nursery	(512) 294-4565	<a href="https://lonestarnursery.com/">https://lonestarnursery.com/</a>	Weekends or online only
Wright's Nursery	(512) 489-2239	<a href="https://www.facebook.com/wrightstexasnursery/">https://www.facebook.com/wrightstexasnursery/</a>	By appointment only
Vivero Growers Nursery	(512) 587-4476	<a href="https://www.viverogrowers.com/">https://www.viverogrowers.com/</a>	
Plant Cowboy	n/a	<a href="https://www.plantcowboy.com/">https://www.plantcowboy.com/</a>	
Bloomers Garden Center	(512) 281-2020	<a href="https://www.bloomerselgin.com/">https://www.bloomerselgin.com/</a>	



# REFERENCES

- 1 Trevino, L., & Uribe, M. L. (n.d.). Native Bees. The Jha Lab. Retrieved June 8, 2022, from <http://w3.biosci.utexas.edu/jha/about-native-bees>
- 2 Danforth, B., Minckley, R. and Neff, J., 2019. The solitary bees. Princeton: Princeton University Press.
- 3 Kingsbury, S. M. 1906. The Records of the Virginia Company of London The Court Book, From the Manuscript in the Library of Congress 1619 – 1622 Vol 1 and 2. Washington: Government Printing Office.
- 4 Cane, J. H., and Tepedino, V. J. 2017. Gauging the Effect of Honey Bee Pollen Collection on Native Bee Communities. *Conservation Letters*, March, 10(2), 205–21
- 5 United States Department of Agriculture. 2022. (March). USDA Honey Report. <https://downloads.usda.library.cornell.edu/usda-esmis/files/hd76s004z/7m01cp956/df65wc389/hony0322.pdf>
- 6 Mallinger R.E., Gaines-Day H.R., Gratton C. 2017. Do managed bees have negative effects on wild bees?: A systematic review of the literature. *PLoS ONE*12(12): e0189268. <https://doi.org/10.1371/journal.pone.0189268>
- 7 Goulson, D. 2003. Effects of Introduced Bees on Native Ecosystems. *Annu. Rev. Ecol. Evol. Syst.* 34. 1–26.
- 8 Barthell, J.F., J.M. Randall, R.W. Thorp, and A.M. Wenner. 2001. Promotion of seed set in yellow star-thistle by honey bees: evidence of an invasive mutualism. *Ecological Applications* 11: 1870–1883.
- 9 Angella, G. M., McCullough, C.T., and O'Rourke, M. E. 2021. Honey bee hives decrease wild bee abundance, species richness, and fruit count on farms regardless of wildflower strips. *Scientific Reports*. 11:3202, <https://doi.org/10.1038/s41598-021-81967-1>
- 10 Valido, A., Rodriguez-Rodriguez, M. C., & Jordano, P. 2019. (March 18). Honeybees disrupt the structure and functionality of plant-pollinator networks. *Nature*. Retrieved June 9, 2022, from [https://www.nature.com/articles/s41598-019-41271-5?error=cookies\\_not\\_supported&code=cd33f16d-71ce-42e2-893c-92ee1fcbba6](https://www.nature.com/articles/s41598-019-41271-5?error=cookies_not_supported&code=cd33f16d-71ce-42e2-893c-92ee1fcbba6)
- 11 Young, B. E., D. F. Schweitzer, G. A. Hammerson, N. A. Sears, M. F. Ormes, and A. O. Tomaino. 2016. Conservation and Management of North American Leafcutter Bees. *NatureServe*, Arlington, Virginia.
- 12 Compiled National List of Species of Greatest Conservation Need. (n.d.). Core Science Analytics, Synthesis, and Libraries - State Wildlife Action Plans. Retrieved May 31, 2022, from [https://www1.usgs.gov/csas/swap/national\\_list.html](https://www1.usgs.gov/csas/swap/national_list.html)
- 13 Antolin-Amerigo, D., Moreno Aguilar, C., Vega, A. and Alvarez-Mon, M. 2014. Venom Immunotherapy: an Updated Review. *Curr Allergy Asthma Rep*, 14:449. DOI 10.1007/s11882-014-0449-1
- 14 Millor, J., Pham-Delegue, M., Deneubourg, J. L., and Camazine, S. 1999. Self-organized defensive behavior in honeybees. Vol. 96. Issue 22. pp. 12611–12616.

# REFERENCES

- 15 Xerces Society for Invertebrate Conservation. (n.d.). Who are the pollinators? Xerces Society. Retrieved May 31, 2022, from <https://www.xerces.org/pollinator-conservation/about-pollinators>
- 16 Schmidt, J. O. 2019. (July 21). Pain and Lethality Induced by Insect Stings: An Exploratory and Correlational Study. MDPI. Retrieved June 9, 2022, from [https://www.mdpi.com/2072-6651/11/7/427%20?type=check\\_update&version=1](https://www.mdpi.com/2072-6651/11/7/427%20?type=check_update&version=1)
- 17 Hill, C., and MacDonald, J. 2008. Stinging Insects | Public Health and Medical Entomology | Purdue | Biology | Entomology | Insects | Ticks | Diseases | Monitoring | Control | Hot Topics | Agriculture | Extension. Stinging Insects. Retrieved May 31, 2022, from <https://extension.entm.purdue.edu/publichealth/insects/stinging.html>
- 18 Gashler, K. 2011. Native bees are better pollinators, more plentiful than honeybees, finds entomologist. Cornell Chronicle. Retrieved May 30, 2022, from <https://news.cornell.edu/stories/2011/10/native-bees-are-better-pollinators-honey-bees#:~:text=The%20honeybee%20has%20hogged%20the,collapse%20disorder%20that%20has%20decimated>
- 19 Crown Bees. No Date. Leafcutter Bee Basics PPT [Slides]. Crownbees.Com. <https://crownbees.com/leafcutter-bee-basics-ppt/>
- 20 Wilson, J. S., & Carril, O. M. (2015). The Bees in Your Backyard: A Guide to North America's Bees. Princeton University Press.
- 21 Eraerts, M., Vanderhaegen, R., Smagghe, G., & Meeus, I. 2019. Pollination efficiency and foraging behaviour of honey bees and non-Apis bees to sweet cherry. Agricultural and Forest Entomology. Retrieved May 31, 2022, from <https://pollinature.net/wp-content/uploads/2020/02/Pollination-efficiency-and-foreaging-behaviour-1.pdf>
- 22 United States Geological Survey. 2020. (July 23). What is the role of native bees in the United States? | U.S. Geological Survey. USGS.Gov. Retrieved June 1, 2022, from <https://www.usgs.gov/faqs/what-role-native-bees-united-states>
- 23 Beekman, M., and Ratnieks, F.L.W.. 2000. Long-range foraging by the honey-bee, *Apis mellifera* L. Functional Ecology. 14. 490 - 496. 10.1046/j.1365-2435.2000.00443.x.
- 24 Xerces Society for Invertebrate Conservation. (n.d.). Nesting & Overwintering Habitat | Xerces Society. Nesting and Overwintering Habitat for Pollinators and Other Beneficial Insects. Retrieved June 13, 2022, from <https://xerces.org/publications/fact-sheets/nesting-overwintering-habitat>
- 25 University of Maryland. 2022. (April 12). Beyond the honeybee: How many bee species does a meadow need?. ScienceDaily. Retrieved April 29, 2022 from [www.sciencedaily.com/releases/2022/04/220412203110.htm](http://www.sciencedaily.com/releases/2022/04/220412203110.htm)