



PennState

Penn State Sentinel Bee Nest Study 2019

Instructions for Participants

Doug Sponsler, 2/25/2019

Introduction

Thank you for your participation in the 2019 Penn State Sentinel Bee Nest Study! Our study has two objectives. First, we aim to document patterns of wild bee diversity across Pennsylvania, with special emphasis on the comparison of different landscape types, such as cities, farmlands, and forests. Second, and no less important, we want people to discover the wild bees of their neighborhoods, to learn their names, know their habits, and become invested in their conservation. Thanks for partnering with us!



Building your nest

Your first task as a participant in this study is to build a nest. At Penn State, we have designed an extremely low-cost wild bee nest that uses a combination of hardware store materials and natural *Phragmites* reeds, following the well-validated methods of Staab et al. ([Staab et al. 2018](#)). It can be built for well under \$10, and once you get the hang of it, you may want to build more -- go for it!

Materials

1. *Phragmites* reeds (enough to pack two PCV pipes)
2. 2" diameter x 9" length PVC pipe (x2)
3. 2" pipe hangers (x2)
4. 1" roofing nails (x4)
5. 60" garden (x1)

Construction

1. **Harvest *Phragmites*¹**. Using a sharp knife or sickle, cut *Phragmites* reeds off at the base, as close as possible to the soil surface. Then, cut off top extremity of the reed that includes the flowering "tassel"; this will reduce the risk of transporting seeds. (**Figures 1-2**)

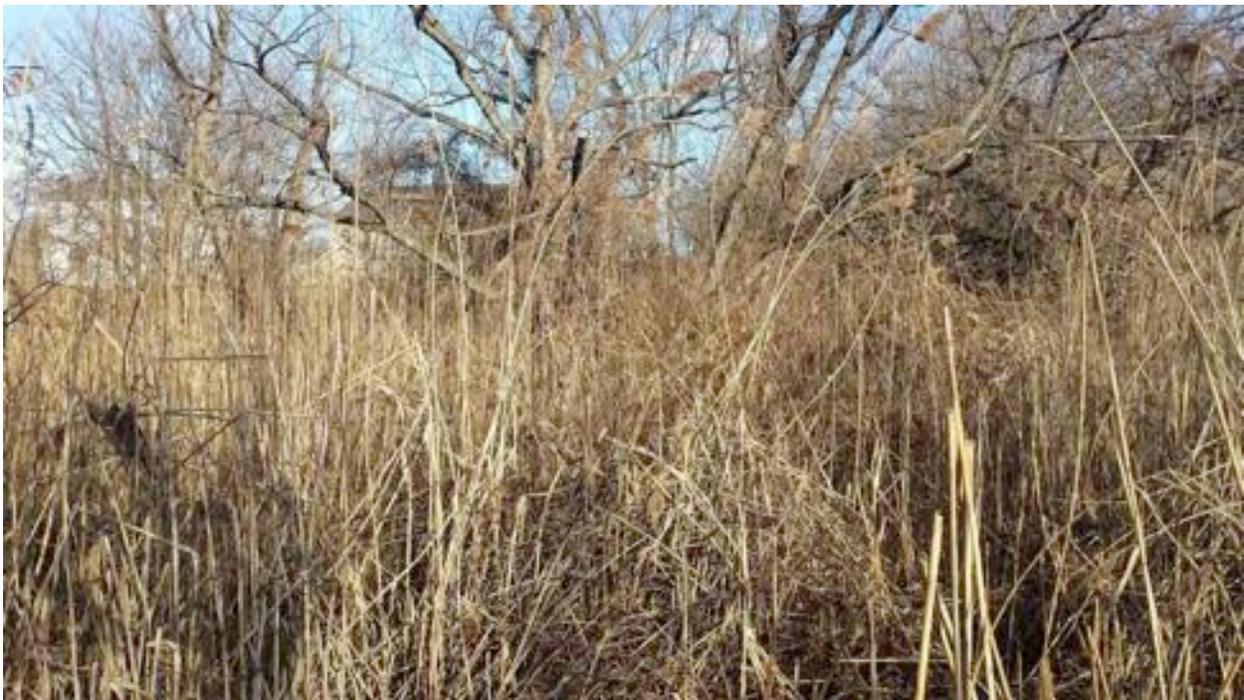


Figure 1. A stand of *Phragmites* in south Philadelphia. Note the conspicuous "tassels" at the apex of each reed. These, combined with the 10-14' height of the reeds, make *Phragmites* easy to identify.

¹ *Phragmites australis* is an extremely common plant that exists in both native and highly invasive subspecies. Look for it along roadside ditches and wetlands. Be sure to get permission to harvest from the land owner, and use caution if collecting along roadsides.



Figure 2. Harvested Phragmites loaded into the ultimate research vehicle -- the versatile minivan.

2. **Cut reeds into ~8" sections²** so that each one contains a node somewhere toward the middle. To find nodes, rub off the flaky sheathing of the reed and look for narrow bands that occur at regular intervals; these nodes form septa that divide the interior of the reed. By including a node in the middle of each section, you give bees a back wall to their house, and you enable two different nests to be made in the same reed section (one in each open end).
3. **Sort reeds by internal diameter into small (3-4 mm), medium (5-6 mm), and large (7-8 mm).** This can be done roughly--no need to measure every reed once you get a feel for what the sizes look like. **(Figure 3)**

² One of the best tools for this is a band saw with a fine-toothed blade. If you do not have one of these available, use another tool that can make clean cuts through brittle material, such as a rotary cut-off wheel (e.g. Dremel tool) or a detail handsaw (e.g. veneer saw, fret saw). The key is making clean cuts so that you don't end up with splinters occluding the end of the reed.



Figure 3: Reed sections sorted by internal diameter: small (left), medium (center), large (right).

4. **Cut PVC pipe into 9" sections.** This can be done easily with either a hand saw or power saw. The pipe is cut slightly longer than the reed sections so that there is some overhang to protect the nest from rain.
5. **Pack PVC sections with reed sections³.** For each PVC pipe, use 4 small reeds, 4 large reeds, and enough medium reeds to achieve a snug fit so that nothing falls out when you shake it. After packing, use a pair of tweezers to remove any splinters or debris that may be blocking the openings of the tubes⁴ (**Figure 4**)

³ *Phragmites* reeds are fairly strong end-to-end, but fairly brittle when compressed laterally. Try not to break the stems while packing; if you do, replace the broken ones.

⁴ Note that you will also see a filmy pith inside the reeds; this does not need to be removed.



Figure 4: PVC tube packed snugly with reed sections.

- 6. Pre-drill holes in your garden stake.** Use your pipe hanger as a guide for where the holes should go. Use a drill bit that is slightly smaller than the diameter of the nails you are using so as to achieve a secure attachment. Pre-drilling is necessary to prevent the stake from splitting when the nails are driven. **(Figure 5)**



Figure 5: Pre-drilling garden stakes using pipe hanger as a guide for where holes should go.

7. Attached pipe hangers to opposite sides of the stake so that 2 PVC tubes can be mounted side-by-side. (Figure 6-7)



Figure 6: Attaching pipe hangers to stake.



Figure 7: Side-by-side arrangement of PVC pipes using two oppositely mounted pipe hangers.

Installing your nest

1. Find a spot on your land where your nest can be unobscured by tall vegetation.
2. Before mounting your PVC tubes on the pipe hangers, drive your stake securely into the ground so that one of the two open sides of your nest faces southeast (to get morning sun).
3. Mount your PVC tubes, and you have a finished sentinel nest! **(Figure 8)**



Figure 8: Finished sentinel nest.

Monitoring your nest

As close as possible to the 1st of every month, please do the following:

1. **Take a crisp closeup** of the open ends of each of your PVC tubes (i.e. 4 pictures per nest unit) and email these photos to dbs31@psu.edu. This will enable us to keep track of which reeds are “capped”, meaning that a female bee has completed a nest in it. Be sure to get the rim of the tube in the picture so that we can use it as a reference to measure the size of each reed. **(Figure 9)**

Name your photos yourname_nest#_photo#_ddMonthYYYY. For example, the photos of my nest #1 that I will take on March 1 will be named:

sponsler1_A_01March2019.jpg
sponsler1_B_01March2019.jpg
sponsler1_C_01March2019.jpg
sponsler1_D_01March2019.jpg



Figure 9. Photo showing stem ends, including PVC rim as a reference for measuring stem diameter.

2. **Take a zoomed out photo standing at your nest and facing north, south, east, and west** (4 photos) and email these photos to dbs31@psu.edu. These will help document

the microhabitat of your nest. **Be sure to aim the camera low enough to capture low-growing plants close to the nest.**

Name your photos yourname_nest#_direction_ddMonthYYYY. For example, the photos from nest #1 that I will take on March 1 will be named:

sponsler1_N_01March2019.jpg
sponsler1_S_01March2019.jpg
sponsler1_E_01March2019.jpg
sponsler1_W_01March2019.jpg

3. **OPTIONAL -- take photos of any insects (you'll probably see more than just bees) that show up at your nest and post them to iNaturalist.** iNaturalist is a crowd-sourced natural history program where you can share observations with other users and help each other identify specimens. Visit their website for more information:
<https://www.inaturalist.org/>

Finally, don't be discouraged if you go a long time without seeing anything at your nest. It's very hard to predict how many bees will show up in a given place, and it is typical in studies of this kind to have a lot of empty nests. But even an empty nest can tell us something, and we are all learning together.

Have fun!



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