Elizabeth Panner answers some questions about her field research on native bee populations at the Crow's Nest Research Center (April 2021).

What does it mean to do a survey of bees?

Doing a survey of bees means that I'll be collecting bees at Crow's Nest Research Center so that I can find out which species are living on the land. I'll be doing it throughout a full season when bees are out, which is from the end of March until the beginning of November. I'm going to go out every two weeks, so that I can overlap with different plant bloom periods and the different times when bees are out (most species are out for about five weeks of the year).

What does it mean for the bees to be native? Why is that important?

A lot of the time when people think of bees, they think of honeybees or bumblebees: something that's furry, black and yellow, and stings. In reality, bees can vary widely from that image, and honeybees are actually *non*-native – they were introduced from Europe. There are hundreds of native species (about 450) in Virginia alone. Many native bees live in holes in the ground or cavities in wood, and most are not social – meaning they don't create hives or colonies and are less likely to sting.

The reason honeybees are so well-known is that they are widely used to produce honey and to pollinate crops in agriculture. Honeybees are the only type of bee that makes honey, and they are often used on farms because they aren't picky about the plants that they will collect pollen from.

Many native bees, though, prefer specific type of plants and therefore can be very effective pollinators for those plants. Because the native bees are specialists, they are better at helping out the native plant species that they are adapted to visit. Even in agriculture, native bees can supplement the pollination of honeybees to produce higher yields of crops. However, since there's not as much of a focus on native bees, we don't know as much about them. It's important for this survey focus on native bees because then we can know more about these insects that provide such invaluable services to native ecosystems.

What will you gain from doing a survey of native bees at CNRC in particular?

This survey will help to start filling a gap in our knowledge about the relationship between bees and natural ecosystems in this area of Virginia. There is relatively little information on the distribution of native bees in general, and that is certainly true for the location of Crow's Nest Research Center in Stafford, Virginia. In the National Native Bee Laboratory Database, which is where I'll be entering the data from my survey, and which has over half a million records, there are no entries from Stafford County and very few records from the counties to the south of Stafford. Also, there is little knowledge about bees in wetlands. The extensive marsh habitat at CNRC will be great for learning more about those species.

How do you collect bees?

I collect bees using three different methods: pan traps, vane traps, and hand netting.

Pan traps are a series of small, painted cups that are filled with soapy water and then set in a spaced-out line for about 150 meters. They are only out for a full day of sunlight every survey day (about every two weeks). The cups are painted fluorescent colors (blue, yellow, and white) alternated in the line, which helps to attract bees that are flying above and mistake them for flowers. The soap in the water breaks the surface tension, so that bees sink rather than floating on the top, and it also makes water enter the bees' bodies more quickly so that they drown. I put six transects out each time, in different spots around the property, so that throughout the survey I get an idea of which species are present everywhere, at some point.

Vane traps are out permanently and this is how I survey the bees of the marsh. Because it's a wetland, I can't set out pan traps or try to walk out and capture bees like with other locations. Vane traps are hung on trees, in this case, and filled with soapy water as well as propylene glycol, a preservative (which is

environmentally safe – it is actually found in some foods like store-bought ice cream cakes). Vane traps are also brightly colored to attract bees – florescent yellow and blue – and the name comes from the fact that there are flat vanes at the top which bees fly between and into the collection jar at the bottom (see picture). These are along the marsh edge and I filter out the contents every couple of weeks and leave them up.

Hand netting is pretty much what it sounds like – I go around with a net and try to capture bees. This is helpful because it allows me to sample bees on plants that attract specialist bees that wouldn't always go to the pan traps, or on plants that have a shorter blooming period. I then put the bees I captured in the net into vials of soapy water.

I take all the bees I collect to the Bee Inventory and Monitoring Lab of the U.S. Geological Survey in Maryland where the lab very generously lets me use their space and resources to wash, dry, pin, label, and identify my bees.

Why do the bees you collect have to be killed and how is this not hurting the bee populations? How is it justified?

This is definitely a common question, because it seems pretty antithetical to the whole project for me to be killing bees. So, first to address the question of bee populations, it is basically impossible for my survey to have a significant effect on the numbers of bees present. There are thousands of bees present for every acre of land. Over the course of the whole survey period, I probably will end up collecting a couple thousand bees total. In addition, capturing bees doesn't mean they won't reproduce. In social bees, many captured bees are not reproductive, and in solitary bees, about half of the female bees will have already laid their eggs for the year, which are always left untended.

I and other people who study bees would use an alternate method of surveying that doesn't kill bees, if it were possible. I by no means enjoy the fact that this survey kills bees, but unfortunately it is the only way to reliably identify bees. All of the bees captured are identified under a microscope which is an essential tool for making correct identifications. All bee identifications must be double checked by trained experts, so sometimes sharing the bee specimens involves shipping bees across the country.

It's also important to put into perspective the effects of our actions on native bees. Agricultural activities that involve chemicals or altering the landscape, as well as maintaining lawns and replacing native plant species, kill more bees than surveying techniques. Through this survey we can gain information helpful for protecting native bee populations in the future.

What information will you gain and what can you do with it?

The survey results will tell us is what species are present at the Crow's Nest Research Center. We'll learn whether there are common species that are missing from the property, or whether there are rare or uncommon species of conservation concern. This information will allow the Crow's Nest Research Center to cater to those populations by providing habitat and food for those species, and augment the native bee populations in the future.