



Buggy Biodiversity

Background

Biodiversity describes the variety of organisms that live in a particular area. If you go to a forest and count all of the different plants, animals, and fungi, that would be a measure of that area's biodiversity. You can also count all of the organisms within a particular group, such as insects, to get a measure of that group's biodiversity in the area.

There are two important aspects of biodiversity. **Richness** describes the number of unique types of organisms (such as species) present, while **evenness** is a measure of how equal the number of individuals of each species is. For instance, there may be a habitat with 20 different species of insects, which would mean the richness of insects is 20. However, if there are 200 mosquitos but only 10 of each of the other species (such as 10 bees, 10 grasshoppers, etc.), then that area would have **low evenness**. Alternatively, if there are equal numbers of each species of insect (such as 20 mosquitos, 20 bees, 20 grasshoppers, etc.), then the area would have **high evenness**.

But biodiversity doesn't always describe the number of species. It may also describe the number of organisms that fulfill certain roles in the ecosystem. For instance, the richness and evenness of predators, herbivores, producers (such as plants), and decomposers regardless of their species has a big effect on the health of an ecosystem. This type of diversity is called **Functional diversity**.

For this activity, we will measure the biodiversity of invertebrates (animals without spines) in a habitat. The third page of this handout is our study area. You'll notice it's filled with bugs! We want to get an idea of how diverse the invertebrates in this habitat are, and while it may be possible to count every single bug in this habitat, there's an even better and faster method. Biologists normally count the number of organisms in smaller sections of an area. By doing this many times spread evenly around the habitat, they're able to get a measurement of the biodiversity of the entire habitat without counting every single organism (which is usually impossible!). So let's give it a try!

Supplies

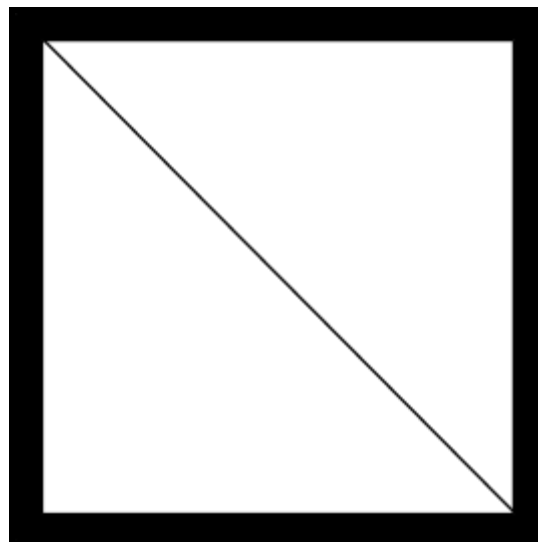
For this activity each student will need:

- Buggy Biodiversity Ecosystem page
- Scissors
- Quadrat cut-out

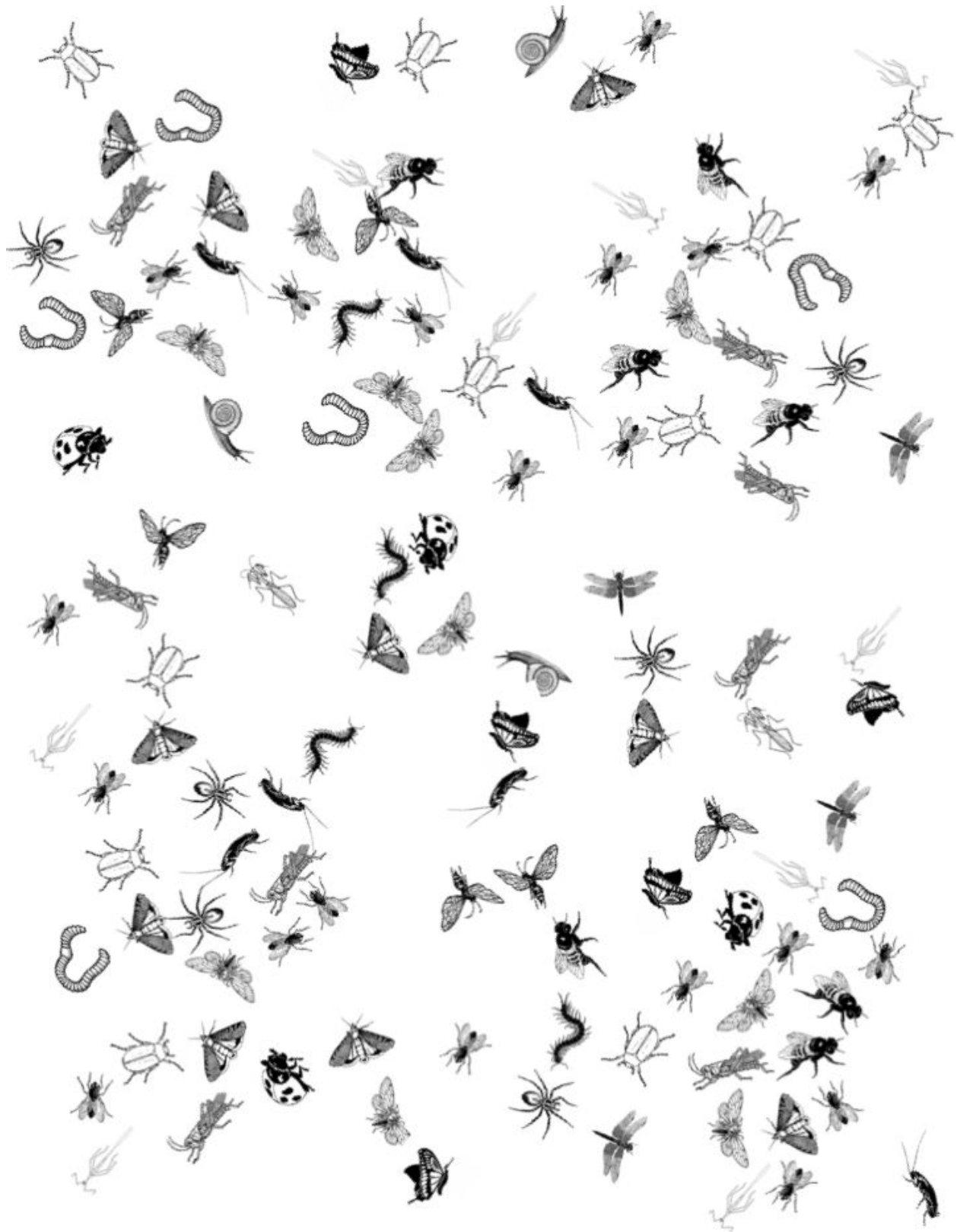
Activity Instructions:

1. Using scissors, cut out your quadrat.
2. Close your eyes and place your quadrat in the Buggy Biodiversity Ecosystem and record the different kinds of bugs in your square.
3. Count and record the number of different kinds of bugs in your sample.
4. Count and record the number of new species. Record the number of species that you haven't seen in previous samples.
5. Graph your results! Graph the Richness (total # of unique species recorded from the start of the activity) on the y-axis versus the # of quadrat samples on the x-axis to estimate the Richness of this community of bugs. You should add together the numbers of new species that you recorded up to the newest quadrat sample.
6. Repeat step 2-5 four times
7. **Bonus:** Count and record the number of unique functional groups in each quadrat sample instead of the number of different bug species to measure functional diversity. Create a graph of functional diversity richness.

This helpful tool is your **quadrat**. A **quadrat** is just a square frame that allows you to survey a standard area from a larger environment for biodiversity. Cut out the square, and then remove the center by folding along the diagonal line and then cutting along the inside of the black border to use it for this activity!



Buggy Biodiversity Ecosystem



KEY: Buggy Functional Groups

Pollinators:



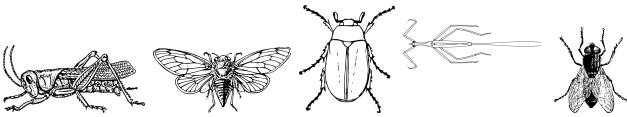
Predators:



Decomposers:



Herbivores:



Think about what we've learned:

- What patterns do you notice within your species richness curve? Can you give an estimate of the biodiversity of the ecosystem?
- Does your graph look the same as those of other groups? Why might these look different?
- If you measured functional diversity, what do you notice that is similar or different from your measurements of species diversity?

Detailed Instructor Activity Directions:

1. Give each participant (or small groups) a copy of the Buggy Biodiversity Ecosystem page. Alternatively, you may be able to project this page onto a projector screen and go through the activity as a class.
2. Using scissors, have each participant cut out their quadrats
3. Go over the instructions for randomly placing the quadrat. You should emphasize that the samples should be random to ensure that we don't bias our estimate of the ecosystem diversity.
4. Have each participant place their quadrat randomly on the page and record the identities of different kinds of bugs in the square, as well as totalling up the number of species, as well as the number of new species.
5. Have students graph the Richness (total # of unique species recorded from the start of the activity) on the y-axis versus the # of quadrat samples on the x-axis to estimate the Richness of this community of bugs. The richness should be calculated by summing together the number of new species found up to the current quadrat sample.
6. Repeat step 4-5 four times,
7. **Bonus:** Have students count and record the number of unique functional groups in each quadrat sample instead of the number of different bug species to measure functional diversity. Have students use the Functional Diversity Key to assign their counted species to different functional groups. Have them record the number of unique functional groups in each quadrat, then graph functional diversity richness in the same way that they graphed species richness.