

## ACTIVITY 3: INDEXING BIODIVERSITY

In this activity, students will conduct an experiment to estimate the diversity of organisms in a given sample for a certain ecosystem area.



*Image Credit: Gary Abud, Jr.*

**Simpson's Diversity Index** is used to calculate how diverse an area is with organisms. This could be with animals, plants, or even humans. The index calculation compares the total number of all the different organisms to the number of each type of organism. It tells the probability when randomly selecting two organisms in an area that each individual will be a different species. Index values closer to 0 indicate low diversity (e.g., low percentage chance of two random individuals being different) and 1 indicates high diversity.

In the study of ecosystems, this index can help you understand the diversity of species as well as the diversity among a particular type of organism. Understanding how populations are distributed and the relative diversity of different areas within an ecosystem using an index like this gives scientists important information on ecosystems, their health, and how they change over time.

For example, say you went into the woods and overturned some logs to reveal what's beneath. You might find a lot of ants. On closer inspection, you notice that not only are there ants but there are several different species of ant in that part of the woods—red ants, black ants, etc. Based on how many of each kind of red ant and black ant that you counted, you could determine an index for the ant diversity in that part of the woods.

Having this kind of an index is helpful to compare other parts of the woods to see if the diversity is the same or different. Let's say that one mile away you overturn another log expecting to see a similar diversity of ants only to find that there are far fewer red ants and many more black ants. One mile farther even away, you notice there are no red ants and only black ants. The diversity index at each spot can help you map an ecosystem.

- **Materials:**
- Glue sticks
- Construction paper or paper plates
- Rainbow sprinkles and single-color sprinkles

First, show the video [Tropical Rainforest Diversity](#) from PBS LearningMedia to students. Follow the discussion prompts in the video and pause at each point in the video to have students turn and talk with a partner about what the narrator asks and is talking about. After the video, engage the class in a discussion about the key question of the video—**how does the biodiversity within an ecosystem influence the stability of that ecosystem?**

Next, inform students that they will model an ecosystem and calculate its diversity index. Distribute the supplies, and then have groups of students cover their paper with a layer of glue and shake a single color of sprinkles plus the rainbow sprinkles on it. Have them move the plate to evenly coat the sprinkles on its surface.

Then, have students tally up how many colors of sprinkles are represented and how many sprinkles of each color there are on the plate. They should organize and display their data information into a table for easy reference. The colors of sprinkles represent different species and the number of each color represent how many individuals of each species are present.

Last, have students calculate the diversity index for their paper plate ecosystem. It will be helpful for you to demonstrate this step and go through a sample calculation together (but not using sprinkles; use something else like coins, beans, candy, or something digital like emojis.) Have students label their paper with the diversity index on it and then put all the plates adjacent to one another and discuss with the whole class how the differences in index values compare to the distribution of sprinkles.

### Simpson's Diversity Index

$$D = 1 - \frac{\sum n(n-1)}{N(N-1)}$$

- D is the diversity index
- N total number of organisms
- n is number of one species

\* $\Sigma$  means sum of all the calculations for individuals of each species