The Bio/Diversity Project

Sonoran Desert Biodiversity Outreach Curriculum Fall 2025
Lesson 7: Calculating Biodiversity

This lesson has been adapted from: Taking Count and Measuring Biodiversity

Grade Level: 6th
Time: 50 minutes

AZ Science Standards:

- *66.L2U1.13* Develop and use models to demonstrate the interdependence of organisms and their environment including biotic and abiotic factors.

Student Facing Learning Objectives:

- I can explain the importance of both species richness and evenness when evaluating biodiversity.
- I can use a transect technique to collect data on species diversity
- I can accurately record species counts in a structured table whose data will be utilized in a later lesson.

Guiding Questions:

- What is species richness?
- What is species evenness?
- How do you calculate biodiversity?
- Why is it important to measure biodiversity?

Vocabulary:

- Biodiversity - variety of life
- Transect technique - a method of measuring species populations of an area by counting all the species that transect a particular line; the line acts as a sample that's representative of the entire region being counted
- Species richness - the abundance of species (how many species there are?)
- Species evenness - relative evenness of species populations (are the populations of each species mostly even?)

Materials:

- L7 Slides
- L7: Biodiversity Index WS (print one for each student)
- L7: Biomes & Species (print one for each group-students can reuse it across classes)
- 5 bags (one for each group) mixed with:
    - pinto beans
    - black beans
    - Green/yellow beads
    - Red pompoms
    - Googly eyes
- 12-inch rulers (1 for each group)
- Roll of masking tape

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🌵 Lesson 7: Calculating Biodiversity🌼

Mini-Lesson (15 min)

Section Objective: Students become familiar with the concepts of species richness and evenness and apply these concepts to determine if an ecosystem is relatively biodiverse or not.

Introduce the topic of calculating biodiversity (7 min):

- Review the scientist of the week - be sure to ask a question to engage students about the scientist of the week.
- Review the learning targets. Ask student volunteers to read aloud.
- Review with students: What is biodiversity? What threatens biodiversity?
- Ask students: Why is biodiversity important? How does it help an ecosystem?
- After students share their answers, explain to students that ecosystems with greater biodiversity exhibit greater stability and resilience in the face of natural disasters. The higher the biodiversity, the higher the stability of that ecosystem.
- Define ecosystem stability: the ability of an ecosystem to stay healthy in the face of environmental disturbances.
- Explain that many factors can disturb an ecosystem such as wildfires, droughts, hot summers, etc. The ability of an ecosystem to bounce back from such disturbances is dependent upon their biodiversity levels.
- Next ask students: Why is it important to measure biodiversity? What can scientists do with this information?
    - Conservation - Knowing biodiversity levels helps scientists identify areas in which conservation is highly needed
    - Track Progress - Measuring biodiversity helps scientists know if their conservation efforts are making an impact or having progress
    - Predict - Calculating biodiversity helps scientists predict how events will impact an ecosystem in the future. It helps scientists plan for the future.

Introduce the concepts of species richness and evenness (8 min):

- Explain to students that when measuring biodiversity, scientists don't just think of species richness or how many species there are–they also consider species evenness as well, which is the relative evenness of species populations.
- Project the slideshow images showing the populations of monkeys, zebras, lions, eagles, and rhinos. Ask students:

    - How many species are there? (5). This represents species richness–how many different species there are.
    - Are the populations of each species relatively even? (Yes) This represents species evenness or the idea that species have relatively similar populations.
    - Overall, this ecosystem is relatively biodiverse because it has both species richness AND species evenness.
- Ask the same set of questions for the next slide image showing populations of lions, eagles, and zebras.
    - How many species are there? (3). This represents species richness–how many different species there are.
    - Are the populations of each species relatively even? (No) This represents species evenness or the idea that species have relatively similar populations. In this case, these species do not have similar population sizes.
    - Overall, this ecosystem is not very biodiverse because even though it has some species richness, there is not a lot of species evenness.
- Thumbs up/Thumbs Down activity: Allow students to further integrate this idea of species richness and species evenness by reviewing three more slides depicting animal populations. Tell students they must count the number of species (species richness) and the population of each species (species evenness) to determine if this ecosystem is biodiverse or not. If it's rather biodiverse, students will show you a thumbs up. If it's not super biodiverse, students will show you a thumbs down.
- End this segment by clarifying with students that it is difficult to calculate and describe biodiversity because:
    - Seasons change which impact migration or hibernation, changing where animals move and how active they are.
    - Times of activity - some animals are nocturnal while others are diurnal. This makes it hard to measure biodiversity since animals are not active at the same time.
    - Climate change - which brings droughts, storms, and shifts in temperatures. These changes impact animal patterns and movement, making it difficult to calculate biodiversity.

Instructions & Work Time (35 minutes)

Section Objective: Students use the biodiversity index formula to calculate the biodiversity of an ecosystem of their creation.

Introduce the Biodiversity Index (10 min):

- Explain to students that there is a formula scientists use to calculate the biodiversity of a region. It's called the Biodiversity Index. Scientists will count the total number of species

in a region and divide that number by the total number of individuals in that region. The higher the index, the higher the biodiversity.

- Distribute the L7: Biodiversity Index Worksheet and tell students they will have a chance to practice using the Biodiversity Index formula. You all will practice together as a class first.
- Project the slide that has the image of the forest with all the cartoon animals in it. The image is labeled Practice 1. There is a table on the slide which lists all the species and includes a column for the class to count the number of each species. Students have this same table on their own worksheets. As a class, count each of the species from the table. Students will write these numbers on their worksheet.
- Once all the species populations are counted, you will direct students to look at the Biodiversity Index formula below their tables on their worksheet. Help students plug in the numbers to the correct place (the total number of species is the numerator; the total number of individuals is the denominator). Project the calculation on the slides and have students copy on their own worksheets.
- Repeat this same practice on the next slide that's labeled Practice 2.
- This activity gets students familiar with the protocol of:
    1) counting the number of total species
    2) counting the number of individuals within each species
    3) calculating the sum of individuals across all species
    4) plugging these numbers into the biodiversity index formula.

Introduce the Line Transect Activity (25 min):

- Tell students they will now participate in an activity in which they calculate the biodiversity of an ecosystem they create. They will need to be in groups of 3-4 for this activity. Be sure students are divided into their groups and sitting next to each other before you proceed.
- Once in groups, tell students to turn to the backside of the L7: Biodiversity Index Worksheet. They will use the backside of this worksheet to complete their line transect activity. (Note: each member of the group will fill out their own worksheet, though all the worksheets within the group should have the same information)
- Project the slide with all the biome choices and tell groups to start by choosing the ecosystem/biome they want to calculate biodiversity for:
    - Tropical rainforest
    - Tundra
    - Desert
    - Wetlands
    - Forest
    - Savanna
- Once groups have made their selection, tell them to write the name of their biome at the top of the table on their L7: Biodiversity Index Worksheet where it says "Biome:" Use the screenshots on the slides to show students where this is on their worksheet.

- Next, distribute the L7: Biomes and Species Handout (one per group).
- Explain to students that each biome on the handout will have 5 species. Those species are represented by objects: pinto beans, black beans, red pompoms, green/yellow beads, and googly eyes. Students should reference the L7: Biomes and Species Handout to know which species each object represents for their biome.
- Direct students to the Legend table at the top of their L7: Biodiversity Index Worksheet. Tell students they must reference the L7: Biomes and Species Handout to fill in the legend on their worksheets so that they know which objects represent which species.
- Next, introduce the concept of line transects. Tell students that line transects is one technique scientists use to measure biodiversity in a region. Essentially scientists will draw a straight line within a condensed space. They will count all species that intersect that line. This line is a representative sample of the biodiversity within that entire region.
- In order to demonstrate how line transects are done you may:
    - Play the demonstration video in the slides so students see how to complete the line transect activity in their groups.

      OR
    - Gather all students around one table/desk and demonstrate how to complete a line transect by modeling the activity for students and narrating what you're doing while you're doing it.

    - *Note: Groups in the past have had more success with performing a live model of the line transect activity rather than solely play the video. Think of the video as a model for you, whereas the live modeling is best suited for students.*

- Give students 10 minutes to complete the line transect activity in their groups.
- Walk around the class to make sure groups are doing the activity correctly. Have your phone calculator on you to help students calculate the biodiversity index at the end of the worksheet.
- **Remember to collect their papers when they are done** because they'll use their papers to create posters in Lesson 8!
