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# K-12 Partnership Lesson Plan

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# *Humans and Biodiversity*

## Overview

This lesson explores potential impacts that humans have on biodiversity as well as defining biodiversity, and exploring the potential positive impacts it has on humans and ecosystems. The lesson includes an outdoor activity consisting of choosing and visiting three sites that span a gradient of human impact. Using data collected during this activity, students will learn to use these data to calculate indexes of biodiversity. Some time will be spent discussing benefits/drawbacks to the methods employed. Data from the three sites will be compared to explore how humans tend to affect biodiversity. The topic of genetic biodiversity will also be covered with some examples where genetic diversity is important for humans and ecosystems.

**Objectives**

At the conclusion of the lesson, students will be able to:

* Assess levels of biodiversity in a given habitat
* Discuss benefits and drawbacks of different methods for measuring biodiversity
* Generate and test hypotheses about the levels of biodiversity in different ecosystems and regions

**Length of Lesson**

This lesson is designed to fit in five 50 –minute classes. The first class will be spent introducing the material and generating hypotheses. Three classes will be spent collecting data from three different habitats (one day per habitat). The last class will be spent assessing the data collected and hypotheses by calculating biodiversity indexes.

**Grade Levels**

High school

**Standards covered (NGSS)**

Disciplinary Core Ideas:

* **HS-LS2-2**: use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales

Cross Cutting Concepts:

* Systems and system models
* Stability and change of systems

Science and Engineering Practices

* Planning and carrying out investigations
* Analyzing and interpreting data

***Previous Michigan Standards Met:***

* **B1.1**: scientific inquiry
* **B1.2**: scientific reflection and social implications
* **L3.p1**: populations, communities, and ecosystems
* **L3.p3**: factors influencing ecosystems
* **L3.p4**: human impact on ecosystems
* **B3**.**4**: changes in ecosystems
* **B3**.**4x**: human impact
* **B3**.**5**: populations
* **B4.4x**: genetic variation

**Materials**

* Tennis ball
* Tape measure
* 4 flags
* Notebook
* Calculator
* Field guides (optional)

**Background**

### (Background material is provided in the powerpoint found on the Human and Biodiversity lesson page on the KBS GK-12 website). Biodiversity can be defined in several different ways. For instance, (1) the organization of life at all levels of biological organization, (2) the relative diversity among organisms in different ecosystems, or (3) the totality of genes, species, and ecosystems of a region. The 1992 United Nation Earth summit defined biodiversity as “the variability among living organisms from all sources, and the ecological complexes of which they are part: this includes diversity within species, between species and of ecosystems.” Regardless of the specific definition, biodiversity is important for both humans and the wider ecosystems in which we live.

### From the human perspective, more biodiverse ecosystems are more likely to provide a variety of food items, medicines, industrial or building materials as well as opportunities for leisure, cultural expression, and aesthetic value. From the perspective of the ecosystem, more biodiverse ecosystems are more likely to provide a variety of ecosystem services, such as water filtration, pollination, decomposition, nutrient cycling, etc.

### Biodiversity varies in both space and time. On a global scale, biodiversity tends to increase as you approach the equator. Local areas with particularly high species richness are known as biodiversity hot spots. Biodiversity has also changed over time, decreasing after large scale extinction events.

### In today’s world, variation in biodiversity over space and time is strongly shaped by human activity. In this activity students will explore ways in which humans have impacted biodiversity and why biodiversity matters.

### Activities of the session

Class 1

1. Using the attached powerpoint presentation, introduce the concept of biodiversity, and discuss topics within.

Classes 2-4

1. Using the attached “Biodiversity Sampling Exercise” document, collect data from three different habitats hypothesized to span a range from low to high biodiversity.
2. Making hypotheses
	1. As a class, you will choose 3 habitats to sample
		1. Record the identities of the 3 habitats in your notebook
		2. Make a hypothesis about which habitat will have the most biodiversity and which will have the least. Record your hypotheses in your notebook and provide justification.
3. Selecting a sampling location
	1. These steps are to be followed at each habitat
	2. Throw the tennis ball over your right shoulder without looking at the target
		1. *\*\*\* the purpose of using the tennis ball is to find a random location to do your sampling- we want to eliminate potential bias, so it is important you do this step without “trying” to hit a good spot*
		2. *If your tennis ball lands outside of the intended habitat, rethrow it*
	3. Find where the tennis ball landed, and use the tape measure to make a 1m square that surrounds the ball
	4. Remove the tennis ball
4. Sampling biodiversity
	1. As a class, you select the types of organisms you will be samplings (plants only, insects, all organisms, etc.). Be sure to make a note of this in your notebook.
	2. Count how many individuals there are of every species in the plot
		1. *\*\*\* you may use the field guides to try to identify each species, but you can also simply categorize species and name them yourself (for example: Species A, Species B, blue flower, thorny bush, etc.)*
	3. Record the data in your notebook or on your data sheet.

Class 5

1. Using the attached “Biodiversity Sampling Exercise” document, calculate biodiversity scores from each habitat, and discuss benefits and drawbacks of the methods employed.
2. Calculating a biodiversity score
	1. We will use 2 different methods to estimate biodiversity in your sample area
	2. Method 1- basic biodiversity index
		1. First, count the total number of species you found in your plot
		2. Now, divide this number by the total number of individuals of all species found in your plot
		3. This is your *basic biodiversity index*, record this value in your field notebook
		4. Share your data with all other groups in your class, and calculate the average basic biodiversity index for each habitat.
	3. Method 2- simpson index of diversity
		1. This method is a little more complicated than method 1- we will be solving this equation:



* D is the index we are calculating
* n is the number of individuals of a given species
* N is the total number of individuals present in your sample
* It is helpful to construct a table to aid you in calculating this index- on the Biodiversity Sampling Exercise document is a sample table that gives an example of how to perform the calculation.
* This index ranges from 0 (no diversity) to 1 (maximum diversity)
	+ 1. Record this number in your lab notebook as the “Simpson Diversity Index”
		2. Share your data with all other groups in your class, and calculate the average basic biodiversity index for this habitat
1. Comparing among habitats
	1. Once you have visited all 3 sites, calculated your biodiversity indexes for all 3 sites (separately), and shared data with other groups, calculate an average biodiversity for each habitat
	2. You will have 2 different average indices for each habitat, the “basic biodiversity index” and the “Simpson biodiversity index”
	3. Compare the results for the 3 habitats and answer the provided discussion questions

**Resources**

* Humans and biodiversity powepoint, biodiversity sampling exercise document and biodiversity discussion questions are available on the “Human and Biodiversity” lesson page on the KBS GK-12 lesson plan.
* Web resource video introducing the concepts presented in this lesson: [www.thewildclassroom.com/home/ecogeeksvideos/biodiversity.html](http://www.thewildclassroom.com/home/ecogeeksvideos/biodiversity.html)
* Website of Costa Rican project to catalog biodiversity of the country: <http://www.inbio.ac.cr/en/>

**Assessment**

 Discussion questions are included in the biodiversity discussion questions document.