Simpson's Diversity Index: Bean/Pasta Diversity

Goal: Practice using the Simpson's Diversity index formula to calculate the diversity of three **model** ecosystems. Apply this practice and determine the diversity of three **actual** ecosystems.

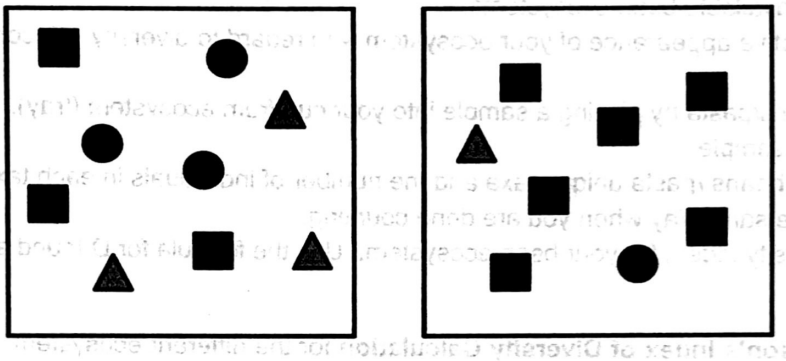
Background:
Healthy ecosystems, such as a salt marsh, temperate forests, and tropical rainforests, are complex webs of living and nonliving elements. An important measure of an ecosystem's health is its **biodiversity**. The term "biodiversity" includes the variety of life that occurs within an ecosystem, the variety of life on earth, and genetic variety among species.

For our purposes we will define and use this biodiversity definition. "**Biodiversity** is the variety of life that occurs within an ecosystem. A population is "a group of one species that live in a particular geographic area". Although it is important to view life at all structural levels, many ecologists use the "species" level to determine the biodiversity of the system being studied. Two simple methods for describing the biodiversity are richness and abundance.

Richness is defined as "the number of kinds of different species present".

Abundance (sometimes called "relative abundance") is "the number of individuals present in each population.

See the example below:



Community A **Community B**

	Community A	Community B
Species Richness		
Abundance		

PRE-LAB QUESTIONS

1. Define the following terms:

a. **Biodiversity-** _____

_____

b. **Community** _____

_____

c. **Richness-** _____

d. **Abundance-** _____

_____

The Simpson's Diversity Index is a formula that accounts for both species richness and relative abundance in order to quantify the diversity of an ecosystem. The formula is:

$$\textbf{Diversity index} = 1 - \Sigma\left(\frac{n}{N}\right)^2$$

Where Σ means the sum of...
n =the total number of organisms of a particular species
N = the total number of organisms of all species.

In This Activity You are Bean Counters (actually, you are ecologists studying biodiversity in the ecosystem defined by the volume of a tray called "bean world")

Procedure

1. Go to one of the 3 available bean ecosystems.
2. Observe the qualitative appearance of your ecosystem with regard to diversity. Record this observation in the space provided.
3. Pour (capture) beans/pasta by placing a sample into your cup from ecosystem (tray). Your teacher will show you how to obtain your sample.
4. Record the type of beans /pasta unique taxa and the number of individuals in each taxonomic group in table 2. Return beans to the same tray when you are done counting.
5. Calculate D (Diversity index) for your bean ecosystem. Use the formula for D found above.
6. Perform the **Simpson's Index of Diversity Calculation** for the different ecosystems. The larger the D value the more diverse the sample. Calculate D for all samples taken in each location.
7. Repeat each step for the other two bean ecosystems. Record data in Tables 3 - 4

Table 1. Species richness and relative abundance from Ecosystem ____

Species/Type of Bean/pasta	Number (n)	$(n/N)^2$
Total	**(N) =**	$\Sigma(n/N)^2$ =

Qualitative Observations:

D = _____

Table 2. Species richness and relative abundance from Ecosystem _____

Species/Type of Bean/pasta	Number (n)	$(n/N)^2$
Total	(N) =	$\Sigma(n/N)^2$ =

Qualitative Observations: D = _____

Table 3. Species richness and relative abundance from Ecosystem _____

Species/Type of Bean/pasta	Number (n)	$(n/N)^2$
Total	(N) =	$\Sigma(n/N)^2$ =

Qualitative Observations: D = _____

Class Data Table: Simpson's Diversity Index for 4 Different "Bean" Ecosystems

D values	1	2	3
Table 1			
Table 2			
Table 3			
Table 4			
Table 5			
Table 6			
Average			
Standard Deviation			

Analysis/Summary

1. Graph the Diversity Index Data.
2. What conclusions can you draw about the diversity of these three ecosystems?
3. Did your qualitative observations match with your quantitative diversity index values? Explain.