Name: _____ **Period:** _____

AP Biology: Parking Lot Diversity Lab

Section 1: Prelab Reading, Practice & Questions

Simpson's Diversity Index is a measure of diversity. In ecology, it is often used to quantify the biodiversity of a habitat. It takes into account the number of species present, as well as the abundance of each species. Before looking at Simpson's Diversity Index in more detail, it is important to understand the basic concepts outlined below.

Biological Diversity - the great variety of life. Biological diversity can be quantified in many different ways. The two main factors taken into account when measuring diversity are richness and evenness.

1. Richness - Richness is a measure of the number of different kinds of organisms present in a particular area. For example, species richness is the total number of different species present in a community. Some communities may be simple enough to allow complete species counts to determine species richness. However, this is often impossible, especially when dealing with insects and other invertebrates, in which case some form of sampling has to be used to estimate species richness.

2. Evenness - Evenness is a measure of the relative abundance of the different species making up the richness of an area. To give an example, we might have sampled two different fields for wildflowers. Both samples have the same number of species (3) and the same total number of individuals (1000). The total number of individuals in sample 1 is quite evenly distributed between the three species. In the second sample, most of the individuals are buttercups, with only a few daisies and dandelions present. Sample 2 is therefore considered to be less diverse than sample 1.

1. What index will we be using in this lab to determine diversity? _____
2. What two main factors are taken into account when measuring diversity?
3. What is species richness? Which sample above is more "rich"?
4. What is species evenness? Which sample above is more "even"?

Simpson's Diversity Index

Simpson's Diversity Index is a measure of **diversity** which takes into account the number of species present, as well as the relative abundance of each species. As species richness and evenness increase, so **diversity** increases.

Simpson's Diversity Index

$$\text{Diversity Index} = 1 - \sum\left(\frac{n}{N}\right)^2$$

n = total number of organisms of a particular species

N = total number of organisms of all species

As an example, let us work out the value of **D** for a single quadrat sample of ground vegetation in a woodland. **Of course, sampling only one quadrat would not give you a reliable estimate of the diversity of the ground flora in the wood. Several samples would have to be taken and the data pooled to give a better estimate of overall diversity.

Species	**Number (n)**	n/N	$(n/N)^2$
Woodrush	2	2/15	.017
Holly (seedlings)	8	8/15	.284
Bramble	1	1/15	.004
Yorkshire Fog	1	1/15	.004
Sedge	3	3/15	.04
Total (**N**)	**15**	**$\Sigma(n/N)^2$**	**.35**

Putting the figures into the formula for Simpson's Index

D = 1 - .35

D = 0.65

The value of D ranges between 1 and 0, with 1 being the most diverse and 0 the least diverse.

5. Practice Problem #1

Species	**Number (n)**	**n/ N**	**$(n/N)^2$**
Woodrush	0		
Holly (seedlings)	2		
Bramble	4		
Yorkshire Fog	6		
Sedge	3		
Total (**N**)		**$\Sigma(n/N)^2$**	

6. Use the space below to show the rest of your work. Make sure you circle or square your final answer:

7. **Practice Problem #2**

Species	Number (n)	n/N	$(n/N)^2$
Woodrush	5		
Holly (seedlings)	4		
Bramble	3		
Yorkshire Fog	2		
Sedge	1		
Total (**N**)		$\Sigma(n/N)^2$	

8. Use the space below to show the rest of your work. Make sure you circle or square your final answer:

9. Which sample is more diverse? Justify your answer with data.

Section 2: The Lab!

Purpose:
To develop an understanding of the Simpsons diversity index and species richness as tools for quantifying biodiversity and assessing human impacts on the environment.

Background:
In this activity your "ecosystem" will be the school parking lot, and the "species" will be the cars. If we were going into genetic diversity the model of car would be used for genetics. For example, the teacher's lot would be the particular ecosystem, a Jeep would be the species, and Wrangler would be the genetics.

As a class, we will be comparing the species diversity of the Student parking lots and the faculty parking lots. The diversity index we will use is the Simpsons Diversity Index. After determining the number of each species (car), in each parking lot, the Simpsons Diversity Index will be calculated separately for the student lot and the staff lot. A rich ecosystem with high species diversity has a large value for the Simpsons Diversity Index (D), while an ecosystem with little diversity has a low D.

Before you do the survey:
Predict which parking lot (faculty or student) you expect to be most diverse and explain why… in detail.

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Procedure OUTSIDE:

1. Remember, safety first, watch for moving cars. If questioned about your work, state your research and class. Show your pass as necessary. Stay together as a lab group.

2. Using a raw data sheet (plain paper) count (tally) the number of individuals of different species of cars in **your assigned parking lot**.

3. As a group you may split up the task when you get to the parking lot. I suggest making a sketch of the parking lot and assign or choose who is going to count where.

4. Back inside, meet with your parking lot people. Come up with **total number for each species** and an agreed on **TOTAL number of cars counted**. We will then share these numbers as a class, and record our class final numbers on the next pages. We must have multiple counts of the same parking lot for repetition and accuracy!!

Data Table – Faculty Lot (these data tables will be provided in a word document on the class website)

n = the total number of organisms of a particular species
N = the total number of organisms of all species

Species (make of car)	Number (n)	n/N	$(n/N)^2$
Example: Jeep	**Ex: 6**	**Ex: 6/60**	**Ex: $(.1)^2$=.01**
TOTAL (N) - Total # of cars in the lot		**$\Sigma (n/N)^2$**	
		$D=1-\Sigma (n/N)^2$	

Data Table – Student Lot (these data tables will be provided in a word document on the class website)

n = the total number of organisms of a particular species
N = the total number of organisms of all species

Species (make of car)	Number (n)	n/N	$(n/N)^2$
Example: Jeep	**Ex: 6**	**Ex: 6/60**	**Ex: $(.1)^2$=.01**
TOTAL (N) - Total # of cars in the lot		**$\Sigma (n/N)^2$**	
		$D=1-\Sigma (n/N)^2$	

Analysis:

1. Which species are more dominant in each community? Why do you think this is the case?
2. Which group, if any, is more diverse? Why do you think this is the case?
3. If you conducted this lab in a shopping mall parking lot, predict whether the diversity index would be high or low, and how it would compare to the school parking lots.
4. If you conducted this lab at a new car dealership, predict whether the diversity index would be high or low, and how it would compare to the school parking lots.

Analysis:

1. Which species are more dominant in each community? Why do you think this is the case?
2. Which group, if any, is more diverse? Why do you think this is the case?
3. If you conducted this lab in a shopping mall parking lot, predict whether the diversity index would be high or low, and how it would compare to the school parking lots.
4. If you conducted this lab at a new car dealership, predict whether the diversity index would be high or low, and how it would compare to the school parking lots.