**Human Disturbance in Biodiversity**

**Objective:**

To determine how varying levels of human disturbance are related to the biodiversity of ants. Students will design a controlled experiment to compare the biodiversity of ants in three areas with varying degrees of human disturbance. Students will then use the Shannon-Wiener index to quantify biodiversity.

**Time:**

This lab will take between 1 hour and 1 ½ hours.

**Materials:**

* Honey diluted 1:1 with water
* Erlenmeyer flasks, 250 ml
* Disposable dropper type pipettes
* Tuna in oil
* Can opener
* Scoops or spoons
* Balances (if students want to weigh baits)
* Petri dishes - 1 to 3 per student depending on class size
* Markers
* Forceps - 1 per student
* Dissecting needles - 1 per student
* Dissecting microscopes or hand lenses
* Masking tape
* Access to freezer overnight to kill ants

**Background Information:**

In this activity, we will use ants as representative organisms to assess the biodiversity of our study areas. Some ants prefer sweet foods while others prefer oily foods. In order to collect as many ants as possible, we will use both a sweet bait (corn syrup) and an oily bait (tuna in oil). As a class, we will develop a hypothesis about the relationship between the degree of human disturbance and biodiversity. Then, we will design and carry out an experiment to test our hypothesis.

**Pre-lab:**

Go to the Maryland Sea Grant Biofilms and Biodiversity website:

<http://www.mdsg.umd.edu/programs/education/interactive_lessons/biofilm/index.htm>

You can also reach the website by Googling “Biofilm Biodiversity.” It will be the first link on the search results page.

Work through the following links from the introductory page:

Introduction

Featured Creatures

How to Calculate Biodiversity

Let’s Calculate Biodiversity

Try These Data

Virtual Samples

**Pre-lab Analysis:**

1. What is the difference between species richness and the other measures of biodiversity?
2. What information do you need to calculate the Shannon-Weiner biodiversity index?
3. Can two systems with the same species richness have different levels of biodiversity? If so, how?

**Procedure:**

1. Follow your procedure to collect ants.
2. Freeze them overnight.
3. Sort and count the ants found in your Petri dishes. Sort them into species using morphoclassification—in other words, assume that two ants that look different are different species. Hand lenses or dissecting microscopes will be helpful in the classification.
4. Give each of your species a descriptive name (e.g., big brown ant, little red ant).
5. Count how many individuals of each species are in your Petri dishes.
6. Keep track of which ants were found in each of the three study areas.
7. After you have counted all of your ants, compare your species with other groups in order to put together a class set of data. Your teacher will help with this.
8. Use the class data set (and the formula that follows) to calculate the Shannon-Weiner index for each study area. Your calculations and results should be clearly shown in your lab notebook.
9. Write a discussion of your results in your lab notebook. Explain what you know about the relative biodiversities of the three study areas based on your data analysis. As always, include information about anything that may have reduced the validity of your data.

Divide into groups and discuss what you know about human disturbance and biodiversity. Then formulate a hypothesis about the relationship between the degree of human disturbance in an ecosystem and biodiversity.

As a class, you will design an experiment and create a procedure to test your hypothesis. Your teacher will help you with this process. Write the procedure you will follow in your lab notebook.

**Formula:**

 **Shannon-Weiner Index**

 H = - sum (Pi ln[Pi])

Where:

 Pi (relative abundance) = ni/N

Where:

 ni = number of individuals in species i

 N = total number of individuals in all species

 **Data Tables:**

**Community #1: Parking lot**

| Species | i=species | ni | Pi | ln (Pi) | Pi(ln(Pi) |
| --- | --- | --- | --- | --- | --- |
|  | 1 |  |  |  |  |
|  | 2 |  |  |  |  |
|  | 3 |  |  |  |  |
|  | 4 |  |  |  |  |
|  | 5 |  |  |  |  |
|  | 6 |  |  |  |  |
|  | 7 |  |  |  |  |
|  | 8 |  |  |  |  |
|  | 9 |  |  |  |  |
|  | 10 |  |  |  |  |
|  | Total= |  |  |  |  |
|  |  |  |  | = - SUM |  |

**Community #2: Grassy field**

| Species | i=species | ni | Pi | ln (Pi) | Pi(ln(Pi) |
| --- | --- | --- | --- | --- | --- |
|  | 1 |  |  |  |  |
|  | 2 |  |  |  |  |
|  | 3 |  |  |  |  |
|  | 4 |  |  |  |  |
|  | 5 |  |  |  |  |
|  | 6 |  |  |  |  |
|  | 7 |  |  |  |  |
|  | 8 |  |  |  |  |
|  | 9 |  |  |  |  |
|  | 10 |  |  |  |  |
|  | Total= |  |  |  |  |
|  |  |  |  | = - SUM |  |

**Community #3: Forested area**

| Species | i=species | ni | Pi | ln (Pi) | Pi(ln(Pi) |
| --- | --- | --- | --- | --- | --- |
|  | 1 |  |  |  |  |
|  | 2 |  |  |  |  |
|  | 3 |  |  |  |  |
|  | 4 |  |  |  |  |
|  | 5 |  |  |  |  |
|  | 6 |  |  |  |  |
|  | 7 |  |  |  |  |
|  | 8 |  |  |  |  |
|  | 9 |  |  |  |  |
|  | 10 |  |  |  |  |
|  | Total= |  |  |  |  |
|  |  |  |  | = - SUM |  |

**Analysis:**

1. Is your hypothesis supported by the results of your experiment?