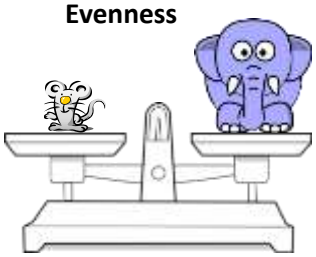
Name _____ Date _____

A.P. Environmental Science Schneck / Romano

POPULATION DYNAMICS

Species Dominance **Richness** **&** **Evenness**



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.

Biological diversity can be quantified in many different ways. The three main factors taken into account when measuring diversity are dominance, richness, and evenness. Ecological dominance is the degree to which a species is more numerous than its competitors in an ecological community, or makes up more of the biomass. However, diversity depends not only on richness, but also on evenness. Evenness compares the similarity of the population size of each of the species present (basically it is the relative abundance of each species). Some ecological communities have a high degree of evenness, while others have a much lower degree. Obviously, if there is an extreme dominance, a high degree of evenness cannot exist and visa-versa. . Species richness is a measure of the number of different kinds of organisms present in a particular area. The more species present in a sample, the 'richer' the ecological community. Bottom line: as species richness and evenness increase, so diversity increases. Simpson's Diversity Index is a measure of diversity which takes into account both richness and evenness.

Example situation:

Two different fields of wildflowers were used in an environmental study of biodiversity. The sample from the first field consisted of 300 daisies, 335 dandelions and 365 buttercups. The sample from the second field was comprised of 20 daisies, 49 dandelions and 931 buttercups. Both samples have the same richness (3 species) and the same total number of individuals (1000). However, the first sample has more evenness than the second. This is because the relative abundance of wildflowers is more 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 with a dominant population of buttercups.

Now, of course there is a more mathematical way to represent richness, evenness, and biodiversity.

In this simulation you will apply the Simpson Index and its formulae:

$D = \sum (n / N)^2$	$D = \frac{\sum n(n-1)}{N(N-1)}$

In addition, you will have to calculate the overall biodiversity of a given region using another formula known as the Shannon Index. $H' = -\sum_{i=1}^{S} p_i \ln p_i$

But don't fret, the numbers usually work out neatly (well …sorta). I hope you are ready to get started …
I know that I'm chomping at the bit! Aren't you, too?

NOW THAT YOU ARE FINISHED READING THE INTRODUCTION … **DO NOT** TURN OVER THIS PAGE UNTIL INSTRUCTED TO DO SO.

PSYCH! (you would probably spell it as “sike!”) While those formulas do exist, we will not be plagued by them. I hope you brought your deodorant because I know some of you might have to reapply… Now that the shock of adrenaline is passing and you realize that I like you way too much to put you through such a mathematical conundrum at this level, do understand that this activity does have an objective. The objective just happens to be a much more simplified one to help you gain a basic understanding of dominance, richness, and evenness.

Procedure:

1. Each of the 6 stations represents different ecological communities. You may start at any station as a group of 4 or less. Once everyone is in place we will establish a rotation.

2. Somewhere, somehow, some way you will each be individually recording the data that you will later organize into a chart. Translated: have a piece of scrap paper and something to write with.

3. At the station you start at, and at all the ecological communities visited during this period, record the following:

   a. Record the names of the organisms that are present. If you need a refresher in animal cracker zoology, extra help is available during office hours. Remember that species richness is the number of different species that exist in an ecological community. Richness will be recorded as an integer.

   b. Count the number of each species and record your findings. You will use this data to determine relative dominance and evenness present in the ecological community. For evenness, we will use qualitative phrases such as a “high degree of evenness” or “low degree of “evenness”. For dominance, you can just state “dominance exists” or dominance does not exist” and then state the organism that is the dominant species.

   c. As explained in the wildflower example, the overall biodiversity can also be described. Remember that there is an elaborate formula to accomplish this, but we will present a simplified version. Rank the overall biodiversity of each community and create a column on your chart that illustrates these rankings.

4. After all data has been collected, the structure of the lab shifts to <u>individual</u> efforts to create a well-organized data chart. The only assistance you may receive will be from me. If any collaboration occurs past this point, points will be deducted from both people engaged in conversation. You may put on your headphones and go into your zone, but there will be no sharing of ideas or helping one another. I need to see your ability to organize data as well as your ability to use software to create an organized data chart. This part of the assignment does have a time limit, so make sure you use your time well. You will share the document with me by that time.

Grading: 15 point lab

1. Participation / Productive Group Member – 2 points

2. Data Calculations are Correct – 6 points

3. Data Chart correctly formatted with <u>all of the information</u> for each of the 6 ecological communities presented in a clear and logical manner – 7 points

** fractions of point may be deducted for minor mistakes **