A *diversity index*

- Diversity indices provide more information about community composition than simply species richness (i.e., the number of species present); they also take the relative abundances of different species into account. By taking relative abundances into account, a diversity index depends not only on species richness but also on the evenness, or equitability, with which individuals are distributed among the different species.
Characteristics for determining Biodiversity

* Species Richness
* Species evenness
* Species density
* Concentration ratio
* Age of individuals in species
* Migration patterns in species in an area
* Time of year
* Whether species is endangered/rarity
* Health of species

More characteristics

* number of each species that die each day (from natural death or killed),
* the reproduction rate of each species
* the availability of food source for each species,
* the availability of shelter for each species.
* use of each species (human resource, ex. medicine, food, fur),
* the specificity of each species for adaptation/survival (is their environment specific vs general)
Biodiversity Indices

- **Simpson’s Diversity Index (D)** - \( D = \sum_{i=1}^{s} \frac{1}{i} \).
- **Shannon Index (H)** - \( H = -\sum_{i=1}^{s} p_i \ln p_i \).
- **Berger-Parker index** - \( \max_{1 \leq i \leq s} p_i \).

Addresses density and species richness.

In order to balance the idea that diversity should include the number of species but also the probability of running into either species, the formula calculates the likelihood of selecting an organism of the same species.

The proportion of each species in the community is the ratio representing the odds of choosing an individual, for instance getting heads on a coin would be \( \frac{1}{2} \), or .5. Squaring this number gives it the odds of choosing it twice in a row, or \( \frac{1}{4} \). So to get Simpson’s diversity, you would add \( \frac{1}{4} \) and \( \frac{1}{4} \) and subtract it by 1, giving the diversity an index of .5.

The value ranges from 0 to 1, with 0 being infinite diversity and 1 is no diversity. This value can then be subtracted from 1 to give a range which represents the likelihood of two random individuals belonging to different species.
Using species richness (S) and the Shannon-Wiener index (H), you can also compute a measure of evenness:

\[ E = \frac{H}{\log(S)} \]

The order is an index of the number of individuals for each subspecies in an area. Similar to the Simpson index, you have to calculate the value of each subspecies. Then you multiply this by the log of the number. Usually the natural log is used. The index is made from the negative sum of these numbers. Usually these values are between 1.5 and 3.5, a larger value meaning higher species evenness and richness.

**Berger-Parker Dominance**

* This index expresses the proportional importance of the most abundant species and is considered a simple but surprisingly effective way to measure biodiversity. \[ d = \frac{N_{\text{max}}}{N} \]

* Nmax is the number of individuals in the most abundant species. N is the total number of individuals in a sample.

* The reciprocal, \( 1/d \), is often used, an increase in the value of the index correlates with an increase in diversity.
Improving Biodiversity Indices

- *Current procedures of measuring biodiversity are at time imprecise.*
- For our biodiversity index, we would incorporate the following factors:
  - Size of the area
  - Relative abundance
  - Total individuals in the community
  - Total members of each species
  - Species health determined by the ratio of individuals that are older than half their average life spans to individuals that are younger than half their average life spans for each species
  - Species rarity which would be represented by a multiplier based on how threatened it is with extinction

- Including the size of the area in question would make it easier to compare the differences in diversity between two ecosystems per unit area. The relative abundance is important to include because the number of individuals in an area alone gives no indication of how well distributed they are in the community. The total individuals and the total species in the area is needed to calculate the abundance of the species relative to the total population of all species in the community.
- Using the average age to determine species health is very useful in determining whether a species population is on its way to extinction. Species rarity is significant because while some species may be widely distributed over multiple geographic areas, other species are endemic and only exist in that specific geographic area, therefore they are much more vulnerable to extinction.
Changes in Biodiversity:
Be aware. Care.

Since 1970, the global Living Planet Index has fallen by 30%.

Works Cited