Biodiversity

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INTRODUCTION

Variation of life forms

Importance of biodiversity

- Natural cycling, food chain and stability of ecosystem
- Medicinal value, ornamental and aesthetic value
- Gene bank
- Many other yet unexplored and unknown importance

Causes of extinction

- Forest cutting, Habitat destruction
- Overgrazing
- Draining of wetlands
- Pollution
- Climate change
- Volcano
- Earthquakes
- Floods
- Genetic pollution by invasive species causing ecological cancer

TYPES OF BIODIVERSITY

Norse et al (1981)

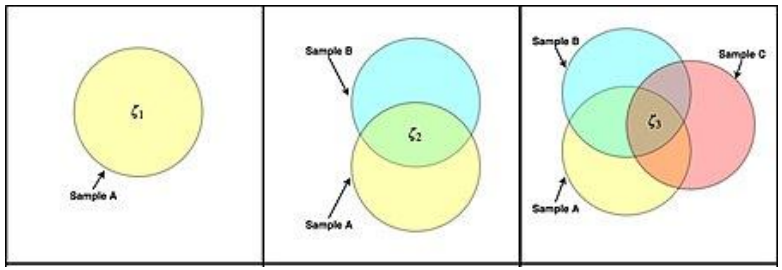
- Genetic diversity
- Species diversity
- Ecosystem diversity

Whittaker (1960)

- Alpha diversity: species diversity within a community
- Beta diversity: Intercommunity diversity
- Gamma diversity: Over all diversity at landscape level

2011-2020
UN Decade on Biodiversity

Zeta diversity (ζ-diversity), measures the degree of overlap in the type of taxa present between a set of observed communities



MEASUREMENT OF BIODIVERSITY

Alpha diversity:

There are two components for Alpha diversity:

- Species richness
- Species evenness or equatability

There are different kinds of indices measuring diversity, some measure both component together (like Simpson index, Shannon index), and other measure these component separately (like Margalef index, Pielou index).

SIMPSON INDEX

The Simpson index was introduced in 1949 by Edward H. Simpson to measure the concentration of dominance and its value ranges from 0 to 1. One value indicates single species dominant and lower value indicates sharing of dominance.

$$L = \sum_{i=1}^{S} Pi^2$$

In formula, Pi = ni / N,

ni is the density of a species; N is the total density of individuals sampled.

SHANNON INDEX

The Shannon index has been a popular diversity index in the ecological literature, where it is also known as Shannon's diversity index, the Shannon-Wiener index, the Shannon-Weaver index, the Shannon-Weiner index and the Shannon entropy. It is calculated as follows:

$$H' = -\sum_{i=1}^{R} p_i \log p_i$$

Where is the proportion of characters belonging to the ith type of letter in the string of interest. In ecology, is often the proportion of individuals belonging to the ith species in the dataset of interest. Then the Shannon entropy quantifies the uncertainty in predicting the species identity of an individual that is taken at random from the dataset.

If practically all abundance is concentrated to one type, and the other types are very rare (even if there are many of them), Shannon entropy approaches zero. When there is only one type in the dataset, Shannon entropy exactly equals zero (there is no uncertainty in predicting the type of the next randomly chosen entity). Zero value indicates single species dominant.

SPECIES RICHNESS

The oldest concept of species diversity that is an indicator of the relative wealth of species in a community is species richness (Peet, 1974). It is number of species per unit area where the species area curve is continuously increases without plateau or asymptote, and else the number of species in the community. The ecologist often uses certain indices that measure species richness (SR) and they are:

Margalef, 1958: $$SR = \frac{S-1}{In(n)}$$

S = total number of species
N = total number of individuals in the sample
In = natural logarithm

Menhinick, 1964: $$SR = \frac{S}{\sqrt{n}}$$

Peet, 1974: $$SR = S.\sqrt{n}$$

EVENNESS

Evenness: can be measured by Pielou's evenness index (Pielou, 1966)

$e = H / \log(S)$

BETA DIVERSITY

Diversity among communities or habitat is termed as β diversity.

Whittaker's β diversity index (βW)

$$\beta_w = \frac{S}{\bar{\alpha}} - 1$$

S = Total number of species in communities

$\bar{\alpha}$ = Mean number of species within the community sample (n samples)

GAMMA DIVERSITY

Schluter and Ricklefs (1993) formula can be used to measure gamma diversity

$$\gamma = \alpha \times \beta$$

where, α and β refers to gamma, alpha and beta diversities