Species-Area Relationships

Species-area relationships (SAR) refers to the relationship between the number of species of plants and animals and the size of a specific area of land. As one would expect, larger areas of land will usually contain more species of plants and animals compared to smaller areas of land. There are many factors that can impact and influence SAR, which include:

Habitat heterogeneity, which is the variation of physical characteristics of a specific habitat, including weather, vegetation, and soil.

Speciation, which is the formation of a new species due to evolution; increased speciation leads to more species in a specific area of land.

Fragmentation, which involves dividing a larger habitat into several smaller habitats that are isolated from one another.

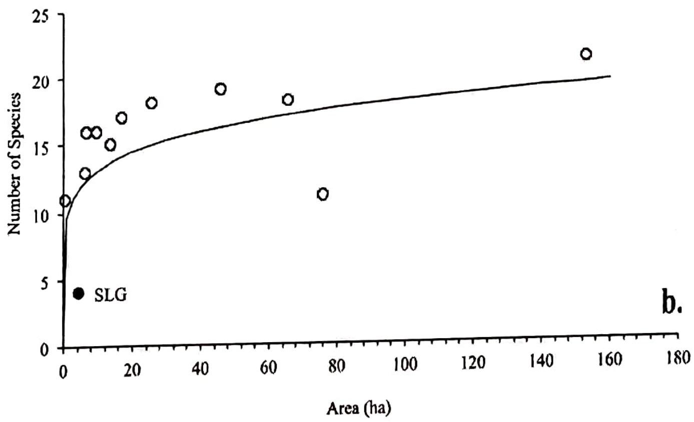
Dispersal, which is the movement of members of a species to a different location from where they were born or originated.

Importance: Studying and examining SAR is important because it can help with understanding the structure and function of a habitat, as well as the factors that impact the survival of a species. Knowing these factors can help with creating more effective conservation strategies. SAR can also be used to describe or study the number of species on an island. Just as with the mainland, larger islands typically have more species of plants and animals. Additionally, islands that are closer to the mainland typically have more species of plants and animals as well.

Graphing SAR

The Species-Area curve is a graphical representation of species richness or number of species found in a habitat, plotted against area of habitat. It shows that species richness increases with increase in habitable area. The graph is a rectangular hyperbola, when plotted in non-logarithmic scale, whereas a straight ascending line, when plotted in logarithmic scale.

Equation on Non-Logarithmic Scale: $S = cA^z$



where, S is species richness (number of species), A is habitable area, z is regression coefficient and c is constant of proportionality. The value of c depends on the unit used for area measurement, and equals the number of species that would exist if the habitat area is confined to one square unit.

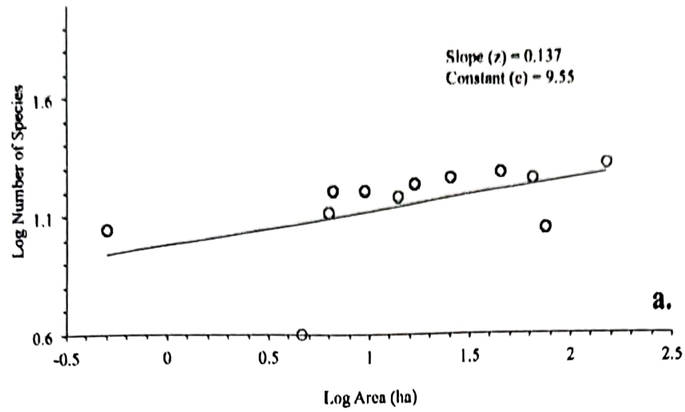
Value of z (Regression Coefficient)

Ecologists have discovered that the value of z lies in the range of 0.1 to 0.2, regardless of the taxonomic group or the region (whether it is the plants in Britain, birds in California or molluscs in New York State, the slopes of the regression line are amazingly similar). But, if you analyse the species-area relationships among very large areas like the entire continents, you will find that the slope of the line to be much steeper (z values in the range of 0.6 to 1.2). For example, for frugivorous (fruit-eating) birds and mammals in the tropical forests of different continents, the slope is found to be 1.15.

Equation on Logarithmic Scale

On a logarithmic scale, the relationship is a straight line described by the equation:

$$\log(S) = \log(cAz) = \log(c) + z\log(A)$$



Theory:

Frequency- It is the number of sampling units or quadrats in which a given species occurs.

Density- It is the number of individuals per sampling unit.

Abundance- It is described as no. of individuals per quadrat of occurrence.

Percentage frequency (%F), density and abundance can be estimated by following formula:

$$\% \text{ Frequency (F)} = \frac{\text{No.of quadrats in which the species occurred}}{\text{Total no.of quadrats studied}} \times 100$$

$$\text{Density (D)} = \frac{\text{Total number of individuals}}{\text{Total no. of quadrats studied}}$$

$$\text{Abundance (A)} = \frac{\text{Total number of individuals}}{\text{Number of quadrats of occurance}}$$

Observation Table:

SN	Name of species	Number of individuals in quadrat number										Total number of quadrat of occurrence	Total number of quadrats studied	Total number of individuals	% Frequency (F)	Density (D)	Abundance (A)
		1	2	3	4	5	6	7	8	9	10						
1	A	7	15	15	0	0	8	5	6	0	4	7	10	60	70%	6	8.57
2	B	0	0	4	0	2	0	4	0	4	8						
3	C	10	0	5	35	4	0	0	6	0	7						
4	D	0	2	2	0	3	0	0	1	0	2						
5	E	0	0	0	0	6	0	0	1	5	0						
6	F	3	8	3	0	0	0	2	2	0	2						
7	G	2	5	0	0	2	2	5	0	2	0						

Theory:

Ground vegetation is the vegetation of ground which is dominated by different species of grasses. Sorensen's Similarity Index is a statistic used for comparing the similarity of two samples. It is calculated by:

Index of similarity (IS) = 2C/A + B

Where, A = no. of species present in site I
B = no. of species present in site II
C = no. of common species

The dissimilarity index (D) is counted by the formula:
D = 1 - IS

The values of Index of /similarity varies between 0 and 1. Similarity is maximum at IS = 1 for completely identical vegetation bearing plots. IS = 0 indicates the the two plots studied have no species in common, i.e. the plots are completely dissimilar.

Observation Table:

Species in Plot I	Species in Plot II	Common Species
A =	B =	C =

Theory:

Basal area is the area of a given section of land that is occupied by the tree trunks and stems at their base.

The formula to calculate basal area is:
Basal Area (BA) = π $(dbh)^2/4$, where dbh is diameter at breast height.

BA ratio= $\frac{Sum\ of\ BA\ of\ all\ species}{Total\ area} * 100\%$

Relative BA = $\frac{Total\ BA\ of\ a\ species}{Total\ BA\ of\ all\ species} * 100\%$

Observation Table:

Species	Diameter (cm)
A1	
A2	
B	
C1	
C2	
C3 ...	