Diversity and community dissimilarity

Block Course

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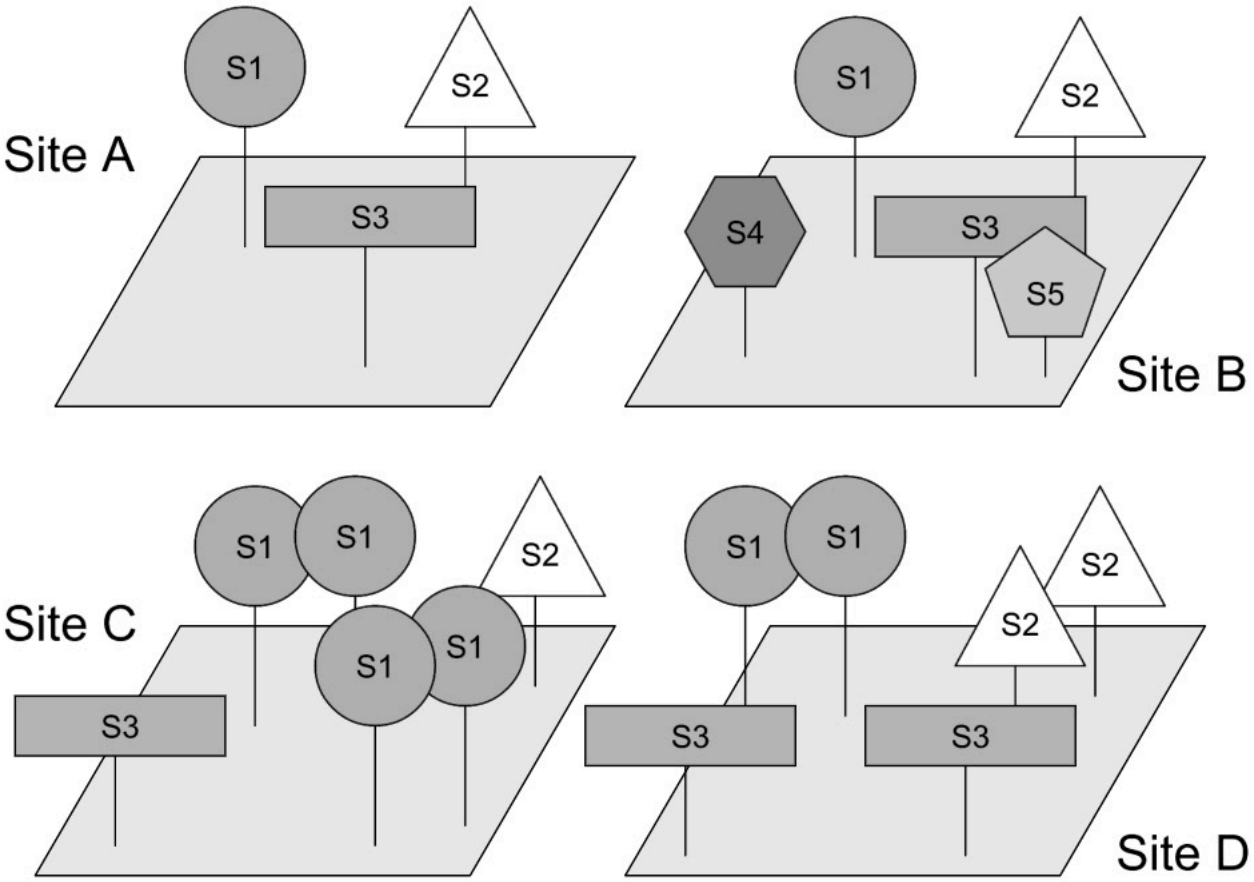
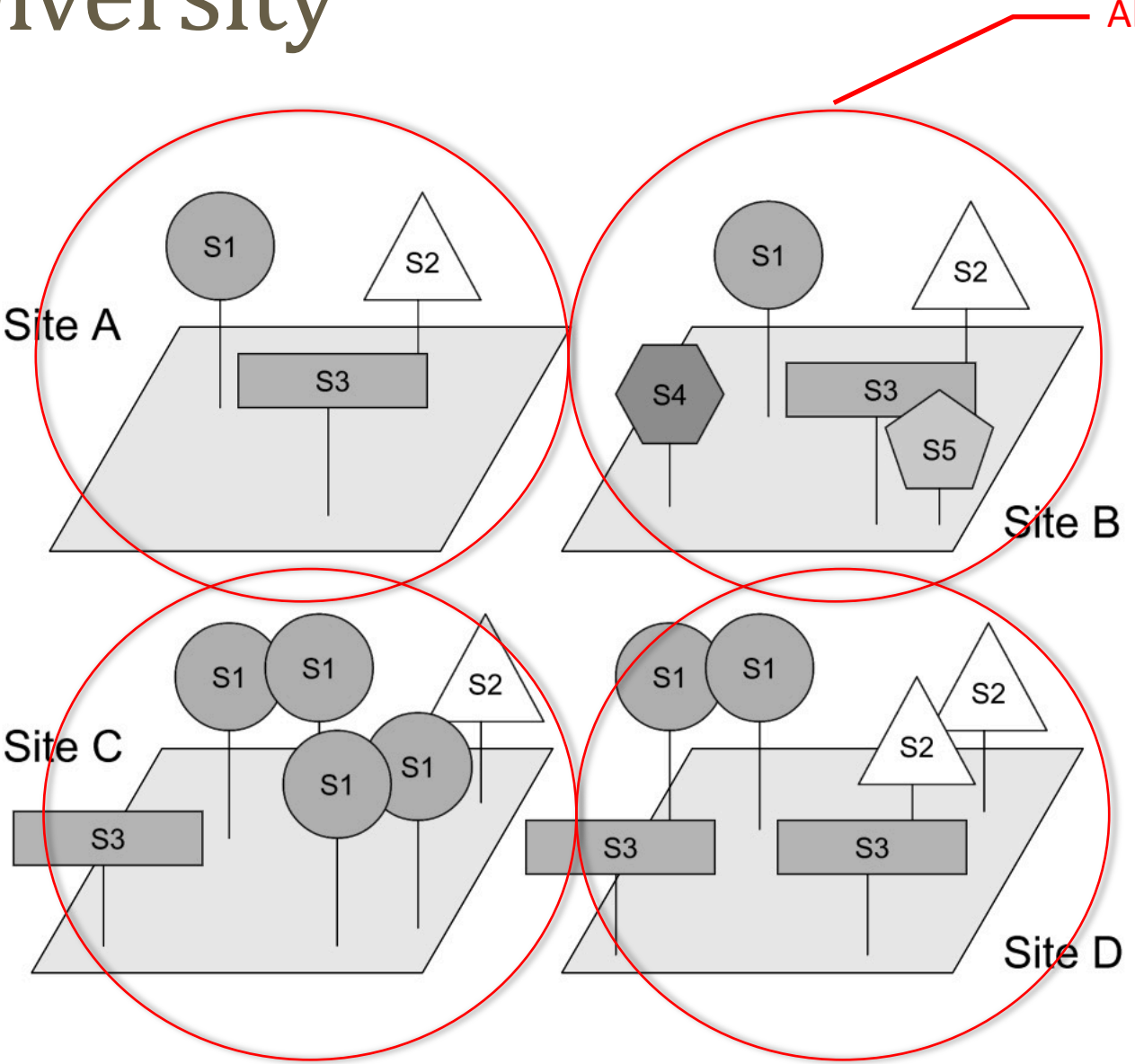
Diversity



Diversity



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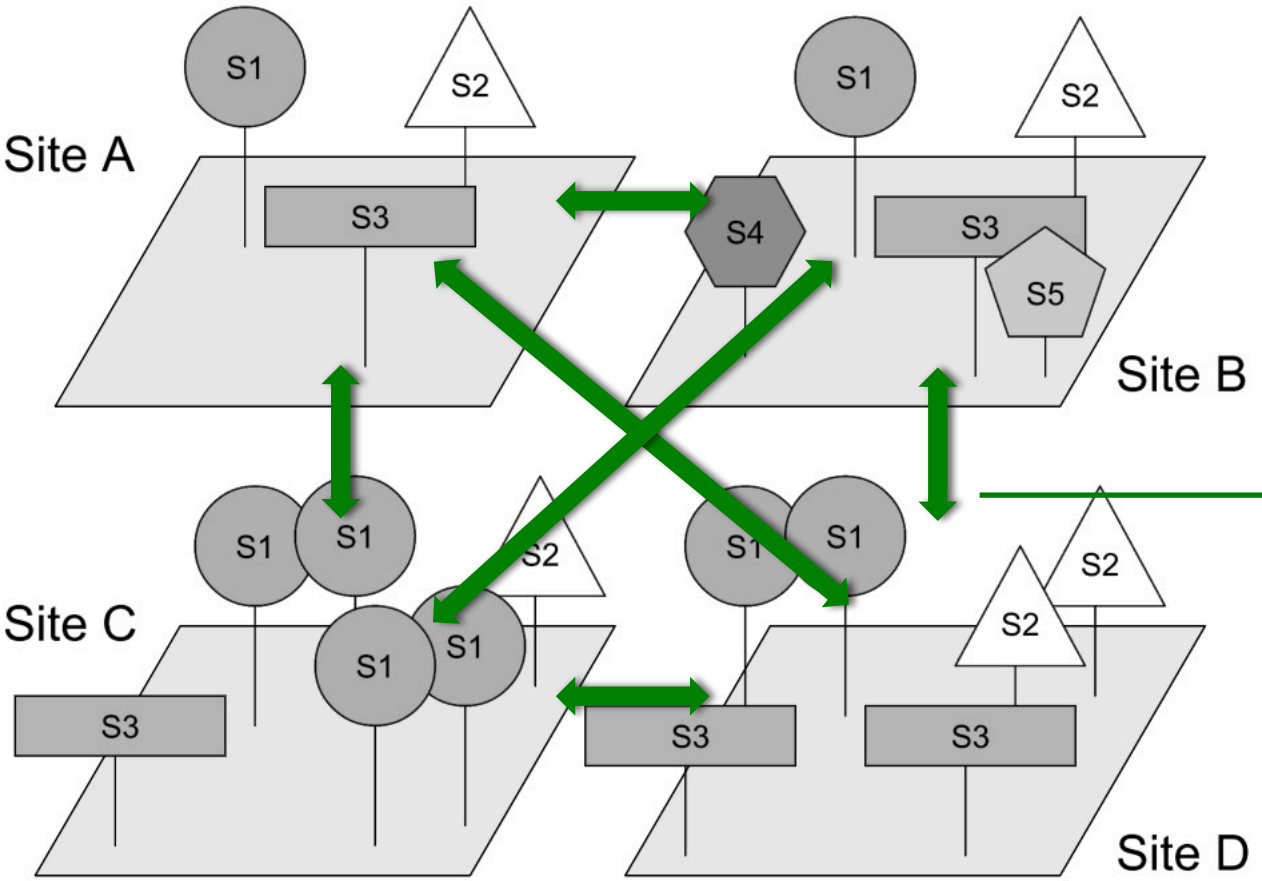
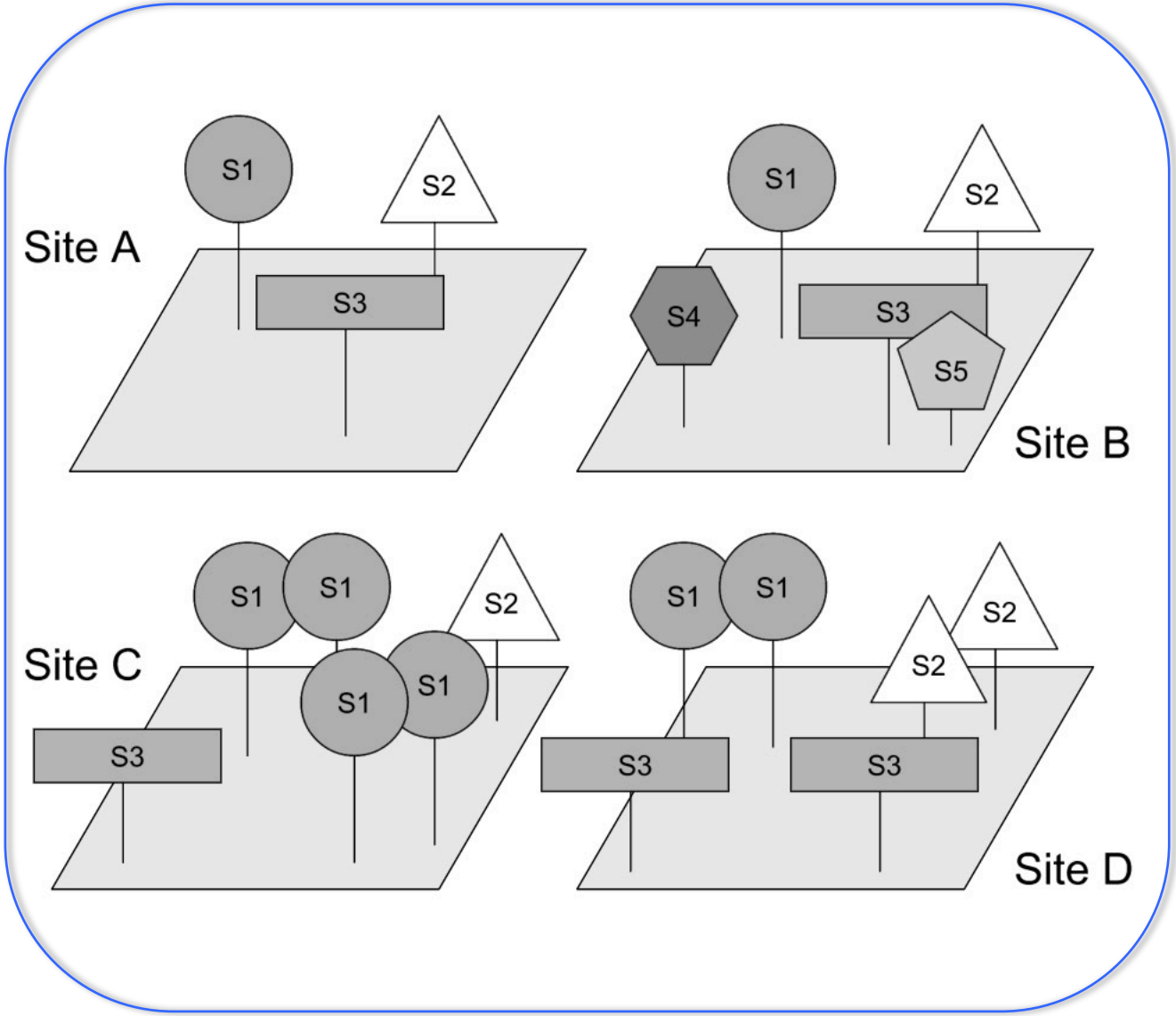
Diversity



Diversity

Gamma-diversity



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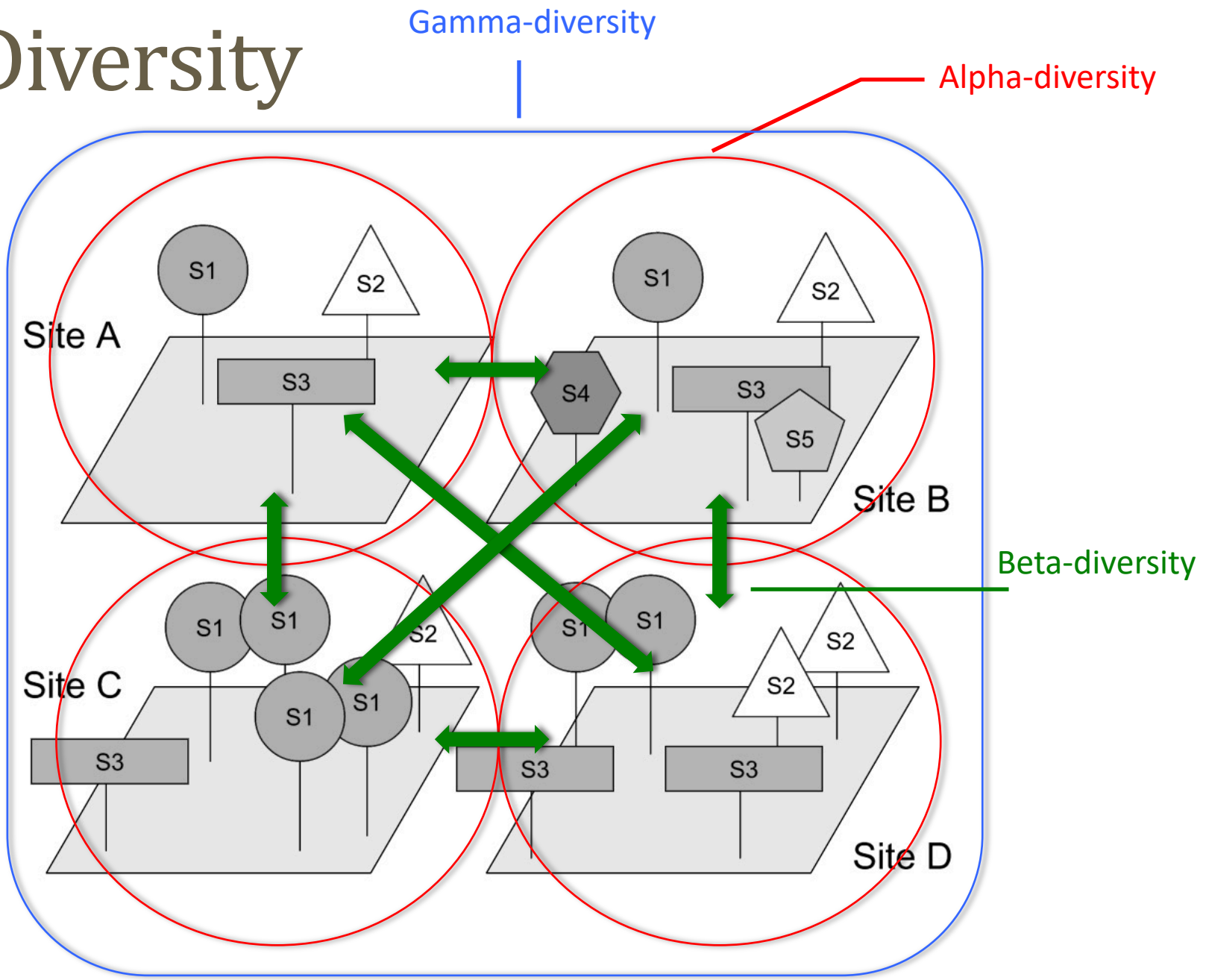
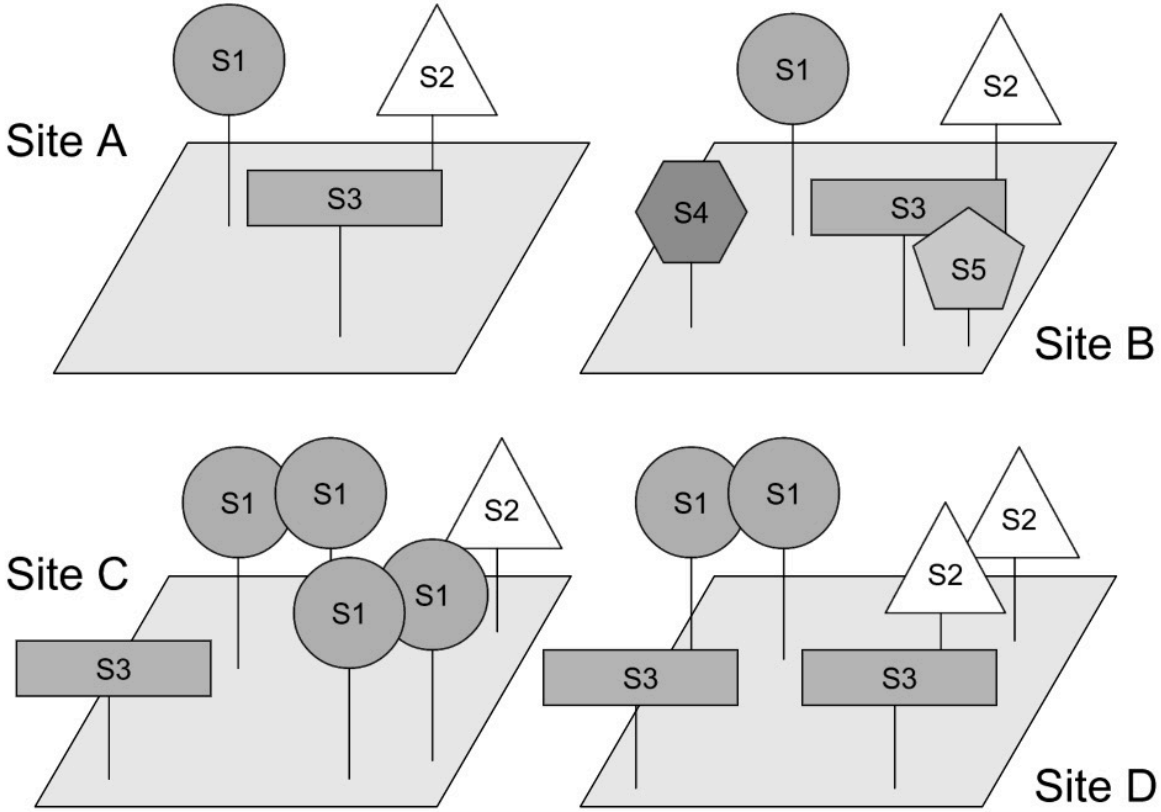
Diversity



Alphadiversity ~ Richness + Evenness

Richness = 3
High evenness

Richness = 5
High evenness



Richness = 3
Low evenness

Richness = 3
High evenness

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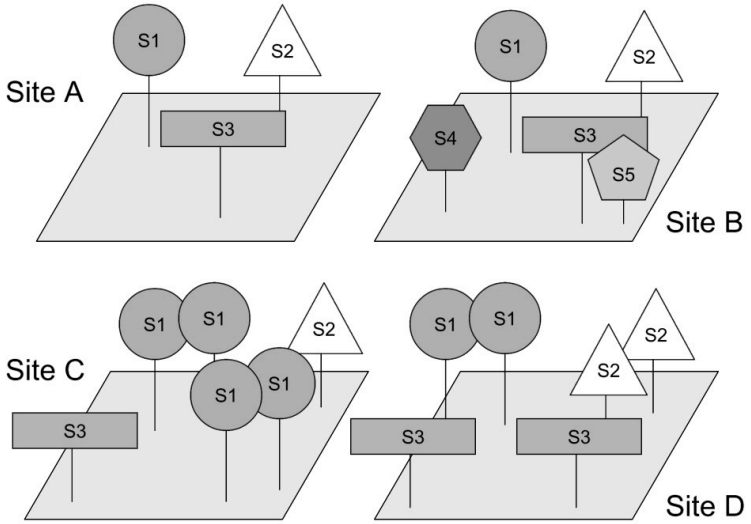
Alphadiversity ~ Richness + Evenness

Shannon diversity:

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

where p_i is the relative abundance of species *i*



Site A:
H' = -(1/3*ln(1/3) + 1/3*ln(1/3) + 1/3*ln(1/3)) = **1.0986**

Site B:
H' = -(1/5*ln(1/5) + 1/5*ln(1/5) + 1/5*ln(1/5) + 1/5*ln(1/5) + 1/5*ln(1/5)) = **1.6094**

Site C:
H' = -(4/6*ln(4/6) + 1/6*ln(1/6) + 1/6*ln(1/6) = **0.8676**

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Community dissimilarity

The formulae for calculating the ecological distances are:

Bray-Curtis: $$D = 1 - 2\frac{\sum_{i=1}^{S}\min(a_i, c_i)}{\sum_{i=1}^{S}(a_i + c_i)}$$

Kulczynski: $$D = 1 - \frac{1}{2}\left(\frac{\sum_{i=1}^{S}\min(a_i, c_i)}{\sum_{i=1}^{S} a_i} + \frac{\sum_{i=1}^{S}\min(a_i, c_i)}{\sum_{i=1}^{S} c_i}\right)$$

Euclidean: $$D = \sqrt{\sum_{i=1}^{S}(a_i - c_i)^2}$$

Chi-square: $$D = \sqrt{\sum_{i=1}^{S}\frac{(a_+ + c_+)}{(a_i + c_i)}\left(\frac{a_i}{a_+} - \frac{c_i}{c_+}\right)^2} \quad \text{with } a_+ = \sum_{i=1}^{S} a_i$$

Hellinger: $$D = \sqrt{\sum_{i=1}^{S}\left(\sqrt{\frac{a_i}{a_+}} - \sqrt{\frac{c_i}{c_+}}\right)^2} \quad \text{with } a_+ = \sum_{i=1}^{S} a_i$$

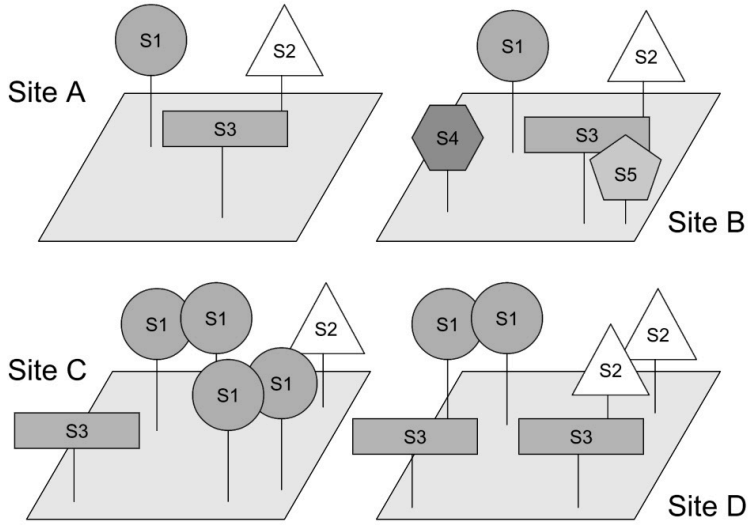
Community dissimilarity (beta-diversity)

Index	Equation	Properties
Jaccard	$S_7 = \frac{a}{a+b+c}$	Compares the number of shared species to the number of species in the combined assemblages placing more emphasis on taxa not shared between sites
Sørensen	$S_8 = \frac{2a}{(2a+b+c)}$	Compares the number of shared species to the mean number of species in a single assemblage placing more emphasis on similarity of samples owing to shared species

In the above table, a = the number of species shared between assemblages, b = the number of unique species in the first assemblage, and c = the number of unique species in the second assemblage.

Community dissimilarity (beta-diversity)

Index	Equation
Jaccard	$S_7 = \frac{a}{a+b+c}$
Sørensen	$S_8 = \frac{2a}{(2a+b+c)}$



In the above table, a = the number of species shared between assemblages, b = the number of unique species in the first assemblage, and c = the number of unique species in the second assemblage.

Similarity	Distance / Dissimilarity
Site A-B: J = 3/(3+0+2) = **0.6**	D = 1-J = **0.4**
Site A-C: J = 3/(3+0+0) = **1**	D = 1-J = **0**

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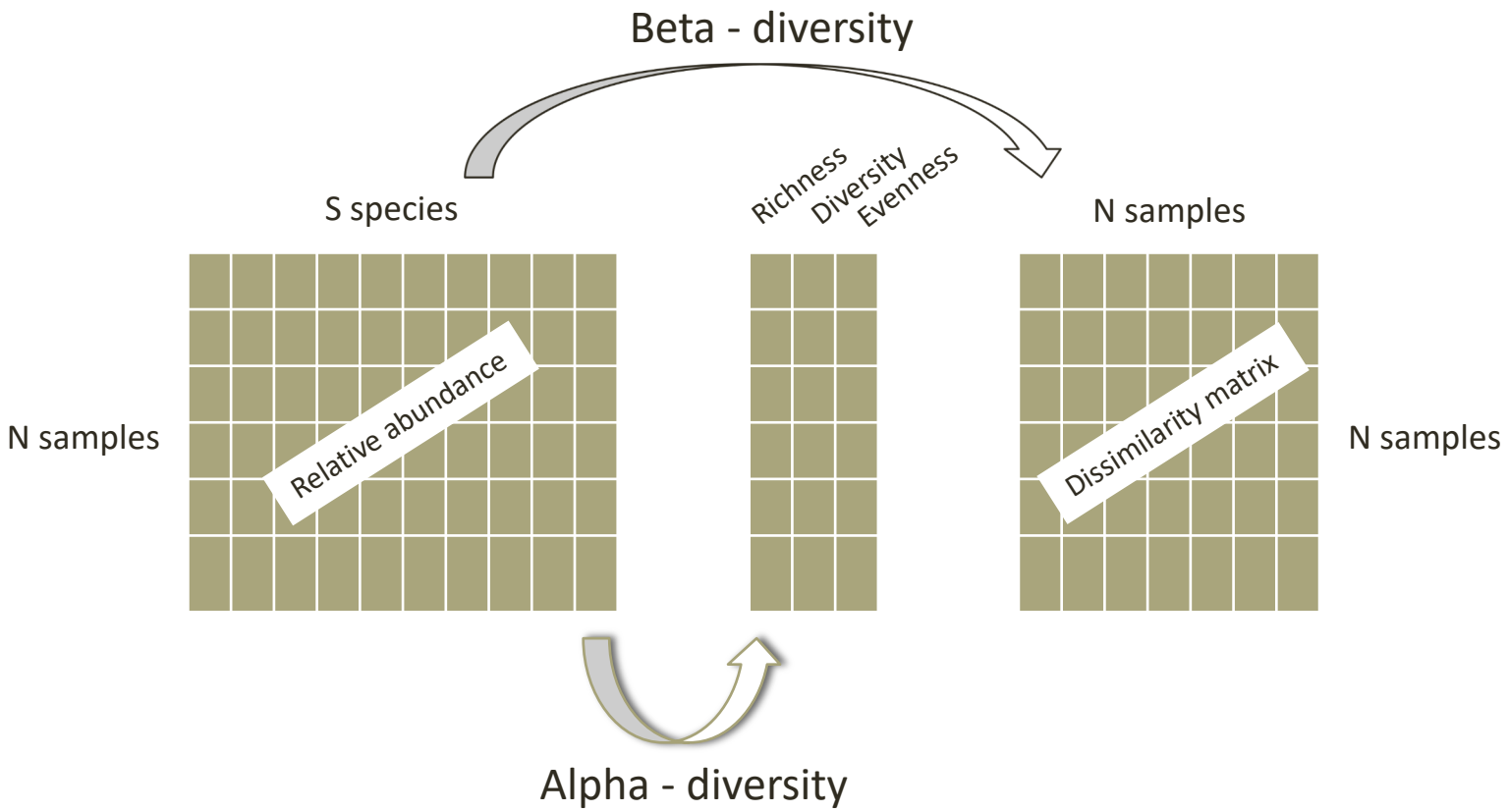
Community dissimilarity



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Community dissimilarity