

Ecometric Terms

Definitions of commonly used terms. (from Polly & Head, 2015).

Community: as used here, community refers to a local assemblage of species without any *a priori* assumption whether ecological interactions among its members give it special coherence or emergent properties. In ecometrics, community is frequently applied to a subset of species that shares a trait of interest, such as the community of vertebrates or the community of large herbivores. Community may also refer to assemblages at any one of several geographic scales, such as local, regional, or continental communities. Ecometric analysis often involves regular sampling of local communities through space or time without any *a priori* assumption adjacent communities will be ecologically distinct. Fossil assemblages are also referred to as communities, with the usual caveats about time averaging and taphonomic bias.

Community assembly: the rules and processes by which species come to be assembled in a community (Diamond, 1975). The sorting of species based on a shared functional trait state into a common environment is one such process.

Ecometric correlation: the correlation between traits in local communities (the trait mean, variance, maximum, or other summary statistic) and a climatic or environmental factor. The coefficient of determination (R^2) has frequently been used to measure the correlation (Polly, 2010).

Ecometric space: a mathematical space whose axes are variables that summarize the distribution of traits within a community (Lawing et al., 2012). Each point in the space corresponds to a particular combination of trait values. More than one trait can be used to construct the space by adding axes, such as vertebrate limb traits and leaf shape traits. Environmental or climatic variables such as vegetation cover or climate can be plotted in the ecometric space by sampling them over a wide geographic area (or through time) and then plotting them by the trait values of the local communities.

Ecometric trait: a quantitative trait that has a functional relationship with one or more environmental or climatic factors. Ecometric traits are especially useful when the mean, standard deviation, maximum or other measure of the trait's distribution in a local community is influenced by its functional relationship with the environment.

Ecometrics: the quantitative study of the relationship between functional traits and environmental factors across space or through time (Eronen et al., 2010a). The basic unit of analysis is the distribution of functional traits in the local community (trait mean, variance, range, maximum, etc.) paired with the local value of a relevant climatic or environmental factor. The relationship between the traits and environmental factors across many local communities is one way of measuring the response of communities to environmental change or estimating paleoenvironment from the traits preserved in a local fossil assemblage.

Functional trait: an anatomical, behavioral, or physiological property of an organism that has a direct functional relationship to the performance of the organism within its local environment (McGill et al. 2006).

Performance currency: a measurable summary of the relative performance of a trait in different environments (McGill et al., 2006).

Taxon-free: any approach to the study of the relationship of organisms to their environment that focuses on the functional properties of the organisms rather than their taxonomic identity (Damuth et al., 1992). Taxon-free methods do not focus on properties of taxa in the ways that ecological niche modeling or environmental index taxa do, but instead focus on functional properties that can be inferred directly from a trait state without regard to which taxon possesses it. While taxon-free methods can be applied without reference to low-level taxonomy, no method is entirely taxon-free because functional traits always have a phylogenetically limited scope at some level (Andrews and Hixson, 2014). The distribution of body masses within and between communities (cenograms) to study habitat openness is an early example of a taxon-free method for vertebrates (Legendre, 1986).

Traits and trait states: For the purposes of ecometrics, a trait is a functional feature of an organism and a trait state is a particular value of that trait. For example, if body mass is the trait, then a particular mass like 50 kg is a trait state. Unless a distinction is being made between states, 'trait' is often used to refer generally to both the trait and its states.

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