

Using morphological leaf functional traits to characterize ancient plant community ecology

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In neo-ecology, functional traits, as opposed to species identities alone, are increasingly used to describe plant community ecology, as they relate more directly to ecosystem function and community responses to environmental change, are more applicable across vegetation types that share few taxa, and their distribution in a plant community can provide clues to community assembly processes. Although many of the traits that neo-ecologists analyze cannot be assessed from fossil remains (e.g., C/N ratios), there are several applicable morphological leaf functional traits. These measures of leaf shape, size, and toothedness have been used to develop methods to reconstruct ancient climates (i.e., ‘a means to an end’), but have been less utilized in describing the ecology of the plant community itself (e.g., functional diversity, community assembly, prevalent ecological strategies, vegetation structure, community resiliency, ecosystem function). One important exception is estimates of leaf mass per area from its relationship with ‘petiole stoutness’ ($\text{petiole width}^2 / \text{leaf area}$), although it is still unclear to what extent community-level distributions of petiole stoutness vary within and between different environments. To address these issues, we are expanding on the community-level modern leaf dataset of Peppe et al. (2011) to include Chinese sites from Su et al. (2010, 2013). We use univariate and multivariate methods to test if, in different Köppen climate types, central moments of morphological leaf functional traits (including petiole stoutness), and functional diversity indices that include these traits, vary in a manner consistent with neo-ecological theory and observations. Preliminary results show that community-level mean varies significantly between climate types, driven mainly by leaf area and tooth count (PCA), but variance does not ($R^2 = 0.55, 0.13$, respectively; PERMANOVA). Estimates of functional richness were higher in favorable climate types (e.g., tropical monsoon) and lower in harsher climate types (e.g., cold temperate, arid), consistent with ecological theory. These preliminary results show some promise for applying similar methods to reconstruct aspects of ancient plant community ecology, though also highlight