

DYNAMICS OF THE ECOLOGICAL HIERARCHY IN LATE PALEOZOIC TROPICAL PLANT COMMUNITIES

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The late Paleozoic floristic ecological hierarchy consisted of taxonomically distinct provinces, generically distinct biomes, and quantitatively different landscapes composed of gradients with several recurrent community types typified by different dominance-diversity patterns. Within this context, Carboniferous and Early Permian classes and orders had distinctive ecological centers of distribution. Clade ecological centroids were preserved during most of this time despite background species turnover. Thus, the ecological character of species pools was preserved within biomes, which contributed to stability of ecological structure for millions of years despite gradual changes in species composition.

Within the tropical wetland biome, periods of elevated extinction were associated with breakdown of the taxonomic partitioning of ecological space; presumably extinctions created opportunities for escalation and restructuring of resource/habitat use patterns. Times of disruption were shorter than intervals of stability.

How can these patterns be reconciled with the individualistic models that predominate in neoecology? Observation of and experimentation on extant ecosystems suggest that species assemblages are momentary in time and space. They result from autecological competitive or stochastic local processes, mesoscale processes that operate among communities, and evolutionary scale processes such as species origination and extinction. Most ecologists recognize that species assemblages broadly recur within the limits of climate and regional species pool, but long-term mutualisms are suspect. Unbridled stochasticism is tempered by island studies, which indicate that some assemblages resist invasion, indicating a role for early colonization and incumbent advantage in limiting local community membership. The importance granted to competition varies and, in some cases, competition in the past is implicated as a force contributing to current structure.

Persistent organization at several levels on geological time spans is not necessarily at odds with individualistic interpretations. The geological patterns do suggest, however, that individualism is limited spatially and has its strongest effects within the constraints of species pool and regional space. During periodic reorganization of the regional species pool competition may be most intense, and be the long sought "ghost of competition past" seen during times of more stability in structure and composition. Late Paleozoic terrestrial patterns mitigate against extreme reductionist interpretations that would derive all ecological structure by extrapolation of local processes, and that deny the existence of processes or attributes at other levels of the ecological hierarchy.