

Small-scale cascading stochasticity coupled with environmental filtering in microarthropod communities of Mediterranean urban soils

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Urban environmental heterogeneity can affect community assembly rules, a phenomenon still poorly understood, especially at fine-scales. Under the hypothesis that fine-scale heterogeneity in urban ecosystems affects microarthropod structural and functional biodiversity through environmental filtering induced primarily by vegetation and soil properties related to the former, this study aims to: i) quantify the fine-scale variation of microarthropod biodiversity and ii) understand how such filters modulate this process. To address these objectives, soil samples, microarthropods and vegetation were collected and characterized in an open grass area and below an adjacent lime tree canopy in a managed Mediterranean urban lawn (Southern Italy), to capture their fine-scale spatial variability. Our results revealed a high degree of community variability between and within (2–12% and 10–60% of the total variance respectively) each habitat, along ecologically relevant relationships with vegetation and soil related characteristics ($\alpha = \sim -0.2$ – 0.2 on Z-scores). These include animal size shrinkage (length: $\rho = -0.8 \pm 0.3$, width: $\rho = -0.6 \pm 0.4$ correlations between intercept and slope), presence of ocelli (Cohen's $h = 0.3 \pm 0.2$) and epiedaphic life strategy (Cramer's $V = 0.3 \pm 0.1$) shifts from open to close fields, especially evident on larger animals and likely attributed to an allometric/metabolic scaling imposed by environmental conditions. Microarthropod community biodiversity appears to be shaped under a two-tiered model, where small-scale management-induced stochasticity in vegetation cascades creates a heterogeneous mosaic of microhabitats for soil mesofauna, that in turn imposes deterministic trait-based selection at broader scales.

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