



Abstract Title (Times New Roman, 14 pt, centered)

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Urban ecosystems are increasingly recognized as important havens for biodiversity and ecosystem services, yet urban expansion continues to reshape wildlife communities through ecological processes across multiple spatial and temporal scales. We present findings from a three-years coordinated research assessing how urbanization, habitat structure, landscape configuration, historical land-use change, disturbance regimes, and community assembly processes shape mammal assemblages in major Italian cities.

Our results show that urban mammal assemblages are structured primarily by species turnover rather than nested species loss, indicating that urban communities emerge through species replacement driven by environmental filtering. Consistently, bats and small mammals responded mainly to habitat and environmental conditions, with little evidence that interspecific interactions influence assemblage composition. Local habitat quality was a key determinant too: structurally complex green spaces and water bodies supported richer and more intact communities, whereas simplified and intensively managed parks were dominated by poor and synanthropic assemblages.

Local habitat quality interacted strongly with landscape structure. In bats, fragmentation reduced species richness independently of habitat amount, demonstrating that landscape configuration constrains diversity even where green cover persists. Fine-scale features such as water availability and heterogeneous tree structure partially buffered these constraints, underscoring the importance of multi-scale environmental filtering.

Historical analyses revealed strong temporal lags in species responses to habitat loss. We detected extinction debt in forest-specialist mammals, and long-term comparisons of bat assemblages documented widespread local extinctions over the past two centuries, with ecological specialization strongly predicting vulnerability to urban extinction. Finally, wildfire compounded urban biodiversity loss, disproportionately affecting sensitive taxa such as Eulipotyphla while altering trophic dynamics through shifts in prey communities.

Together, these findings show that urban mammal communities are shaped by interacting effects of environmental filtering, fragmentation, historical legacy, species traits, and disturbance, highlighting the need for Nature-Based Solutions that prioritize habitat complexity, water availability, connectivity, and ecological functionality.