Spatial scaling of urbanization impacts on species distribution within the ant genus Tetramorium

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Abstract

Urbanization is a global change of high magnitude and speed, which deeply impacts biodiversity. Weakly mobile species (e.g. insects or small mammals) should respond to urbanization patterns at finer spatial scales than larger species and could benefit from man-made structures which could provide them with alternative nesting or sheltering sites in urban environments. All studies about impacts of urbanization on ant communities show strong differences in species composition in urban habitats compared to nearby natural areas, suggesting that urbanization, through factors such as temperature or land-use changes, significantly alters ant species distributions. Within the ant genus *Tetramorium* the scales at which urbanization shapes species spatial distribution have never been investigated. The present study focuses on *Tetramorium* species at four spatial scales, from urban microhabitats (one meter around the nest) to urban landscapes (500 meters around the nest). We investigated how urbanization structures the distribution of *Tetramorium* species at these different spatial scales, and which scale is the more impactful for each of the studied species. We sampled ca.1400 colonies belonging to four common species (*Tetramorium immigrans*, *T. semilaeve*, *T. moravicum* and *T. caespitum)* along 19 urban gradients in South-eastern France. Microhabitats were characterized in the field and landscape data were obtained from semi-automated interpretation of high-resolution (one meter) aerial imagery. Combining similarity analyzes (anosim, simper) with model selection procedures and model averaging, we show that species distributions are affected by urbanization differentially at different scales. We discuss how at these different scales, urbanization leads to environmental filters favoring some species while hindering others. This study highlights the importance of considering several nested scales when investigating species distribution patterns. **Keywords**: Landscape, Microhabitat, Spatial scaling, *Tetramorium* species, Urbanization

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