The Urban Heat Island effect on carabid beetles phenology: a case study of Rennes, France

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Abstract

The Urban Heat Island (UHI) is a local climate phenomenon due to urbanization. It raises temperatures in cities at night that could lead to discomfort and over-mortality during heat waves. However, the UHI has a spatial variability as urban parks and green places form cool islands in comparison with surrounding built environment (Oke 1987). The UHI phenomenon is known to influence the phenology of several plants (Chmielewski and Rotzer 2001; Sparks *et al.* 2001; Mimet *et al.* 2009). The highest urban temperatures make earlier step of growth development. Impacts of the UHI on animals have been less investigated (Baur and Baur 1993; Parris and Hazell 2005; Youngsteadt *et al.* 2015; Youngsteadt *et al.* 2017) and there is no study on the effect of the UHI on carabid beetles to our knowledge. Those insects have a larval development in the soil and their activity is sensitive to temperature (Saska and Honek, 2003; Tuf *et al.* 2012). In this study, we evaluate the influence of the UHI on the emergence and activity of carabids beetles along urban and rural areas. In spring 2013, we investigated the composition of species carabids beetle and the temperature for 19 woodlots. The carabids activity was estimated with pitfall traps and the emergence were assessed by adding arenas to the pitfall traps. In addition, thermal sensors were placed in each site to measure air and soil temperature. Based on previous studies on the UHI in Rennes (Foissard *et al.* 2015, 2018), we investigate connections between the UHI, landscape metrics and the carabids community or phenology (for 2 species). We lead a spatial analysis with evaluating the influence of landscape and temperature on carabid communities according the woodlot context. The temporal variability is studied with the effect of temperature on potential carabids lagged phenology.

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