Grassland habitat islands in urban areas: testing ecological theories

Béla Tóthmérész*†[1], Bernadett Hüse[2], Orsolya Valkó[2], Éva Katona[2], and Balázs Deák[1]

[1]MTA-DE Biodiversity and Ecosystem Services Research Group – University of Debrecen, Department of Ecology H-4032 Debrecen, Egyetem tér 1., Hungary

[2]University of Debrecen, Department of Ecology – University of Debrecen, Department of Ecology H-4032 Debrecen, Egyetem tér 1., Hungary

Abstract

During the past millennia urbanization considerably changed natural ecosystems and formed new artificial habitat islands. Habitat loss and changes in the abiotic environment are seriously affecting urban biodiversity. We investigated the effect of urbanisation on the grassland vegetation islands in the city of Debrecen, East-Hungary (Europe). Along an urbanisation gradient we studied three kinds of habitat islands (vacant lots, urban parks, and peri-urban grasslands) with five spatial replicates of each habitat type, and five random plots in every site. We tested the following hypotheses: (i) species numbers increase with increasing island area in fragmented urban landscapes, as predicted by the theory of island biogeography; (ii) according to the increasing disturbance hypothesis lower species numbers and diversity, and higher ratio of weeds and disturbance-tolerant species is present in the city centre, (iii) the ratio of warm- and nitrogen-demanding species increases towards the city centre, (iv) we also tested if there is an increase in cosmopolitan and alien species and a decrease in species of the natural flora towards the city centre as predicted by the urban homogenization hypothesis. We found a positive species-area relationship for the permanent habitat islands, while such relationship was not detected for vacant lots. The most intensively disturbed urban parks harboured the lowest number of species and the lowest Shannon diversity. The ratio of weeds and disturbance-tolerants was the highest in the city centre (vacant lots and urban parks) likely due to the high-intensity trampling and soil disturbances. Plant species of the city centre were more drought-tolerant compared to peri-urban grasslands. The ratio of nitrogen-demanding species was the lowest in the urban parks, and the highest in the peri-urban grasslands due to the high nitrogen deposit in the cities. We found that the ratio of alien species were high both in vacant lots and peri-urban grasslands. Ratio of cosmopolitan species was significantly higher in urban parks compared to vacant lots and peri-urban grasslands. Our results suggest that urban habitats have some biodiversity conservation potential. But classical ecological theories may fail in urban environment. This is not just 'new' environment, but new prospect for ecological theories.

Keywords: urbanisation, gradient, urban homogenisation hypothesis, cosmopolitan, increasing disturbance hypothesis

*Speaker

†Corresponding author: tothmerb@gmail.com