WORKING PROJECT TITLE	Do urban areas provide thermal refugia to invasive species?
CORE TEAM MEMBER	S Clusella-Trullas
ACADEMIC LEVEL OF THE PROJECT	MSc/PhD
PROJECT BACKGROUND	Climate change and invasive alien species are two primary drivers of biodiversity loss globally, and yet the integration of thermal ecology and invasion biology is just starting to get momentum in invasion biology research (Garcia & Clusella-Trullas 2019). Some invasive species, such as the Harlequin beetle (*Harmonia axyridis*), have spread rapidly in South Africa since their introduction and have the potential to negatively affect native species. However, *H. axyridis* is mostly found in urban environments and is rarely reported to occur in large numbers within extensive areas of native habitat. Other species, such as the diurnal gecko *Lygodactylus capensis*, have also rapidly spread from their native tropical range in the North-East of South Africa to human-transformed habitats across the country (Rebelo et al. 2019). Urbanized areas may therefore function as points of entry, favouring population growth and spread of alien species. Whether urban environments will remain the main centres of occurrence for these species or whether these species can spread into native areas given sufficient time since introduction or as climate continues to change, is presently unknown. This project aims to explore potential climatic factors that favour but also confine alien species' distributions into urban areas. While some information is available on the physiology, performance and thermal biology of some of these species under controlled experimental conditions (e.g. Shinner et al. 2020), we know far less about the microclimatic environment that they experience across their life stages and more importantly, how different

environmental factors filter their ability to expand into natural areas.

This project will aim to measure and assess differences in the mosaics of thermal microclimates available to alien species such as *H. axyridis* and *L. capensis* in urban and natural areas, and account for the diversity of stage-specific habitats. The integration of available data on individual performance and the microclimates measured in this study will enable predictions of realized performance and thus, predict population fitness in a more accurate manner. We expect that microsites in urban areas act as a buffer of environmental conditions (drought, heat extremes), but future warming scenarios in urban areas may limit this role.

FURTHER READING

Davis et al. 2019. Microclimatic buffering in forests of the future: the role of local water balance. Ecography 42:1-11.

Garcia, Clusella-Trullas. 2019. Thermal landscape change as a driver of ectotherm responses to plant invasions. Proceedings B. Royal Soc. 286: 20191020.

Rebelo et al. 2019. Range expansion of the common dwarf Gecko, Lygodactylus capensis: South Africa's most successful reptile invader. Herpetology Notes 12:643-650.

Shinner, Terblanche, Clusella-Trullas. 2020. Across-stage consequences of thermal stress have trait-specific effects and limited fitness costs in the harlequin ladybird, *Harmonia axyridis*. Evolutionary Ecology, https://doi.org/10.1007/s10682-020-10045-1

Woods H.A. et al. 2015. The roles of microclimatic diversity and of behaviour in mediating the responses to ectotherms to climate change. Journal of Thermal Biology 54:86-91.

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