

What environmental conditions influence the patterns of bat activity and species presence in urban ecosystems?

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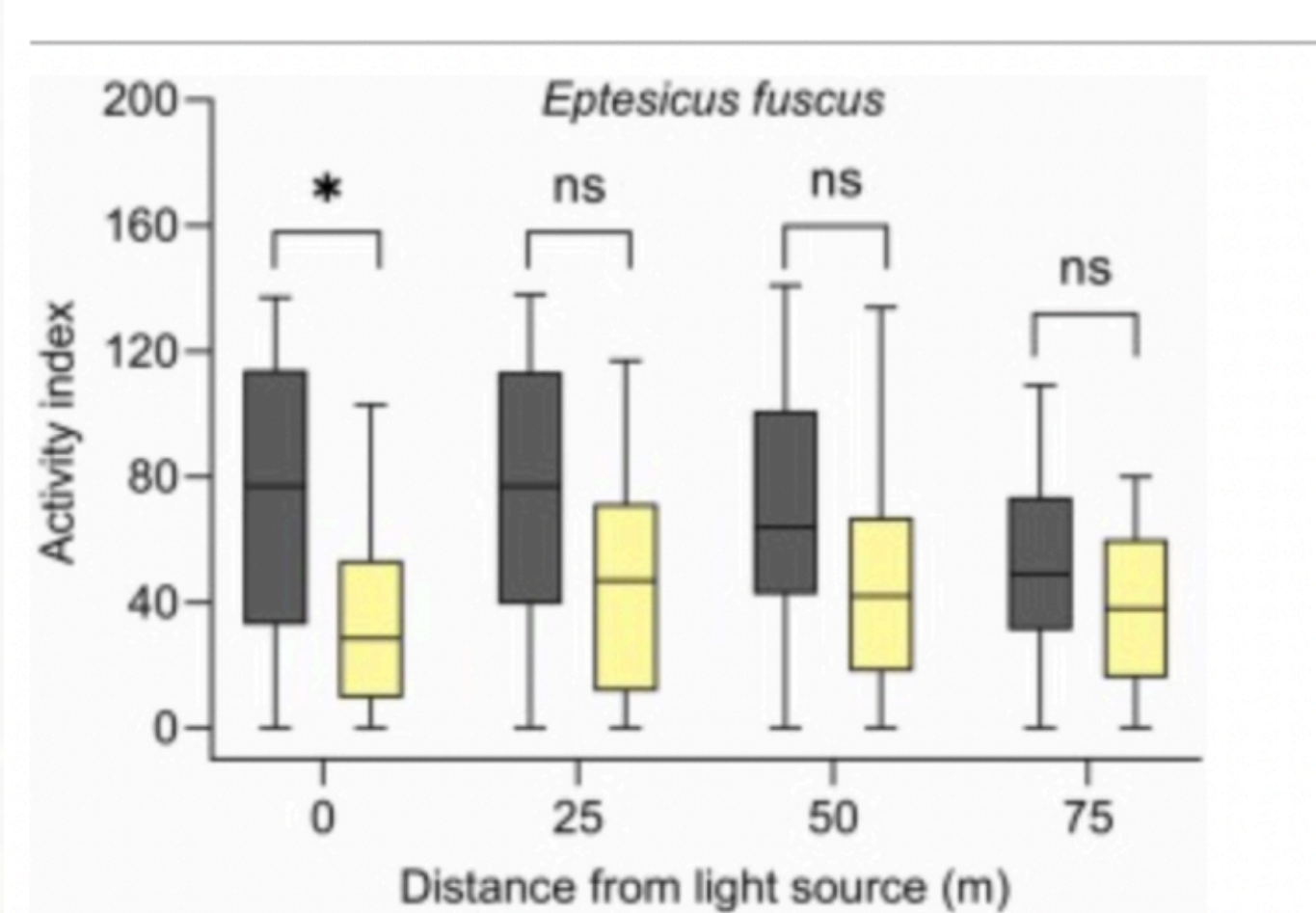
Introduction

Bats play a vital role in urban ecosystems, contributing to pest control, seed dispersal, and pollination. However, their activity patterns and species presence are influenced by various environmental conditions, including light pollution, temperature variations, and canopy cover. This study aims to explore the presence of bats across different radiance levels in urban areas, with a focus on identifying factors that influence their activity under artificial lighting and other urban environmental settings. By understanding these patterns, we can better inform conservation efforts and create more bat-friendly urban habitats.

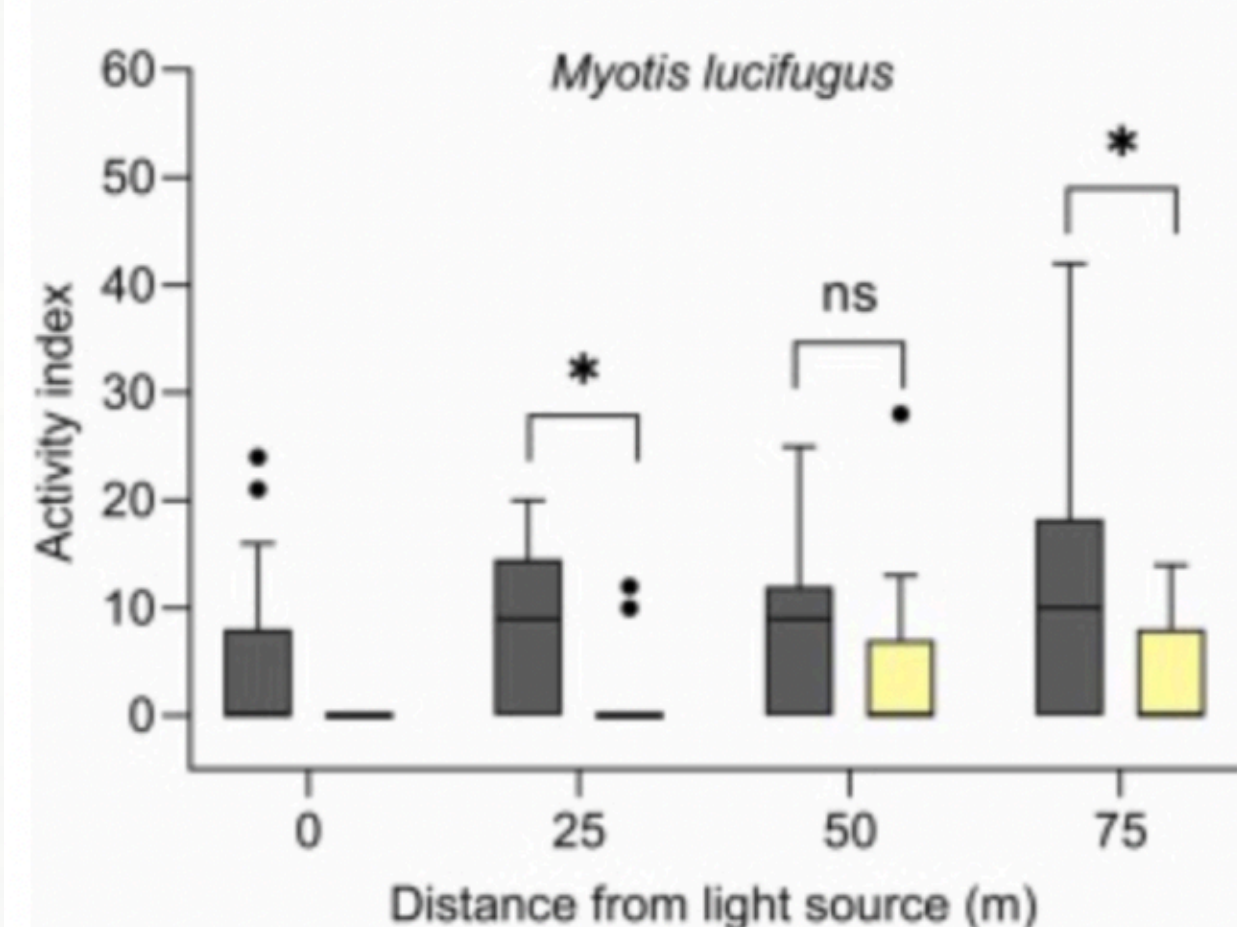
Methods

Since our research is a comparison between bat activity in urban landscapes and suburban/rural, we had to look beyond the data at our initial point of research, Van Cortland Park. To investigate bat activity under diverse environmental conditions, we systematically reviewed existing research and incorporated data from various studies within the field. For data processing and visualization, we utilized multiple analytical tools, with Microsoft Excel serving as the primary platform due to its efficiency in handling large datasets and its robust capabilities for generating clear, interpretable visual representations.

Bat activity under artificial light (Brown bats)



Eptesicus fuscus

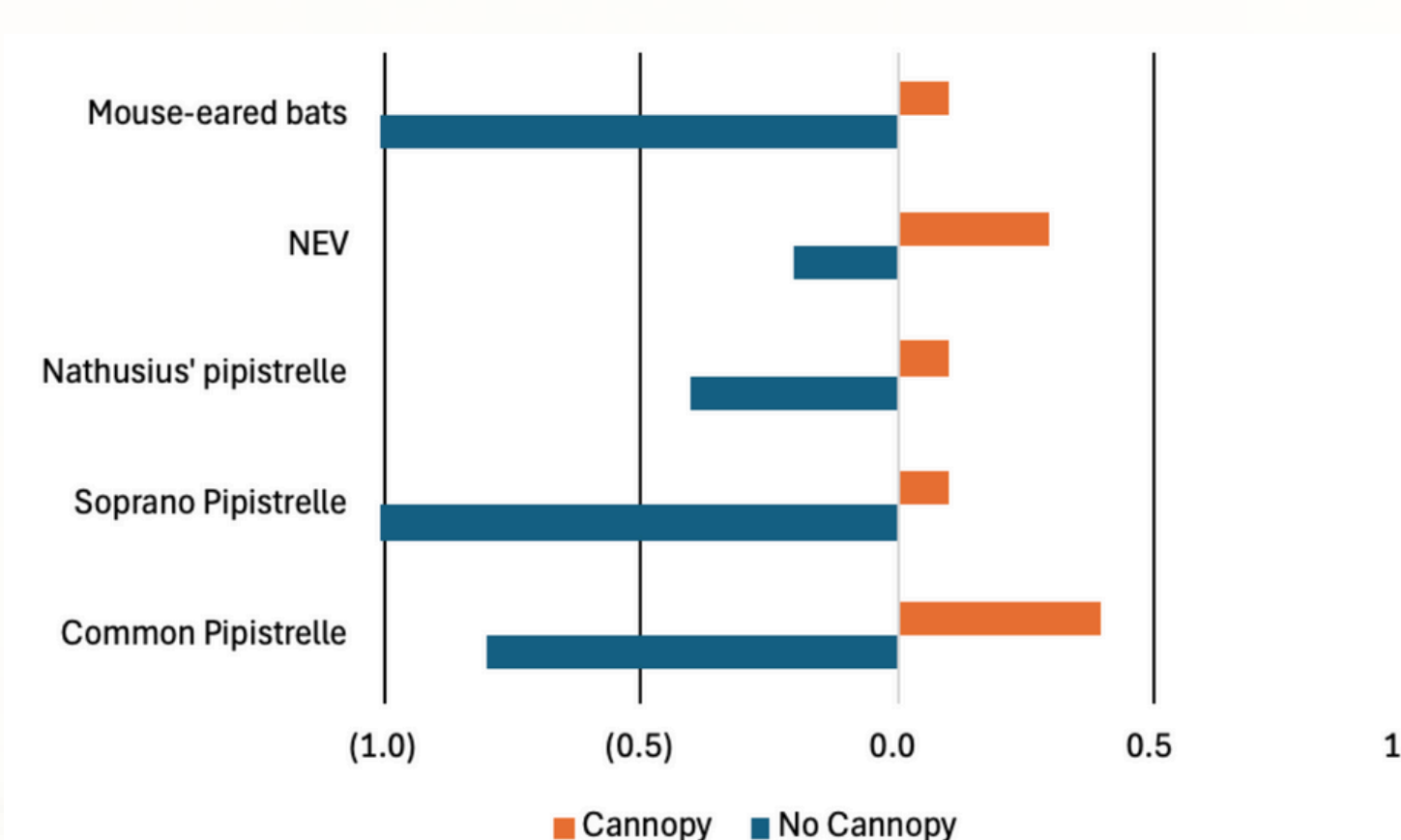


Myotis lucifugus

The study concludes that artificial light affects bat species differently, with *Myotis lucifugus* showing reduced activity levels near light sources, while *Eptesicus fuscus* appears unaffected.

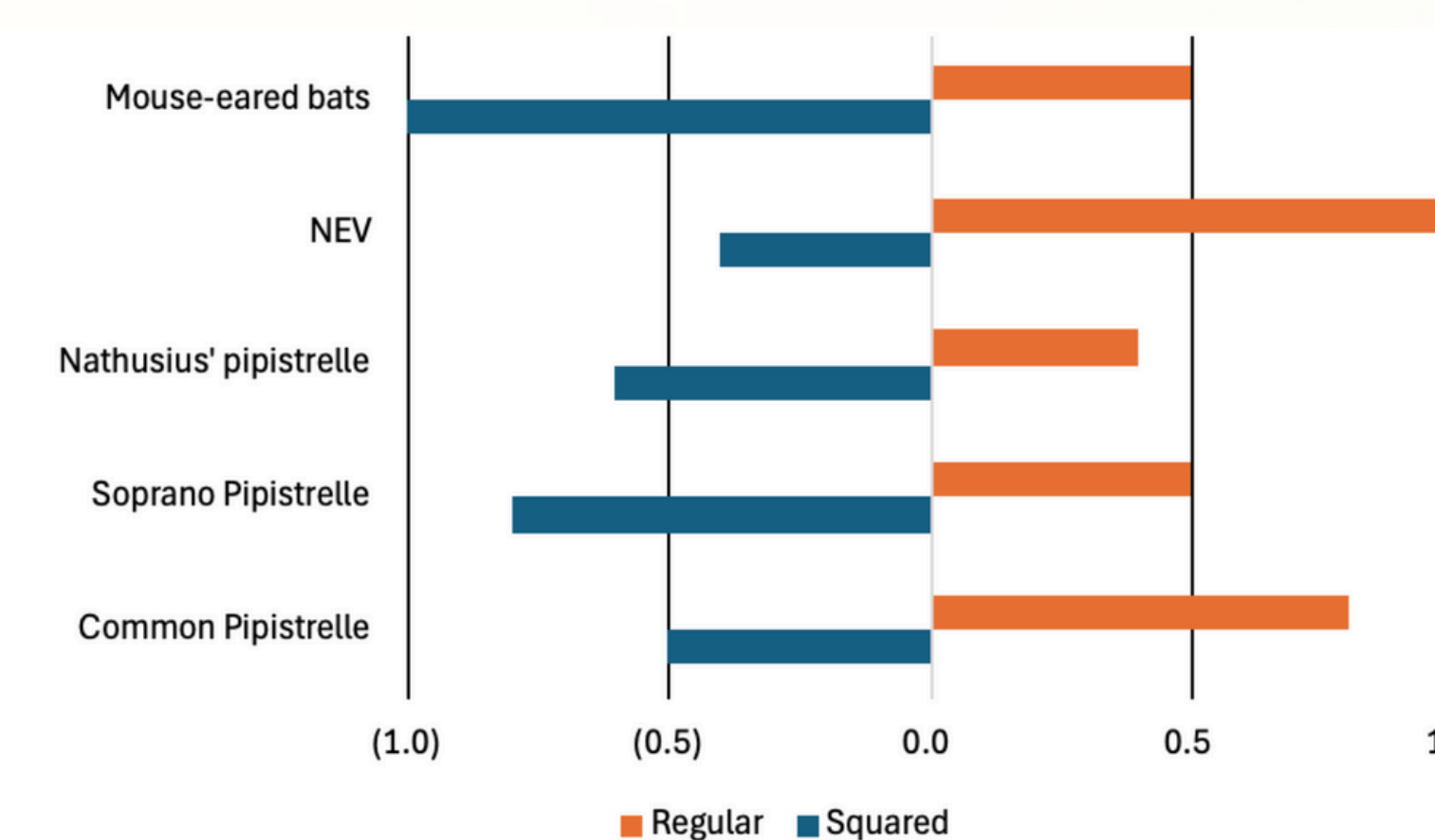
Environmental Conditions and Bat Activity

Presence of Bats Across Different Radiance Levels



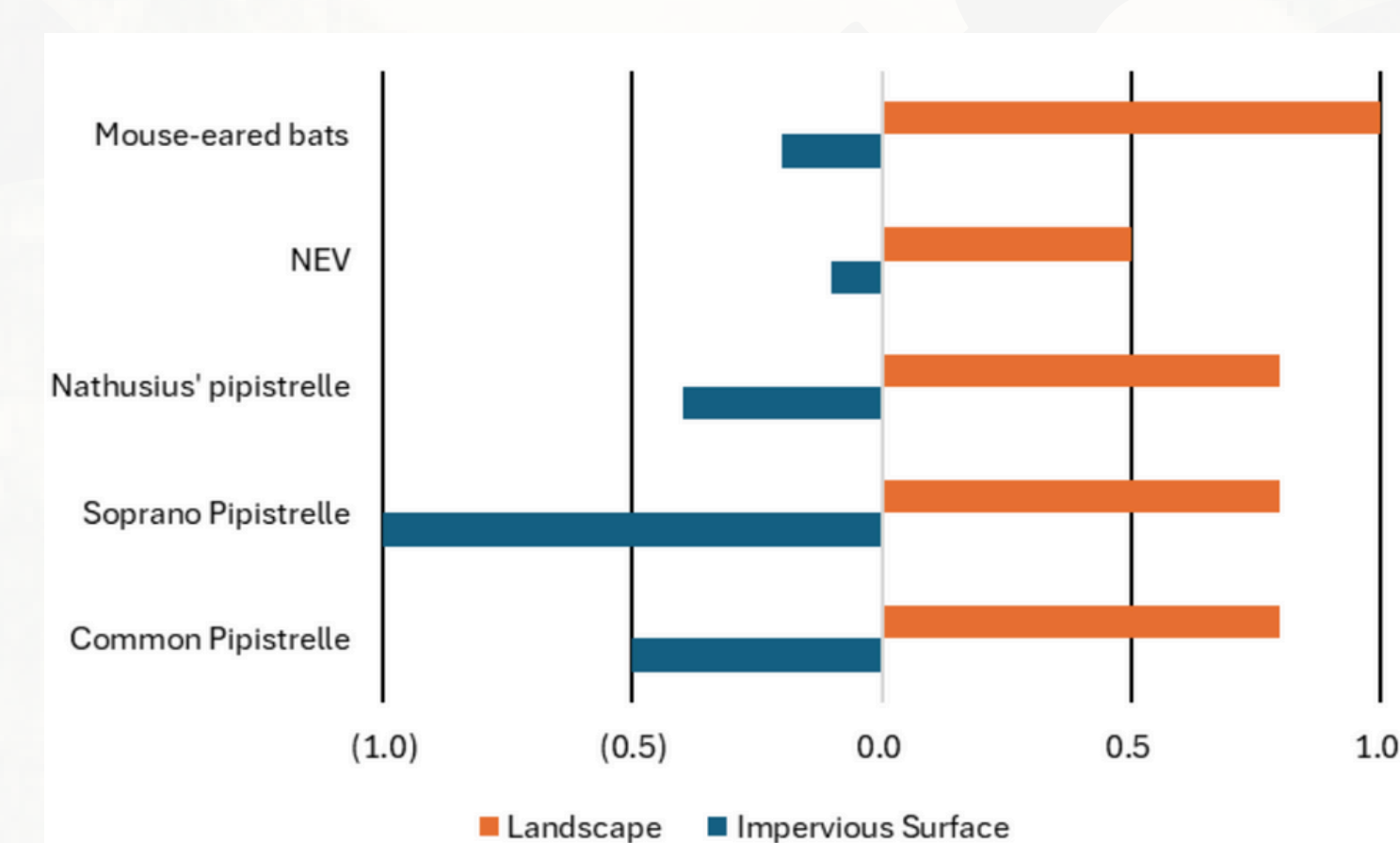
The graph illustrates the presence of bat species across different radiance levels, with negative values indicating reduced presence and positive values indicating increased presence. "Canopy" represents areas with tree cover, while "No Canopy" reflects open areas, showing species like mouse-eared bats and soprano pipistrelles having stronger associations with no canopy environments.

Presence of Bats Across Different Temperature Levels



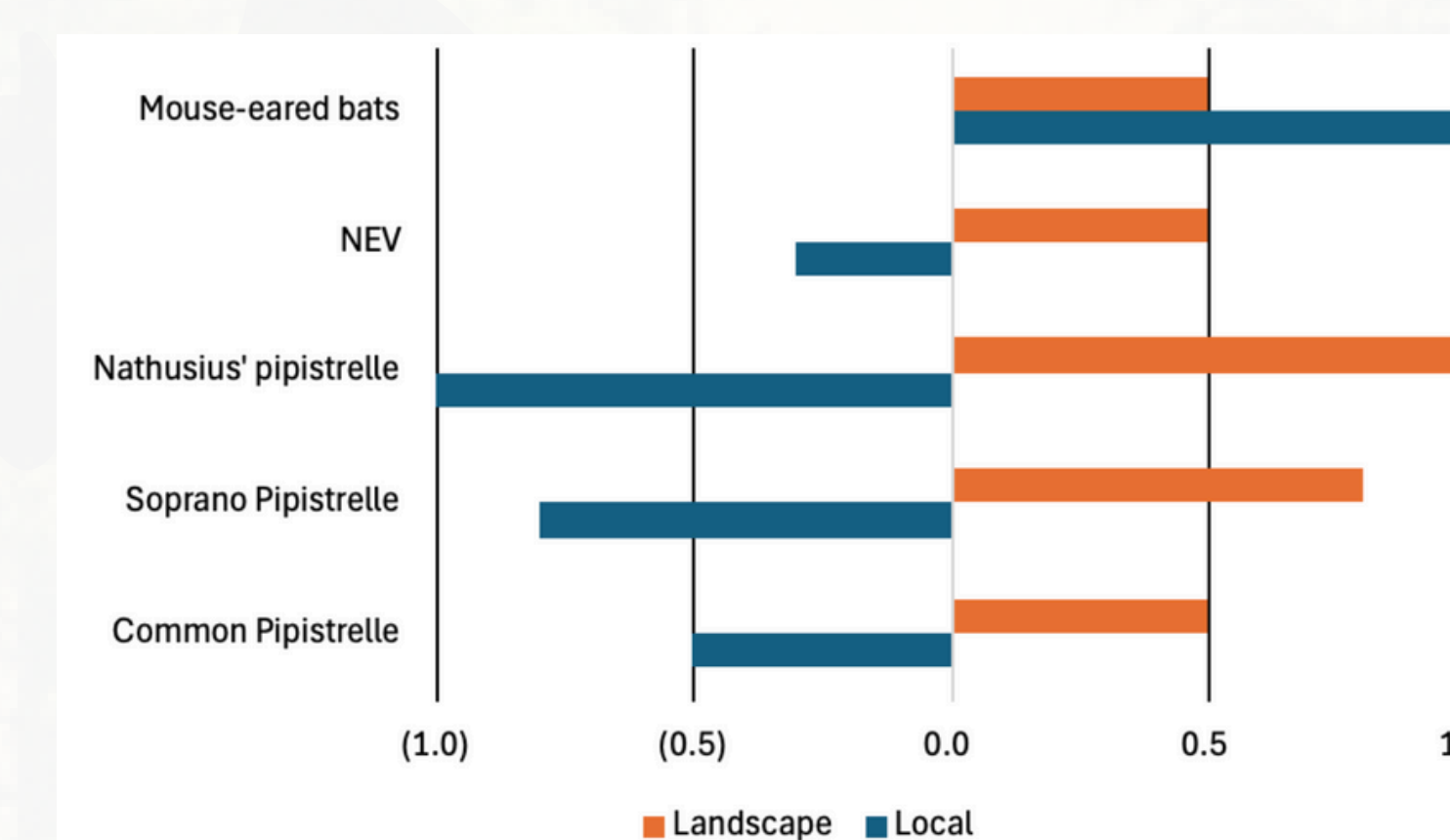
The graph illustrates the presence of bat species across different temperature levels, with negative values indicating reduced presence and positive values indicating increased presence. "Regular" values reflect a direct relationship with temperature, while "Squared" values show the effect of temperature squared, highlighting species like *Nathusius' pipistrelle* with stronger positive presence at extreme temperature levels.

Presence of Bats Across Different Surface Environments



The graph illustrates the presence of bat species across different surface environments, with negative values indicating reduced presence and positive values indicating increased presence. "Landscape" refers to broader environmental factors, while "Impervious Surface" highlights the impact of urban or paved surfaces, showing species like soprano and common pipistrelles having a stronger association with impervious surfaces.

Presence of Bats Across Different Canopy Levels



The graph illustrates the presence of bat species across different canopy levels, with negative values indicating reduced presence and positive values indicating increased presence. "Landscape" refers to broader environmental factors, while "Local" focuses on nearby canopy features, showing species like mouse-eared bats favoring local canopy presence and soprano pipistrelles associating more with landscape-level canopy features.

Conclusion

In urban ecosystems, environmental conditions such as canopy cover, surface environments, temperature levels, and radiance significantly influence the patterns of bat activity and species presence. Species like mouse-eared bats demonstrate a preference for local canopy features, while soprano and common pipistrelles are more associated with landscape-level factors, including impervious surfaces and open environments. Temperature also plays a critical role, with some species showing stronger activity under extreme conditions, as highlighted by squared temperature effects. Radiance levels further shape bat presence, with variations between canopy-covered and open areas. These findings highlight the complexity of bat activity in urban areas, where species respond differently to local and broader environmental factors, underscoring the importance of diverse habitats to support urban bat populations.

References

- Gili, Fabrizio, et al. "Bats in Urbanising Landscapes: Habitat Selection and Recommendations for a Sustainable Future." *Biological Conservation*, vol. 241, 2020, Elsevier.
- Lewanzik, Daniel, et al. "Evaluating the Potential of Urban Areas for Bat Conservation with Citizen Science Data." *Environmental Pollution*, vol. 297, 2022, Elsevier.
- Seewagen, Chad L., et al. "Far-Reaching Displacement Effects of Artificial Light at Night in a North American Bat Community." *Global Ecology and Conservation*, Elsevier, 11 Nov. 2023.