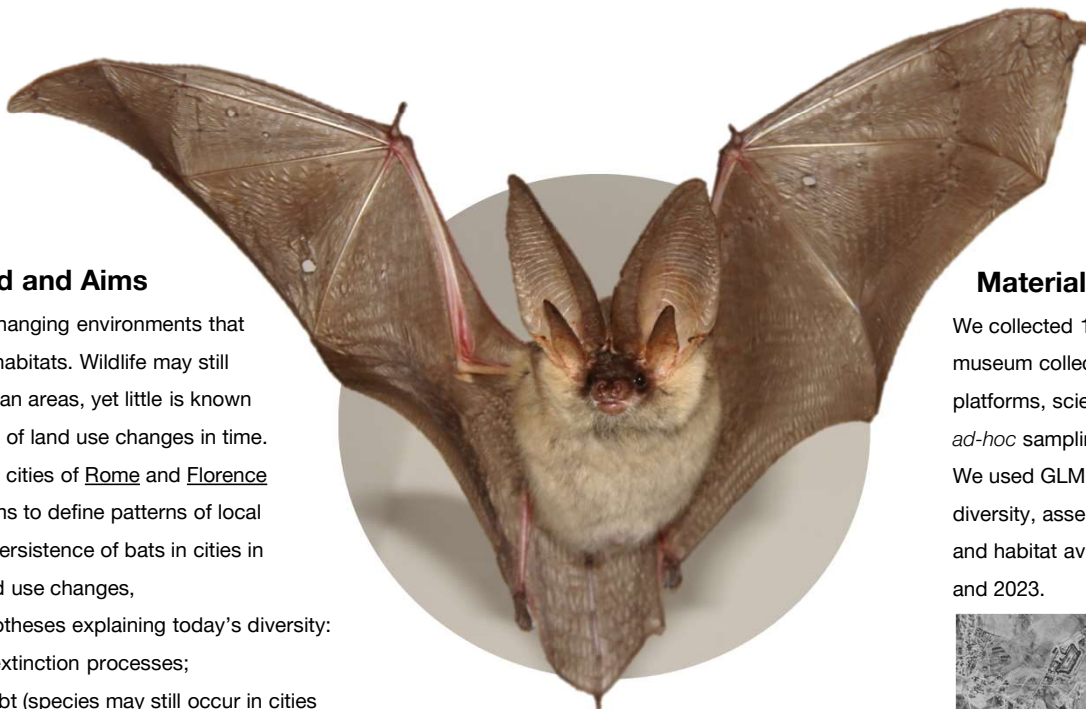


Bats as indicators of past and present land use in urban areas

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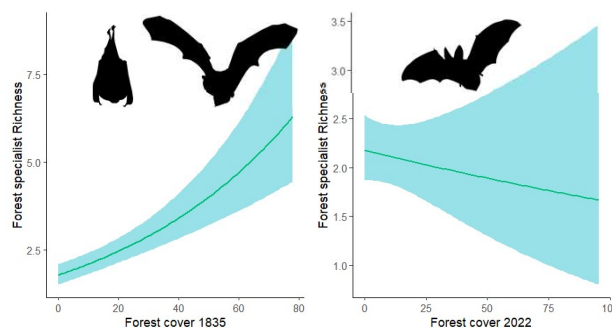
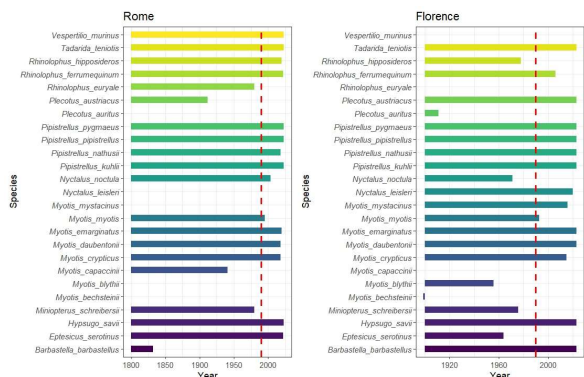
Background and Aims

Cities are fast-changing environments that replace natural habitats. Wildlife may still occur within urban areas, yet little is known upon the effects of land use changes in time. Here we use the cities of Rome and Florence as model systems to define patterns of local extinction and persistence of bats in cities in response to land use changes, testing two hypotheses explaining today's diversity:

- 1) trait-biased extinction processes;
- 2) extinction debt (species may still occur in cities because associated with past favourable conditions).

Materials and Methods

We collected 1865 bat records from museum collections, citizen science platforms, scientific literature, and *ad-hoc* sampling in the two cities. We used GLMMs to compare bat diversity, assemblage composition, and habitat availability from <1990 and 2023.



1) The local extinction of 6 and 7 bat species from Rome and Florence, respectively, is biased towards species that glean prey from the substrate and feed on moths and beetles, in comparison to those preying mainly dipterans by aerial hawking.

2) Bat diversity is influenced more by past habitat availability than by current one, indicating an ongoing extinction debt in urban bat assemblages, especially for species associated with forest habitats.

Take-home messages

Our long-term analyses indicate bats as reliable indicators of past environmental conditions in urban environments. Current diversity at urban sites is due to both filtering effects and the lagged response to habitat loss, indicating that bats with specific sets of traits actually represent examples of "living dead" populations that will be lost if no action is taken to re-establish profitable habitat.

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