Morphological variation in white-footed mice across an urban-to-rural gradient in Georgia

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Background

- We investigated how urbanization might cause morphological differentiation between small mammal populations.
- **Urbanization:** increasing human population density and artificial structures.
- As human population increases, natural areas are becoming more fragmented, leading to population isolation.
- Urbanization may also lead to different selective pressures.
- We used white-footed mouse (*Peromyscus leucopus*) as a model because it is widespread and easily captured.
- **Objective: Investigate whether variation in skull morphology is correlated with urbanization.**

Figure 1. Measuring white-footed mice in Kennesaw, Georgia, in summer 2024.

Methods

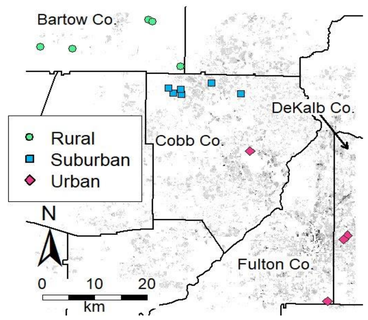

Figure 2. Left: Map of field sites in Northern Georgia. **Right:** white-footed mouse caught at suburban site.

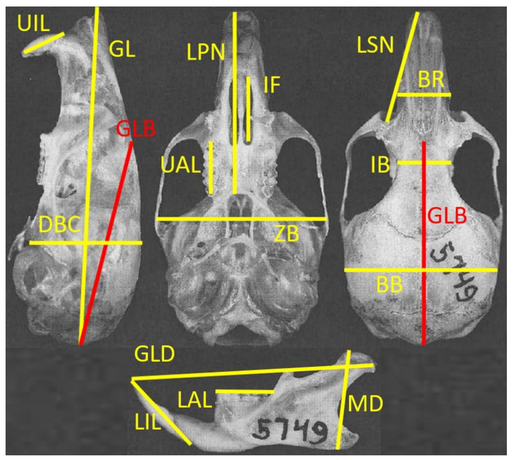

Figure 3. Illustration of measurements taken from each skull and mandible. Image adapted from Fernandez et al. (2010; Mammalian Species 42: 867).

- Trapped small mammals at 17 sites in urban, suburban, and rural areas and collected 61 skulls in total.
- Took 19 measurements of each skull and mandible using Mitutoyo vernier calipers.
- Analyzed data using principal components analysis (PCA) and perMANOVA.
- All procedures involving animals were approved by the KSU Institutional Animal Care and Use Committee and Georgia DNR.

Results

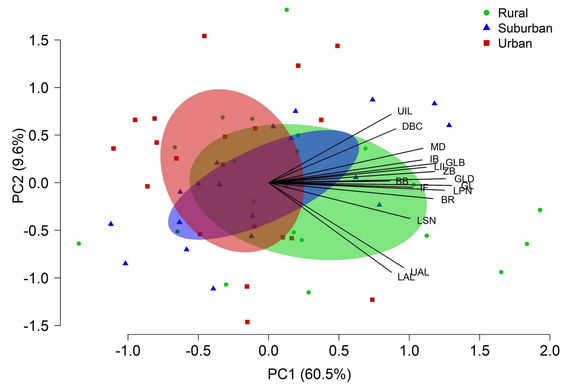

Figure 4. PCA of *z*-scaled *P. leucopus* skull measurements at urban, suburban, and rural sites. Skulls differed by site type (perMANOVA $P < 0.05$, partial $R^2 = 0.077$), but not sex ($P > 0.05$, partial $R^2 < 0.01$).

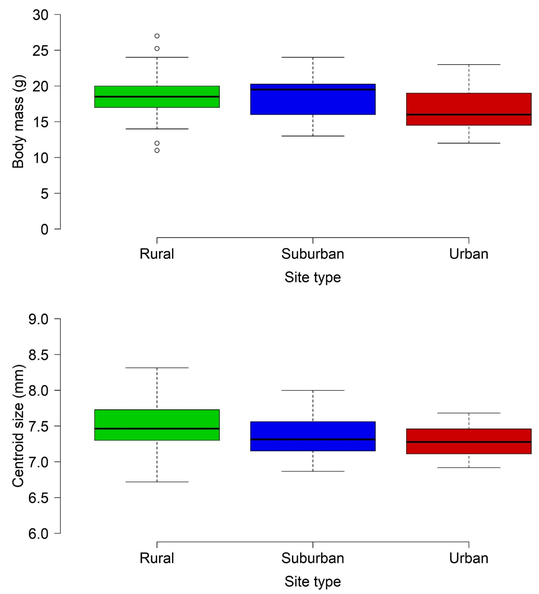

Figure 6. Top: Body mass did not vary between urban, suburban, and rural sites (ANOVA $F_{2,58} = 1.85$, $P > 0.10$). **Bottom:** Skull centroid size did not differ between site types ($F_{2,58} = 2.80$, $P = 0.07$).

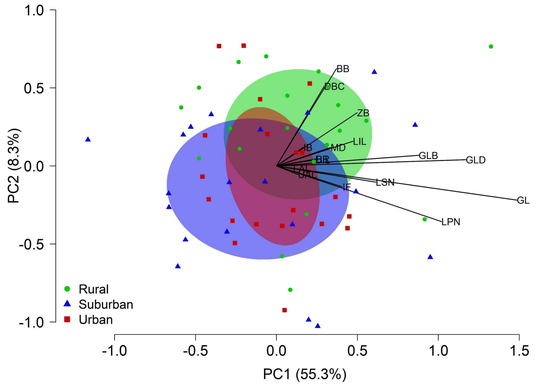

Figure 5. PCA of length-mass residuals of *P. leucopus* skull measurements at urban, suburban, and rural sites. Residual skull measurements did not differ by site type (perMANOVA $P > 0.05$, partial $R^2 = 0.054$), but not sex ($P > 0.05$, partial $R^2 = 0.01$).

Discussion

- Results support our hypothesis that urbanization may contribute to changes in skull morphology.
- Effect of urbanization is small (partial $R^2 = 0.077$) but statistically significant.
- The changes may indicate altered diets, predation pressures, or other challenges associated with urbanization.
- These findings help inform both biodiversity conservation and public health measures, as shifts in small mammal populations can affect disease dynamics and ecosystem services in urban areas.