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

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Background

- We noticed that pelt color seemed to be highly variable amongst white-footed mice (*Peromyscus leucopus*) along the urban-rural gradient associated with Atlanta, Georgia, USA, with urban animals darker than rural counterparts.
- Urbanization has been found to affect wildlife coloration by many mechanisms, including pollution and altered substrate color.
- We investigated how urbanization might cause colorimetric variation between small mammal populations.
- **Hypothesis: Urbanization affects fur color in *P. leucopus* because of the overall darker ground cover and pollution in urban areas.**

Figure 1. Variation in pelage color in white-footed mice (*Peromyscus leucopus*) captured near Atlanta, Georgia.

Methods

- Collected 48 *P. leucopus* from 17 sites in urban, suburban, and rural areas.
- All procedures approved by KSU Institutional Animal Care and Use Committee (IACUC) protocol 2022-089.

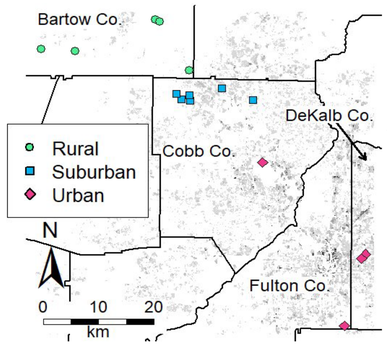
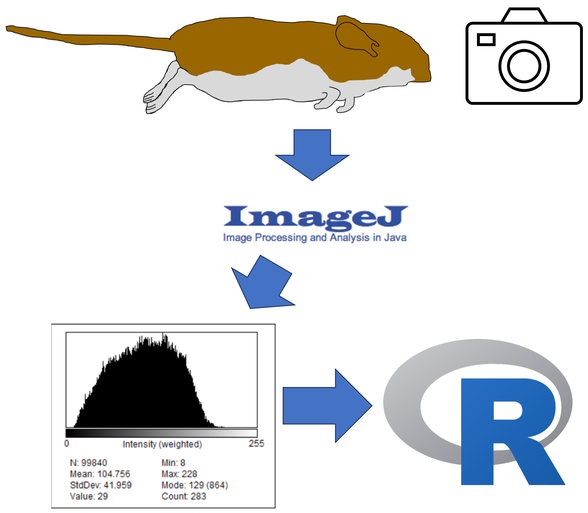


Figure 2. Map of study sites (n = 17 in and around Atlanta, Georgia. Shading shows population density.

- Quantified pelt color as red, green, and blue (RGB) and overall brightness using imageJ.
- Analyzed color variation using linear models, nonparametric tests, principal components analysis (PCA), and perMANOVA.



Results

Dorsal pelage coloration

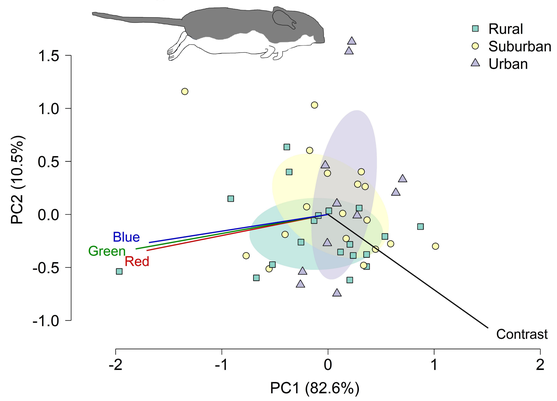


Figure 3. PCA of *z*-scaled *P. leucopus* dorsal coloration at urban, suburban, and rural sites. Color did not vary with urbanization (perMANOVA $F_{2,45}$ = 1.16, P = 0.321, R^2 = 0.049). Most variance in color (82.6%) was associated with principal component 1 (PC1), a gradient from lighter to darker dorsal pelage.

Ventral pelage coloration

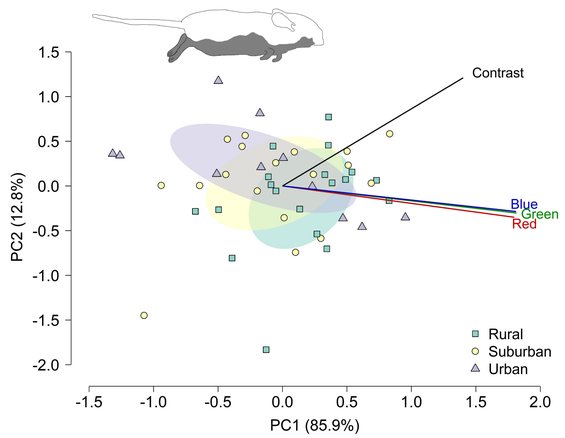


Figure 4. PCA of *z*-scaled *P. leucopus* ventral coloration at urban, suburban, and rural sites. Color did not vary with urbanization (perMANOVA $F_{2,45}$ = 1.69, P = 0.196, R^2 = 0.069). Most variance in color (85.9%) was associated with principal component 1 (PC1), a gradient from darker to lighter ventral pelage.

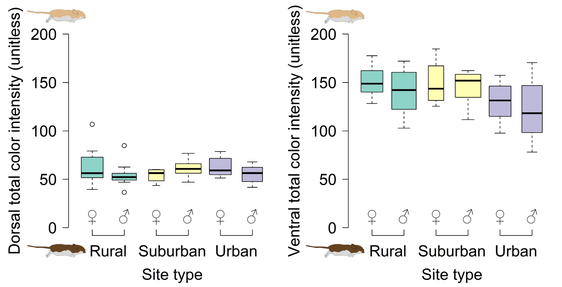


Figure 5. Color intensity (i.e., overall brightness) of pelt was explained by aspect (Three-way ANOVA $F_{1,90}$ = 439.8, P < 0.001) but not sex ($F_{1,90}$ = 1.9, P = 0.177) or site type ($F_{2,90}$ = 2.8, P = 0.069). Total model R^2 = 0.824.

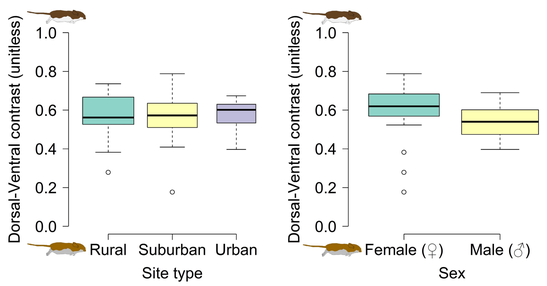


Figure 6. Dorsal-ventral color contrast did not vary by site type (Kruskal-Wallis χ^2 = 0.143, 2 d.f., P = 0.930), but females had significantly greater dorsal-ventral contrast (Wilcoxon W = 408, 2 d.f., P = 0.011).

Discussion

- Our suspicion of darker pelage in urban animals was not borne out by the data.
- Interestingly, dorsal-ventral contrast was greater in females, but no color variation was related to urbanization.
- Future work may include better standardization of images or examination of other aspects of appearance.