What's in a name?: How we define “urbanization” has strong implications for its effects on mammal abundance

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BACKGROUND

Urbanization strongly impacts wildlife communities and populations. However, we typically do not know which feature(s) affect individual species most strongly, and this lack of understanding impedes effective urban planning for conservation and management goals. Here, we examined variation in mammal relative abundance as a response to different features of urbanization.

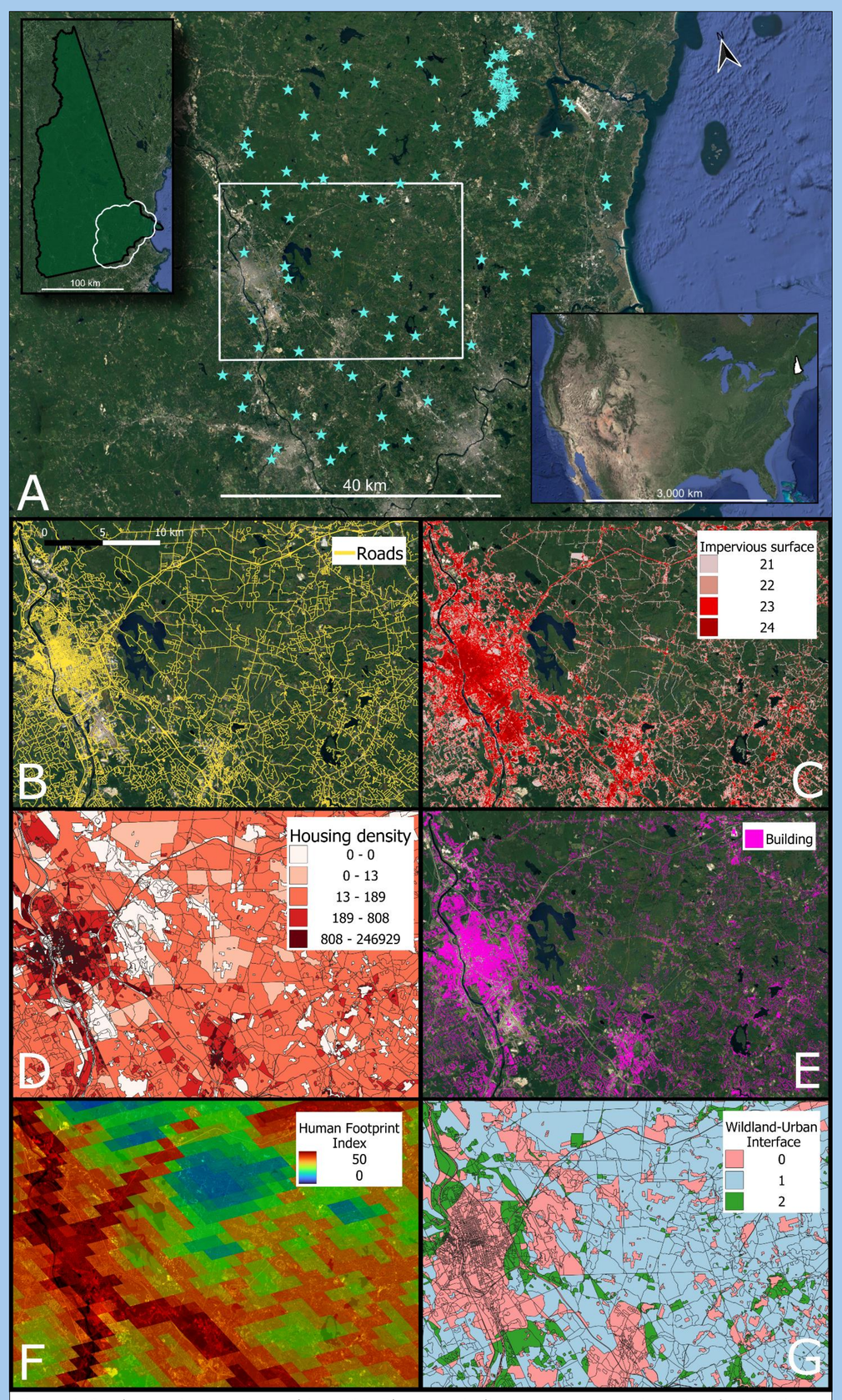

Figure 1. Study area in New Hampshire, USA. Blue stars indicate camera trap sites. Panels B-G: Six urban features near Manchester, NH.

METHODS

- 112 camera traps across a gradient of urbanization in New Hampshire, USA (Figure 1)
- Two years of data
- Ten mammal species
- Six features of urbanization
- Five spatial scales
- Bayesian hierarchical models to measure response of abundance to each feature and scale

RESULTS

- No singular urban feature or spatial scale featured in the best model for all species
- Species responded uniquely to features across scales, and the scale of urban features in the best model also varied (Figure 2)
- The most frequently included feature in the top model for each species was Wildland-Urban Interface, followed by the Human Footprint Index and housing density
- Aggregate features (HFI, impervious surface, WUI) were included more frequently than singular features
- Within a species, the magnitude and direction of response varied across features and scales (Figure 3)

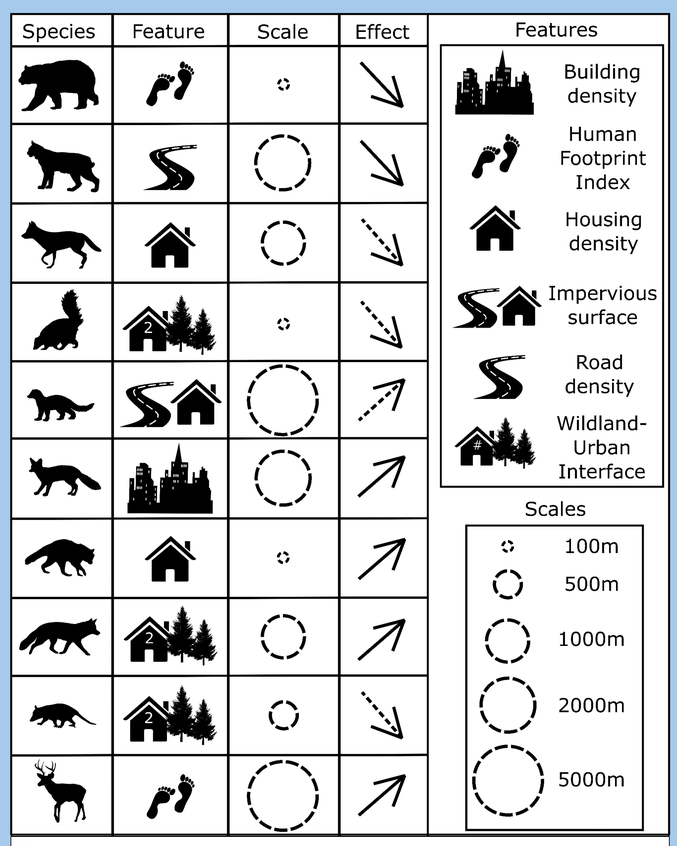

Figure 2. Urban features and spatial scales in the best model (lowest DIC) based on abundance models fit to camera trap data collected in New Hampshire, USA 2021-2022. Wildland-Urban Interface numbers indicate (1) intermix, (2) interface, and (0) neither. Arrows represent the direction (up: positive, down: negative) and magnitude of the effect, with solid arrows indicating a 95% credible interval not crossing 0, and dashed lines indicating otherwise.

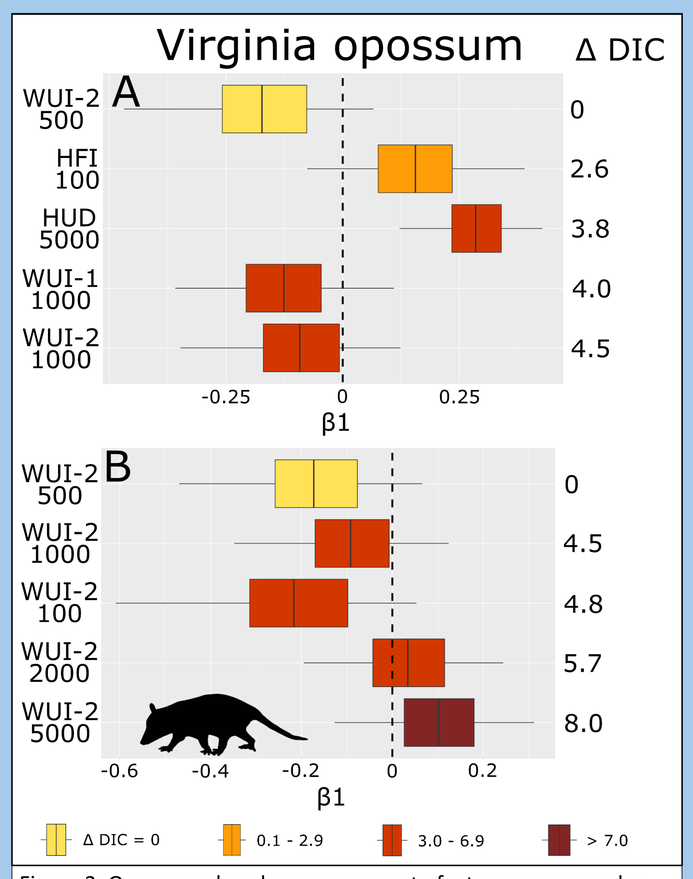

Figure 3. Opossum abundance response to features across scales based on models fit to camera trap data collected in New Hampshire, USA 2021-2022. Panel A represents the top 5 models with the lowest DIC, while panel B represents the change in effect across scales for the top model feature. Numbers in the x-axis indicate the spatial scale in meters. Abbreviations: BUD: building density, HUD: housing density, and WUI: Wildland-Urban Interface.

DISCUSSION

Using aggregate features to examine species responses to urbanization may be most useful if the goal of research is predictive accuracy in mapping species’ distributions or abundances. For more applied goals, examining singular features is likely better suited to inform landscape and urban planning decision-making.

CONCLUSIONS

Species respond to specific urban features, thus a failure to include certain features can cause misleading inference about wildlife response to “urbanization”. Therefore, researchers must carefully justify the choice of urban feature and the spatial scale at which it is represented for each species of interest. An expanded inclusion of multiple urban features in wildlife research will inform landscape planning and management decisions and help attain conservation goals for species impacted by urbanization.

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