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The Effects of Anthropogenic Disturbances on the Auditory Processing of the House Sparrow (*Passer domesticus*)

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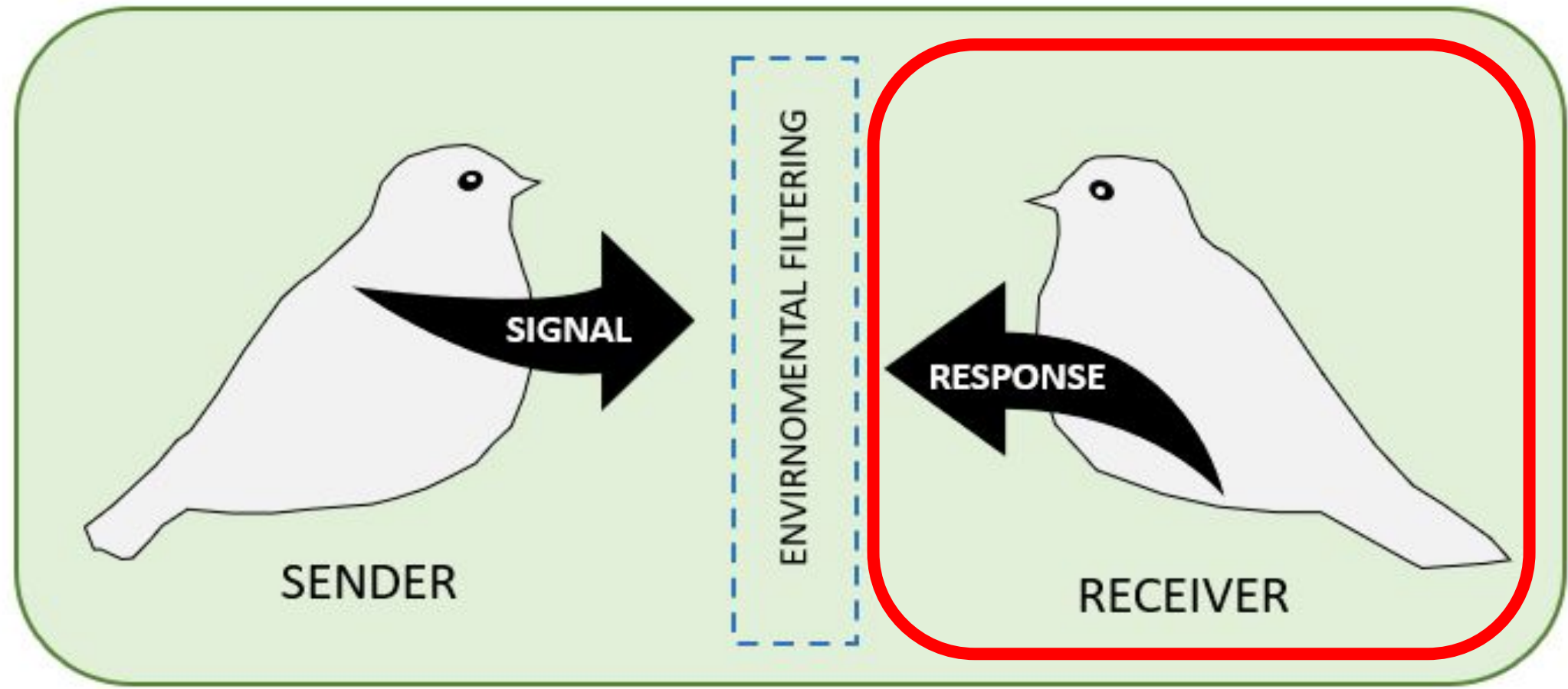
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INTRODUCTION :

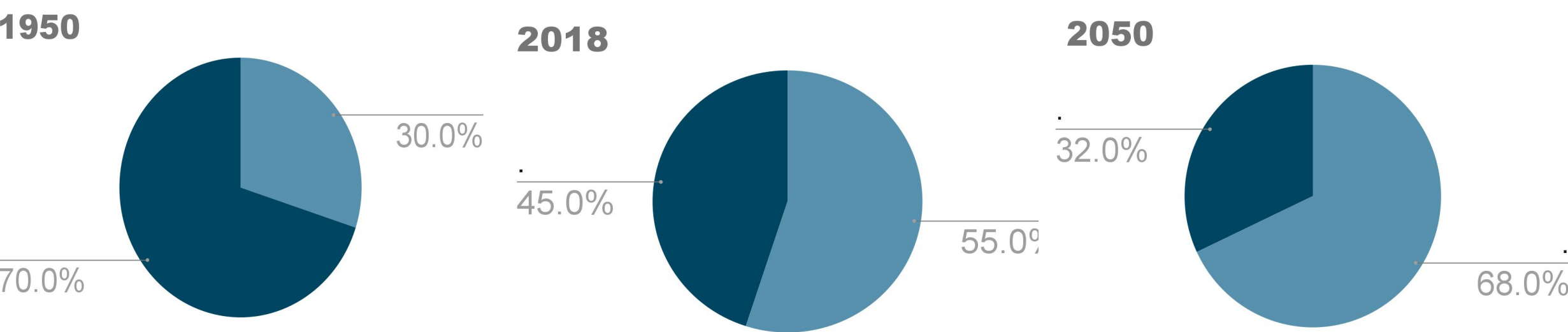
- Animal communication is important for reproduction and survival



- House sparrows inhabit areas across the urbanization gradient
 - Rely on social cues from conspecifics



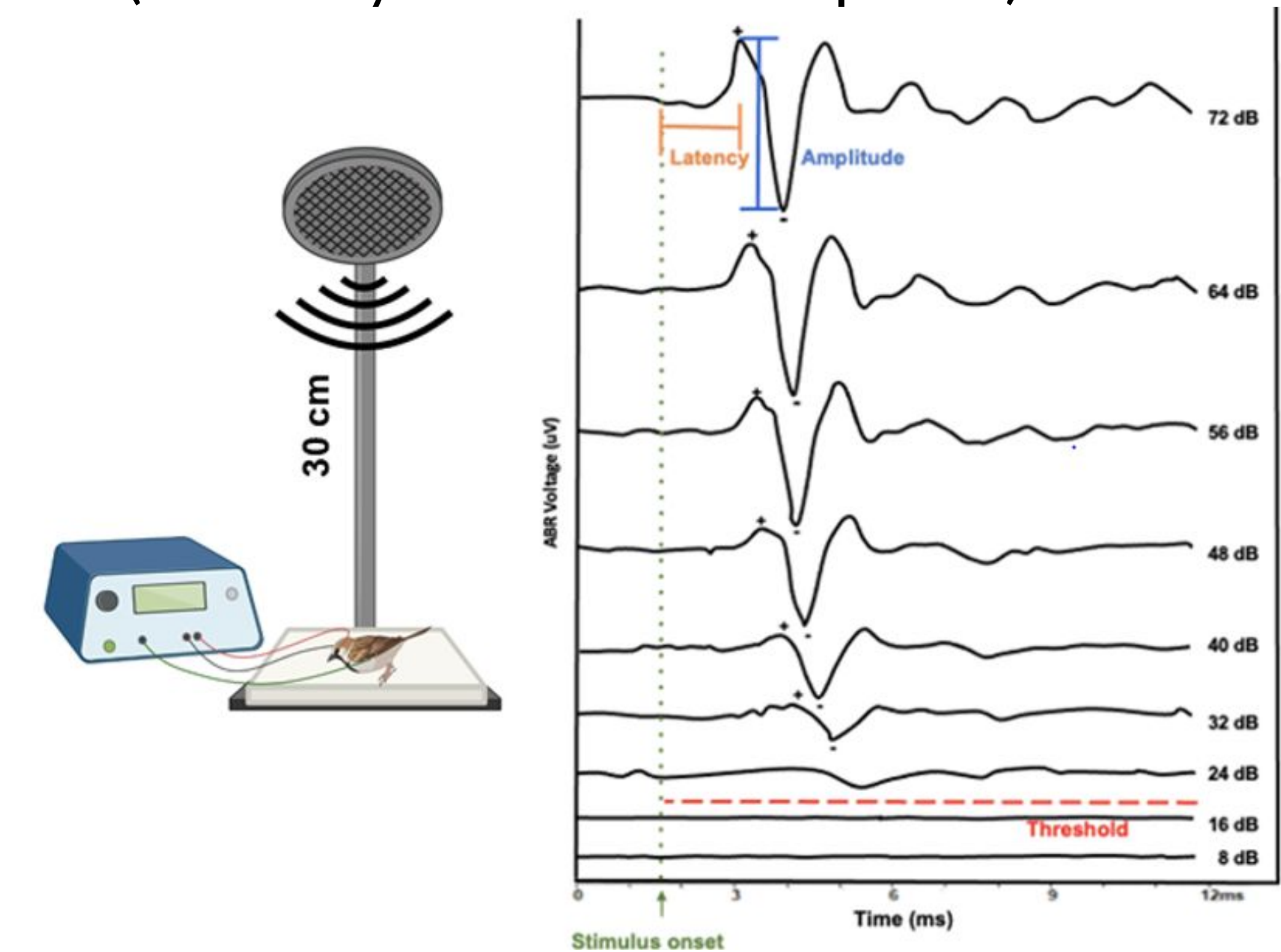
- Urbanization is increasing and is predicted to continue to increase.



*Global Urban Population *Other

METHODS:

1. Collection of house sparrows (N= 57) from urban, rural, and suburban locations.
2. Tarsus and weight measurements were taken
3. One week acclimation period
4. ABRs (Auditory-Brainstem Response)



5. Data Analysis
- We measured thresholds, the lowest level intensity sound that still elicits an ABR.

The Effects of Anthropogenic Disturbances on the Auditory Processing of the House Sparrow (*Passer domesticus*)

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Research Question:

Does auditory sensory processing differ between house sparrows as the environment varies from urban to rural?

Predictions:

The auditory processing of urban house sparrows will have less sensitivity to the presented stimuli compared to rural birds

We predict threshold to increase from rural to urban

Results:

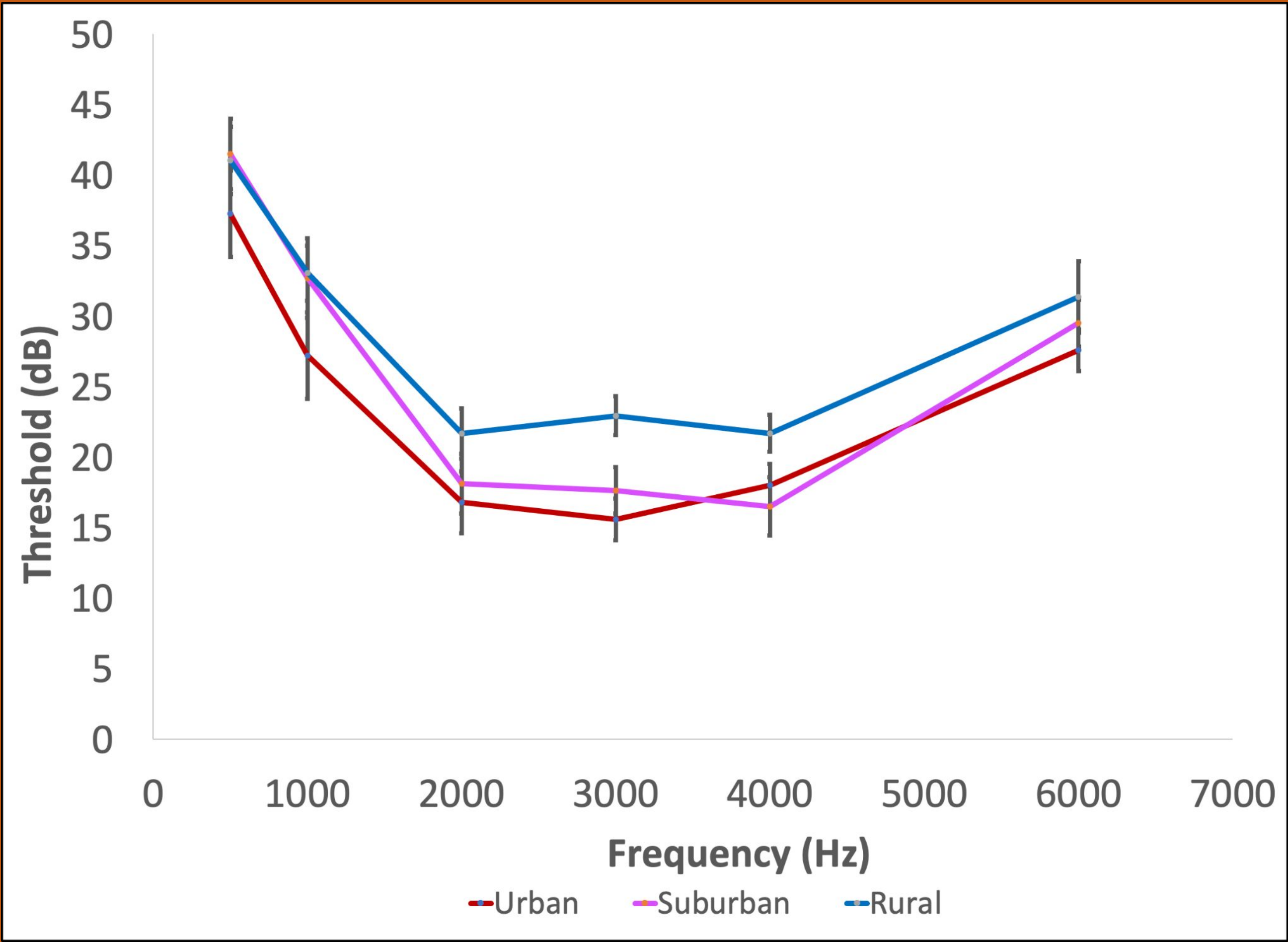


Figure 1: We found a significant difference at 3000 Hz based on the location of capture ($F_{2,46} = 4.77, P = 0.01$)

Urbanization Classification	Average Background Noise (dB)
Urban	54.9 ± 6.9
Suburban	48.7 ± 10.7
Rural	46.3 ± 1.5

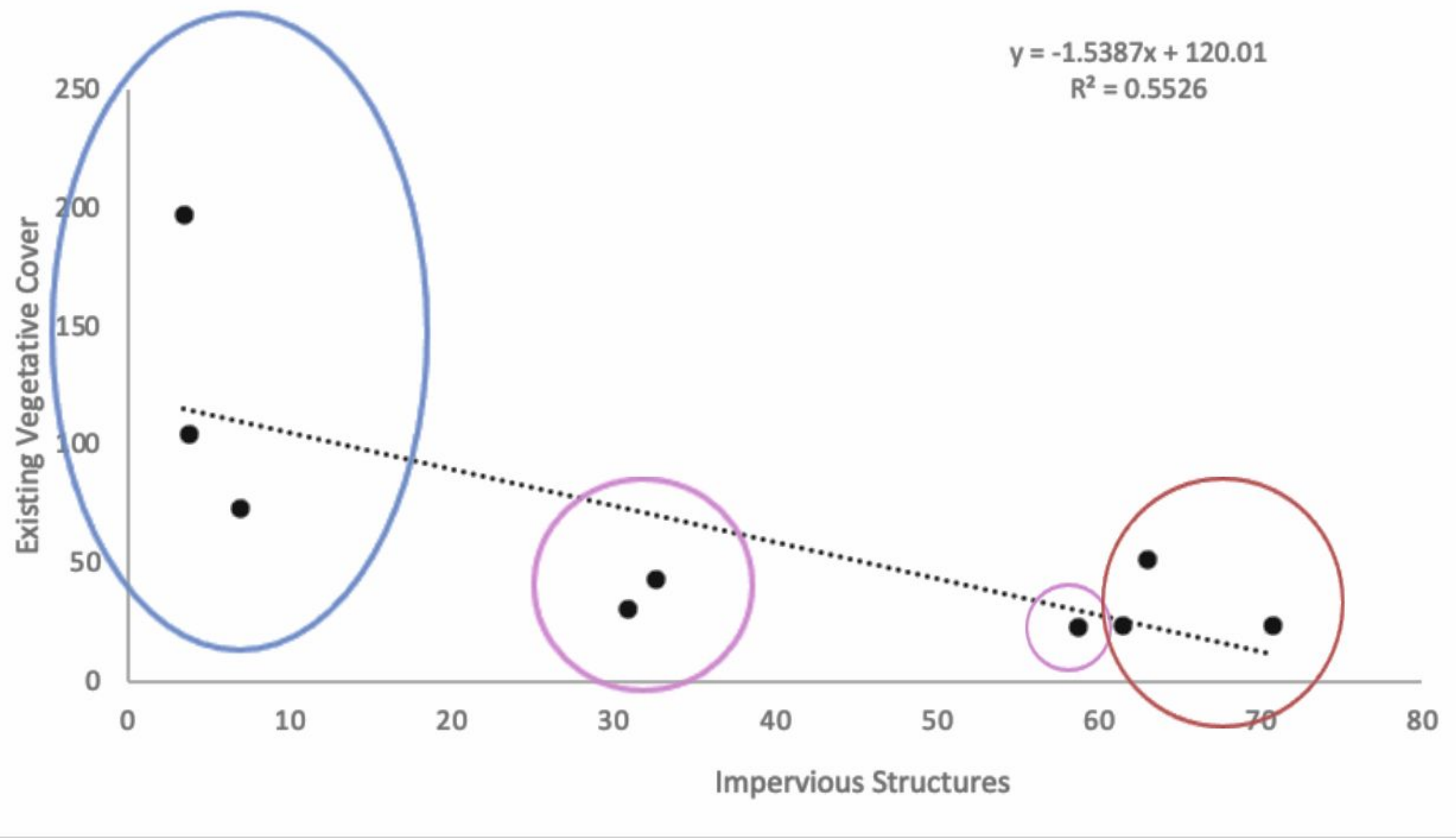
Background noise was taken at sunrise and averaged across site type. Noise levels decreased moving from urban, to suburban, to rural

URBANIZATION GRADIENT:

- Sites at least 1 km from each other



- Sites classified based on level of imperviousness



DISCUSSION:

Our data did not support our hypothesis. Rural house sparrows had greater thresholds as frequency increase.

- 3000 Hz is in the most sensitive range of the audiogram (i.e., where birds hear the best); therefore changes at this frequency may have large consequences for reproduction and survival.
- House sparrows have been able to adapt to urban environment (Ravinet et al., n.d). Potentially, part of the adaptation is better hearing to communicate and detect prey
- Evidence of bird adjusting song to overcome masking (Dowling et al., 2012), and perhaps also adjusting to urban conditions.

Citations:

City of Holland Michigan. (2017). Downtown Holland [Photo]. <https://www.flickr.com/photos/cityofhollandmi/37254647320/>

Dowling, J. L., Luther, D. A., & Marra, P. P. (2012). Comparative effects of urban development and anthropogenic noise on bird songs. *Behavioral Ecology*, 23(1), 201–209. <https://doi.org/10.1093/beheco/arr176>

House Sparrows' Dance | BirdNote. (2020, June 8).<https://www.birdnote.org/listen/shows/house-sparrows-dance>

Ravinet, M., Elgvin, T. O., Trier, C., Aliabadian, M., Gavrilov, A., & Sætre, G.-P. (n.d.). Signatures of human-commensalism in the house sparrow genome. *Proceedings of the Royal Society B: Biological Sciences*, 285(1884), 20181246. <https://doi.org/10.1098/rspb.2018.1246>

Ronald, K. L., Fernández-Juricic, E., & Lucas, J. R. (2018). Mate choice in the eye and ear of the beholder? Female multimodal sensory configuration influences her preferences. *Proceedings of the Royal Society B: Biological Sciences*, 285(1878), 20180713. <https://doi.org/10.1098/rspb.2018.0713>

Ronald, K., Sesterhenn, T., Lucas, J., & Fernández-Juricic, E. (2017). The sensory substrate of multimodal communication in brown headed cowbirds: Are females sensory "specialists" or "generalists"? *Journal of Comparative Physiology*, 203. <https://doi.org/10.1007/s00359-017-1203-7>

United Nations, Department of Economic and Social Affairs, & Population Division. (2019). *World urbanization prospects: The 2018 revision*.