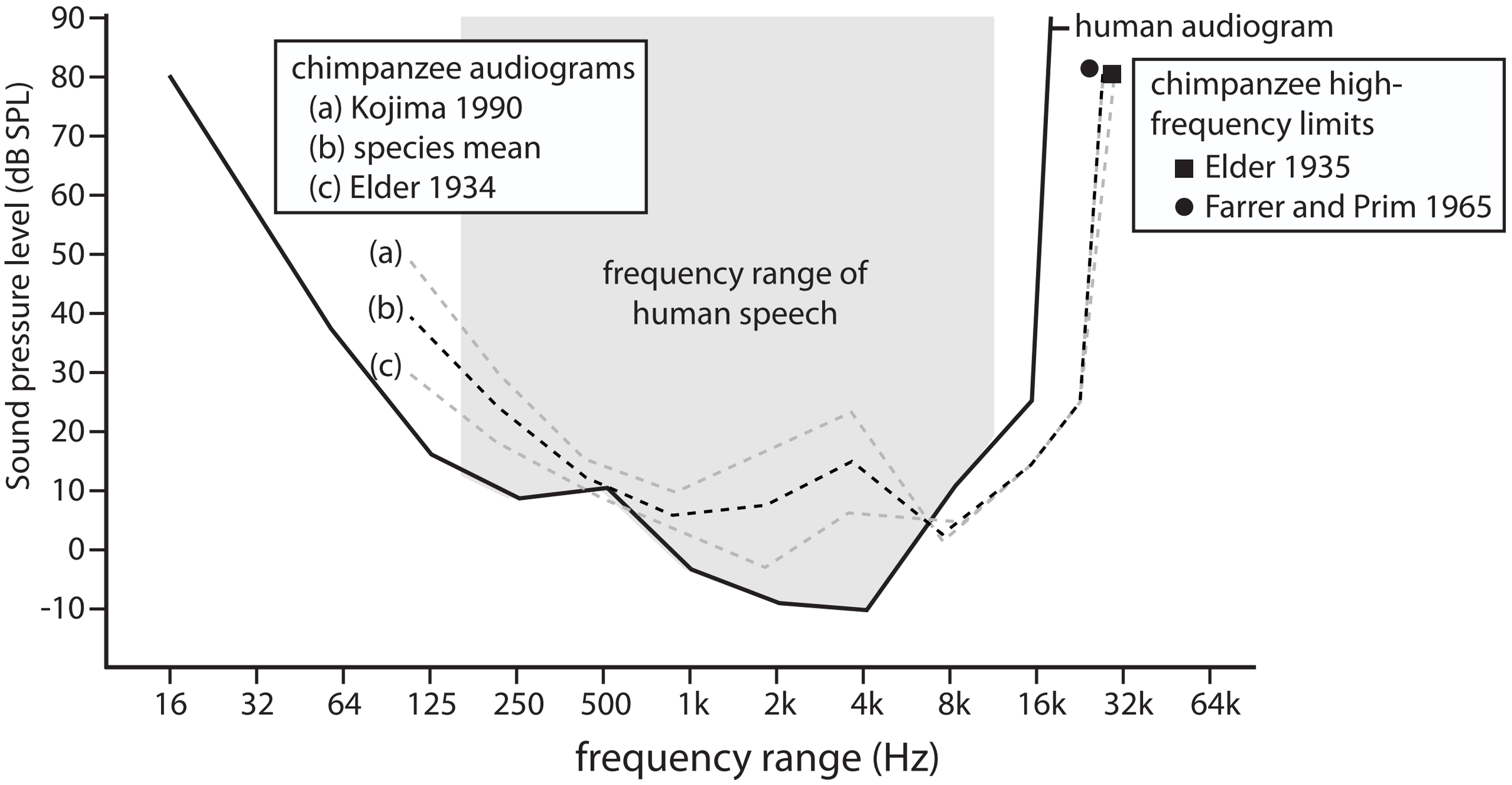
HABITAT ACOUSTICS AND THE EVOLUTION OF HUMAN AUDITORY SENSITIVITY

NATHANIEL DOMINY
DARTMOUTH

STANISLAUS M. KIVAI
INSTITUTE OF PRIMATE RESEARCH

HANNAH TER HOFSTEDE
UNIVERSITY OF WINDSOR


chimpanzee audiograms
(a) Kojima 1990
(b) species mean
(c) Elder 1934
(a)
(b)
(c)
frequency range of
human speech
human audiogram
chimpanzee high-
frequency limits
Elder 1935
Farrer and Prim 1965
Sound pressure level (dB SPL)
90
80
70
60
50
40
30
20
10
0
-10
16
32
64
125
250
500
1k
2k
4k
8k
16k
32k
64k
frequency range (Hz)

Auditory capacities in Middle Pleistocene humans from the Sierra de Atapuerca in Spain

Martinez et al. (2004) PNAS 101:9976-9981

nature ecology & evolution

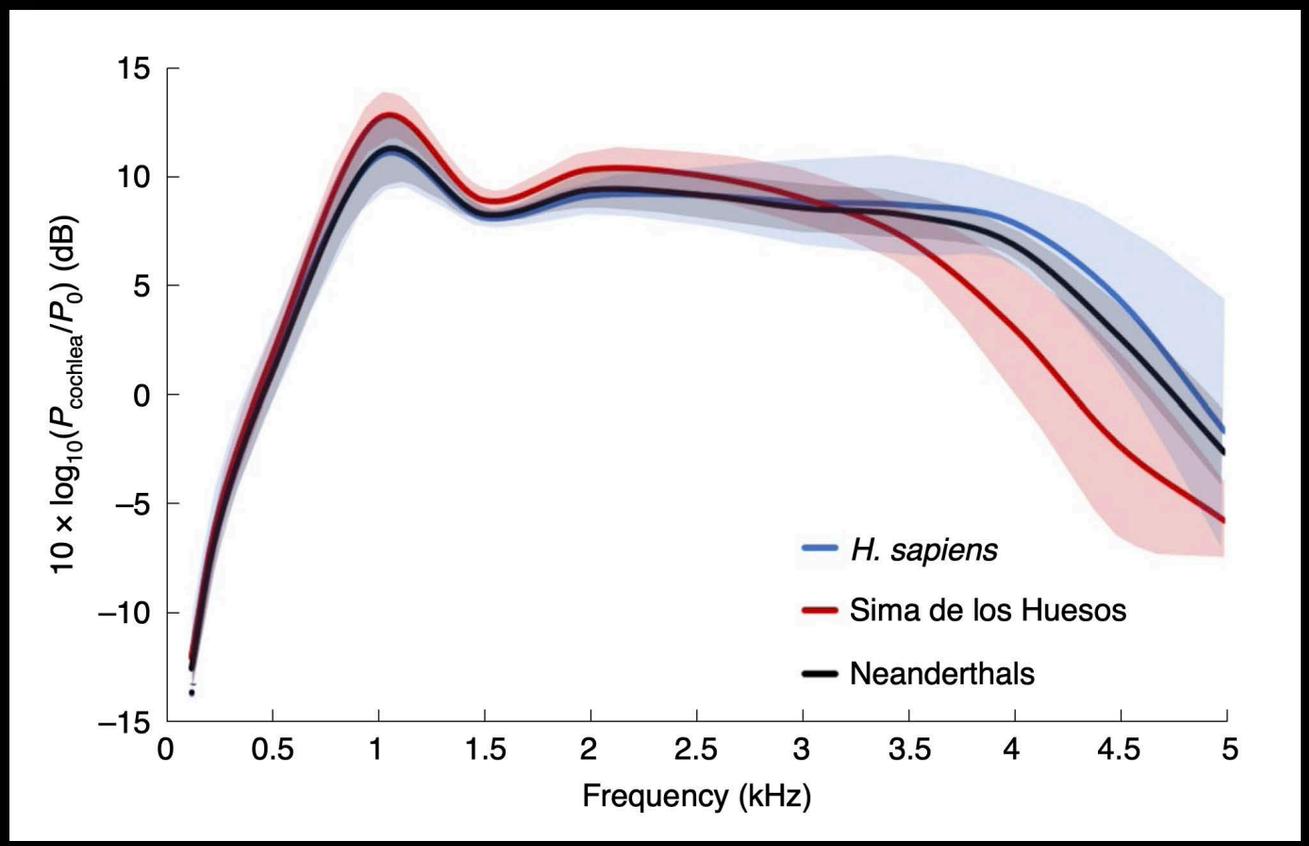
ARTICLES

https://doi.org/10.1038/s41559-021-01391-6

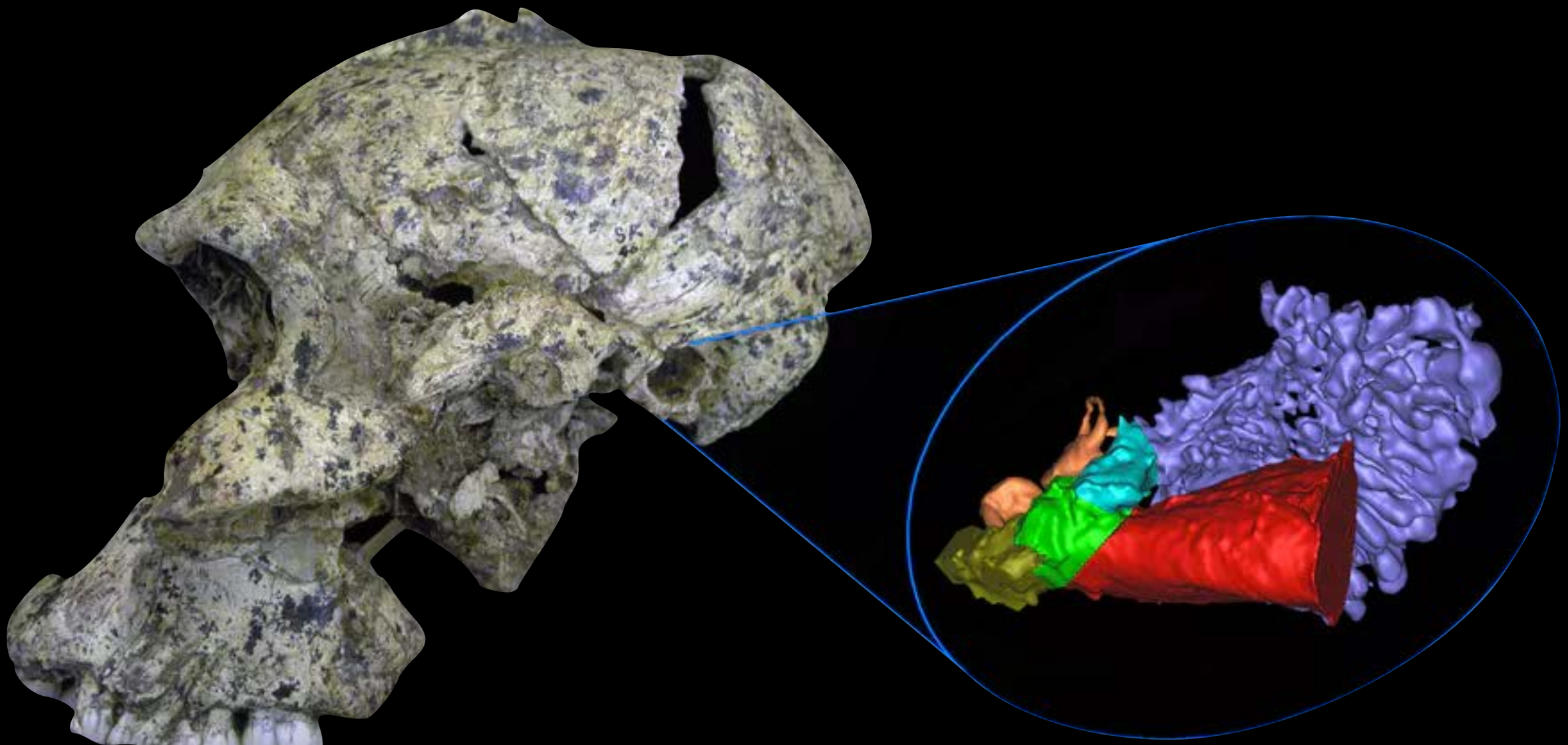
Check for updates

Neanderthals and *Homo sapiens* had similar auditory and speech capacities

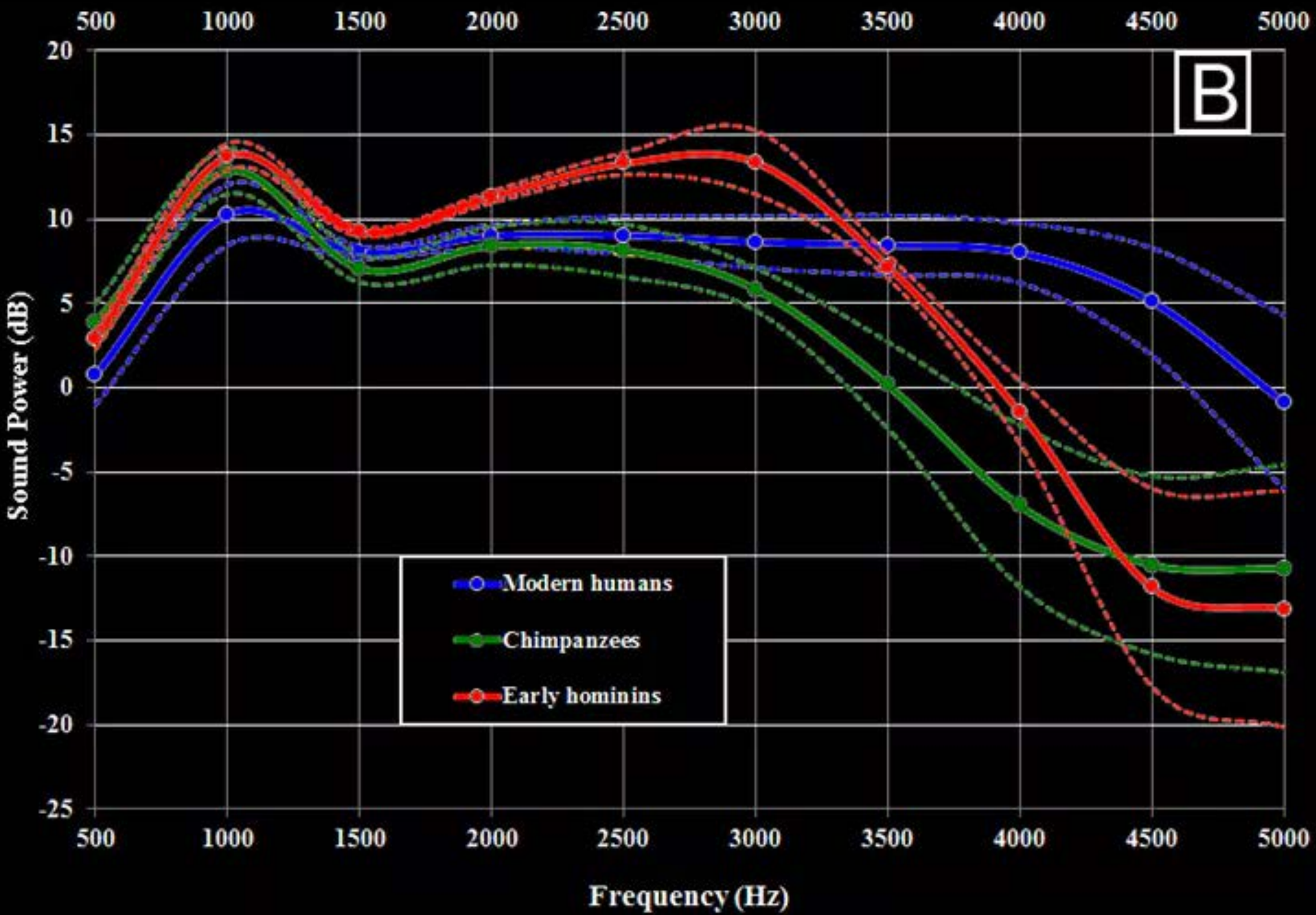
Conde-Valverde et al. (2021)



Australopithecus africanus



Quam et al. (2015) *Science Advances 1:1500355*



Quam et al. (2015) Science Advances 1:1500355

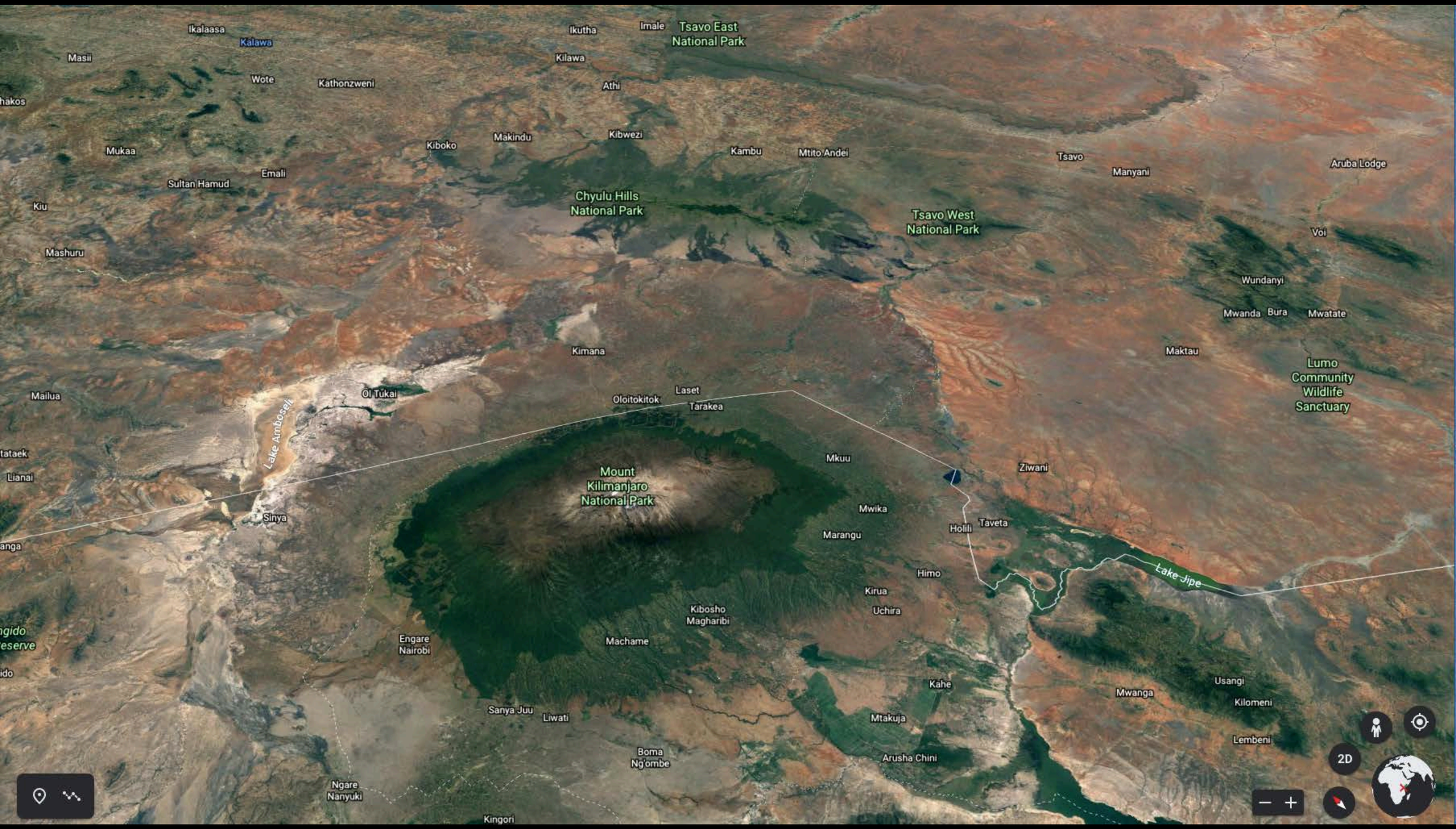
THE BURNING QUESTION

Which African habitats favored enhanced hearing in the 1-4 kHz range?

African land snails are extremely sensitive ecological indicators, and the snail assemblage of Aramis points to a“groundwater forest”

WoldeGabriel et al. (2009) Science 326:65

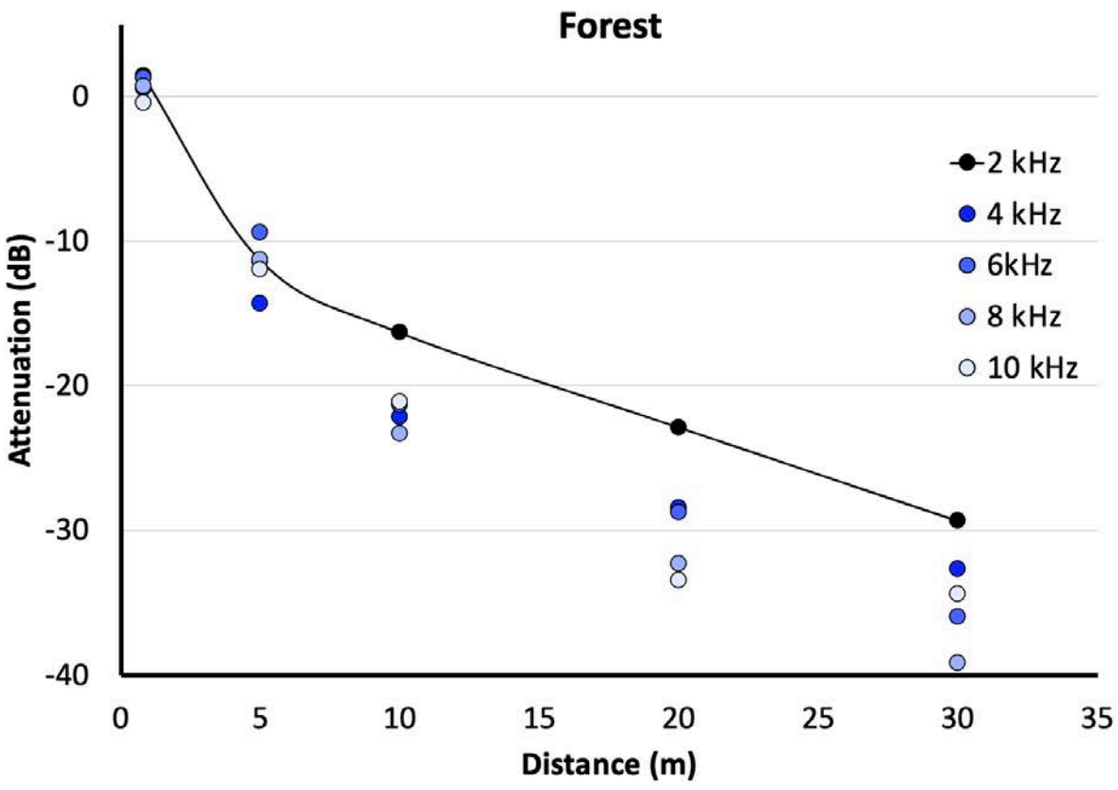
Kibwezi Forest, a “groundwater forest”

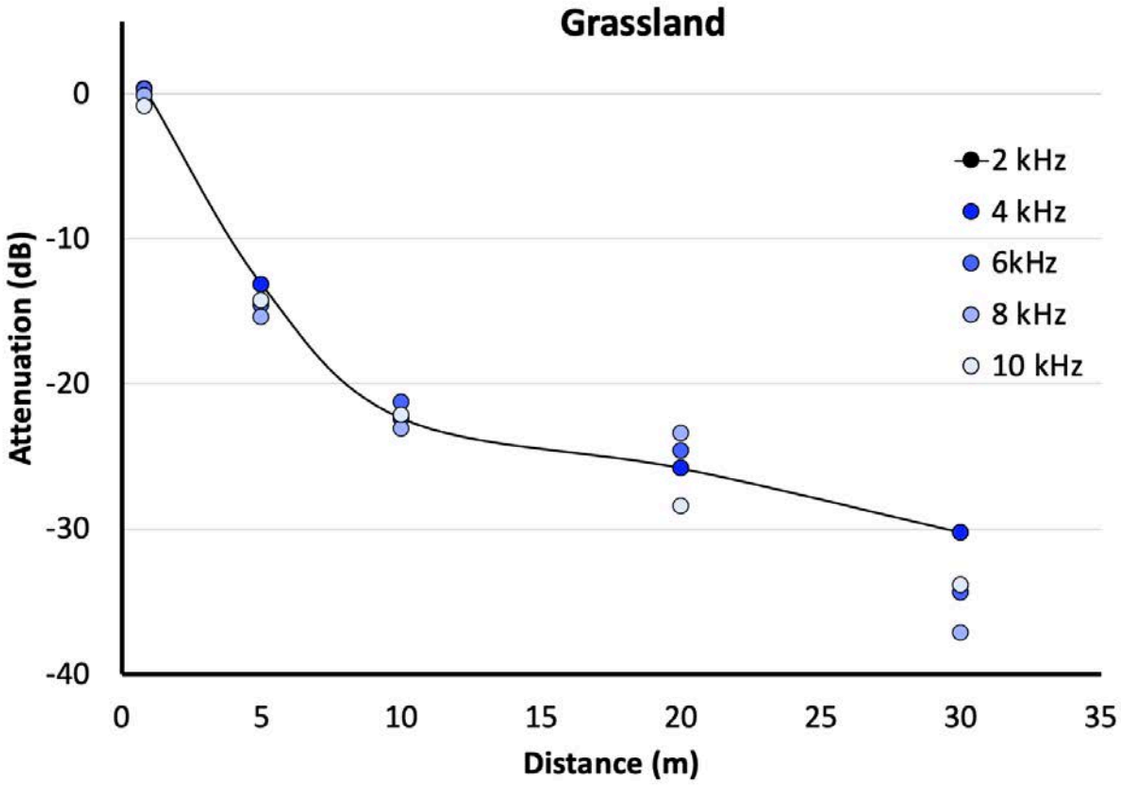


2019 field season

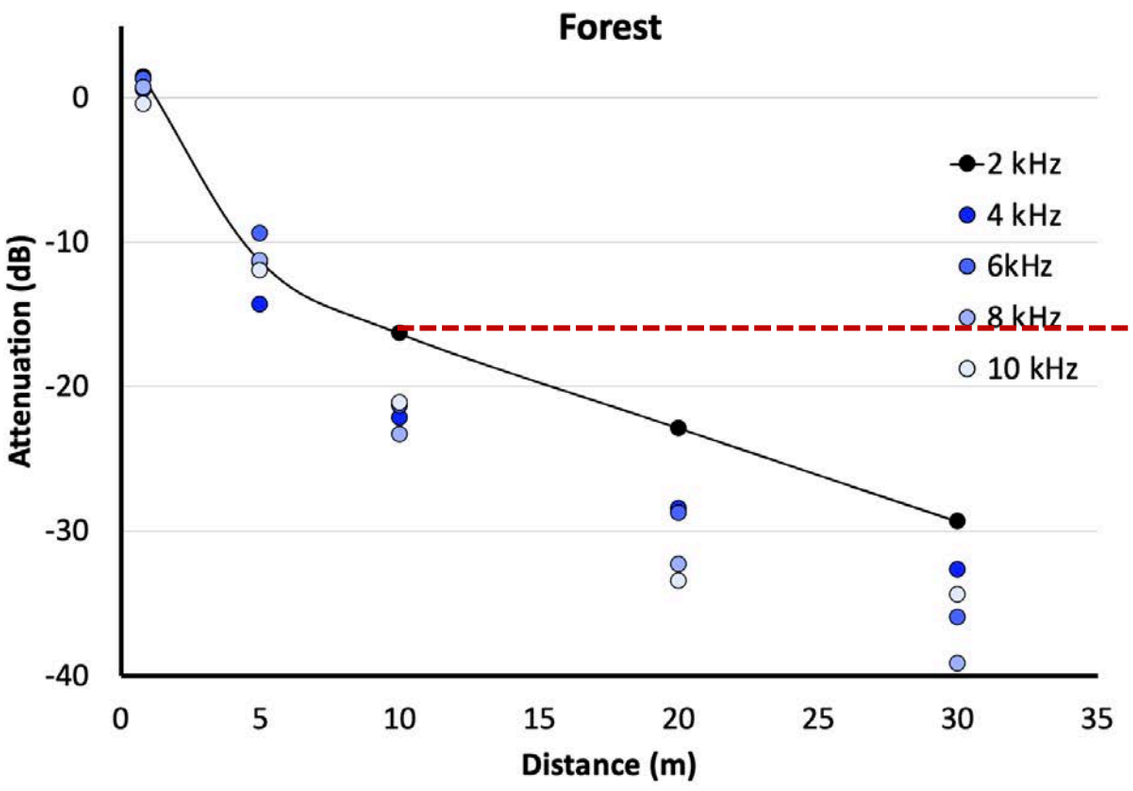
Umani Spring, Kibwezi Forest

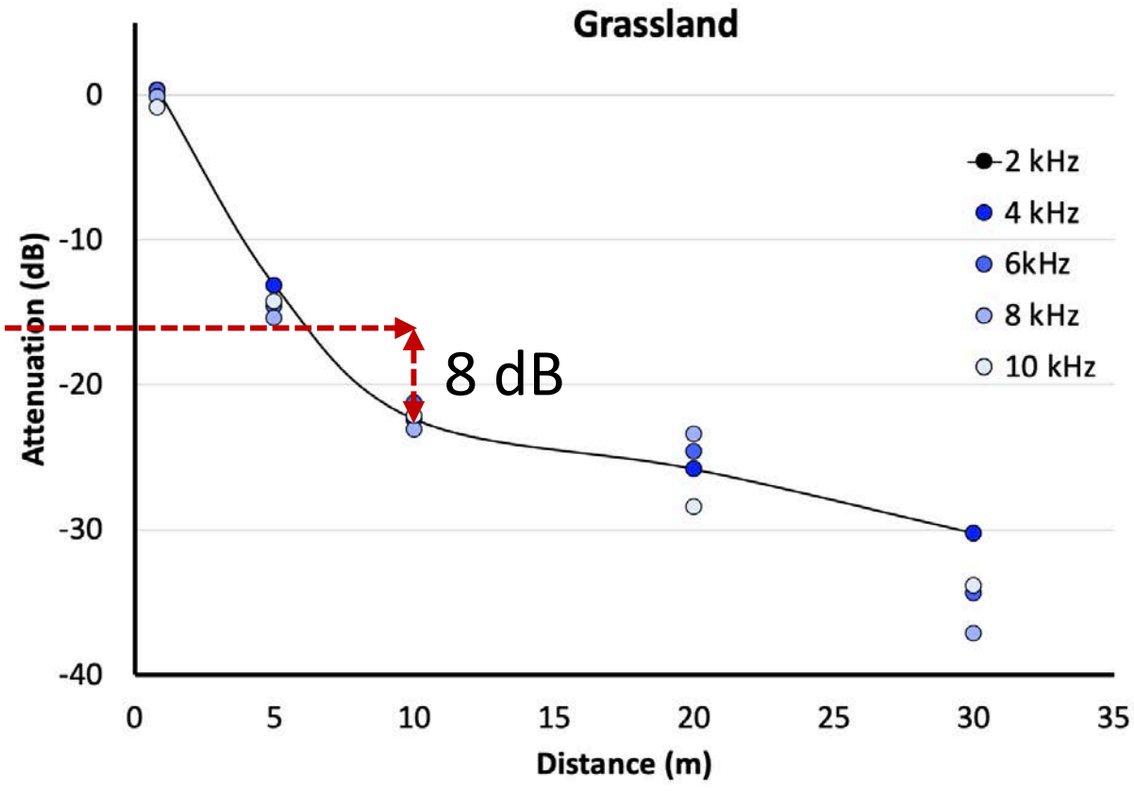

SENNHEISER


Forest
0
-10
-20
-30
-40
Attenuation (dB)
0
5
10
15
20
25
30
35
Distance (m)
2 kHz
4 kHz
6kHz
8 kHz
10 kHz


Grassland
0
-10
-20
-30
-40
Attenuation (dB)
0
5
10
15
20
25
30
35
Distance (m)
2 kHz
4 kHz
6kHz
8 kHz
10 kHz

Human language frequencies (1-3 kHz) travel farther in forest than grassland





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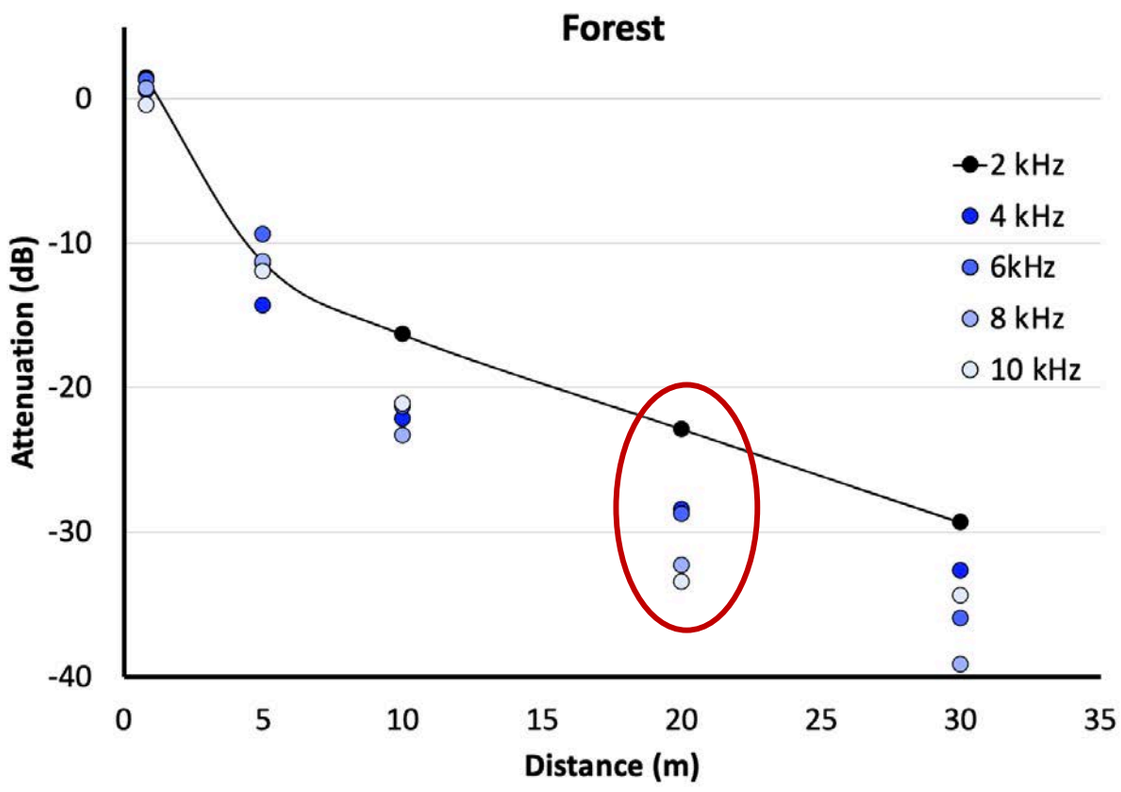

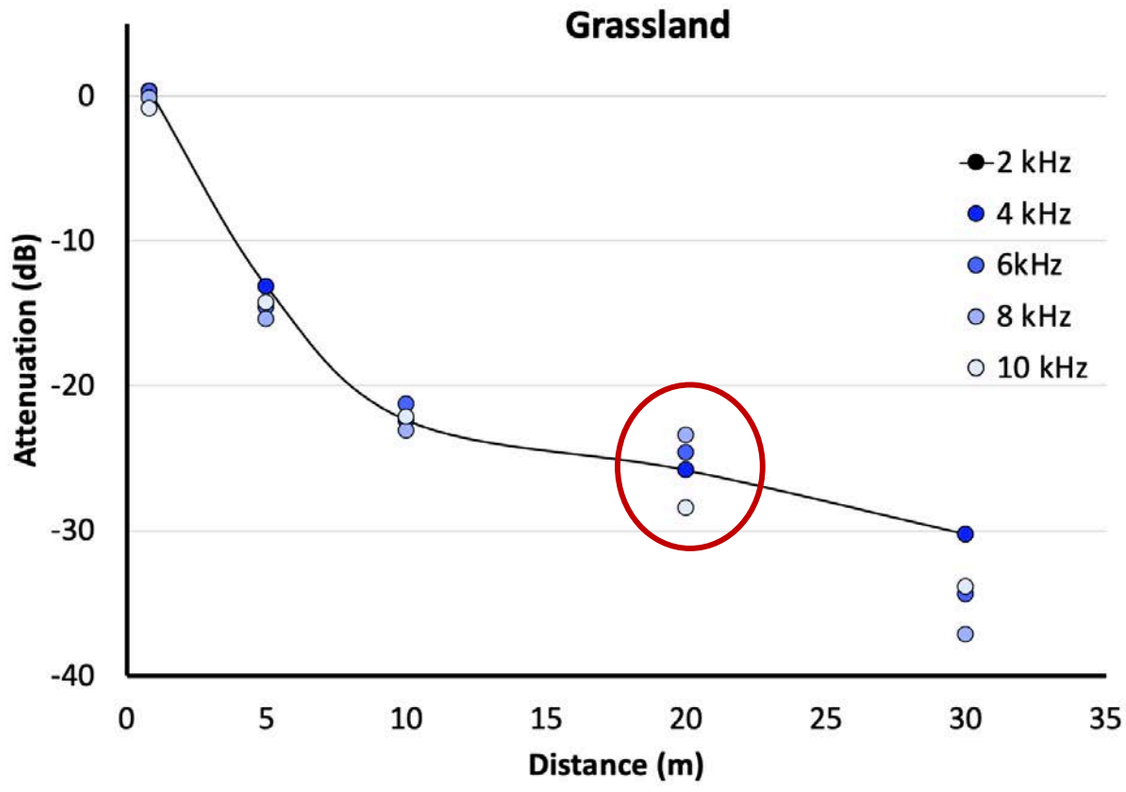

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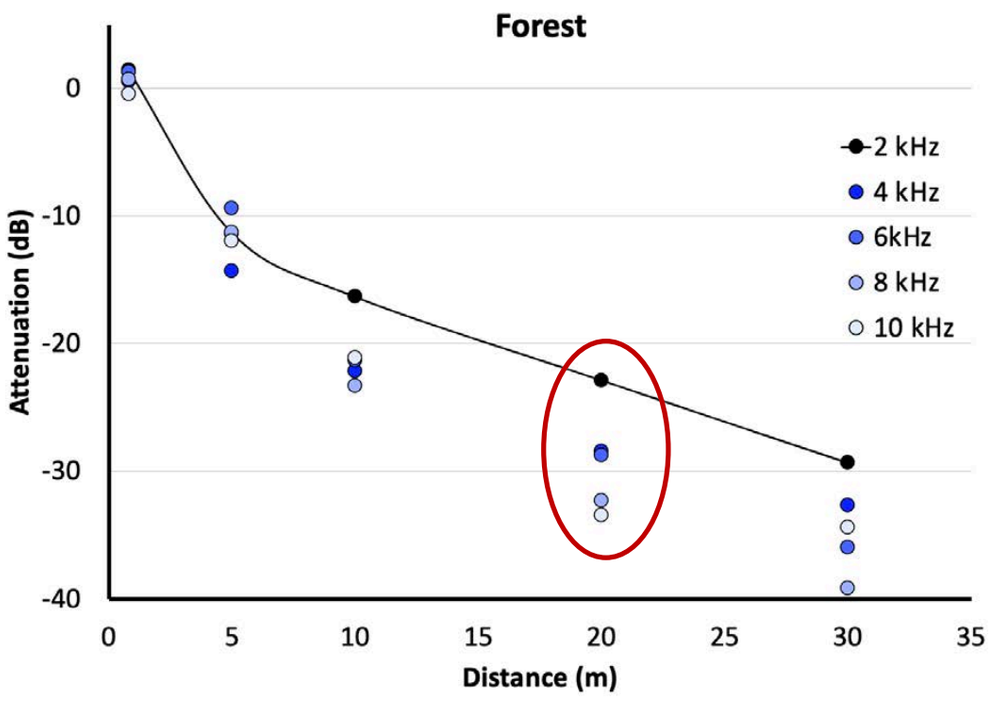
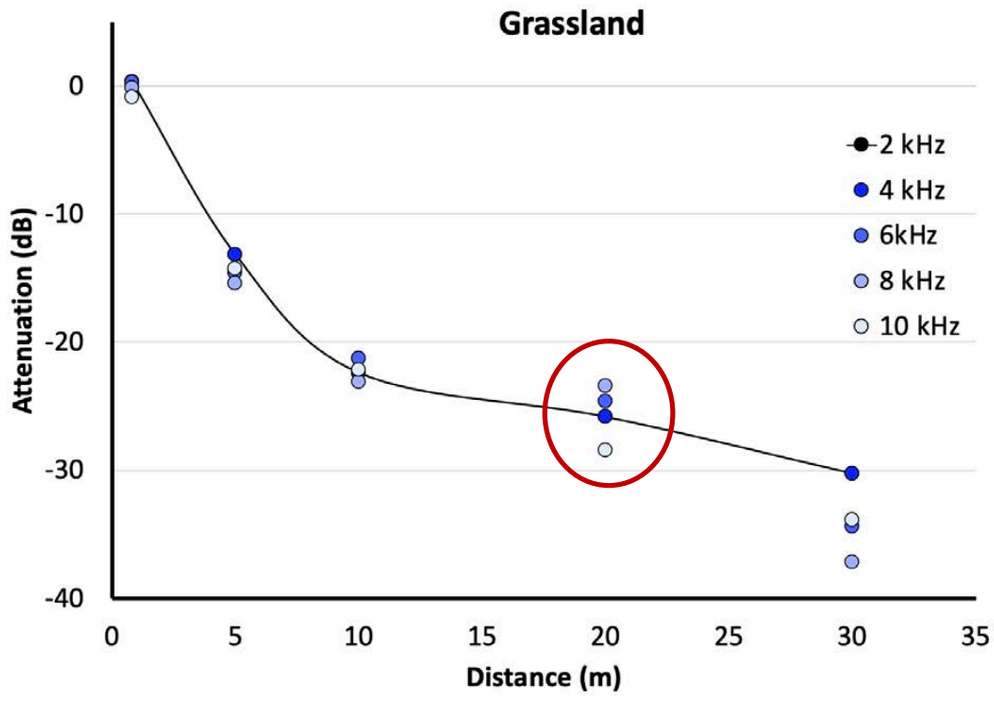
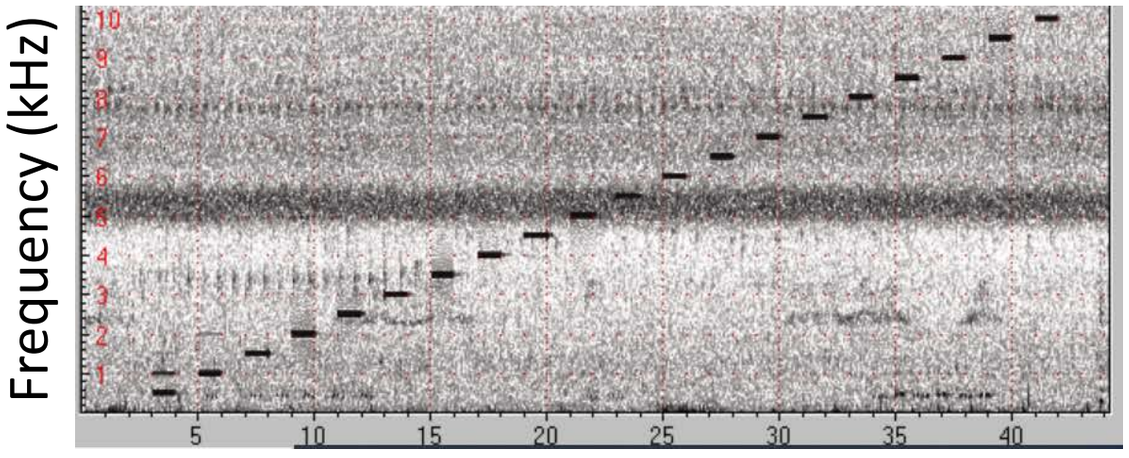
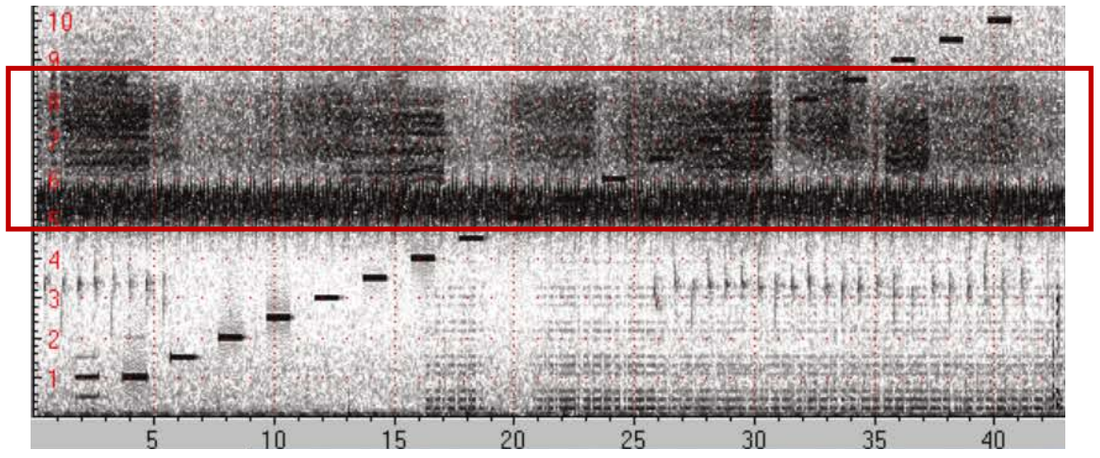




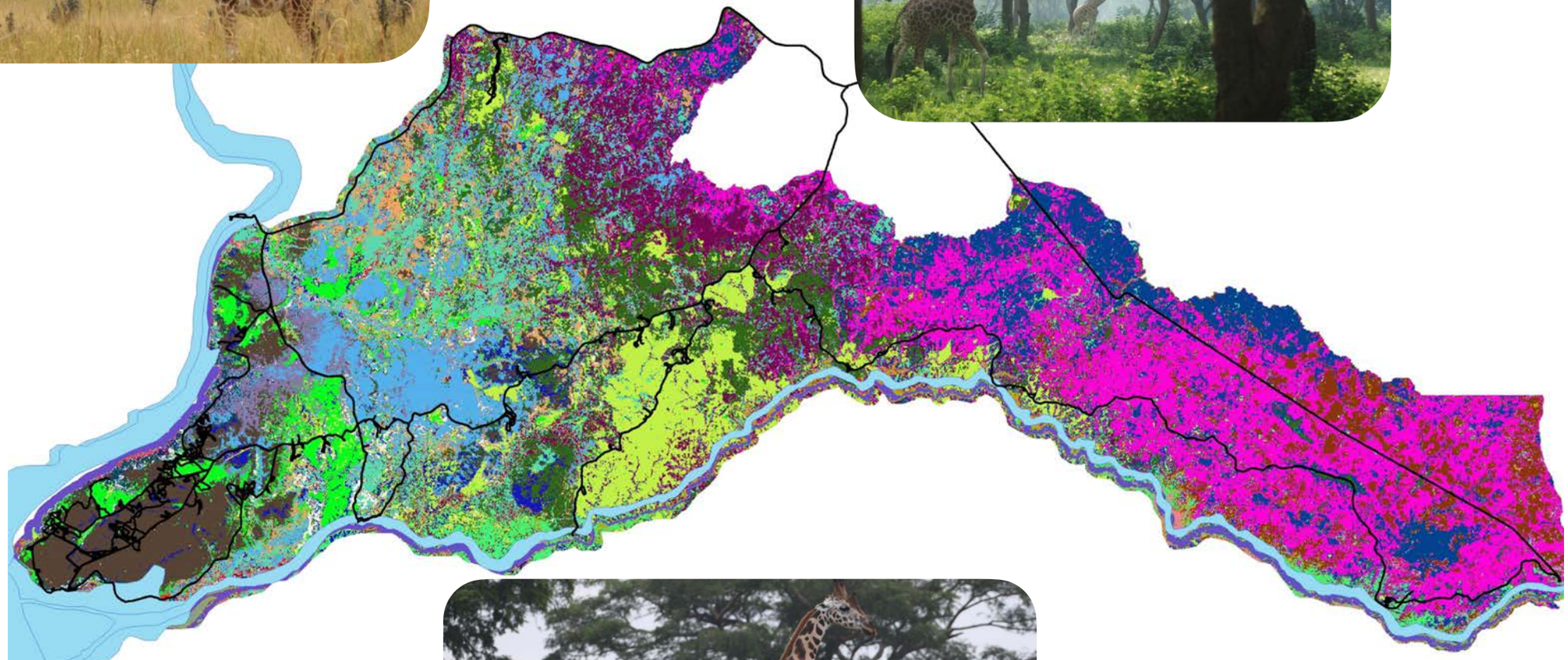
Frequencies between 5-8 kHz cannot be accurately measured in grassland due to singing insects

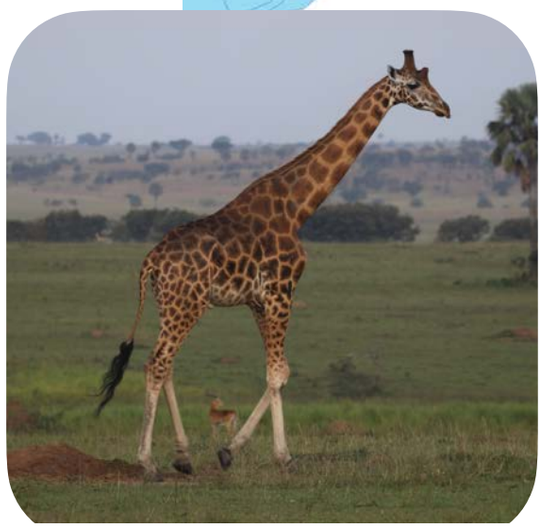




2022 field season

Sampling a wider range of habitats in Murchison Falls National Park, Uganda






TASCAM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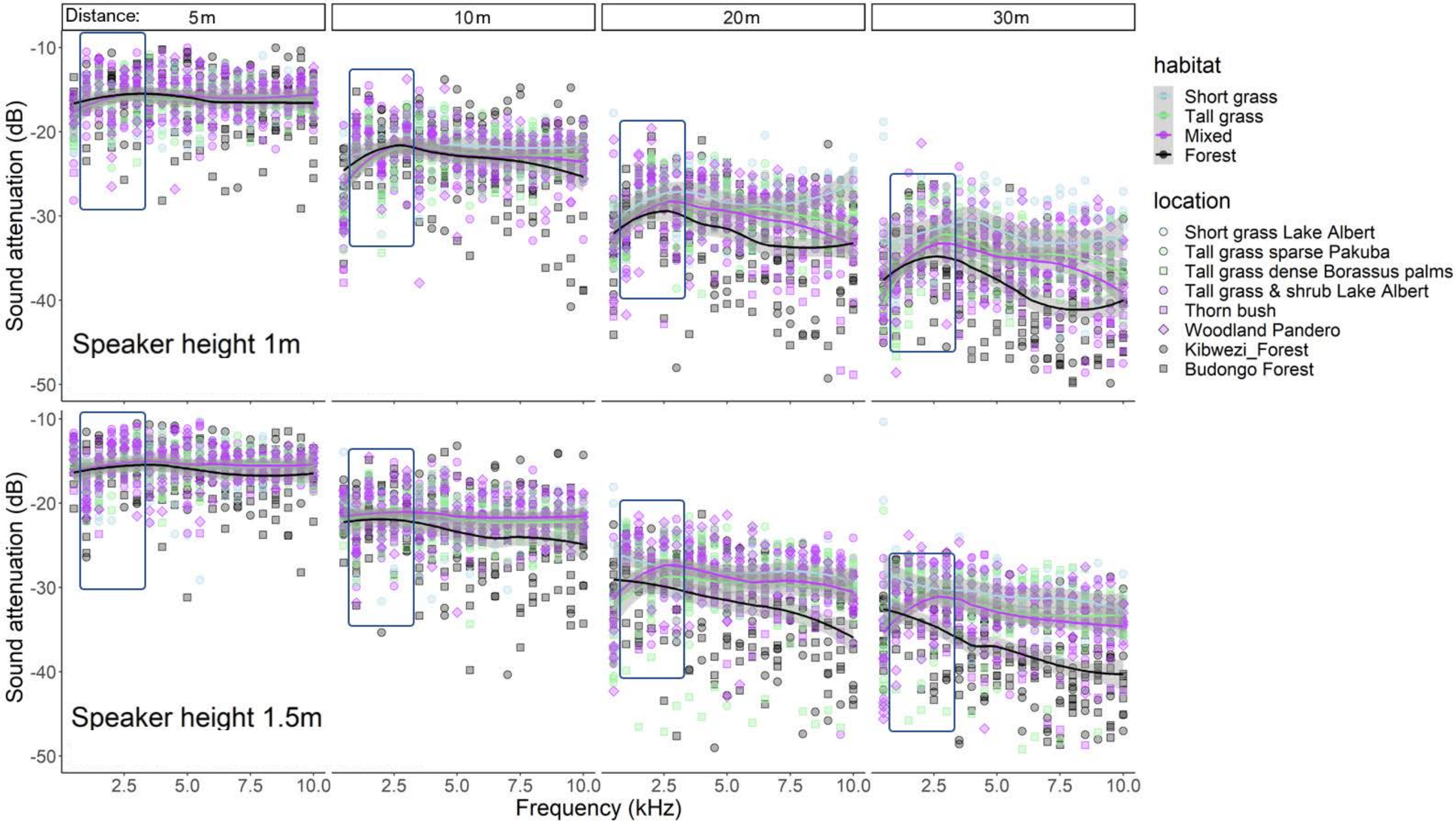
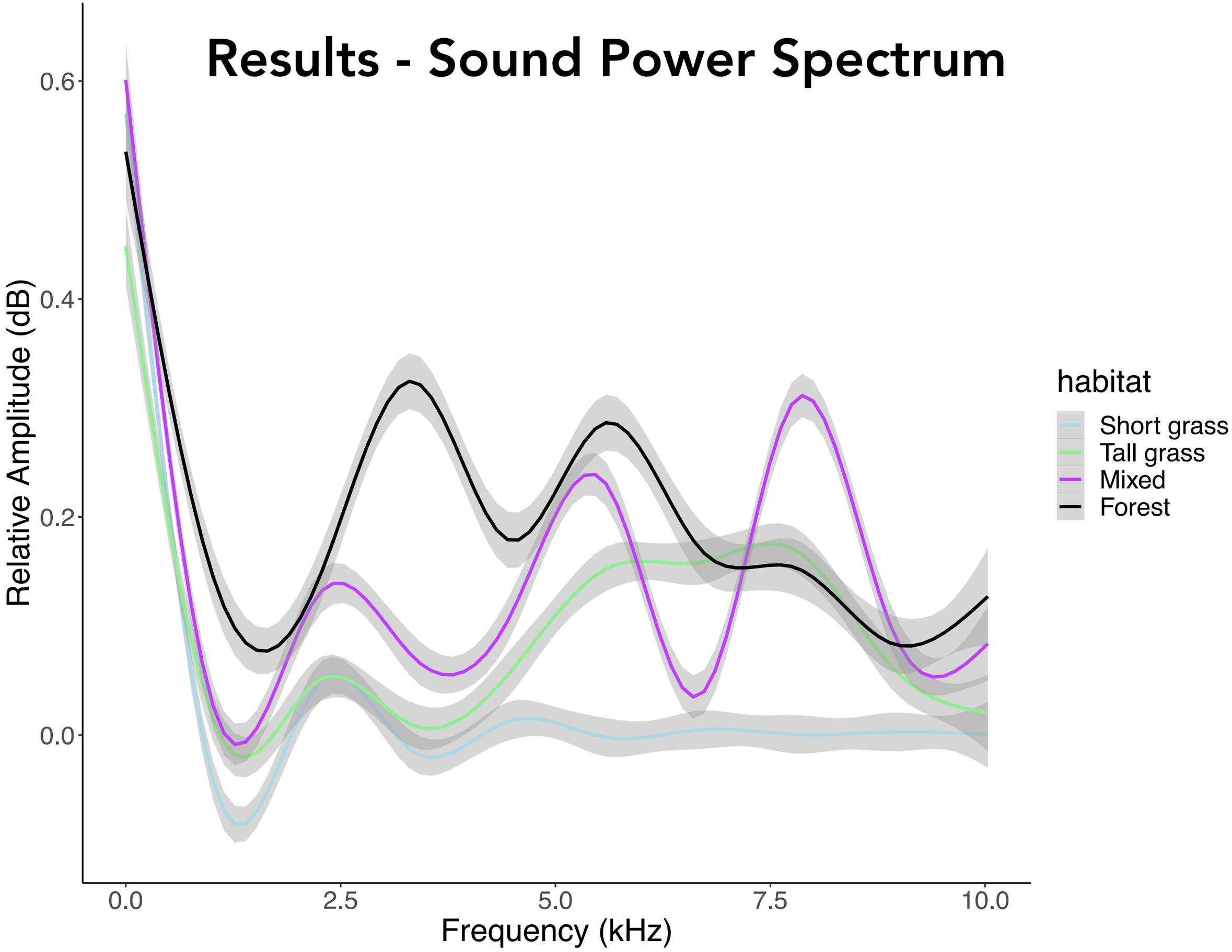
Bioacoustics Research Program

Results - Sound Attenuation Data



Results - Sound Power Spectrum



CONCLUSIONS

- Enhanced hearing (and vocal communication) between 1 and 4 kHz is well suited to the habitat acoustics of grasslands and woodlands

THANK YOU!

INSTITUTE neukom
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FULBRIGHT

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