IMPACT OF NEGATIVE FACTORS FROM TRAFFIC ON THE WILDLIFE PERMEABILITY OF GREEN BRIDGES

Jurečka Mořic, Mikita Tomáš, Čermák Petr

Mendel University in Brno / Faculty of Forestry and Wood Technology

e-mail: xjureck1@mendelu.cz

Keywords: Green bridges, Landscape fragmentation, Mitigation measures, Noise pollution, Vegetation, Transport, Wildlife behaviour, Surface Scanning, 3D model, Road ecology, Traffic safety, Photo traps

1 INTRODUCTION

Nowadays, transport not only causes better mobility for people, but also a number of negative impacts. Many associated negative factors such as noise, light pollution, temperature, etc. from traffic are generally known that affect human and wildlife. Traffic noise is one of the most significant negative factors affecting people (Jariwala et al. 2017; Singh et al. 2018) and wildlife (Parris & Schneide 2009; McClure et al. 2013; Shilling et al. 2018). Terrestrial wildlife responses to noise are reported to begin at noise levels of approx. 40 dB (Shannon et al. 2016; Fig. 1). There is a lack of studies that look at the effect of traffic noise on wildlife permeability (inc. comparison already applied mitigation measures) on directly green bridges (wildlife overpasses).

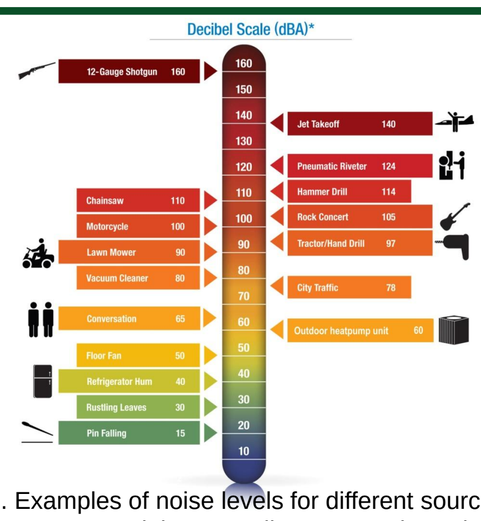

Figure 1. Examples of noise levels for different sources (source: www.rotorualakescouncil.nz; www.cdc.gov)

2 AIMS OF THE STUDY

Figure 2. Green bridge near Arbesthal

- **1)** Clarify the diffusion of negative factors from traffic on the green bridge, with a particular focus on traffic noise.
- **2)** Evaluate mitigation measures against negative factors from traffic (e.g., vegetation, noise barriers, screening fencing, etc.) on wildlife permeability across selected green bridges.
- **3)** Propose optimization for the future.

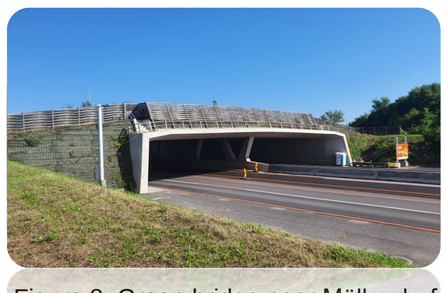

Figure 3. Green bridge near Müllendorf

3 MATERIAL AND METHODS

- The study focused on 3 green bridges over main motorways A3, A4 a expressway S4 in Austria (Fig. 2,3,4), which are located on the important migration route of the Alpine-Carpathian corridor.
- Each of the green bridges had different mitigation measures at the edge of the bridge body (i.e. fence screening, noise walls) and a different structure of planted vegetation.
- The daily traffic volume on the road sections was greater than 20 000 vehicles per day (ASFiNAG 2023), which can be considered a consistent source of noise (MZ ČR 2002).
- Wildlife permeability on green bridges have been monitored using automated photo traps (Browning, Coolife; aprrox. 30 000 records).
- Planned monitoring duration: January - December 2023
- Traffic noise was measured at regular length intervals (GPS fixed points, 61 measuring points for each bridge) and time intervals using the NTI Acoustilyzer AL1 (Fig. 5)
- Hand-held ZEB HORIZON 3D scanner by GeoSLAM was used to scan the surface and density of vegetation (Fig. 6)

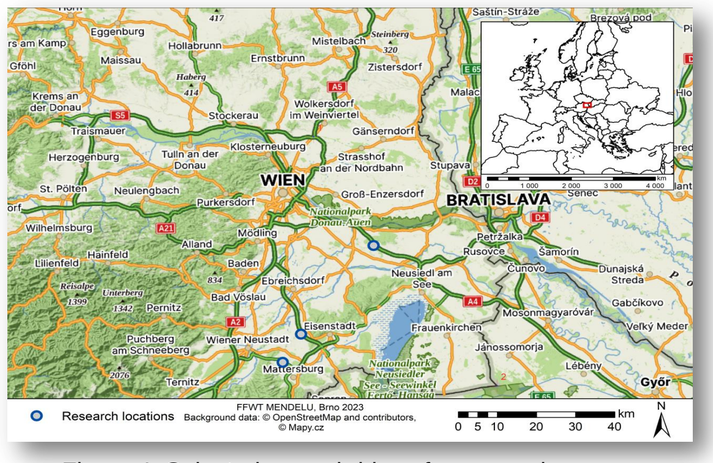

Figure 4. Selected green bridges for research

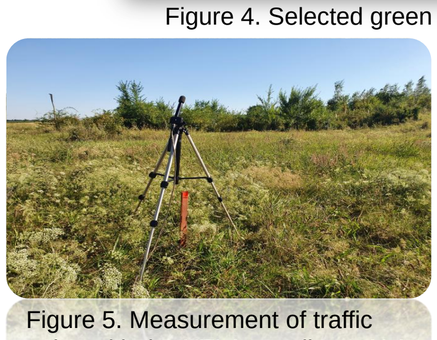

Figure 5. Measurement of traffic noise with the NTI Acoustilyzer AL1

Figure 6. Hand-held ZEB HORIZON 3D scanner

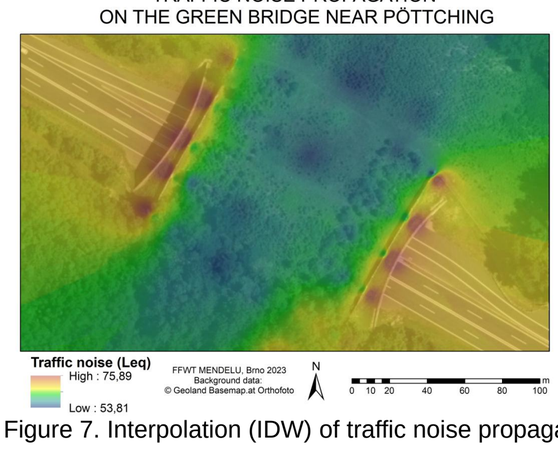

Figure 7. Interpolation (IDW) of traffic noise propagation

4 PRELIMINARY RESULTS

- Traffic noise ranging from approx. 45 dB to almost 76 dB for integrated average sound pressure (Leq) were measured.
- The wood noise barrier wall seems to reduce traffic noise (approx. 10 dB).
- The most frequent record was a roe deer.
- 3D model of the surface of the green bridges was created and interpolated map output of traffic noise (Fig. 7,8).

Figure 8. 3D model of the surface and vegetation of the green bridge

4 CONCLUSION

- Preliminary results suggest that traffic noise can be a problem, especially for sensitive species.
- Presence of vegetation or noise barriers can have an impact on the propagation of traffic noise and, as a result, probably also on the permeability of green bridges.
- Further studies in the field of road ecology are needed to ensure better landscape permeability and traffic safety.

REFERENCES

ASFiNAG. Verkehrsstatistiken 2023, Available from: https://www.asfinag.at/verkehr-sicherheit/verkehrszahlung/.

MCCLURE, Christopher JW, et al. An experimental investigation into the effects of traffic noise on distributions of birds: avoiding the phantom road. *Proceedings of the Royal Society B: Biological Sciences*, 2013, 280.1773: 20132290.

MINISTRY OF HEALTH OF THE CZECH REPUBLIC (MZ ČR). Věstník Ministerstva zdravotnictví České republiky Věstník 1/2002, Prague, 2002.

JARIWALA, Hiral J., et al. Noise pollution & human health: a review. *Noise and Air Pollutions: Challenges and Opportunities, Ahmedabad: LD College of Eng*, 2017.

PARRIS, Kirsten M.; SCHNEIDER, Angela. Impacts of traffic noise and traffic volume on birds of roadside habitats. *Ecology and society*, 2009, 14.1.

SHANNON, Graeme, et al. A synthesis of two decades of research documenting the effects of noise on wildlife. *Biological Reviews*, 2016, 91.4: 982-1005.

SHILLING, Fraser, et al. Wildlife-Crossing mitigation effectiveness with traffic noise and light. A National Center for Sustainable Transportation Research Report, 2018.

SINGH, Devi; KUMARI, Neeraj; SHARMA, Pooja. A review of adverse effects of road traffic noise on human health. *Fluctuation and Noise Letters*, 2018, 17.01: 1830001.

ACKNOWLEDGMENTS

Many thanks to the Internal Grant Agency (IGA MENDELU) for supporting the IGA research project LDF-23-IP-019. We would also like to thank Mr. Miroslav Doložílek from Technical University of Brno (Faculty of Mechanical Engineering), Mr. Jan Mareš (Greif-akustika, s.r.o.) and Environment Agency Austria for their consultation and support.

https://www.ldf.mendelu.cz/

MENDELU
Faculty of Forestry and Wood Technology