



On the association of residential green with road, railway and aircraft noise annoyance

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ABSTRACT

Residential green has recently come into focus as a measure to reduce annoyance due to traffic noise exposure. Literature suggests that various indicators of residential green may be important, namely, "greenness" of the residential areas, visible vegetation, or the presence of functional green spaces such as urban parks. Accessibility and noise pollution of the latter may also play a role. So far, studies mostly focused on road traffic noise. The objective of the present study was to investigate the effects of residential green on noise annoyance at a national scale, accounting for different transportation noise sources. We complemented the data set of the recent Swiss SiRENE survey on road traffic, railway and aircraft noise annoyance with a range of green indicators and investigated their association with noise annoyance. In this contribution, we will reveal the most promising green indicators. We will further show that exposure to residential green is positively associated with reduced noise annoyance to road traffic and railway noise, but strongly linked to increased annoyance to aircraft noise.

INTRODUCTION

Residential green has recently come into focus as a measure to reduce annoyance due to traffic noise exposure. Literature suggests that various indicators of residential green may be important, namely, "greenness" of the residential areas, visible vegetation, or the presence of functional green spaces such as urban parks. Accessibility and noise pollution of the latter may also play a role. So far, available studies mostly focused on road traffic noise.

The objective of the present study was to investigate the effects of residential green on noise annoyance at a national scale, accounting for different transportation noise sources as well as for the degree of urbanisation. To that aim, we complemented the data set of the recent Swiss SiRENE survey, a nation-wide stratified random sample of 5592 residents exposed to

transportation noise, with a range of green metrics. Their effect on noise annoyance was then investigated by means of logistic regression analysis.

This study has already been published in "Environment International", and all study details may be found there [1].

RESULTS

We found that increasing residential green is associated with reduced road traffic and railway noise annoyance. The effect corresponds to equivalent level reductions of ~6 dB for road traffic and ~3 dB for railway noise, when comparing situations with "not much green", corresponding to the 5th percentile of the study sample distribution, to "a lot of green" corresponding to the 95th percentile (Figure 1). Aircraft noise annoyance, in contrast, was found to strongly increase with increasing residential green. The latter effect corresponds to an equivalent level increase of ~10 dB (Figure 1).

The Normalized Difference Vegetation Index (NDVI) and public green spaces as identified by land use classification data (LU-green) turned out to be best suited to predict the influence of vegetation on annoyance. The effects of visible vegetation from home and accessibility and/or quietness of green spaces were found to be less strong overall, but showed interesting interactions with the degree of urbanisation regarding their effect on noise annoyance. For road traffic noise, visible vegetation and accessibility of green spaces seem to be particularly important in urban areas, while quiet green spaces are more effective in rural areas. For aircraft noise, in contrast, the degree of urbanization most noticeably modified the association between quiet LU-green or visible vegetation from home and (increased) noise annoyance, with stronger effects in urban areas.

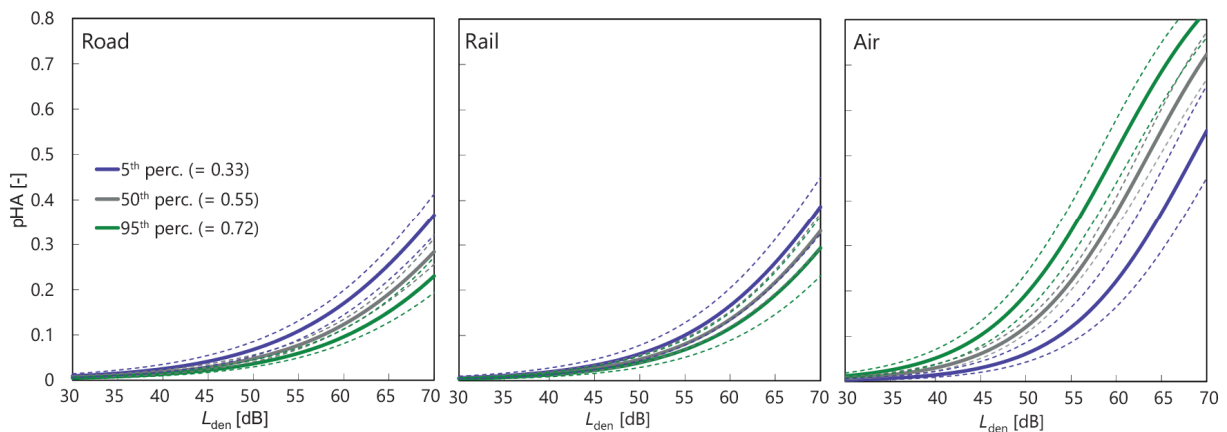


Figure 1: (taken from [1], licensed under [CC BY 4.0](https://creativecommons.org/licenses/by/4.0/)) Exposure-response curves for the probability of high annoyance (pHA) as a function of the L_{den} and residential green (quantified as Normalized Difference Vegetation Index, NDVI) for road traffic, railway and aircraft noise, including 95% CI. The three curves per plot represent the 5th, 50th and 95th percentiles of the study sample.

CONCLUSIONS

Our study demonstrates that residential green has a major positive effect on road traffic and railway noise annoyance. The unexpected effect of residential green to be strongly linked to increased aircraft noise annoyance should be confirmed and further explored in future studies. Overall, our study emphasizes that the effects of residential green is not primarily due to increased sound attenuation but goes beyond a mere reduction of the noise exposure. Consequently, noise abatement should not solely focus on reducing noise exposure but should consider a more holistic approach. It is therefore recommended to city planners, particularly in densely populated areas, to promote the protection and expansion of green spaces as a way to reduce noise annoyance and to improve the quality of life in general.

Full publication

This study has already been published in *Environment International*, DOI 10.1016/j.envint.2020.105885, and all study details may be found there [1].

REFERENCES

- [1] Schäffer, B., Brink, M., Schlatter, F., Vienneau, D., & Wunderli, J. M. (2020). Residential green is associated with reduced annoyance to road traffic and railway noise but increased annoyance to aircraft noise exposure. *Environment International*, 143. doi:10.1016/j.envint.2020.105885