

Reporting Summary

Nature Portfolio wishes to improve the reproducibility of the work that we publish. This form provides structure for consistency and transparency in reporting. For further information on Nature Portfolio policies, see our [Editorial Policies](#) and the [Editorial Policy Checklist](#).

Statistics

For all statistical analyses, confirm that the following items are present in the figure legend, table legend, main text, or Methods section.

n/a Confirmed

- | | | |
|-------------------------------------|--------------------------|--|
| ☒ | ☐ | The exact sample size (n) for each experimental group/condition, given as a discrete number and unit of measurement |
| ☒ | ☐ | A statement on whether measurements were taken from distinct samples or whether the same sample was measured repeatedly |
| ☒ | ☐ | The statistical test(s) used AND whether they are one- or two-sided
<i>Only common tests should be described solely by name; describe more complex techniques in the Methods section.</i> |
| ☒ | ☐ | A description of all covariates tested |
| ☒ | ☐ | A description of any assumptions or corrections, such as tests of normality and adjustment for multiple comparisons |
| ☒ | ☐ | A full description of the statistical parameters including central tendency (e.g. means) or other basic estimates (e.g. regression coefficient) AND variation (e.g. standard deviation) or associated estimates of uncertainty (e.g. confidence intervals) |
| ☒ | ☐ | For null hypothesis testing, the test statistic (e.g. F , t , r) with confidence intervals, effect sizes, degrees of freedom and P value noted
<i>Give P values as exact values whenever suitable.</i> |
| ☒ | ☐ | For Bayesian analysis, information on the choice of priors and Markov chain Monte Carlo settings |
| ☒ | ☐ | For hierarchical and complex designs, identification of the appropriate level for tests and full reporting of outcomes |
| ☒ | ☐ | Estimates of effect sizes (e.g. Cohen's d , Pearson's r), indicating how they were calculated |

Our web collection on [statistics for biologists](#) contains articles on many of the points above.

Software and code

Policy information about [availability of computer code](#)

- | | |
|-----------------|---|
| Data collection | The data used in this manuscript was recently published in Scientific Data (https://www.nature.com/articles/s41597-024-03287-z) and is available online: https://doi.org/10.3929/ethz-b-000666313 . The global maps of REZs aggregated in 5x5 km raster cells are available via the following link: https://doi.org/10.3929/ethz-b-000745533 . |
| Data analysis | The Python-code used to calculate the road effect zones is available on GitHub: https://github.com/mvszuri/traffic-induced-road-effect-zones . |

For manuscripts utilizing custom algorithms or software that are central to the research but not yet described in published literature, software must be made available to editors and reviewers. We strongly encourage code deposition in a community repository (e.g. GitHub). See the Nature Portfolio [guidelines for submitting code & software](#) for further information.

Data

Policy information about [availability of data](#)

All manuscripts must include a [data availability statement](#). This statement should provide the following information, where applicable:

- Accession codes, unique identifiers, or web links for publicly available datasets
- A description of any restrictions on data availability
- For clinical datasets or third party data, please ensure that the statement adheres to our [policy](#)

The time series of traffic volume predictions is available via the following link: <https://doi.org/10.3929/ethz-b-000666313>. The global maps of REZs aggregated in 5x5 km raster cells are available via the following link: <https://doi.org/10.3929/ethz-b-000745533>.

Human research participants

Policy information about [studies involving human research participants and Sex and Gender in Research](#).

Reporting on sex and gender

Use the terms sex (biological attribute) and gender (shaped by social and cultural circumstances) carefully in order to avoid confusing both terms. Indicate if findings apply to only one sex or gender; describe whether sex and gender were considered in study design whether sex and/or gender was determined based on self-reporting or assigned and methods used. Provide in the source data disaggregated sex and gender data where this information has been collected, and consent has been obtained for sharing of individual-level data; provide overall numbers in this Reporting Summary. Please state if this information has not been collected. Report sex- and gender-based analyses where performed, justify reasons for lack of sex- and gender-based analysis.

Population characteristics

Describe the covariate-relevant population characteristics of the human research participants (e.g. age, genotypic information, past and current diagnosis and treatment categories). If you filled out the behavioural & social sciences study design questions and have nothing to add here, write "See above."

Recruitment

Describe how participants were recruited. Outline any potential self-selection bias or other biases that may be present and how these are likely to impact results.

Ethics oversight

Identify the organization(s) that approved the study protocol.

Note that full information on the approval of the study protocol must also be provided in the manuscript.

Field-specific reporting

Please select the one below that is the best fit for your research. If you are not sure, read the appropriate sections before making your selection.

☐ Life sciences

☐ Behavioural & social sciences

☒ Ecological, evolutionary & environmental sciences

For a reference copy of the document with all sections, see [nature.com/documents/nr-reporting-summary-flat.pdf](https://www.nature.com/documents/nr-reporting-summary-flat.pdf)

Ecological, evolutionary & environmental sciences study design

All studies must disclose on these points even when the disclosure is negative.

Study description

In this study, traffic-dependent Road Effect Zones (REZs) are calculated by fitting a kernel density function to a dataset of traffic volume predictions on extra-urban roads. From the resulting traffic exposure maps, REZs are delineated for three different traffic volume ranges: 500-5000, 5000-10000 and above 10000 vehicles per day. This procedure is repeated for traffic predictions of 1975, 1990, 2000 and 2015. We analyse the development of the REZs at a local level (5x5 km raster cells), for global regions and globally. We also assess to what degree land use classes and Key Biodiversity Areas are influenced by REZs.

Research sample

The dataset of extra-urban road traffic volume predictions has recently been described in Scientific Data (<https://www.nature.com/articles/s41597-024-03287-z>). The traffic volumes have been predicted on all highways, primary roads and secondary roads for the years 1975, 1990, 2000 and 2015. To make these predictions, a random forest model was trained and validated on empirical traffic volume data from 46 countries or 99 328 road sections (= 3 % of the road sections in the dataset) for the year 2015. With this model predictions were made for all of the years. The hold-out as well as the out-of-sample validation indicated a high accuracy of the predictive model.

Sampling strategy

The empirical traffic volume data was collected across all continents (except Antarctica) and special attention was given that the sample of traffic volumes was representative for roads across the globe. To ensure a truly independent validation of the predictions for the year 1975, empirical traffic volume data was found from two countries that were not included to train the model. All roads contained in the traffic volume dataset were included to calculate the traffic exposure maps.

Data collection

The empirical traffic volume data was collected by national and regional road authorities in the different countries. The sources of the data are given in <https://www.nature.com/articles/s41597-024-03287-z>

Timing and spatial scale

The empirical road traffic volume data (measurements for points on a road or for entire road sections) was for the years around 2015. The earliest records were from the year 2009 and the latest records from 2020.

Data exclusions

To delineate the REZs in this paper, we only considered areas that were maximally 300 m from a road and that were along roads with 500 or more vehicles per day. These two thresholds were set based on literature about the ecological and environmental impact of roads. Most of the effects of roads are local and limited to several hundred meters from a road. The three different traffic volume ranges are applicable to different ecological and environmental impacts.

Reproducibility

The reproducibility of the study is ensured by indicating all data sources as well as publishing the computer code used to run the analyses.

Randomization

The REZs were calculated for every extra-urban highway, primary road and secondary road. In the manuscript, we aggregate the

Randomization

results locally (5x5 km raster cells), per global region and globally.

Blinding

Blinding was not relevant for our study, as we were using freely available empirical road traffic data that was not specifically collected for this study.

Did the study involve field work?

☐ Yes

☒ No

Reporting for specific materials, systems and methods

We require information from authors about some types of materials, experimental systems and methods used in many studies. Here, indicate whether each material, system or method listed is relevant to your study. If you are not sure if a list item applies to your research, read the appropriate section before selecting a response.

Materials & experimental systems

n/a	Involved in the study
☒	☐ Antibodies
☒	☐ Eukaryotic cell lines
☒	☐ Palaeontology and archaeology
☒	☐ Animals and other organisms
☒	☐ Clinical data
☒	☐ Dual use research of concern

Methods

n/a	Involved in the study
☒	☐ ChIP-seq
☒	☐ Flow cytometry
☒	☐ MRI-based neuroimaging