

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 (<i>n</i>) 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. <i>F</i> , <i>t</i> , <i>r</i>) with confidence intervals, effect sizes, degrees of freedom and <i>P</i> 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 <i>d</i> , Pearson's <i>r</i>), 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	No commercial, open-source, or custom code was used to collect the data in this study. All datasets were obtained from publicly available sources, and no software tools were involved in the data acquisition process.
Data analysis	Spatial data were processed and maps produced with ArcGIS Desktop 10.8 (Esri, Redlands, CA, USA). Statistical plots were created using Origin 2024 (OriginLab Corporation, Northampton, MA, USA). No custom or open source code was used.

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 global 1 km resolution river flood hazard maps with a 1-in-100-year return period were obtained from the European Commission Joint Research Centre (<https://data.jrc.ec.europa.eu/collection/id-0054>). Historical urban extent data were sourced from the STARCloud platform (<https://data-starcloud.pcl.ac.cn/data-nav/>)

remote-sensing). Future urban expansion projections under the Shared Socioeconomic Pathways were obtained from the GeoSimulation database (<http://www.geosimulation.cn/GlobalSSPsUrbanProduct.html>). Urban population data for 2000–2020 were downloaded from the Global Human Settlement Layer (<https://human-settlement.emergency.copernicus.eu/>). Future urban population projections under Shared Socioeconomic Pathways were accessed via Figshare (<https://doi.org/10.6084/m9.figshare.19608594.v2>). Urban economic data were obtained from Zenodo (<https://zenodo.org/records/5880037>). Global administrative boundary data were retrieved from GADM version 4.1 (<https://gadm.org/data.html>).

Research involving human participants, their data, or biological material

Policy information about studies with [human participants or human data](#). See also policy information about [sex, gender \(identity/presentation\)](#), [and sexual orientation](#) and [race, ethnicity and racism](#).

Reporting on sex and gender	No sex and gender information was collected in this study.
Reporting on race, ethnicity, or other socially relevant groupings	No information on race, ethnicity, or other socially relevant groupings was collected in this study.
Population characteristics	No information on population characteristics was collected in this study.
Recruitment	No recruitment was conducted in this study.
Ethics oversight	This study did not involve human or animal subjects and therefore did not require ethical approval.

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

Ecological, evolutionary & environmental sciences study design

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

Study description	This study assessed global urban flood exposure using gridded spatial datasets of urban land, population, and economy. No treatment or experimental manipulation was applied. The analysis was based on observational data aggregated to subnational administrative units, with urban areas as the primary unit of analysis. Statistical models were used to evaluate spatial and temporal exposure patterns, without experimental replicates.
Research sample	The study sample consists of urban areas worldwide.
Sampling strategy	No formal sample size calculation was performed. The study includes all available global urban areas with complete data to maximize coverage and representativeness.
Data collection	All data used in this study were obtained from publicly available global databases and remote sensing products. Data collection was performed by the original data providers using satellite imagery and statistical surveys. The authors did not conduct primary data collection but compiled and processed these datasets for analysis.
Timing and spatial scale	The data cover the period from 2000 to 2020 with observations every five years, and future projections from 2030 to 2100 at ten-year intervals. All data were obtained from publicly available global datasets at the urban scale.
Data exclusions	No data exclusions were performed. All datasets obtained according to the study's criteria were fully analyzed without omission.
Reproducibility	This study is based on analysis of publicly available observational datasets and modeling. No laboratory or field experiments were conducted. All data processing and analysis steps were documented to ensure reproducibility.
Randomization	This study did not involve grouping of samples or participants, as it is based on observational spatial data analysis of global urban areas. Therefore, allocation into groups or control of covariates through grouping is not applicable.
Blinding	Blinding was not applicable to this study because the analysis was based on publicly available spatial datasets without experimental treatments or subjective assessments.
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
☒	☐ Plants

Methods

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

Plants

Seed stocks	No seed stocks or plant materials were used in this study. Therefore, this item is not applicable.
Novel plant genotypes	No novel plant genotypes were produced or used in this study. Therefore, this item is not applicable.
Authentication	No seed stocks or novel genotypes were used in this study. Therefore, authentication procedures and mutation effect assessments are not applicable.