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Reporting Summary

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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 *Only common tests should be described solely by name; describe more complex techniques in the Methods section.*
☒	☐	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 *Give P values as exact values whenever suitable.*
☒	☐	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	We used the Ecosystem Demography Model Version 2 (ED2) in order to simulate the effect of global climate change and regional deforestation on the water cycle. ED2 is an individual-based terrestrial biosphere model that describes vegetation dynamics (growth, reproduction, and mortality), and accompanying energy, carbon and water fluxes of heterogeneous and functionally diverse plant canopies as a function of climate, soils, and annually-changing human disturbance characteristics.
Data analysis	we created a model network of 37 dams and reservoirs using HEC-ResSim, a well-established and simulation model developed by the US Army Corps of Engineers for feasibility and planning purposes.

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/reviewers. We strongly encourage code deposition in a community repository (e.g. GitHub). See the Nature Research 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 list of figures that have associated raw data
- A description of any restrictions on data availability

The HEC-ResSim model with all input and out data will be available from the corresponding author upon reasonable request

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 interdisciplinary study synthesize information from global/regional projections, hydropower development plans, and a series of computer models considering biosphere dynamics, surface hydrology, and reservoir routing. The study aimed at understanding the effects of Amazon's future climate and deforestation on hydropower generation in Brazil.
Research sample	We studied 37 large proposed hydropower dams in the Tapajos river basin in the Brazilian Amazon. These dams account for nearly 50% of the inventoried potential expansion in Brazil.
Sampling strategy	The Tapajos region was selected because it represents the critical sustainability challenges that Brazil and other Amazon countries are facing. This region is an important Amazonian tributary, with large natural parks and indigenous reserves, but it is also the center of agricultural (soy) production and hydropower development. We selected these 37 dams specifically based on the Brazilian classification of large national dams, which are those with a installed capacity of 30 MW or greater.
Data collection	A database compiled for this study from the national hydropower inventory at ANEEL's library in Brasilia in November 2014 and updated it in February of 2016 based on recent project status updates and information collected in the field. All other data were compiled from online databases.
Timing and spatial scale	Baseline (historical) simulations were carried out for 1986-2005. Future projections were made for 2026-2045. All simulations were carried out at daily time steps.
Data exclusions	No data were excluded from the analysis.
Reproducibility	Reproducibility in this study was ensure by using datasets and models that are well recognized in the scientific literature and that are available for future use. For instance, all input metereological data came from the UK's Met Office Hadley Centre and are widely available in their website. Moreover, the hydropower reservoir simulation tool used can be downloaded and used for free by anyone. Apart from that, the experiments carried out were based on computer simulations and can be repeated at any given time.
Randomization	This aspect is not particular to our study as we based most of our analyses in computer simulations. In order to account for variability and uncertainty, however, we did carried out 20-yr long simulations at daily temporal resolution
Blinding	Blinding was not particularly relevant to our study for the same reasons as stated above.

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
☒	☐ Animals and other organisms
☒	☐ Human research participants
☒	☐ Clinical data

Methods

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