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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 | no software code was used in data collection |
| Data analysis | the code for Figure 4 is on github (https://github.com/YanleiFeng/Hot-droughts-in-the-Amazon-A-window-to-a-future-hypertropical-climate-Figure4/tree/main). R version 4.4.2 was used for the BIONTE statistics, with rjags 3.2.0, lavaan 0.6-3 with details on github found in Dyer et al. (Dyer, L., Chambers, J., Pastorello, G. & Weber, A. Hot Droughts and Forest Tree Dynamics in the Amazon - Statistical Models, Scripts, Data, and Outputs. https://www.osti.gov/biblio/2561510 (2025) doi:10.15485/2561510.) |

Policy information about [availability of data](#)

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

Data

- 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 datasets used in this publication are available in the NGEE-Tropics Data Archive (<https://data.ess-dive.lbl.gov/portals/ngeetropics>). Lima et al. (2022) contains plot-level growth, mortality, wood density, and biomass data for the BIONTE inventories in Manaus. Pastorello et al. (2022)⁸³ includes species-level wood density data for Central Amazon species, harmonized from multiple sources. Meng et al. (2023)¹⁰⁵ packages forcing data from CESM2/CMIP6, with sub-daily resolution vapor pressure deficit estimates and adding corresponding projections of drought impacts at the ZF2 K34 site for the period between 2015-2100. Pastorello et al. (2023)⁸⁸, contains long-term (1980-2016) micrometeorological data from the Embrapa data collection system at Adolpho Ducke Reserve in Manaus, Brazil, which was used to derive drought index data, also included in this dataset. Araujo et al. (2023)⁹² contains selected micrometeorological and soil moisture data from the ZF2 K34 site around the period of the 2015/16 El Niño event. Finally, Gimenez et al. (2021)¹⁰⁶ includes sap velocity data used in this analysis. We also included the code and outputs for the mortality analysis as a data package⁴¹ (Dyer et al. 2025).

Lima, A. J. N. et al. Growth, Mortality, Wood Density, Biomass Data from BIONTE Inventories in Manaus, Brazil. NGEE-Tropics Data Collection. (Dataset). <https://doi.org/10.15486/ngt/1898910> (2022).

Pastorello, G. et al. Harmonized Wood Density Data for Central Amazon Species. NGEE-Tropics Data Collection. (Dataset). <https://doi.org/10.15486/ngt/1898906> (2022).

Meng, L., Koven, C., Pastorello, G. & Chambers, J. Forcing Data (CESM2/CMIP6) for Projection of Drought Impacts (2015-2100) at the K34 Site in Manaus, Brazil. NGEE-Tropics Data Collection. (Dataset). <https://doi.org/10.15486/ngt/1923910> (2023).

Araujo, A. et al. Selected Micrometeorological and Soil Data from the Manaus ZF2 K34 Eddy Covariance Tower for the 2015/16 El Niño Event. NGEE-Tropics Data Collection. <https://doi.org/10.15486/ngt/1958362> (2023).

Gimenez, B. et al. Sap Velocity and Leaf-Level Measurements in Manaus and Santarém - Brazil. NGEE-Tropics Data Collection. <https://doi.org/10.15486/ngt/1570380> (2021).

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- 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 datasets used in this publication are available in the NGEE-Tropics Data Archive (<https://ngt-data.lbl.gov/api/api-auth/login/?next=/>). Datasets were published as part of our submissions process and identified with these references:

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

n/a

Reporting on race, ethnicity, or other socially relevant groupings

n/a

Population characteristics

n/a

Recruitment

n/a

Ethics oversight

n/a

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	Annually-resolved forest demographics data from a > 30 year selective logging experiment were employed to study changes over time. Demographics data were coupled with ecophysiological field data to explore for mechanistic drivers. Data from a suite of Earth system climate models were used to place the field data into the context of future climate states.
Research sample	Samples included annual measurements for trees on 12 ha of forest demographics plots, along with ecophysiological field data at nearby locations that included soil moisture, transpiration from sapflow sensors, and micrometeorology.
Sampling strategy	The demographics plots were established as an experimental block design to study the impacts of selective logging on forest dynamics processes, with experimental logging treatments initiated in the mid 1980s. Ecophysiological sensors were installed on trees and in pits near an eddy covariance tower ~10km from the logging treatment plots in similar forests.
Data collection	Data collection for the BIONTE experiment has included dozens of field techs, students from all levels and researchers for more than 30 years on an annual basis. The ecophysiological data was collected by INPA students and researchers and scientists working on the NGEE-Tropics project (https://ngee-tropics.lbl.gov/)
Timing and spatial scale	Data for the demographics plots were collected annually. Ecophysiological data was collected by either automated sensors with collection at minute to hourly time scales, or with handheld sensors and collection times that varied with the specific measurements.
Data exclusions	Gaps in tree diameter measurements from missed years or missing individual measurements were filled linearly between the two closest measured data points.
Reproducibility	The scale and duration of the BIONTE experiment is not reproducible in the sense indicated here. The other measurements were observational and not experimental.
Randomization	Given the scale of the BIONTE experiment, randomization as indicated here was not possible. The ecophysiological sensors required installation near the tower to provide power.
Blinding	This approach is not applicable to our study.
Did the study involve field work?	☒ Yes ☐ No

Field work, collection and transport

Field conditions	Field work was conducted over a > 30 year period at forest sites in the Brazilian Amazon with mean annual precipitation of ~2300mm and mean annual temperature of 26.7 C
Location	Plot were located ~50km north of Manaus, Brazil (-2.638, -60.157) on a reserved managed by Brazil's National Institute for Amazon Research (INPA)
Access & import/export	The research was conducted in close collaboration with INPA scientists and students who are co-authors on the paper following all appropriate Brazilian laws and regulations.
Disturbance	No activities causing disturbance were conducted as part of this study. The logging treatments were conducted in the mid-1980s by INPA scientists.

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

Methods

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

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

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Dual use research of concern

Policy information about [dual use research of concern](#)

Hazards

Could the accidental, deliberate or reckless misuse of agents or technologies generated in the work, or the application of information presented in the manuscript, pose a threat to:

No	Yes
☒	☐ Public health
☒	☐ National security
☒	☐ Crops and/or livestock
☒	☐ Ecosystems
	Any other significant area

Experiments of concern

Does the work involve any of these experiments of concern:

No	Yes
☒	☐ Demonstrate how to render a vaccine ineffective
☒	☐ Confer resistance to therapeutically useful antibiotics or antiviral agents
☒	☐ Enhance the virulence of a pathogen or render a nonpathogen virulent
☒	☐ Increase transmissibility of a pathogen
☒	☐ Alter the host range of a pathogen
☒	☐ Enable evasion of diagnostic/detection modalities
☒	☐ Enable the weaponization of a biological agent or toxin
☒	☐ Any other potentially harmful combination of experiments and agents