

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
<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 | Data for this study was collected via Google Earth Engine (MODIS) and the following sources: http://www.gloh2o.org/ (MSWEP), https://cds.climate.copernicus.eu/cdsapp#!/dataset/reanalysis-era5-land?tab=overview (Soil Water Content and temperature), https://lpdaac.usgs.gov/dataset_discovery/measures/measures_products_table/vcf5kyr_v001 (Vegetation Fractional Cover), https://sedac.ciesin.columbia.edu/data/collection/gpw-v4 (Population) and https://data.worldbank.org/indicator/ny.gdp.mktp.cd (Income) |
| Data analysis | Data processing was performed with python 3.0 and the core scripts (change in vegetation functioning and driver attribution) will be publicly available on GitHub and from the corresponding author directly upon request. Data visualisation was done with python (statistics and plots) and ArcGIS 10.5 (maps). |

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

A data availability statement was presented in the manuscript. All data are either publicly accessible or are available upon 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](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	This study presents a remote sensing-based approach to assess vegetation functioning based on alterations in the vegetation-precipitation relationship in global drylands over the past two decades (2000 - 2015). Moreover, potential drivers of observed changes, including both climatic and anthropogenic driving factors are assessed.
Research sample	The study is restricted to global drylands and satellite data at a spatial resolution of 1km has been used determining the number of pixels analyzed.
Sampling strategy	Global drylands within this study are defined as environments that are predominantly water-limited, that is when the relative importance of the water constraint (compared to radiation and temperature) is greater than 50% . Areas that have more than 1000 mm mean annual precipitation have been excluded, as in these areas vegetation is likely to be impacted by other climatic variables beyond precipitation. Bare soil, irrigated cropland, water bodies and areas with an aridity index below 0.3 (hyper-arid areas), were removed.
Data collection	The satellite imagery were all collected and provided in their own standard formats. These have been analysed by a method to quantify changes in vegetation functioning (SeRGS) introduced by the main author (Christin Abel) in a previous paper. Only areas showing significant positive or negative changes (Mann-Kendall, $p < 0.05$) were considered in the following. An empirical approach to estimate the relative importance of driving factors to identified changes (in %) has been used. Drivers were grouped into four classes: meteorological drivers, fire frequency, changes in population (density) and changes in vegetation cover; and both the main and second most important driver have been reported. The method is described in detail in the method section in the paper.
Timing and spatial scale	Archived satellite imagery used in this study covered the period from 2000-2015. While MOIDS and population data are provided at 0.0083 degree spatial resolution, MSWEP, soil water content and temperature are provided at 0.25 degree and vegetation fractional cover at 0.05 degree respectively. We resampled all datasets to 0.0083 degree (ca. 1km) spatial resolution and integrate them on an annual basis.
Data exclusions	Pixels that fall outside the dryland mask are excluded in the study.
Reproducibility	All the analyses were based on freely available satellite products. Methods used to determine changes in vegetation functioning and potentially related driving factors are described in detail in the method section of the paper and the code used will be available on GitHub and from the corresponding author (Christin Abel) directly upon request, so the results can be reliably reproduced.
Randomization	Randomization does not apply to this study as we performed wall-to-wall mapping globally with satellite images.
Blinding	Blinding is not relevant for our study as we used well-defined criteria for grouping and included all the valid observations within each group.
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