nature research

https://doi.org/10.1038/s41893-020-00597-z

Supplementary information

The human–environment nexus and vegetation–rainfall sensitivity in tropical drylands

In the format provided by the authors and unedited

Supplementary material

The human-environment nexus and vegetation-rainfall-sensitivity in tropical drylands

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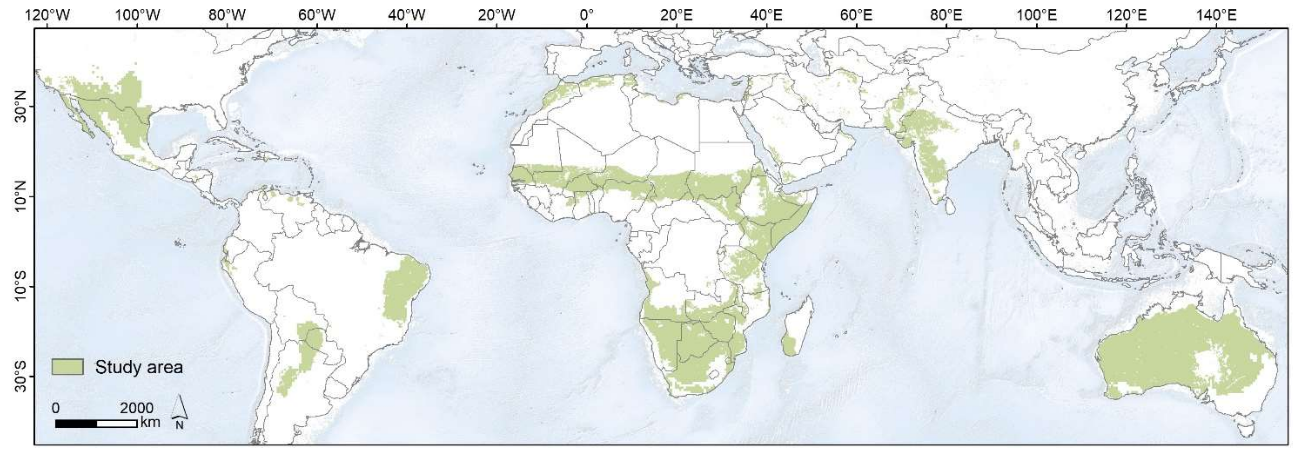
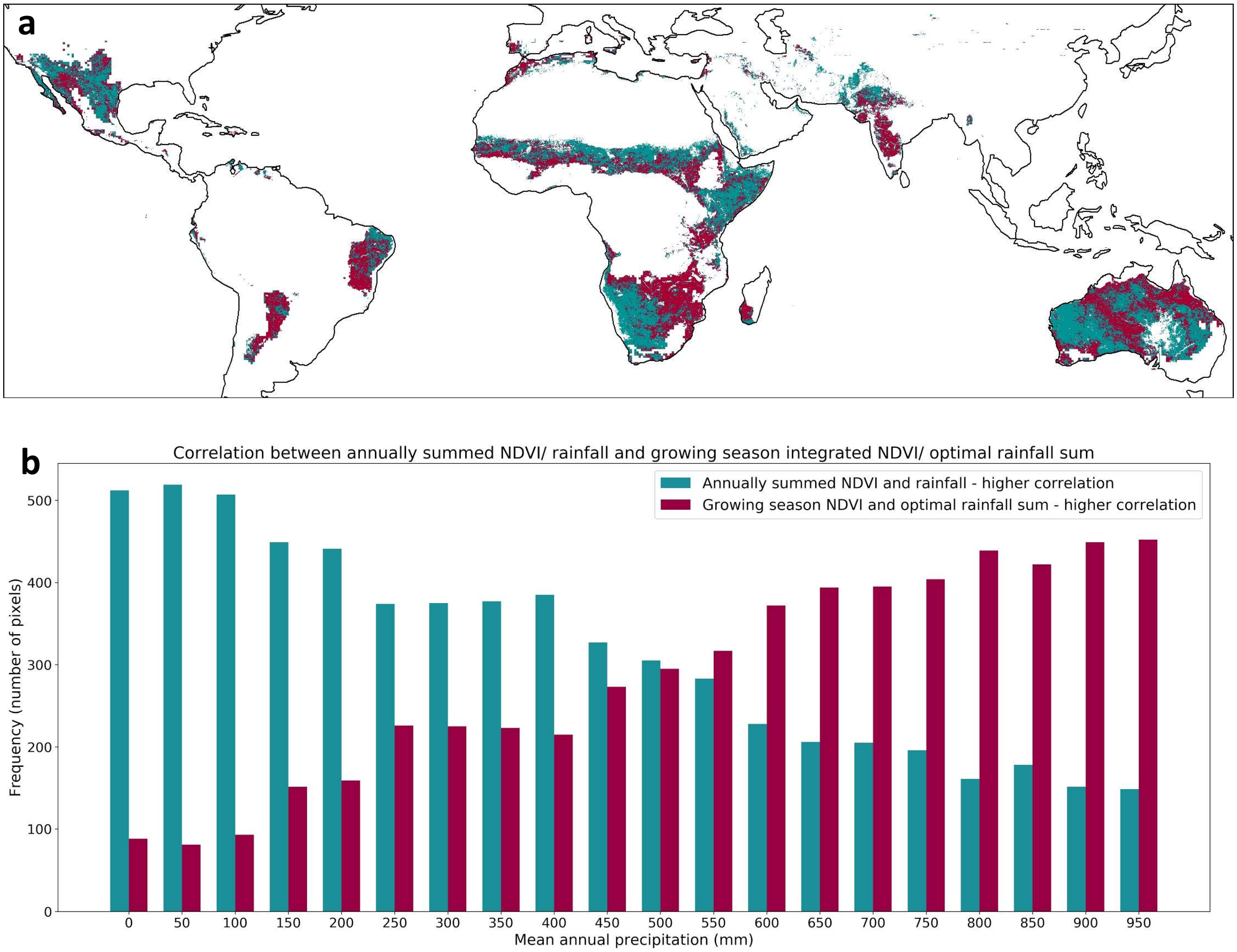
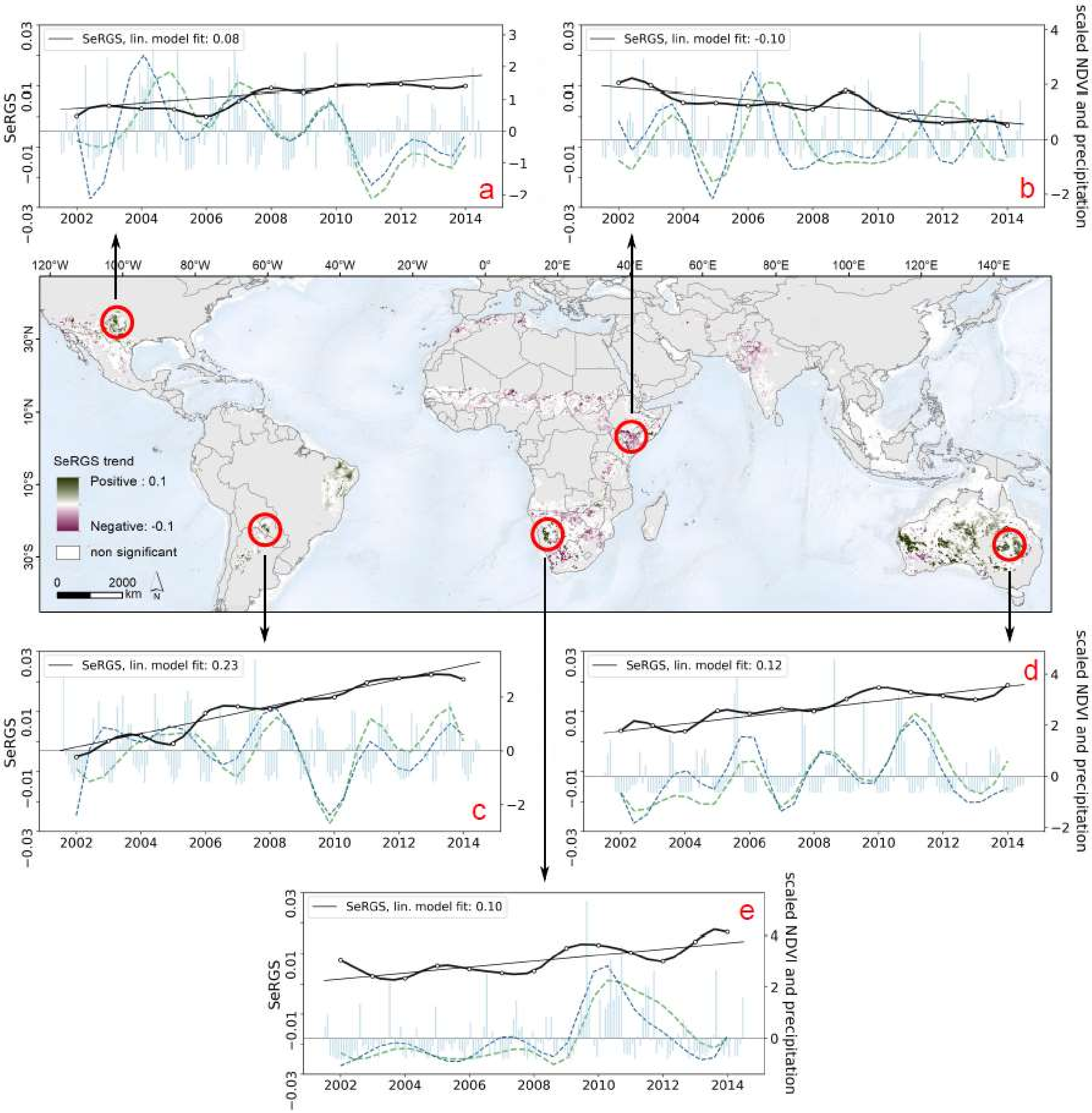


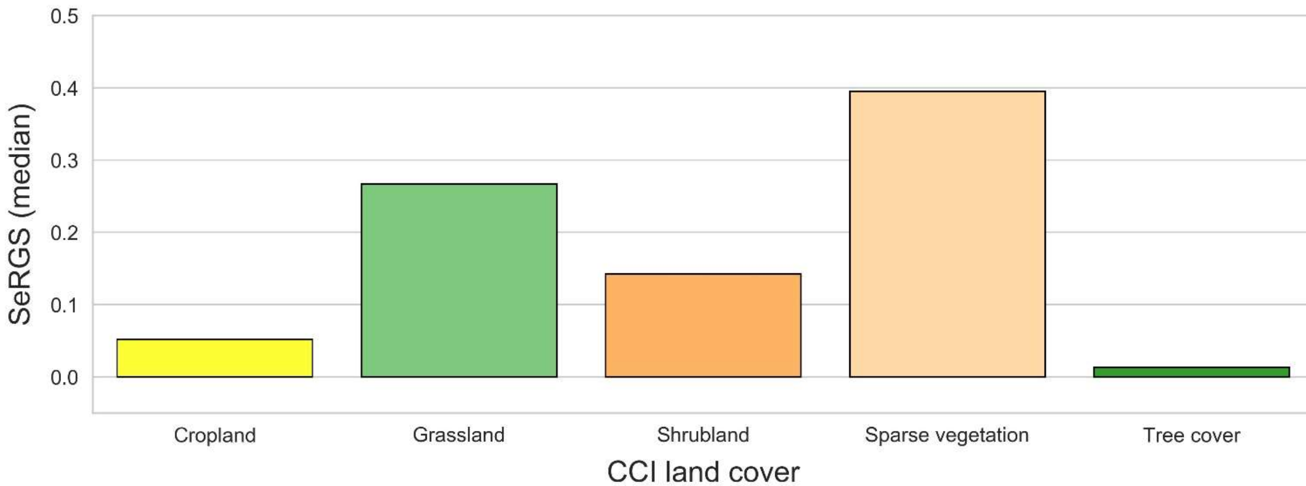
Supplementary Fig. 1. Tropical dryland areas as delineated in this study (see methods) at 0.05 degrees spatial resolution.



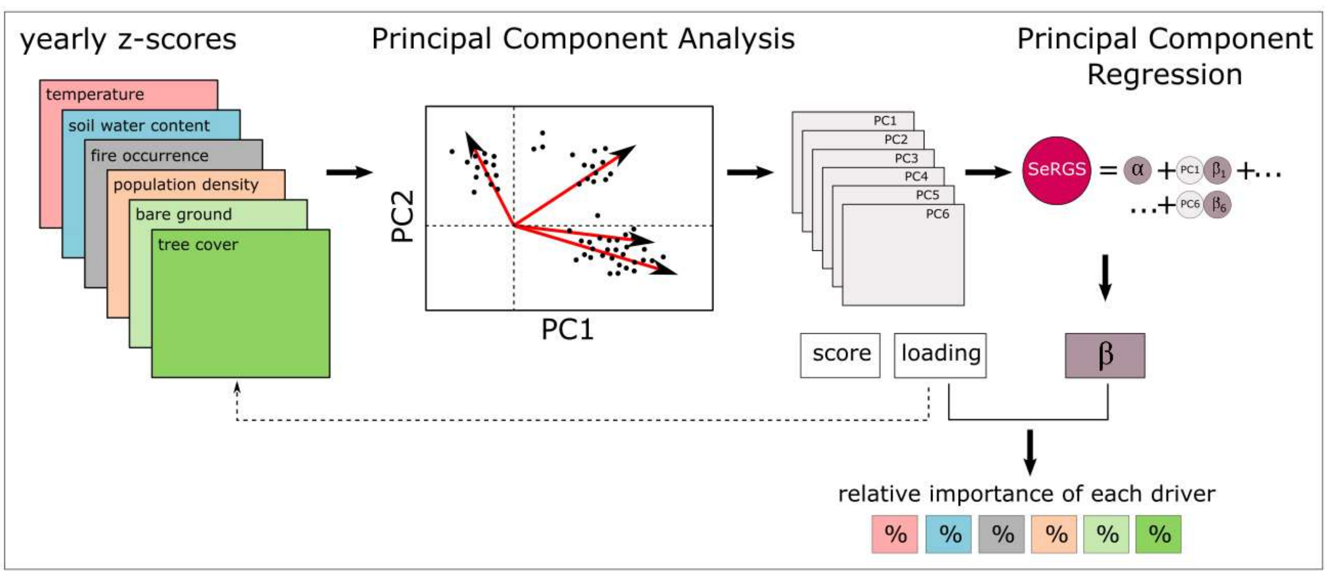
Supplementary Fig. 2. a) Correlation between NDVI and rainfall (annually and seasonally integrated) over all years from 2000 – 2015. Blue areas denote that the correlation between the NDVI and rainfall annual sums is higher than the correlation between NDVI integrated over the growing season and the rainfall optimal sum. The optimal sum describes rainfall that falls within the growing season + x months prior (selecting the period being most significantly related to growing season NDVI), where x is the number of months ranging from 1-12. Red colors represent the opposite. Based on that, we conclude that different integration methods (annual or seasonal) are appropriate for different areas. As such, we used both annual and seasonal integrated NDVI and rainfall data to calculate SeRGS. b) Number of pixels for the two NDVI and rainfall integration methods along the rainfall gradient from 0 to 1000 mm. Blue represents pixels where annually summed NDVI and rainfall yielded a higher correlation and red represents pixels where NDVI summed over the season and the optimal rainfall sum yielded a higher correlation.



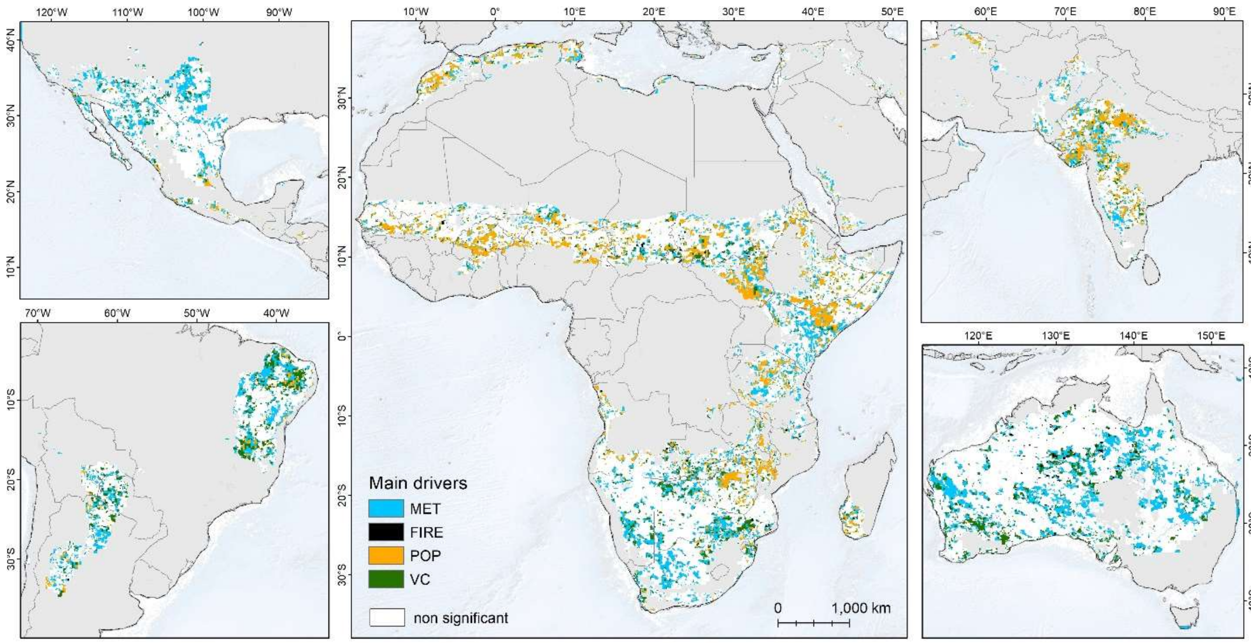
Supplementary Fig. 3. Examples of NDVI-Rainfall time series and the resulting SeRGS. Blue bars represent monthly rainfall, blue curves the annually integrated rainfall and green curves the annually integrated NDVI. Corresponding slope values from the Vegetation-Rainfall-Relationship are shown in black.



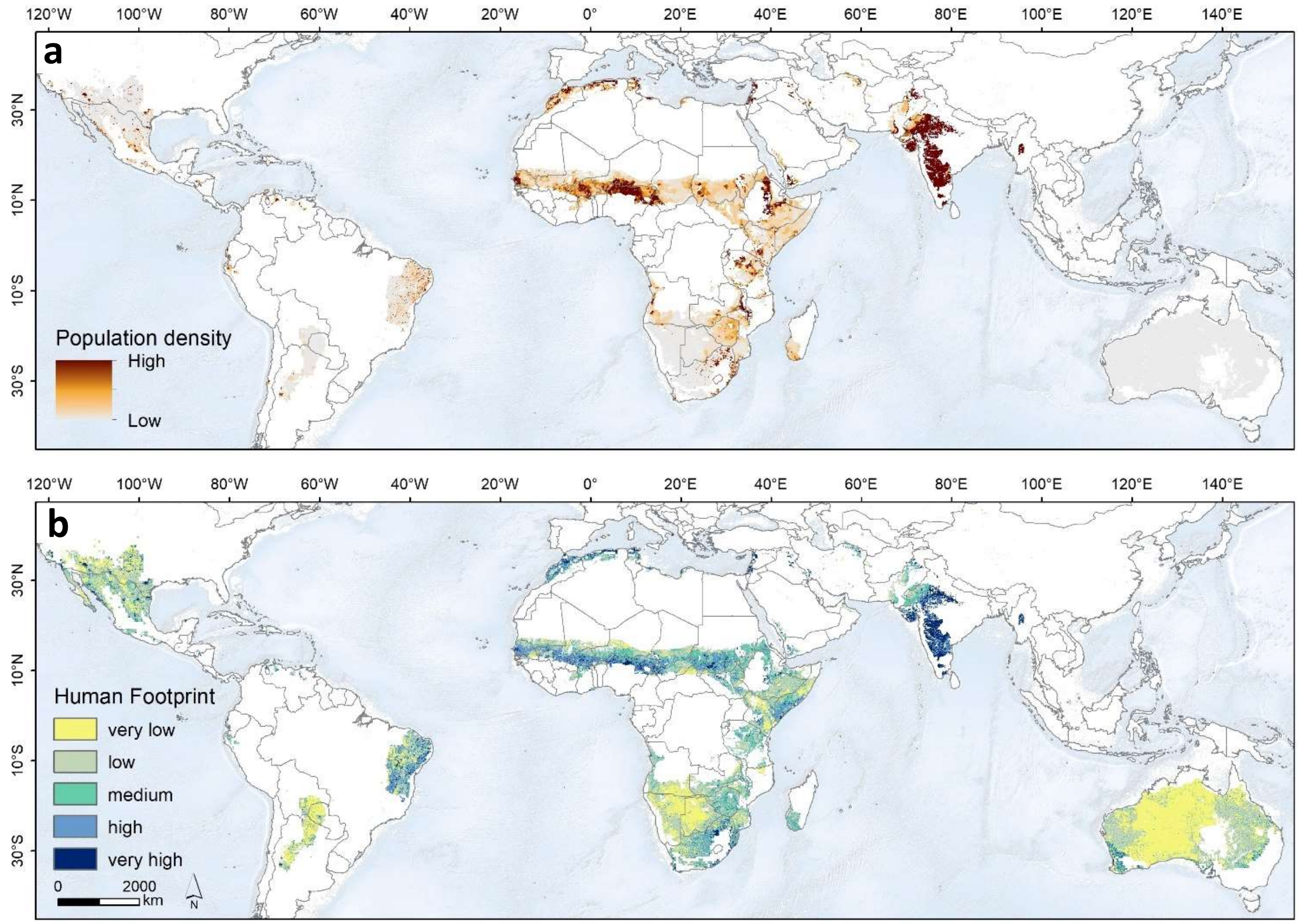
Supplementary Fig. 4. Generalized (median values) information about how SeRGS (Vegetation-Rainfall-Relationship) values shown for different types of vegetation composition: Median SeRGS values per land cover class (based on ESA CCI).



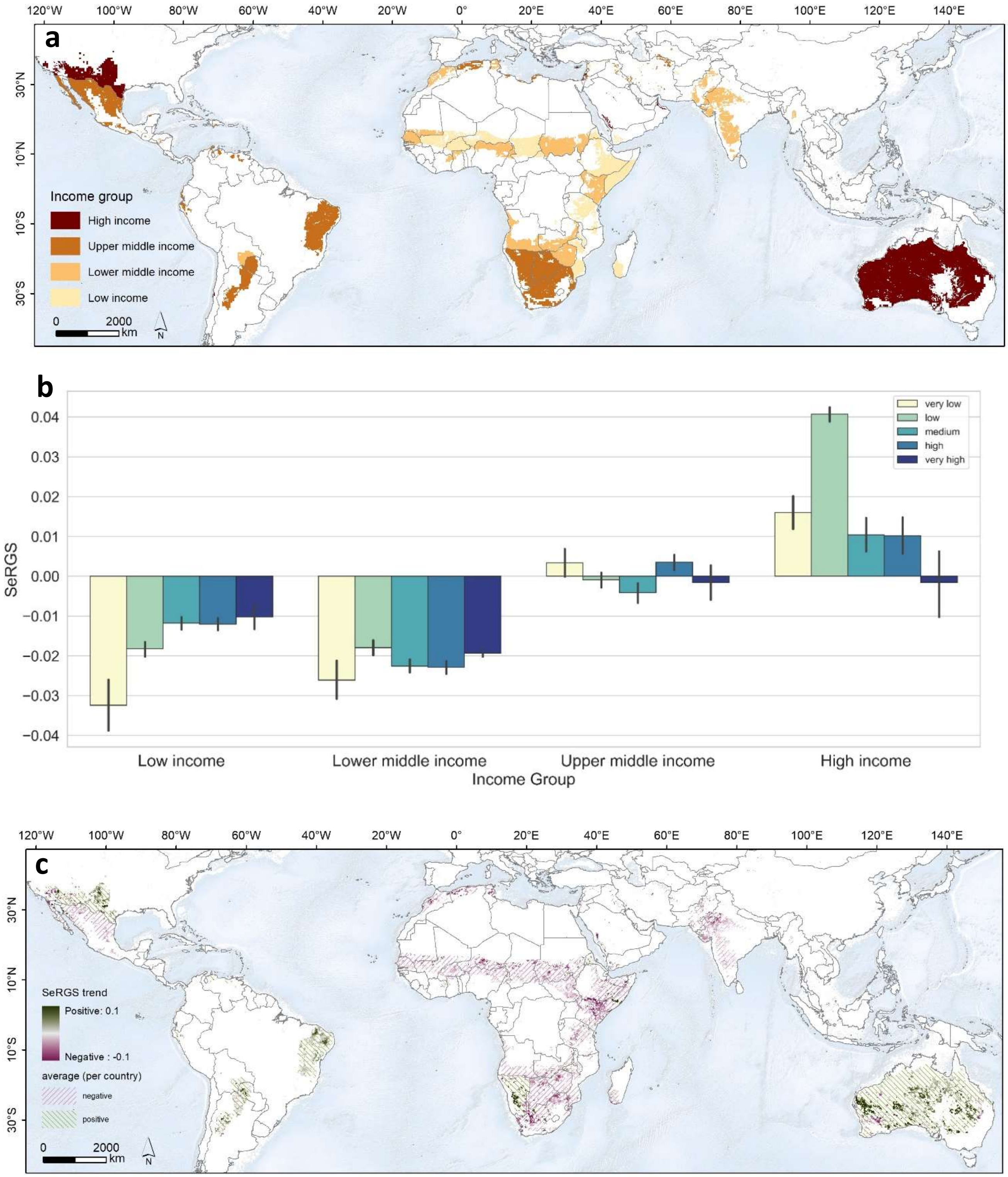
Supplementary Fig. 5. Flow chart of the method used to estimate the relative importance of each driver variable.

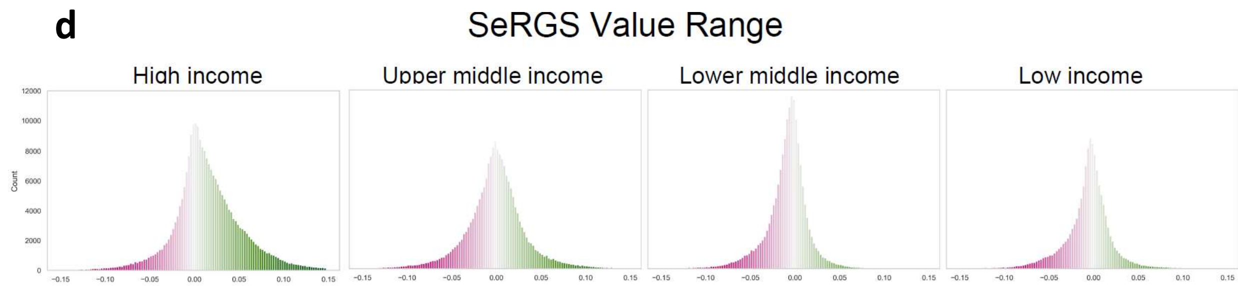


Supplementary Fig. 6. Main drivers of changes in vegetation-precipitation sensitivity per pixel at 0.25 degrees spatial resolution. (MET: meteorological variables, FIRE: fire occurrence, POP: population density, VC: vegetation cover).

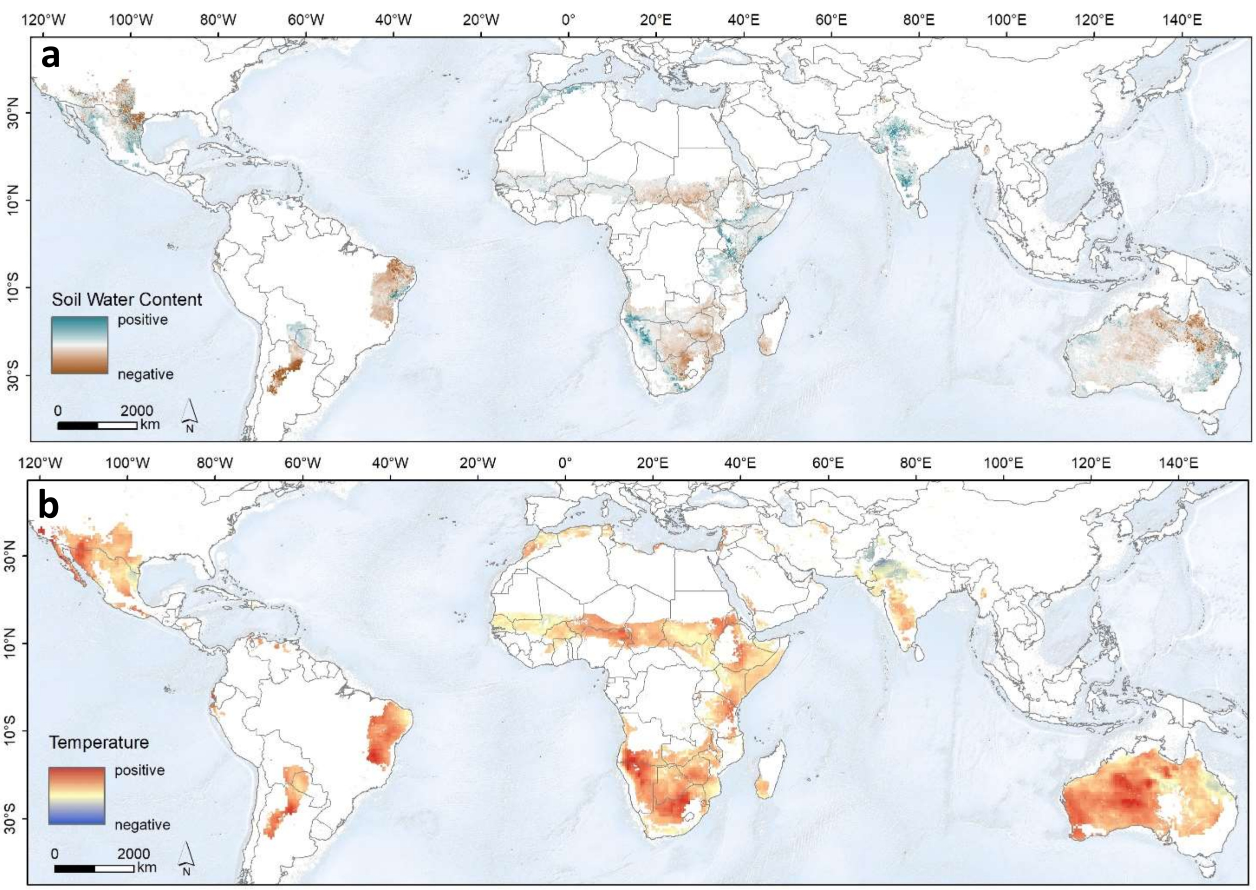


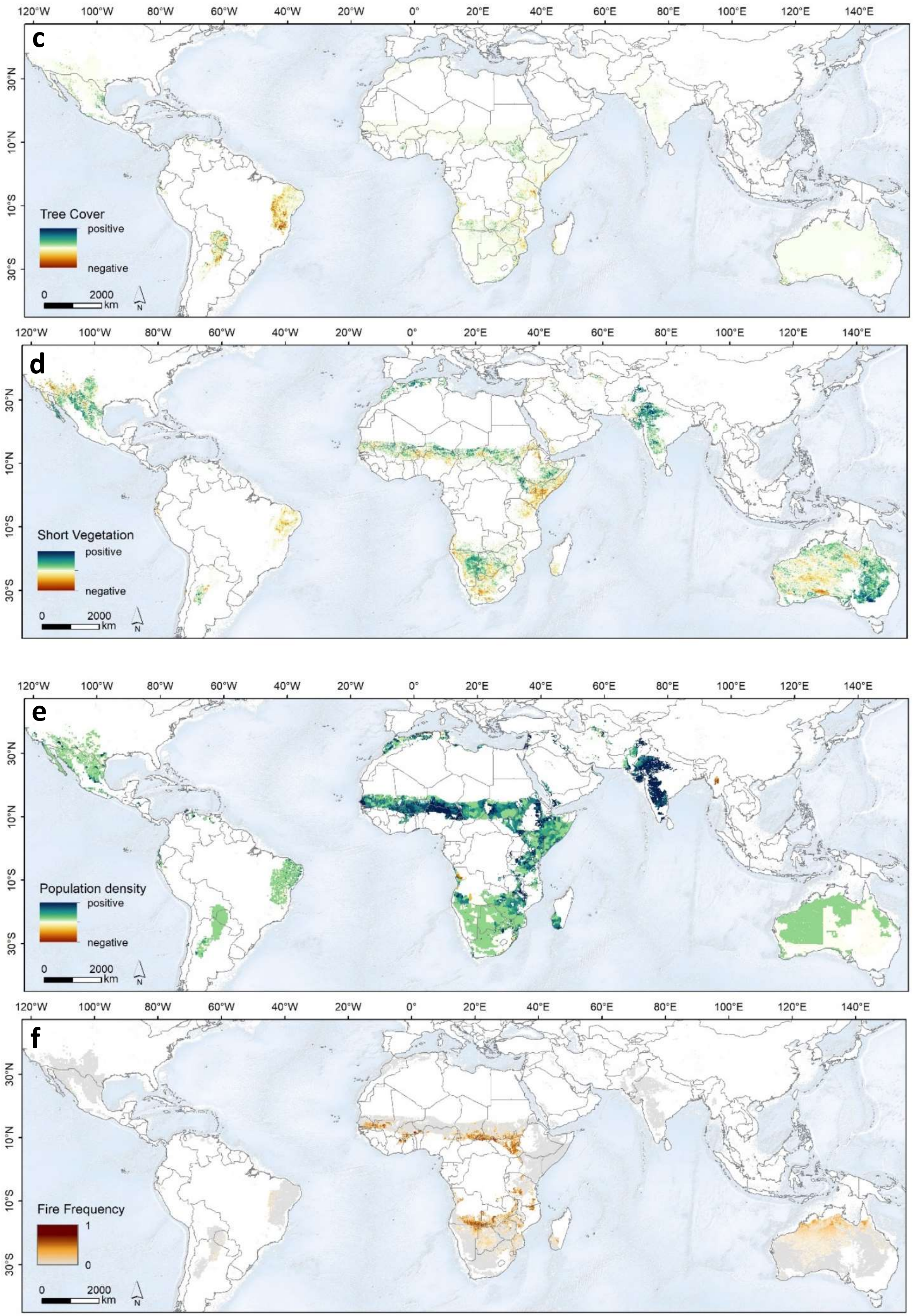
Supplementary Fig. 7. a) Global population density 2015 from Gridded Population of the World (GWP v4.11) at 0.05 degrees spatial resolution. Accessed May 2020: https://sedac.ciesin.columbia.edu/data/collection. b) the Global Human Footprint Map. Accessed May 2020: https://sedac.ciesin.columbia.edu/data/set/wildareas-v2-human-footprint-geographic.


a
Income group
High income
Upper middle income
Lower middle income
Low income
0 2000 km
b
very low
low
medium
high
very high
SeRGS
Low income
Lower middle income
Upper middle income
High income
Income Group
c
SeRGS trend
Positive: 0.1
Negative : -0.1
average (per country)
negative
positive
0 2000 km

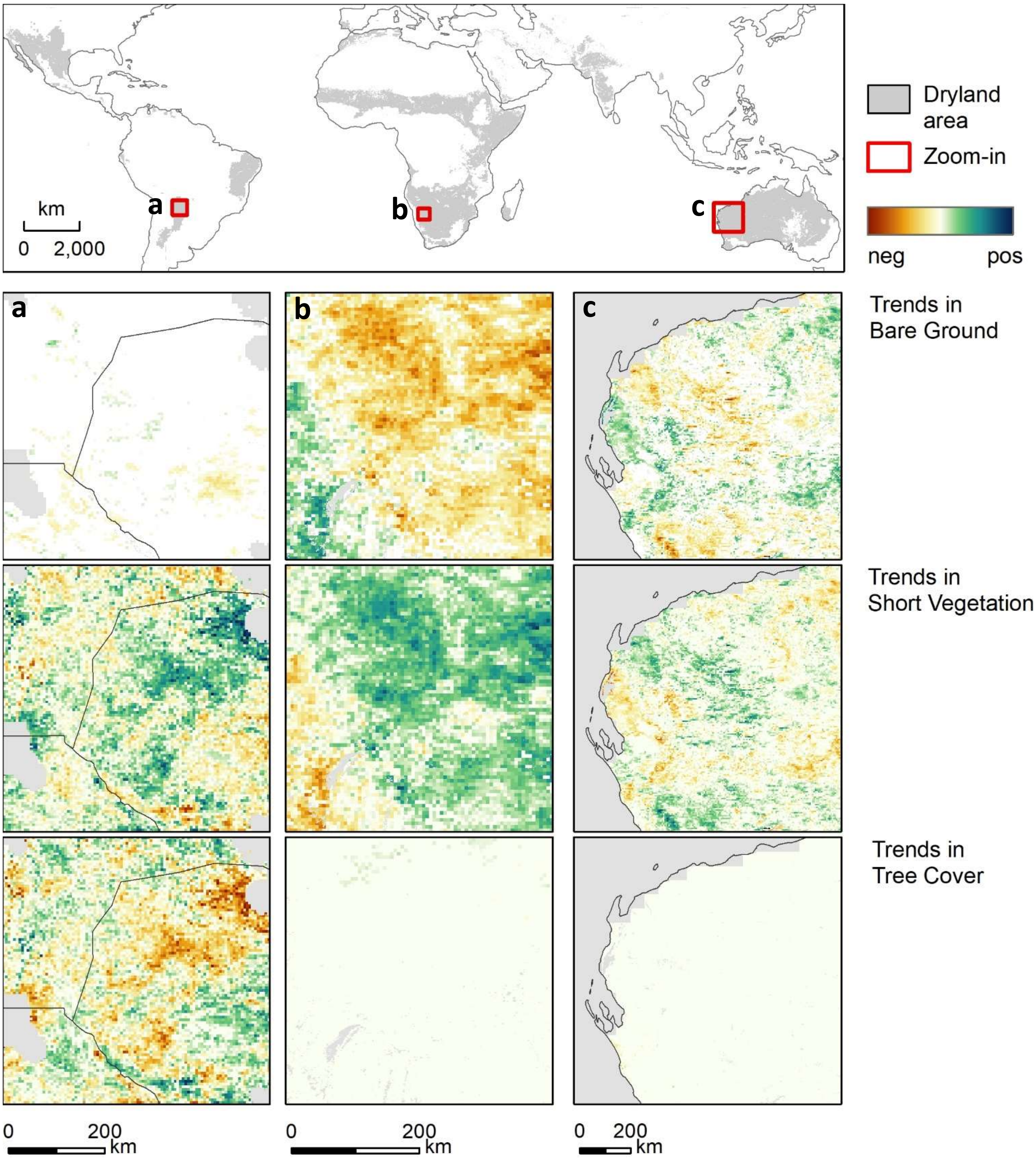


Supplementary Fig. 8. a) Global income groups per country based on Gross Domestic Product (GDP) in US$ (2015), accessed October 2019: https://data.worldbank.org/indicator/ny.gdp.mktp.cd, b) median SeRGS trends per income group for different Human Footprint levels (very low: 0-2, low: 2-5, medium: 5-8, high: 8-14, very high: >14.). Black vertical lines denote the 95% confidence interval. c) SeRGS trends overlaid by the average SeRGS trend per country and d) value range of SeRGS trends per income group.




c
Tree Cover
positive
negative
d
Short Vegetation
positive
negative
e
Population density
positive
negative
f
Fire Frequency
1
0
0
2000
km
N
120°W
100°W
80°W
60°W
40°W
20°W
0°
20°E
40°E
60°E
80°E
100°E
120°E
140°E
30°N
10°N
10°S
30°S

Supplementary Fig. 9. Linear trends in a) soil water content, b) temperature, c) tree cover, d) short vegetation and e) population density and f) fire frequency from 2000 – 2015 (n = 16) at 0.05 degrees spatial resolution. (data source as referenced in method section in the main article.)



Supplementary Fig. 10. Trends in Vegetation Cover Fractions (VCF): bare ground (BG), short vegetation (SC) and tree cover (TC) (Song et al. 2018) and how they relate to one another, for three exemplary dryland regions in a) the Chaco, b) Southern Africa and c) Australia.