

Lasting influences of past land-surface conditions on species assemblages

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Background Humans have changed the surface of the Earth for millennia and as a result most of the land possesses complex histories. Differences in the past can make similar sites incomparable and have been shown to continue to influence biodiversity. Data from satellites can help to assess the dynamics of past land surface conditions, yet few global comparative studies have explicitly investigated influences of the past.

Aims Investigate if differences in past land surface conditions have lasting influences on species assemblages, and test if specific taxonomic and functional groups are affected differently.

Data preparation

Globally representative spatially-explicit dataset of local species assemblages (Fig. 1).

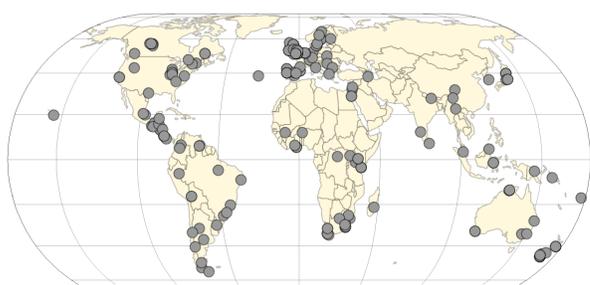


Fig. 1 Map showing center points of species assemblages sites

Time series of MODIS spectral reflectances resembling vegetation cover.

Ensured that spatial and temporal scale and resolution match.

Defined **current** (1 year before sampling) and **past** (1-5 years before current) land surface conditions (Fig. 2).

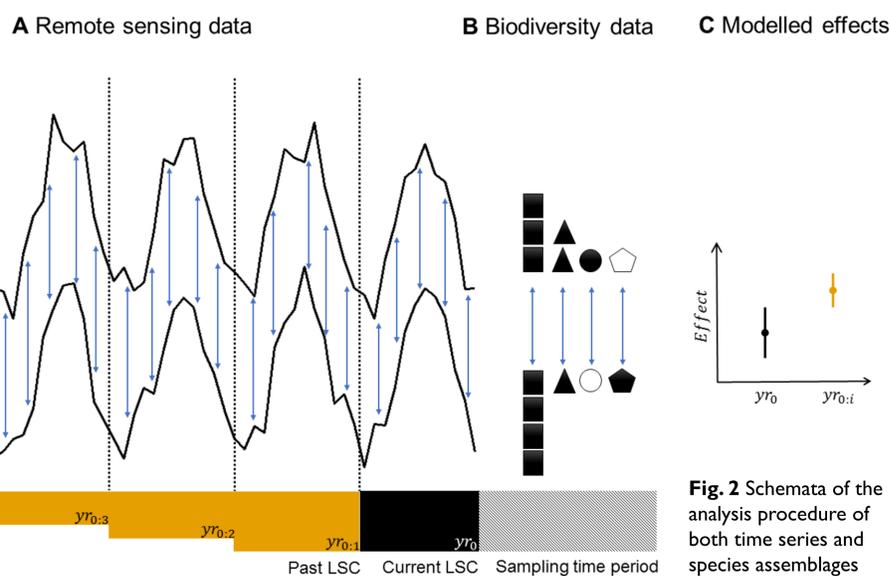


Fig. 2 Schemata of the analysis procedure of both time series and species assemblages

Analyses

Calculated the Bray-Curtis dissimilarity index between time series (A) and species assemblages (B) as a unified continuous measurement of differences.

Analysed pairwise differences in species assemblages as a function of differences in land surface conditions using generalized linear mixed effect models on permuted datasets.

Results

Lasting influences on species assemblages

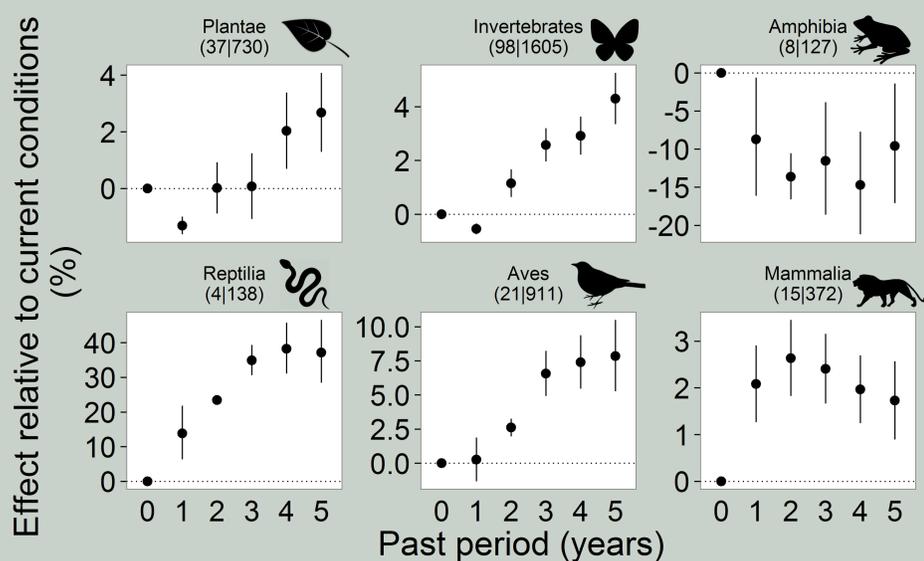


Fig. 3 Effect (\pm SE) of past land surface conditions on species assemblages of various taxonomic groups. Plotted relatively to the effect of current land surface conditions. Numbers in parentheses indicate number of used studies and sites.

Differences among functional groups

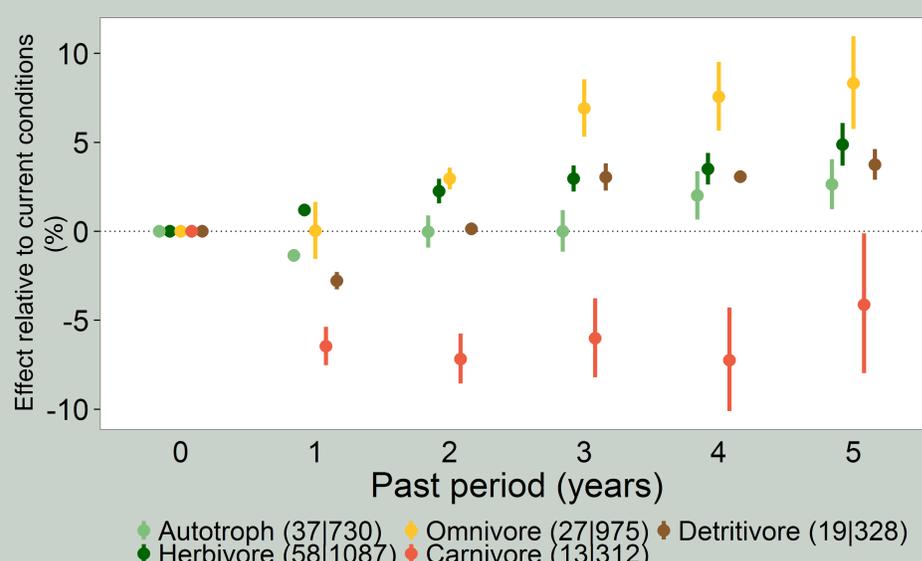


Fig. 4 Effect (\pm SE) of past land surface conditions on functional groups. Classified by the most dominant group within each assemblage. Plotted relatively to the effect of current land surface conditions. Numbers in parentheses indicate number of used studies and sites.

Key findings More dissimilar past land surface conditions lead to more dissimilar species assemblages, but the magnitude of this effect changes with longer time periods. Most taxonomic groups and vegetation dependent groups are more affected by past land surface conditions, while amphibians and carnivore assemblages are more affected by current land surface conditions.

We demonstrate that most species assemblages are more affected by past rather than current land surface conditions. Future studies investigating the response of species assemblage to differences in land surfaces should incorporate past conditions. These results are particularly relevant for biodiversity modellers and conservation planners as they demonstrate that static estimates of land surface conditions can underestimate the influence of land surface changes.



Acknowledgements

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