

EGU23-2415, updated on 27 Feb 2024

<https://doi.org/10.5194/egusphere-egu23-2415>

EGU General Assembly 2023

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Citizen science observations capture global patterns of plant traits

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As global change accelerates, the urgency for a solid understanding of biosphere-environment interactions grows. However, we need more data on plant functional traits to test such relationships reliably across ecosystems. The TRY database contains an impressive collection of plant trait measurements for thousands of species already, and there have been some approaches to spatially extrapolate them using geospatial predictors and remote sensing data; however, the original data is spatially sparse so that extrapolations come with substantial uncertainties. At the same time, citizen scientists have collected increasingly dense observations of species occurrences around the globe. Here, we test if we can link species occurrences from the citizen science project iNaturalist with trait observations from TRY to produce global trait maps without the need for spatial extrapolation. We generated spatial grids for 18 traits, calculating a mean for each grid cell by averaging trait values associated with observations within that cell. We compared mean trait values from iNaturalist observations to community-weighted mean traits from sPlotOpen, a globally sampled dataset of vegetation plot data.

Our results show correlations between the two datasets of up to $r = 0.69$, especially in biomes with higher iNaturalist observation density and those not dominated by trees. Also, we show that iNaturalist-derived maps have higher correlations to sPlotOpen-derived maps than previously published trait maps. This strong correlation between two fundamentally different datasets is astounding and unexpected. iNaturalist is noisy and heterogenous, sampled by citizen scientists who share the species they encounter and find interesting; sPlotOpen is a data collection of vegetation plots that were measured and recorded within the framework of specific research questions. The fact that these two datasets exhibit such a strong resemblance opens up a promising avenue for using the data treasure trove that is crowd-sourced data to help fill the gaps in plant trait data and demonstrates that crowd-sourced data, such as the iNaturalist observations, can be used to complement professional data collection efforts.

