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Intercomparing global foliar trait maps: upscaling approaches and spatial patterns

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Foliar traits such as leaf nitrogen and phosphorus content (LNC, LPC) as well as specific leaf area (SLA) are key components of the leaf economic spectrum and hence important to characterize ecosystem functioning and functional diversity. However, up to now, global-scale maps of these traits have been produced using rather indirect approaches: either statistical upscaling on the basis of large plant trait databases or process-based modeling. Although there are more direct approaches to estimate such leaf traits from remote sensing, their applicability is still limited in coverage due to the sparsity of suitable ground reference data and satellite or airborne imagery.

Here, we report a comprehensive intercomparison of the currently available global maps of LNC, LPC, and SLA. In total, we examined global plant trait maps from seven different upscaling approaches. Here we categorize these different upscaling approaches and analyze the spatial patterns in the trait maps at different scales.

Overall, global foliar trait maps show considerable differences in both the distribution of values and spatial patterns. Major differences in spatial patterns among products were related to differences in the use of plant functional type (PFT) categories from land cover maps in the upscaling. While some of the upscaling approaches did not rely on PFT information at all, others used it in one or several steps of the upscaling. Similarities in spatial patterns emerged when the foliar trait maps are subset according to whether PFT information was used or not. Only the maps that used PFT information showed similarities in spatial patterns at smaller scales.

Future upscaling approaches should take into account new remote sensing data sources, such as hyperspectral reflectance from upcoming satellite missions, and provide sufficient details on the upscaling methodology as well as the intended purpose of the resulting maps.

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