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### Research Papers

## The variation of tree beta diversity across a global network of forest plots

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## ABSTRACT

**Aims** With the aim of understanding why some of the world's forests exhibit higher tree beta diversity values than others, we asked: (1) what is the contribution of environmentally related variation versus pure spatial and local stochastic variation to tree beta diversity assessed at the forest plot scale; (2) at what resolution are these beta-diversity components more apparent; and (3) what determines the variation in tree beta diversity observed across regions/continents?

**Location** World-wide.

**Methods** We compiled an unprecedented data set of 10 large-scale stem-mapping forest plots differing in latitude, tree species richness and topographic variability. We assessed the tree beta

diversity found *within* each forest plot separately. The non-directional variation in tree species composition among cells of the plot was our measure of beta diversity. We compared the beta diversity of each plot with the value expected under a null model. We also apportioned the beta diversity into four components: pure topographic, spatially structured topographic, pure spatial and unexplained. We used linear mixed models to interpret the variation of beta diversity values across the plots.

**Results** Total tree beta diversity within a forest plot decreased with increasing cell size, and increased with tree species richness and the amount of topographic variability of the plot. The topography-related component of beta diversity was correlated with the amount of topographic variability but was unrelated to its species richness. The unexplained variation was correlated with the beta diversity expected under the null model and with species richness.

**Main conclusions** Because different components of beta diversity have different determinants, comparisons of tree beta diversity across regions should quantify not only overall variation in species composition but also its components. Global-scale patterns in tree beta diversity are largely coupled with changes in gamma richness due to the relationship between the latter and the variation generated by local stochastic assembly processes.

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