Can we predict forest composition across space and time in Central Africa?

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Abstract

Predicting the current and future natural distributions of species is challenging, especially in the tropics where large remote areas remain poorly known. Such challenge can only be met with an in-depth understanding of the drivers of species distribution, a well-designed and extensive survey and appropriate statistical models.

In this study, we use a large dataset of forest inventories from logging companies, which provides information on the abundance of 123 tree genera, in 140,000 plots spread over four Central African countries. In order to predict the current and future distribution of these tree genera, we use a set of bioclimatic, geological and anthropogenic variables. We rely on a published methodology, called Supervised Component Generalized Linear Regression (SCGLR), which identifies the most predictive dimensions among a large set of predictors.

Using a calibration and validation scheme, we show that the distribution of most tree genera can be well predicted over the whole study area at the present time. At the community level, the floristic and functional composition of tree genera is also inferred with a good accuracy. Using spatially explicit null models, we show that species-climate association are in most cases not better than chance, thus challenging our ability to predict how forest composition will be affected by climatic changes.

Overall, our study shows that tropical tree distributions can be predicted with good accuracy at the present time, offering new perspectives to manage tropical forests at large spatial scales, but that predicting shifts in species distribution under climate change scenarios is challenging.

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