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Exploring the effects of biodiversity and elemental stoichiometry on terrestrial carbon balance

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Global change is affecting the capacity of terrestrial ecosystems to sequester carbon. While the effect of climate on ecosystem carbon balance has largely been explored, the role of other potentially important factors that may shift with global change, such as biodiversity and the concentration of nutrients remains elusive. More diverse ecosystems have been shown to be more productive and stable over time and differences in foliar concentrations of N and P are related to large differences in how primary producers function. Here, we used 89 eddy-covariance sites included in the FLUXNET 2015 database, from which we compiled information on climate, species abundance and elemental composition of the main species. With these data, we assessed the relative importance of climate, endogenous factors, biodiversity and community-weighted concentrations of foliar N and P on terrestrial carbon balance. Climate and endogenous factors, such as stand age, are the main determinants of terrestrial C balance and their interannual variability in all types of ecosystems. Elemental stoichiometry, though, played a significant role affecting photosynthesis, an effect that propagates through ecosystem respiration and carbon sequestration. Biodiversity, instead, had a very limited effect on terrestrial carbon balance. We found increased respiration rates and more stable gross primary production with increasing diversity. Our results are the first attempt to investigate the role of biodiversity and the elemental composition of terrestrial ecosystems in ecosystem carbon balance.