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The phylogenetic diversity of grassland plants has no influence on the temporal stability of community biomass production

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Hundreds of experiments have now manipulated species richness of various groups of organisms and examined how this aspect of biological diversity influences ecosystem functioning. Ecologists have recently expanded this field to look at whether phylogenetic diversity (i.e. relatedness) among species also predicts ecological function. Some have hypothesized that phylogenetic divergence should be a superior predictor of ecological function than species richness because evolutionary relatedness represents the degree of ecological and functional differentiation among species. But studies to date have provided mixed support for this hypothesis. Here, we re-analyze data from 16 experiments that have manipulated plant species richness in grassland ecosystems and examine the impact on aboveground biomass production over multiple time points. Using a new molecular phylogeny of the plant species used in these experiments, we quantified how the phylogenetic diversity of plants impacts average community biomass production as well as the stability of community biomass production through time. We show that, after statistically controlling for variation in species richness, phylogenetic diversity is related neither to mean community biomass nor to the temporal stability of biomass. These results run

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counter to past claims. However, after controlling for species richness, phylogenetic diversity was positively related to variation in community biomass over time due to an increase in the variances of individual species, but this relationship was not strong enough to influence community stability.

Our study on grasslands offers a cautionary tale when trying to relate phylogenetic diversity to ecosystem functioning, suggesting that there may be ecologically important trait and functional variation among species that is not explained by phylogenetic relatedness. Our results fail to support the hypothesis that the conservation of evolutionarily distinct species would be more effective than the conservation of species richness as a way to maintain productive and stable communities under changing environmental conditions.