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Plant traits as predictor of ecosystem carbon fluxes - a case study across European grasslands

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Predicting ecosystem responses to global change has become a major challenge, particularly as terrestrial ecosystems contribute to the mitigation of global climate change through carbon sequestration. Plant traits are major surrogates of ecosystem physiology may thus help to predict carbon (C) fluxes and their consequences for the delivery of ecosystem services (e.g. C sequestration) across climatic gradients and in changing environments. However, linkages between community abundance-weighted means (CWM) of plant functional traits and ecosystem C fluxes have rarely been tested. It is also not known to what degree traits, which are typically measured at a defined point in time, are suitable for predicting annual C fluxes. We analysed the relationships between ecosystem fluxes and community level plant traits for 13 European grasslands under contrasting climate and management regimes, using multiyear eddy covariance data. Plant traits (specific leaf area SLA, leaf dry matter content LDMC, specific root length SLR) were determined at peak biomass.

Analyses showed that GPPmax (at maximum radiation) was related to SLA, SRL and LDMC across sites and management, where GPPmax was an excellent indicator for annual GPP. Similar relations were found between root density (and –diameter) and ecosystem respiration. Ecosystems respiration at GPPmax was also in line with annual respiration, indicating the strong predictive potential of plant community traits. Our study therefore suggests that above- and belowground community level plant traits are well suited surrogates for predicting ecosystem C fluxes at peak biomass and at annual scale.