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Incorporating plant functional diversity effects in ecosystem service assessments

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Abstract

Global environmental change affects the sustained provision of a wide set of ecosystem services. Although the delivery of ecosystem services is strongly affected by abiotic drivers and direct land use effects, it is also modulated by the functional diversity of biological communities (the value, range, and relative abundance of functional traits in a given ecosystem). The focus of this article is on integrating the different possible mechanisms by which functional diversity affects ecosystem properties that are directly relevant to ecosystem services. We propose a systematic way for progressing in understanding how land cover change affects these ecosystem properties through functional diversity modifications. Models on links between ecosystem properties and the local mean, range, and distribution of plant trait values are numerous, but they have been scattered in the literature, with varying degrees of empirical support and varying functional diversity components analyzed. Here we articulate these different components in a single conceptual and methodological framework that allows testing them in combination. We illustrate our approach with examples from the literature and apply the proposed framework to a grassland system in the central French Alps in which functional diversity, by responding to land use change, alters the provision of ecosystem services important to local stakeholders. We claim that our framework contributes to opening a new area of research at the interface of land change science and fundamental ecology.

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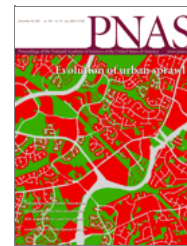
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 Author contributions: S.D. and S.L. designed research; S.D., S.L., F.d.B., F.Q., K.G., and T.M.R. performed research; S.L. and K.G. analyzed data; and S.D., S.L., F.d.B., F.Q., K.G., and T.M.R. wrote the paper.

The authors declare no conflict of interest.

This article is a PNAS Direct Submission.

Abbreviations:

- AGB**, aboveground biomass;
- ANPP**, aboveground net primary productivity;
- SANPP**, specific ANPP;
- CWM**, community weighted mean value;



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EP, ecosystem property;
 ES, ecosystem service;
 FD, functional diversity;
 FDvg, functional divergence;
 LNC, leaf nitrogen content;
 NNI, nitrogen nutrition index;
 RL, root length;
 VH, vegetative height.

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Correction for Turner et al., Land Change Science Special Feature: The emergence of land change science for global environmental change and sustainability
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