
Effects of land use on plant diversity – A global meta-analysis

Katharina Gerstner*¹, Carsten Dormann², Anke Stein³, Ameer Manceur¹, and Ralf Seppelt¹

¹Department of Computational Landscape Ecology, Helmholtz Centre for Environmental Research - UFZ, Leipzig – Germany

²Biometry and Environmental System Analysis, University of Freiburg – Germany

³Biodiversity, Macroecology Conservation Biogeography Group, University of Göttingen – Germany

Abstract

1. Plant diversity is globally threatened by anthropogenic land use including management and modification of the natural environment. At regional and local scales, numerous studies worldwide have examined land use and its effects on plant diversity but evidence for declining species diversity is mixed. This is because, first, land use comes in many variations, hampering comparisons of studies. Second, land use directly affects the environment, but indirect effects extend beyond the boundaries of the land in use. Third, land-use effects greatly depend on the environmental, historical and socio-economic context.

2. To evaluate the generality and variation of studies' findings about land-use effects we undertook a quantitative synthesis using meta-analytic techniques.

3. Using 572 effect sizes from 375 studies distributed globally relating to 11 classes of land use, we found that direct and indirect effects of land use on plant diversity (measured as species richness) are variable and can lead to both local decreases and increases. Further, we found evidence (best AIC model) that land-use specific covariables mostly determine effect size variation and that in general land-use effects differ between biomes.

4. Synthesis and applications. This extensive synthesis provides the most comprehensive and quantitative overview to date about the effects of the most widespread and relevant land-use options on plant diversity and their covariables. We found important covariables of specific land-use classes but little evidence that land-use effects can be generally explained by their environmental and socio-economic context. We also found a strong regional bias in the number of studies (i.e. more studies from Europe and North America) and highlight the need for an overarching and consistent land-use classification scheme. Thereby our study provides a new vantage point for future research directions.

*Speaker