
Global patterns of agricultural land-use intensity and biodiversity

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Abstract

Land-use change is the single biggest cause of biodiversity loss. A deeper understanding of how and where agriculture threatens biodiversity is required in order to improve food security while at the same time conserve biodiversity. Agricultural expansion has received much attention, but where intensification threatens biodiversity remains unclear. The major reason for this knowledge gap is that land-use intensity is intrinsically complex and multi-dimensional. Consistent global datasets for most dimensions of land-use intensity have been lacking until recently. Here we compare and quantify the relationship between spatial patterns of land use intensity and biodiversity. We overlaid an array of agricultural intensity metrics with endemism richness, a range size-weighted species richness indicator, for mammals, birds and amphibians. We then used local indicators of spatial association (LISA) to delineate statistically significant ($p < 0.05$) areas of land-use intensity associated with biodiversity. We show that metrics of land-use intensity are heterogeneously distributed in space, especially in areas of high biodiversity. Many regions where high land-use intensity and high biodiversity coincide, for example in Papua New Guinea, South-America, China and Eastern Africa, are not within currently recognized biodiversity hotspots. Vast areas of high land-use intensity and relatively low biodiversity were found in Europe and North America. Most assessments of land-use impacts on biodiversity have either disregarded land-use intensity or included only a single metric to measure it. The broad variety in spatial patterns we found among different land-use intensity metrics suggests that such assessments risk substantially underestimating biodiversity threat. A wider spectrum of complementary land-use intensity metrics needs to be considered when attempting to improve global food security by increased production while minimizing the risk to biodiversity.

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