

Combining taxonomic and functional approaches to assess land-use impacts on macroinvertebrate assemblages and improve bioindication

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Abstract

Most studies exploring land use impacts have focused on taxonomic metrics, but interest in the functional approach has increased because it helps to understand the relationships between community structure and functioning of aquatic ecosystems. We evaluated how functional and taxonomic approaches contribute to assessing the effects of land use on macroinvertebrate assemblages of lowland streams. We also studied the relationships between both approaches. We sampled benthic macroinvertebrates in 17 sites with different land uses (agricultural, peri-urban, and extensive livestock). We computed the taxonomic metrics and biotic indexes as well as functional richness (FRic), divergence (FDiv), dispersion (FDis), and Rao diversity indexes for each site. We performed general linear mixed models to compare land-uses and also performed correlation analysis between taxonomic and functional indexes. Taxonomic richness was significantly higher in extensive livestock than in the other two land uses, while Shannon diversity was significantly different between land uses (extensive livestock>peri-urban>agriculture). FRic and FDiv were significantly lower in peri-urban land use than in agricultural and extensive livestock sites. Only taxonomic richness showed a significant and positive relationship with FRic, FDis, and Rao, but they fit better to a logarithmic function. Therefore, an increase in taxonomic richness and Shannon diversity did not necessarily imply an increase in the functional aspects of the macroinvertebrate assemblage. Using only one of these approaches could lead to partial evaluations and loss of information. Combining them could improve bioindication and predictive potential and help assess the effects of multiple stressors on freshwater ecosystems to improve biomonitoring.

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