

Complex temporal trends in biomass and abundance of Diptera driven by the impact of agricultural intensity on community-level turnover

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Abstract

Insect declines have been reported widely and are expected to alter ecosystem functions and processes. Land-use change is recognised as a major cause of decline in insect biodiversity and abundance. Variation in local environmental drivers and the scale of available monitoring data have left large knowledge gaps in which taxa are declining and where declines are the greatest, and how these declines will impact ecosystems. We used 11 years (2006-2016) of monitoring data on 40 farms distributed over ~10,000 km² in southern Québec, Canada, to quantify the impact of agricultural intensity on temporal trends in abundance and biomass of Diptera (true flies). There was a large difference in temporal trends between farms, which we found to be driven by agricultural landcover. Contrary to expectation, increases in abundance over time were greater in areas with higher agricultural intensity, especially with an increase in cereal crops. In contrast, declines in dipteran biomass were steeper in areas of higher agricultural intensity, although only with greater maize and soy production rather than cereals such as wheat. Variation in forest cover around farms had the least effect on trends. We found steeper declines in biomass per total number of Diptera with increasing agricultural cover, suggesting the presence of community turnover toward smaller-bodied flies with lower individual biomass. Our results reveal further complexities in insect trends driven by changes in land-use and show the importance of long-term monitoring and the use of multiple indicators for understanding biodiversity change.

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