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Global export of biomass and contaminants from water to land by aquatic insects

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Abstract

The production of anthropogenic chemicals has increased sixfold in the last decades and represent major drivers of global change. Streams and rivers receive contaminants from the watershed, but also export them back to land via the bioaccumulation and emergence of adult aquatic insects. This flux of contaminants can offset the benefits of transported subsidies and increase the exposure of terrestrial consumers. Here, leveraging extensive dataset on in-stream insects production and contaminants concentration, we provide the first global estimates of biomass and contaminant fluxes from water to land. Rivers export an average of ~1910 mg of dry-mass/m²/y of adult aquatic insects. That translates to ~860 mg of carbon/m²/y, which is similar to previous estimates. GAM models accounting for precipitation and global river surface areas estimate that the global flux of adult aquatic insects is ~2.8 million metric tons of dry mass and ~1.2 million metric tons of carbon. We combined these mass estimates with predictions of contaminant tissue concentrations derived from predicted aqueous concentrations. The results suggest global export of ~0.5 metric tons of Hg, 5 metric tons of Pb, and 1.3 metric tons of Se, from water to land.