Flow intermittency and macroinvertebrate functional traits – a colonization/competition game in drying river networks

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Résumé

Drying river networks (DRN) undergo significant hydrological fluctuations, which challenges aquatic invertebrate survival during drying and flowing alternation events. The development, persistence, and recovery of invertebrate communities in these DRNs greatly depend on their ability to colonize, withstand drought, and disperse across the network.
We introduce a process-based model that simulates the colonization and extinction dynamics of DRN communities, and demonstrate how drying and connectivity shape the composition of these communities. Our model assumes that the river network is made of local patches with limited carrying capacity, and that the invertebrate species inhabiting that patches can have varying trait values, including fecundity, mortality, migration, and dispersal modes (aquatic, drift, and aerial). We illustrate how drying recovery change the trait structure of communities and how drying can either promote or hinder species coexistence at the meta-community level depending on the frequency and duration of drying events.
In conclusion, we link these theoretical expectations to empirical data about the functional structure of macroinvertebrate communities in DRNs spanning different biogeographical and environmental contexts in Europe.

Mots-Clés: Macroinvertebrate, river connectivity, perturbation, resilience, resistance

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