LabEx DRIIHM

Dispositif de Recherche Interdisciplinaire sur les Interactions Hommes-Milieux

CNRS - Observatoires Hommes-Milieux - Investissements d'avenir

Production

Type

ACL

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Year

2021

The interplay of flow processes shapes aquatic invertebrate successions in floodplain channels - A modelling applied to restoration scenarios

OHM(s) involved

- OHM Vallée du Rhône

Edition

Elsevier

Revue

Science of the Total Environment

DOI

10.1016/j.scitotenv.2020.142081

Number

750

Paging

142081

Influence

National

The high biotic diversity supported by floodplains is ruled by the interplay of geomorphic and hydrological processes at various time scales, from daily fluctuations to decennial successions. Because understanding such processes is a key question in river restoration, we attempted to model changes in taxonomic richness in an

assemblage of 58 macroinvertebrate taxa (21 gastropoda and 37 ephemeroptera, plecoptera and trichoptera, EPT) along two successional sequences typical for former braided channels. Individual models relating the occurrence of taxa to overflow and backflow durations were developed from field measurements in 19 floodplain channels of the Rhône floodplain (France) monitored over 10?years. The models were combined to simulate diversity changes along a progressive alluviation and disconnection sequence after the reconnection with the main river of a previously isolated channel. Two scenarios were considered: (i) an upstream + downstream reconnection creating a lotic channel, (ii) a downstream reconnection creating a semi-lotic channel. Reconnection led to a direct increase in invertebrate richness (on average x2.5). However, taxonomical richness showed a constant decrease as isolation progressed and reached an average of 2 for EPT and 7 for gastropods at the end of the scenarios. With more than 80% of the taxonomic models with an AUC equal or higher than 0.7 and slopes of linear relations between observed and predicted richness of 0.75 (gastropods) and 1 (EPT), the Boosted Regression Trees (BRT) provided a good basis for prediction of species assemblages. These models can be used to quantify a priori the sustainability and ecological efficiency of restoration actions and help floodplain restoration planning and management.

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