



Linking hydrogeomorphological and biological typologies of rivers in the French Ill-Rhine fluvial hydrosystem

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The aim of this paper is to compare a hydro-geomorphological typology with a biotypology based on aquatic macrophytes communities in streams. The study area is the French part of the Rhine alluvial plain, which extends over 2.800 km². The rivers of interest, i.e. the Rhine, the Ill (the main French tributary of the Rhine) and the anastomosing channels of these two rivers, are very diverse as a result of their Holocene paleo-dynamics.

In the concerned rivers, the water mineralisation is rather homogeneous and the water content of organic matter is very low. Therefore, the bio-indication system is mainly reflecting the trophic level of the water. The hydro-geomorphological typology discriminates the watercourses of the Rhine alluvial plain in 5 groups according to both the intensity of the morphodynamics and their genesis (allochthonous rivers versus anastomosing rivers of the Rhine or the Ill).

The comparison between the two typologies is essentially based on a simple factorial correspondence analysis. The statistical analysis uses data of 301 points located at 500 m interval on the studied watercourses. The results show that the macrophytes communities depend on both the trophic level and the origin of the water. The results

also show a weak correlation with morphodynamics. Nevertheless, the analysis reveals a functional link between the two typologies. For the Ill anastomosing rivers, this link reflects lateral hydrological connectivity, except for some sub-types with polluted springs. For the allochthonous rivers, the link between the two typologies is related to the downstream eutrophication of the water and to the Rhine paleo-dynamics.

A "functional solidarity" is also demonstrated between lateral and vertical connectivity for the dynamic anastomosing rivers. Indeed, the floods of the Ill generate fluvial dynamics in these channels. The morphodynamics also activates the limnocrène springs (i.e. vertical connectivity) in these anastomosing channels and increases the biodiversity through local oligotrophication of the water, the groundwater of the Ill floodplain being nutrient-poor.

Finally, some useful aspects for management are highlighted: the silting problem of the nondynamic anastomosing rivers requires specific management practices; protection of the Ill floodplain and the dynamic anastomosing rivers is of primary importance because these processes are fundamental to the functioning of the Ill hydrosystem. Furthermore, the great functional heterogeneity of watercourses in the entire French Rhine alluvial plain is demonstrated as well. This heterogeneity is a consequence of the Rhine and Ill fluvial paleo-dynamics and has to be taken into account in management practices and river restoration projects.