



The Loire River islands: the fluvial response to the coupled effects of hydrologic and socio-economic change

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With a basin of 112,120 km² and a length of 1012 km, the Loire River is one of the major fluvial hydrosystems in France. The islands represent nowadays very specific fluvial land forms dominating the middle valley landscape. Because of their patchwork of hard and soft wood forests, grassland ..., providing diversified habitats for the fauna, numerous Loire River islands are included in protected sites (Special Protection Area, Natural Reserve ...).

The aim of this paper is a better understanding of islands formation, evolution pattern and rhythm, on a basis of a geomorphologic approach developed at different spatial and time scales. Firstly, the diachronic analysis (since the 18th century) reveals the recent development of islands related to the metamorphosis of the fluvial bed. The integration of the data in a GIS provides precise information about their evolution rhythm. Appeared during the last decades of the 19th century, the islands show a first evolution period characterized by a moderate planform development, whereas the rate has increased rapidly since the 1950s, being three times higher. The precise analysis of the evolution schemes allows also the determination of different islands types associated with specific accretion and mobility rates (with a gradient from totally stabilized forms, to mobile islands undergoing a downstream migration).

The second approach is based on the comparison of cross-section profiles of the river bed at two time scales (pluri-decadal and annual time scale). It highlights i) the vertical accretion rate that is particularly rapid for the youngest forms and decreases with the

island elevation and ii) the impact of lateral sand levees construction on the island lateral extension.

The current fluvial forms and the islands express river readjustments to hydro-climatic, sedimentary and socio-economic factors evolution, which act at different temporal scales. The 18th and 19th centuries are characterized by frequent high floods that regenerated actively the fluvial forms and limited the vegetal colonisation in the fluvial bed. Consequently, artificial levees were built to avoid the channel lateral instability and frequent inundations. During the 1830s–1840s, submersible dikes were built in the inter-levees channel to better the navigation. A moderate channel incision was initiated at the end of the 19th century in response to the engineering works. Synchronously, the change of hydro-climatic processes caused the absence of high floods since 1866; both factors contribute to the fluvial bed readjustment. Another major human impact must be underlined: a recent pronounced bed entrenchment has been triggered by massive gravel extractions conducted after World War II. The incision has left secondary channels and bars suspended above the main channel, thus reducing their submersion frequency and duration and favouring their colonization by vegetation. Furthermore, recent studies point out the disappearance of traditional land uses, that clearly enhanced the colonization of important parts of the river bed by riparian vegetation.