Geophysical Research Abstracts
Vol. 19, EGU2017-12386, 2017
EGU General Assembly 2017

Using a conceptual model to assess the role of flow regulation in the hydromorphological evolution of riparian corridors

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Riparian corridors result from active vegetation-fluvial interactions, which are highly dependent on flow regime conditions and sediment dynamics. Colonization, establishment and survival of species are constrained by fluvial processes which vary according to topographic and sedimentological complexity of the corridor. In order to manage these dynamic and complex riparian systems there is a need for practical tools based on conceptual models.
The objective of this study was to apply the conceptual model of riparian corridors lateral zonation in response to the dominant fluvial processes established by Gurnell et al. (2015) and verify its usefulness as a tool for assessing the effect of flow regulation.
Two gravel rivers have been selected for this purpose from the north of Spain, the Porma River regulated by Boñar large dam and the unregulated Curueño River. The historical series of flows and the aerial photographs of 1956 and 2011 on which the river corridor has been delimited have been analyzed and identified the permanent inundated zone (1) and four areas of riparian vegetation dominated respectively by fluvial disturbance with coarse sediment erosion and deposition (zone 2), fluvial disturbance with finer sediment deposition (zone 3), inundation (zone 4) and soil moisture regime (zone 5).
Likewise, a two-dimensional hydraulic simulation was performed with avenues of different return periods and calculated the prevailing hydraulic conditions (depths, velocities and drag forces) to characterize each of the vegetation zones mentioned in both rivers.
The results show that the most active zone 2 (fluvial disturbance dominated showing coarse sediment erosion and deposition) disappears due to the regulation of flows and vegetation encroachment, while the riparian corridor is dominated by the less active zone where the vegetation is maintained by the humidity of sporadic floods and underground runoff.
Moreover, by means of the hydraulic simulation we have found a close relationship between the different areas of fluvial processes recognized through its vegetation and hydraulic conditions, which predicts the expected evolution of vegetation at different scenarios of regulation.