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History of river regulation of the Noce River (NE Italy) and related bio-morphodynamic responses

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The Noce River is a hydropower-regulated Alpine stream in Northern-East Italy and a major tributary of the Adige River, the second longest Italian river. The objective of the research is to investigate the response of the lower course of the Noce to two main stages of hydromorphological regulation; channelization/ diversion and, one century later, hydropower regulation.
This research uses a historical reconstruction to link the geomorphic response with natural and human-induced factors by identifying morphological and vegetation features from historical maps and airborne photogrammetry and implementing a quantitative analysis of the river response to channelization and flow / sediment supply regulation related to hydropower development. A descriptive overview is presented. The concept of evolutionary trajectory is integrated with predictions from morphodynamic theories for river bars that allow increased insight to investigate the river response to a complex sequence of regulatory events such as development of bars, islands and riparian vegetation.
Until the mid-19th century the river had a multi-thread channel pattern. Thereafter (1852) the river was straightened and diverted. Upstream of Mezzolombardo village the river was constrained between embankments of approximately 100 m width while downstream they are of approximately 50 m width. Since channelization some interesting geomorphic changes have appeared in the river e.g. the appearance of alternate bars in the channel. In 1926 there was a breach in the right bank of the downstream part that resulted in a multi-thread river reach which can be viewed as a recovery to the earlier multi-thread pattern. After the 1950's the flow and sediment supply became strongly regulated by hydropower development. The analysis of aerial images reveals that the multi-thread reach became progressively stabilized by vegetation development over the bars, though signs of some dynamics can still be recognizable today, despite the strong hydropeaking that dominates the flow regime.
The results of the historical analysis will be used in a larger framework that focuses on interdisciplinary research of interactions between flow, sediment and vegetation in regulated rivers and aims to enhance knowledge on the interplay between river bars and vegetation in the perspective of providing enhanced tools for river rehabilitation and restoration.