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Analysis of Stream Channel Geometry Temporal and Spatial Evolution after Historic Dam Removal - two French case studies

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IRSTEA, in partnership with the French Office national de l'eau et des milieux aquatiques (ONEMA), has begun a study of channel geomorphology in small streams where dams have been removed or breached between two and 200 years ago, without any subsequent restoration of the channel in the legacy sediments. A preliminary analysis of two sites in the Morvan, Burgundy, will be presented; a dam breached at the beginning of the 20th century and another in the last decade. Using ergodic reasoning, historical and recent upstream and downstream channel geometry is being used to predict the future temporal and spatial scales of channel physical habitat restoration.

With the implementation of the European Water Framework Directive (WFD), dam removal has become a more frequently used method for restoring stream ecological continuity. In France, these obstacles are ubiquitous in medium and small streams and considerably reduce lateral and longitudinal connectivity. Improvement in the hydromorphologically controlled, physical habitat, particularly flow and sediment transport regimes, is often essential to improvement in stream biology. However, dam removal may cause long-term disturbances in flow and sediment transport regimes. In the absence of channel restoration measures in addition to dam removal, these disturbances may result in long-term negative impacts on fish, macroinvertebrate, and riparian plant physical habitat. These negative impacts may include channel incision and lowering of the water table, disconnection from floodplains, increased stream power and bed scouring, and increased sediment load from headcutting and bank erosion.

Over time, these negative impacts may resolve themselves. However, the time frame necessary for reestablishing adequate physical habitat is not well-known. Some studies have indicated that many decades or longer may be required, depending on a variety of factors. Under the WFD, the REstoring rivers FOR effective catchment Management (REFORM) project is stressing the use of reference condition benchmarks when identifying objectives for and designing stream restoration projects. To identify appropriate reference condition benchmarks, it is important to understand over what temporal and spatial scales physical habitat improvement may take place after dam removal, including:

1. defining the spatial and temporal objectives for physical habitat restoration as a result of dam removal and
2. determining if dam removal alone will be sufficient to achieve those objectives or if additional channel restoration measures might be required.