

Science for Environment Policy

River ecosystems damaged by agriculture and dams at local and basin scales

Human activities are threatening river ecosystems in the Mediterranean. Recent research in south-east Spain has highlighted the need to assess biodiversity and the ecological condition of river ecosystems at both basin-wide and local scales. The researchers say this will provide a better assessment of river ecosystems, aiding management decisions.

Mediterranean aquatic ecosystems are among the world's biodiversity hotspots. The Segura River basin in south-east Spain is in one of the driest parts of Europe and is extensively [farmed](#). The river system has been heavily modified, and contains 24 large dams which store water to meet agricultural demand. For this study, the researchers investigated how agricultural [land use](#) and dams have affected the biodiversity and ecological condition of aquatic and riparian, or riverbank, communities.

The researchers surveyed 56 sites across the river basin. They used the total number of riparian plant species at each site as an indicator of riverbank biodiversity and the number of different water beetle species they found in the rivers as an indicator of freshwater biodiversity.

The ecological quality of the riparian communities was assessed by the researchers using the Riparian Quality Index. This indicator reveals the impacts of human activities on riparian ecosystems. They also assessed the ecological quality of the rivers using the Iberian Biomonitoring Working Party indicator which is sensitive to the impact of nutrient pollution, such as nitrogen, on aquatic beetles and similar species.

To estimate changes in river structure at the basin scale, they assessed the combined impact from human pressures at each site, based on dam regulation (number of dams, their capacity and water withdrawal) and the agricultural area occurring upstream to each site. At the local scale, the researchers determined the extent of local modifications in the river channel and the agricultural area close to the river.

The researchers found that, as human pressures gradually increased from the river source in the sparsely populated mountains to the agricultural lowlands, there was a drop in both the ecological quality and biodiversity of the riparian and aquatic communities.

Although riparian and aquatic communities were negatively affected by both types of human pressures, agricultural land use had a more profound impact on riparian communities, whereas changes in the river structure were the most important disturbances for aquatic communities. Agricultural practices directly affect the riverbank, by clearing riparian forests or by causing bank erosion, for example. Mediterranean aquatic species are adapted to natural variation in water flows, but most cannot deal with daily sudden water releases from dams for irrigation.

The researchers also found that although human pressures at local and basin scales similarly affected riverbank and aquatic communities, the impact of basin scale disturbances was greater than those at the local scale. This is because basin-level disturbances also strongly affect local areas. For example, large-scale run-off of sediment or exotic species can be transported through the entire river system.

The researchers point out that measures to restore riparian and aquatic ecosystems tend to be decided upon locally. However, these results indicate that if management is to be successful basin-level decisions affecting land use and river structure changes should be included to complement local measures.



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