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# Effects of a large irrigation dam on aquatic and riparian plants: a history of survival and loss

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## Abstract

Dammed rivers have unnatural streamflows, disrupted sediment dynamics and rearranged geomorphologic settings. Fluvial landscapes of regulated rivers are also altered in land-use and land cover (LULC) and in human infrastructures. Consequently, fluvial biota experiences disturbed functioning on the novel aquatic and riparian ecosystems, and alter their abundance, composition, and functions. Usually, ecological studies on effects of damming on flora and vegetation are traditionally focused on downstream sections. Here, we studied: i) the backwater effect of dammed flows upstream, ii) the dramatic change of a river to a lentic waterbody in the reservoir area and iii) the effect of reduced flows downstream. The case study is the Alqueva dam, a large irrigation dam in Guadiana river, Southeast Iberia. We analyzed airborne imagery before and after the commissioning year (1990, 2013, respectively), and floristic data in comparable dates (1987-1999 and 2017, respectively). We positioned 45 circular sampling units in the three sections of the river. We collected information on LULC, aquatic and riparian cover and geomorphology using high resolution airborne images in both periods. We used floristic data (aquatic and riparian) and classified the recorded species into functional groups related to species origin, plant growth-forms, or resources. We performed non-metric multidimensional scaling to assess the pairwise dissimilarity between sections and periods. Regulation of Guadiana river by Alqueva dam resulted in a novel landscape with an increase of irrigation crops in detriment of oak woodlands, and in dramatic declines in plant abundance and biodiversity values in all river sections. Loss of native and endemic species (e.g. *Salix salviifolia*, *Flueggea tinctoria*, *Nerium oleander*, *Marsilea batardae*) and gains on alien plants were observed. However, we found some ‘relic habitats’ in adjacent wetlands nearby the reservoir holding species-rich communities of riparian herbs. Hard bedrock substrates halt partially biodiversity losses in the downstream section.

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