



Recent Trends in the Ebro River Basin: Is It All „Just“ Climate Change?

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Water resources are under pressure from a variety of stressors such as industry, agriculture, water abstraction or pollution. Changing climate can potentially enhance the impact of these stressors, especially under water scarcity conditions. The aim of the GLOBAQUA project ("Managing the effects of multiple stressors on aquatic ecosystems under water scarcity") is, therefore, to analyze the combined effect of multiple stressors in the context of increasing water scarcity. As part of the GLOBAQUA project, this study examines recent trends in climate, water quantity and quality parameters in the Ebro River Basin in Northern Spain to identify stressors and determine their joint impact on water resources. Mann-Kendall trend analyses of temperature, precipitation, streamflow, groundwater level, streamwater and groundwater quality data (spanning between 15 and 40 years) were performed. Moreover, anthropogenic pressures such as land use and alteration of natural flow by reservoirs were considered.

Climate data indicate increasing temperatures in the Ebro River Basin especially in summer and autumn, and decreasing precipitation particularly in summer. In contrast, precipitation mostly shows upwards trends in autumn, but these are counterbalanced by greater evapotranspiration due to higher temperatures. Overall, this results in annual and seasonal streamflow decreases at the majority of gauging stations. Declining trends in streamflow are most pronounced during summer and are also observed in subbasins without reservoirs. Diminishing water resources become also apparent in generally decreasing groundwater levels in the Ebro River Basin. This decrease is most pronounced in areas where groundwater serves as main origin for irrigation water, which demonstrates how land use acts as a local rather than regional driver of change.

Increasing air temperatures correlate with increasing water temperatures over the past 30 years, which indicates the effect of changing climate on water quality. However, the correlation between air and water temperatures decreases in the presence of reservoirs upstream of the sampling points. Reservoirs can thus alter the thermal regime of rivers, which might, in turn, pose a threat to aquatic ecosystems. Apart from the water demand for irrigation, agriculture is a main cause of nitrate pollution of both surface water and groundwater in the Ebro River Basin. Nitrate concentrations in streamwater have mostly decreased for the last 15 years, which is consistent with less fertilizer consumption in Spain since the early 2000s. However, nitrate concentrations remain high in many groundwater wells. Overall, the analysis of multiple pressures on water resources suggests that recent changes in the Ebro River Basin are driven by a variety of anthropogenic influences including changing climate. This emphasizes the importance of adapted land use and water resources management to secure sufficient quantity and quality of water resources in this large river basin.