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## ANALYSIS

# Economic valuation of environmental services sustained by water flows in the Yaqui River Delta

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## ABSTRACT

We attempted to estimate the economic value of environmental services provided by restored instream flows in the water-scarce Yaqui River Delta in Mexico. The Yaqui River begins near the U.S.–Mexico border and continues for 400 km before reaching the Oviachic dam, but has not reached the nearby Gulf of California for decades due to diversions for irrigation. These diversions have degraded the riparian ecosystem, coastal wetlands, and estuaries. Environmental services provided by restored flows in the Yaqui River would include healthy riverside vegetation, wetlands and estuaries, fish and wildlife habitats, non-use values, and recreation. A contingent valuation survey in 40 neighborhoods in the most populated Delta city, Ciudad Obregon, was administered to estimate non-market values of instream uses. Respondents were given a current and hypothetical Delta scenario (the latter assumed restored water flows in the River) and asked a willingness-to-pay (WTP) question regarding purchasing water for environmental flows through higher water bills. Results from 148 in-person interviews indicated that households would pay an average of 73 pesos monthly. WTP was found related to key variables suggested by economic theory and contingent valuation studies elsewhere: income, educational level, number of children in the household, and initial bid amount. These results will allow decision makers to compare the benefits generated by different water uses, including environmental services, and to manage scarce water resources under a long-term sustainable approach.

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## 1. Background

The objective of this study is to estimate non-market values for water in the Yaqui River Delta, Sonora, Mexico, based on residents' willingness-to-pay for existing or potential environmental services sustained by water flows in the Yaqui River. The Yaqui River is located in a trans-boundary 72,540 km<sup>2</sup> basin, largely situated in the Mexican State of Sonora and a small part in Chihuahua, as well as small

portions of Arizona and New Mexico in the United States (Fig. 1). The Yaqui River Basin is within one of the driest hydrologic regions in Mexico. The predominant climate is arid and semi-arid throughout the Basin, except in the eastern portion where the high mountains are located. The average annual rainfall in the area is 527 mm. The majority of the precipitation falls in the months of July to September and is dominated by the North American Monsoon (CNA, 1997). The runoff from precipitation is captured by several reservoirs on

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