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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 km² 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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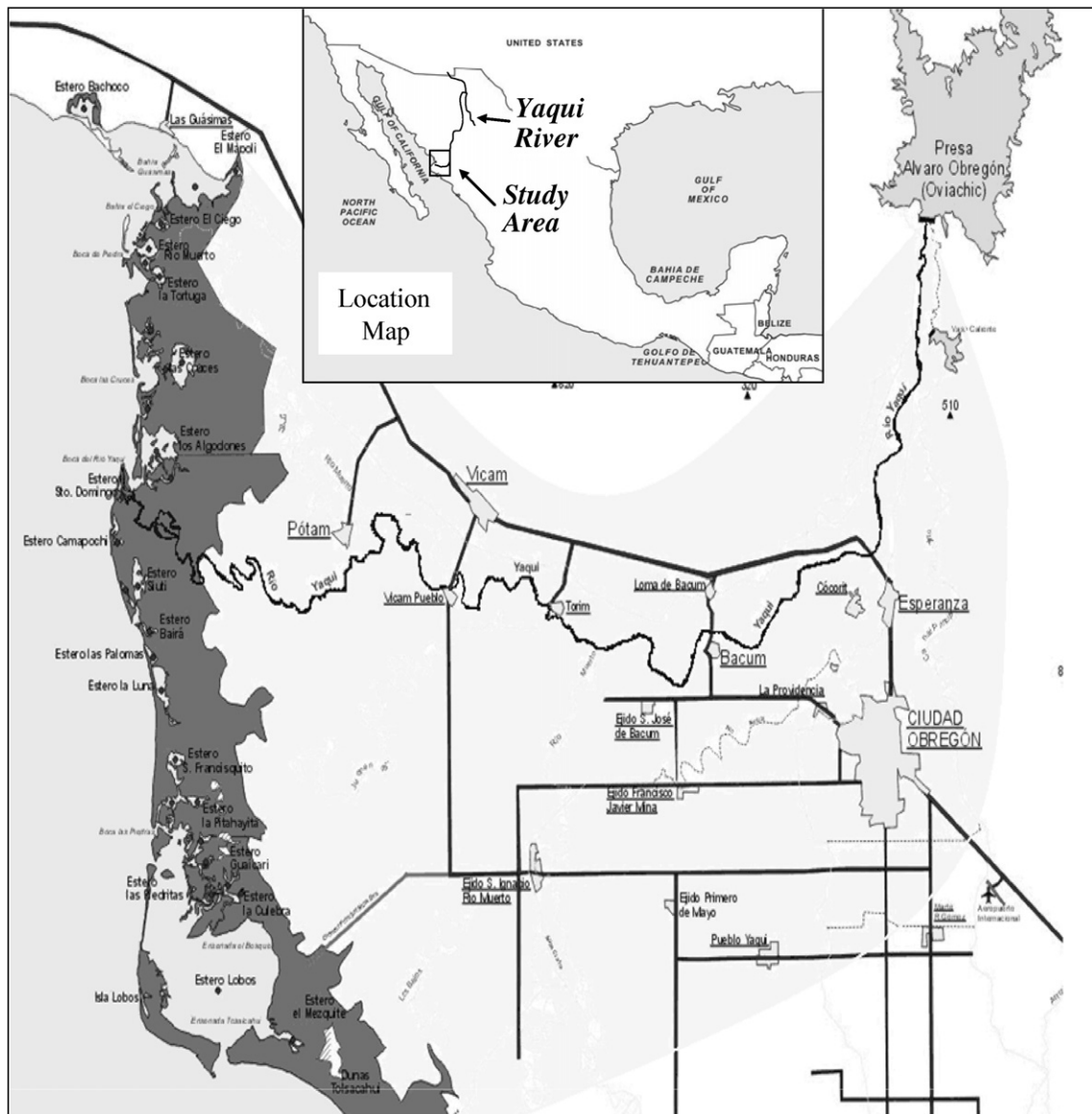


Fig. 1 – Yaqui River Delta and location of study area. Source: Adapted from **Departamento de Ciencias del Agua y del Medioambiente del ITSON, 2004.**

the Yaqui River and its tributaries, and is used mainly for irrigation purposes.

The Yaqui River Delta occurs where the River meets the Gulf of California, also called the Sea of Cortez (Fig. 1). The Delta is the location of two of the more important ecosystems in the lower part of the Yaqui River Basin: the riparian ecosystem, and the coastal wetlands and estuaries. The Yaqui Valley farming region, which is encompassed within the Delta, is the most important agricultural area (more than 250,000 ha) in Sonora State. Home of the Green Revolution in 1970s, this agricultural area comprises a wheat-based agricultural system developed since the establishment of the two main reservoirs on the Yaqui River between 1939 and 1964. Other crops include soybeans, cotton, maize, sorghum, and alfalfa. Agriculture is the largest user of water, representing more than 96% of the total water withdrawal in the Delta.

Water demand from cities and towns of more than 800,000 inhabitants in the entire Basin is concentrated in the growing

urban centers of Ciudad Obregon (433,000 residents in 2005), Esperanza, Villa Juarez, and Bacum. The urban water demand is increasing due to the accelerated migration of rural inhabitants to nearby cities. Other significant economic activities that exert a water demand in the Delta include manufacturing, animal husbandry, aquaculture and fisheries.

The environmental concerns associated with water management in the Yaqui River Delta are clearly linked to a decrease in water flows and deterioration of water quality. These concerns can be summarized by five major problems: salinity intrusion, agrochemical pollution, deterioration of wetlands and estuaries, habitat destruction, and loss of biodiversity (Keller et al., 1996). After completion of Oviachic Dam in 1952, the majority of the flow in Yaqui River has been used for irrigation. As a result, the Yaqui River has not reached the Gulf of California for several decades. This situation has deteriorated the quality of the environmental services provided by the ecosystems that depend on the water flows in the Yaqui River Delta.

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