

## **Response of riparian vegetation and birds to flow releases in the Colorado River Delta, Mexico**

Osvel Hinojosa-Huerta<sup>\*1</sup>, Edward P. Glenn<sup>2</sup>, Pamela L. Nagler<sup>3</sup>

[\\*osvelhh@gmail.com](mailto:osvelhh@gmail.com)

<sup>1</sup>Pronatura Noroeste, Avenida Jalisco 903. San Luis Río Colorado, Sonora, México. 83440. (+52) 653 53 367 38

<sup>2</sup>Environmental Research Laboratory, University of Arizona, 2601 East Airport Drive, Tucson, AZ. 85706.

<sup>3</sup>U.S. Geological Survey, Sonoran Desert Research Station, Biological Sciences East 115, University of Arizona, Tucson, AZ, 85721.

The restoration of riparian systems in western North America deals with the challenge of scarce water resources and the prevalence of the invasive saltcedar. These have been critical issues in the Colorado River delta, in Baja California and Sonora, Mexico, where the development of the basin caused the loss of over 80% of the wetland area in the last 100 years. In spite of the impacts, the Colorado River delta has experienced a recovery of riparian vegetation and birds in response to flows that have reached the area since 1981. During the last 12 years we have monitored the dynamics of riparian vegetation and the avian community, particularly in relation with river flows. In these studies we have found that cottonwoods and willows regenerate in the floodplain in response to water releases, despite the presence of saltcedar. Native tree populations are young and dynamic (ages 5–10 years), and have reached up to 12% cover in the floodplain of the Colorado in Mexico. In addition, a large proportion of water use in the riparian zone is provided by the shallow regional aquifer, derived from agricultural return flows that approach the surface in the riparian zone, and the depletion of groundwater levels has been a major cause of mortality in native trees. The riparian corridor supports a rich and diverse avifauna, with 61 regular breeding species, including sensitive birds, such as Yellow-billed Cuckoo and Yellow-breasted Chat, with higher bird densities than in the Lower Colorado River in the US. We found that avian diversity and species richness was more influenced by the presence of water than by vegetation type and that the major factors that determine the ecological value for birds in riparian areas are vegetation biomass, structural diversity, and the presence of surface water. Since 2002, precipitation in the basin has been below average, diminishing flows to the delta. From 2002 to 2008 the vegetation density in the floodplain decreased 29%, the percent cover of trees decreased 28% and open water decreased 80%. Both cottonwood and willow decreased, 42% and 76% respectively, and saltcedar increased 17%. Bird abundance remained without a significant trend and species richness had a decrease of 1.82% per year, but the community composition changed and species had different responses: 28 species had a significant downward trend, particularly riparian specialist and waterbirds, while 21 species had a significant upward trend. The birds with upward trend included exotic species or birds related to agricultural environments. In this context, we identify that the major issue for the control of saltcedar and the restoration of the riparian ecosystem is the maintenance of instream flows and adequate groundwater levels, as well as the dedication of pulse floods. The current conditions in the basin present significant obstacles to achieve this. However, the collaboration and participation of stakeholders and water users in both the U.S. and Mexico could lead to agreements for the dedication of water for the environment and the restoration of the Colorado River delta.