

Effects of Changing Climate and Water Availability on Four Riparian Species in the Southwestern United States

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The Lower Colorado River and Rio Grande Basins are home to many riparian species of different degrees of rarity. In our study we focused on two species of birds and two species of gartersnakes that are associated with water: the Yellow-Breasted Chat (*Icteria virens*), the American Yellow Warbler (*Setophaga petechia*), the Mexican Gartersnake (*Thamnophis eques*) and the Narrow-headed Gartersnake (*T. rufipunctatus*). While the extent of distributions of these species is relatively large, they are often patchily distributed in populations that are small. To evaluate the vulnerability of these species at a landscape scale due to changes in hydrology, we built models of suitability of current and future landscapes for these species. We relied on climatic and hydrological predictions, developed by the Bureau of Reclamation (as part of the WATERSmart program) and NASA's Moderate-Resolution Imaging Spectroradiometer (MODIS), to derive spatially-explicit metrics that quantify the greenness of riparian vegetation in time. Using WATERSmart data, we were able to project these metrics into the future. The projected changes in water availability by end of the century will directly affect the availability of permanent water and riparian vegetation that surrounds suitable habitats of our study species. Our results suggest significant changes in future landscape suitability (up to 64% of area) for all species that are in addition to other threats. Best models included riparian vegetation as an important component of the predictions but we note that finer scale examination of hydrology and climate effects on habitats would be more useful for effective management.