

The changing ecology of western honey mesquite in Grand Canyon

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The distribution and ecological role of western honey mesquite (*Prosopis glandulosa* var. *torreyana*) has changed in the Colorado River ecosystem in Grand Canyon since completion of Glen Canyon Dam in 1963. This population, extending 390 km through the canyon, may be one of the largest in this subspecies' declining southwestern range. Following river regulation that has eliminated annual flooding, western honey mesquite is no longer replacing itself on the pre-dam floodplain terraces it has occupied in Grand Canyon for more than a thousand years. The elimination of natural high volume floods may account for this change, since mesquite seeds experience greater germination following flooding events which scarify them, wet soils and, essentially, plant them in organic debris.

Despite a lack of recruitment on pre-dam terraces, mesquite is aggressively colonizing the lower, post-dam, stabilized shoreline in Grand Canyon, along with other riparian species. This convergence of mesquite and riparian species including coyote willow (*Salix exigua*), several seepwillow species (*Baccharis spp.*), arrowweed (*Tessaria pluchea*) and nonnative salt cedar (*Tamarix spp.*), has created a unique set of interactions in Grand Canyon. Collectively, these species have come to support a great diversity of animals that are dependent on riparian ecosystems.

Another consequence of river regulation—significant losses of critical soil nutrients—is further changing the role of mesquite in Grand Canyon. This study determined that mesquite is fixing nitrogen in Grand Canyon and, as a result is exerting a positive influence on both soils and native riparian vegetation growing along the river. This is due to its contributions of nitrogen, and by functioning as a nurse plant. This study has shown that mesquite along the river, as well as in pre-dam terraces, is contributing a significant amount of nitrogen to otherwise nitrogen-deficient soils. Native plants including several species of *Baccharis* are using nitrogen fixed by mesquite. Nearest neighbor measures show that common riparian plants occur most often in close proximity to mesquite rather than away from it in study plots, and these neighboring plants tend to be larger when growing close to mesquite rather than when growing at a distance from it. These findings are important because few studies have considered the ecological relationships of mesquite and shrub species in riparian settings.

Most mesquite along the river are establishing in rockier geomorphic substrates such as debris fans, cobble bars and backchannels, which may become the predominant substrate types in this ecosystem due to ongoing sediment loss. While the new ecological role of western honey mesquite along the dammed Colorado River reflects an expanding population that supports both plant and animal diversity there, it must be viewed cautiously, since mesquite is highly susceptible to drowning when inundated during flooding, so the population establishing along this new shoreline will be highly vulnerable to significant unforeseen flooding events in the future. The perched, pre-dam mesquite population was found to be in relatively good health, despite the damming of the Colorado River in 1963, and it may be the survival of this population that ultimately determines the fate of western honey mesquite in Grand Canyon.