Busch, D. E. 1992. Analyses of the structure and function of lower Colorado River riparian plant communities. Ph.D. dissertation. University of Nevada. Las Vegas, Nevada. 253 pp.

Throughout western North America, riparian ecosystem function has been transformed by anthropogenic influences on riverine environments. Modified flood frequencies, durations or intensities, depressed floodplain water tables, and increased rhizosphere salinities contribute to change in communities formerly dominated by alluvial forest taxa. In addition, the invasion of a naturalized arborescent shrub, Tamarix ramosissima, potentially alters competitive hierarchies and disturbance regimes in riparian ecosystems. To evaluate southwestern riparian community structure and function, comparison of ecophysiological characteristics of dominant woody taxa with site physical parameters was undertaken in riparian ecosystems that are relatively pristine (Bill Williams River) and highly perturbed (lower Colorado River). Analyses of leaf elements and tissue water relations parameters indicated that Tamarix was halophytic, apparently using Na to adjust osmotically to moisture or salinity stress. Tamarix leaf litter accumulation may also contribute to episodic fires, a form of disturbance that appears to be new in southwestern riparian ecosystems. Post-fire soil salinization and hydraulic efficiency in resprouting burned Tamarix individuals provided evidence for fire adaptation in this species relative to native woody taxa. The shrub, Tessaria sericea, appeared to share certain of these traits with Tamarix, apparently contributing to its success in colonizing perturbed floodplain habitats. Stable isotopic analyses of moisture sources and xylem water showed that Tamarix may be facultatively phreatophytic while the formerly dominant alluvial forest taxa, Salix gooddingii and Populus fremontii, are obligate phreatophytes. Leaf tissue carbon isotopic discrimination provided evidence for high water use efficiency in Tamarix relative to the other three taxa evaluated. Experimental removal of Tamarix from stands where Salix was codominant resulted in morphological change, less negative water potentials and higher leaf conductance in Salix, all evidence for interspecific competition. The persistence of Salix but not Populus on the Colorado River may occur due to lower osmotic potentials and higher cell elasticity in the former species. A high proportion of senescent Populus in Colorado River riparian vegetation plots provided an indication that this species is approaching local extinction in this ecosystem. Ordination analyses provided evidence for riparian community structure along gradients of moisture, salinity, disturbance from fire, and community maturity.