Hydrogeomorphic effects of a controlled flood release on *Tamarix* and *Salix*, Bill Williams River, AZ

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Abstract:
We examined geomorphic and vegetation responses to a controlled flood releases on the Bill Williams River (BWR) in western Arizona. In March 2005, a controlled flood release resulted in the widespread establishment of woody riparian seedlings, including many seedling patches co-dominated by *Tamarix* spp. and *Salix gooddingii*. In March 2006, a controlled flood of 56 m^3/s for two days, followed by a gradual daily drawdown of approximately 1 m^3/s, was released from Alamo Dam on the BWR. We investigated whether this relatively small flood release (1.1–1.2 year event compared to pre-dam peak flows) would result in greater damage to and mortality of *Tamarix* versus *Salix*, and affect geomorphic changes associated with vegetation responses. Physical data collection included pre- and post-flood topographic surveys, bed sediment sampling, and deployment of scour chains and velocity and stage measurements during the flood at two field sites. Biological data collection included pre- and post-flood density, diameter, and height of 1 year-old *Tamarix* and *Salix* seedlings growing on channel bars at the sites. At the upstream site, approximately 18 km downstream from Alamo Dam, the flood caused scour of *Tamarix* seedlings and their substrates from mid-channel bars, lateral shifting of bars, and coarsening of bed sediment. In the downstream reach, approximately 48 km downstream from Alamo Dam, we observed burial of *Tamarix* seedlings as a result of aggradation, but no significant change in bed sediment sizes. In both cases, *Tamarix* suffered greater reductions in density than *Salix*. Our results suggest that this is largely due to the substantially greater first-year height and diameter growth of *Salix* relative to *Tamarix*. Although boundary shear stresses during the flood were lower in the downstream reach than in the upstream reach, total suspended sediment concentrations were approximately half as large in the latter reach, perhaps as a result of downstream decreases in the effect of dam-induced reductions in sediment supply. Our observations suggest that in a dynamic, sand-bed river such as the Bill Williams, even relatively small floods can generate sufficient forces and/or geomorphic changes to cause higher mortality of first-year *Tamarix* than *Salix*. These results also illustrate how the effect of floods or other components of hydrologic regimes on riparian vegetation are mediated by geomorphic processes on both a reach scale, where local bed gradients and geomorphic characteristics influence shear stress dynamics, and on a basin scale, where sediment supply dynamics may have important influences on morphologic and vegetation responses.