Importance of Understanding Sedimentation for Tamarisk Control Efforts

Jesse D. Roberts[1], Scott C. James[1], Craig A. Jones[2], and David Groeneveld[3]

[1] Soil and Sediment Transport Group, Sandia National Labs, NM, 88220. jdrober@sandia.gov, scjames@sandia.gov
[2] Sea Engineering Inc., Santa Cruz, CA, 95060. cjones@seaengineering.com
[3] HydroBio, Santa Fe, NM, 87501. David@hydrobio.org

Abstract:
Non-native phreatophytes, such as tamarisk, are an invasive tree species infesting and seriously impacting millions of acres of land in the American West. These species have no natural enemies in the United States, and are swiftly replacing native vegetation thus impacting livestock/wildlife habitat, increasing wildfire intensity, decreasing recreational activities, and most notably, consuming significantly more water than native species.

Although the motives for tamarisk control are born from a desire to promote healthy ecosystems and watersheds, it is vital to recognize that tamarisk provides important value, at a minimum for; a) stabilizing the banks of Western rivers prone to avulsion and erosion and, b) endangered species habitat (although often considered poor-is better than no habitat). Destroying these trees without rational planning may produce negative impacts such as inducing severe, costly erosion and displacing endangered species. All western states have begun or completed strategic management plans to control non-native phreatophytes. Difficulties in tamarisk management lie in formulating and implementing effective/efficient tactical control plans *(built from the foundations provided by strategic plans)* suited for any given riparian environment or watershed, while minimizing negative risk or creating new problems.

If tamarisk removal successfully frees water that would otherwise be lost to evapotranspiration, a portion of this extra water must flow into the river and be stored in reservoirs to be available for beneficial use. Recently, salt cedar control efforts along the Pecos River have been conducted through application of herbicides by aerial spraying. This has resulted in defoliation and presumably killing of thousands of acres (14,000-16,000) of salt cedar in this area. Brantley Reservoir is the primary repository of salvaged water of current tamarisk control efforts. There are approximately 160 river miles between Brantley and the next upstream reservoir, Ft. Sumner. The Bureau of Reclamation cleared the flood plain of saltcedar on most of this 160 mile reach thirty years ago. However, the Bureau of Reclamation left a 50 foot buffer of salt cedar growing on each river bank for wildlife cover and stream bank stabilization. Once this saltcedar is removed from the river banks, so too will be the root system that has stabilized the banks for many years. This will leave the banks of the river susceptible to mobilization during subsequent significant flood flows until native plants and trees can be restored. With over 320 miles of banks (accounting for both sides of the river) and many significant bends and lots of potential high flows due to thunderstorm runoff, these bank sediments threaten to be eroded into the river and transport to and accumulate in Brantley reservoir. Sediments are not the only concern. Dead tamarisk biomass left on the rivers edge could be washed downstream during large flow events and accumulate at river crossings, significantly increasing chances for over bank flooding.

In this study, erosion has been assessed in a variety of ways, including field measurements and aerial/satellite imagery. Stream bank erosion in the forms of lateral migration (channel widening/narrowing) and bank slope degradation were assessed. Field measurements included repeated, detailed bathymetric surveys at several locations across the river channel as well as repeated GPS measurements used to map large sections of river at the top and bottom of a stream bank to assess lateral migration and bank slope patterns. Measurements of texture and observations of plant types (dead and new growth) were also made. Aerial photography for the entire state of New Mexico was taken between 1996 and 1998. Since then only scattered aerial

images existed, until now. In 2005 the entire state was flown again, which has enabled investigation of pre-saltcedar control images (1996-1998) in comparison to post-saltcedar control images (2005).

Predictions of sediment stability and transport are made using a combined hydrodynamic and sediment transport model recently developed at Sandia (called SNL-EFDC). The Adjustable Shear Stress Erosion and Transport (ASSET) Flume is a unique Sandia developed device for measuring erosion and transport of sediments at depth, under high flow conditions, and because the device is mobile, in the field for ex-situ measurements. The data from the ASSET Flume is directly input into the SNL-EFDC model and the monitoring data described above will help to calibrate model results. The model is used to predict under what conditions the Pecos River bed and bank sediments become mobile as well as where and how far sediments are transported downstream.