

Nagler, P. L. 2001. Remote sensing applications: Environmental assessment of the Colorado River delta in Mexico. Ph.D. dissertation. University of Arizona. Tucson, Arizona. 411 pp.

The extent of revegetation in the Colorado River delta in Mexico is described, with emphasis on the return of native cottonwood (*Populus fremontii*) and willow (*Salix gooddingii*) trees. Low-level aerial and satellite remote sensing methods were combined with ground surveys to census the vegetation in a 100 km reach of riparian corridor in Mexico. Although the invasive plant, saltcedar (*Tamarix ramosissima*), still dominates the riparian zone, native trees now account for 23% of the vegetation in the delta. Multi-band digital camera images obtained by aircraft were used to calculate the Normalized Difference Vegetation Index (NDVI) and scored for percent vegetation cover (NDVI:%C has $r = 0.91^{***}$). A Thematic Mapper (TM) image taken concurrently with the aerial survey was similarly classified, and by comparing scenes on the TM and aeriels, it was possible to calibrate NDVI with percent vegetation on the TM image. This information was used to conduct a change analysis relating flows in the Colorado River with summer vegetation patterns on TM images for the years 1992-1999. The results support the importance of pulse floods in restoring the ecological integrity of arid-zone rivers. This dissertation also compared transpiration rates of three Sonoran Desert riparian trees using sap flow and leaf temperature methods using constructed canopies (two of each species: *Populus fremontii* (cottonwood), *Salix gooddingii* (willow) and *Tamarix ramosissima* (saltcedar)) in an outdoor experiment in Tucson, Arizona. Canopies were measured over 11 days for both sap flow and canopy and air temperature differential ($T_c - T_a$) under non stressed and stressed conditions. Objective 1: to determine the strength of the relationship between transpiration (E_t) and $T_c - T_a$ to determine if $T_c - T_a$ can be a useful remote sensing method to measure E_t for these species. Objective 2: to compare E_t rates among species, to determine if the invasive species, saltcedar, has higher E_t rates or ecophysiological advantages over the native trees species. We conclude that the $T_c - T_a$ method could be useful in estimating E_t by remote sensing over riparian corridors, and that native trees are not at an ecophysiological disadvantage to saltcedar so long as sufficient non-saline soil moisture is available to support E_t .