

This is an abstract and the conclusions from Jose Solis' M.S. thesis (Fall 2008) based on ET measurements in the Rio Grande at locations where saltcedar is managed using different methods. We have been conducting this ET study since 2005.

ABSTRACT

EVAPOTRANSPIRATION DEPLETION OF SALT CEDAR MANAGED AREAS IN THE NEW MEXICO ARID ENVIRONMENT ALONG THE RIO GRANDE

Many federal, state, and local water management agencies have been extremely concerned with the infestation of this exotic saltcedar (*Tamarix* spp.) plant due to its reputation for high water consumption and the difficulty and cost involved in its management. Several methods of control have been implemented in an effort to reduce saltcedar evapotranspiration (ET), improve ecological health of riparian regions along the river, and re-establish indigenous plants such as cottonwood, willows and saltgrass among others. Management practices for controlling saltcedar include mechanical, biological, chemical and ecological competitive means.

This study investigated evapotranspiration (ET) depletion of saltcedar managed areas where three common methods i) mowing, ii) herbicide treatment and iii) plowing or clearing have been practiced. Eddy covariance method was used to measure ET at four sites which included Caballo mowed saltcedar site, Monticello herbicide saltcedar treated site, Bosque del Apache National Wildlife Refuge (NWR) plowed or cleared saltcedar site, and Bosque del Apache NWR monotypic dense saltcedar site.

The mean ET measured at the study sites during 2006 and 2007 for mowed saltcedar was 997 mm/yr, for Monticello herbicide treated saltcedar site was 633 mm/yr, for Bosque del Apache NWR plowed site was 907 mm/yr, and for Bosque del Apache NWR dense monotypic saltcedar site was 1321 mm/yr.

Results showed an average reduction in ET from 5 mm/day to 3.8 mm/day for 19 consecutive days during first mowing and from 5.3 mm/day to 4.8 mm/day for 22 consecutive days during second mowing at Caballo mowed saltcedar site. Precipitation during the second mowing period was reflected in the ET reduction. A comparison of mowed, herbicide treated and plowed ET to a dense monotypic saltcedar stand as a baseline resulted in mean ET reduction of 24.5% (mowed twice in 2007 and previously in 2005), 52%, and 31%, respectively. After deducting mean precipitation from the measured ET, assuming all precipitation evaporated, a reduction in ET of 38% was achieved when mowed saltcedar site was compared to the dense site; ET reduction of 66% and 37% was achieved when herbicide treated and plowed sites were compared to dense site.

Conclusion from the study:

Evapotranspiration rates were measured at four saltcedar sites using eddy covariance method along the Rio Grande. Three of the sites were managed for saltcedar control by mowing (Caballo mowed study site), treating with herbicide (Monticello treated study site) and by plowing (Bosque del Apache NWR plowed study site). One of the sites was not managed and was composed of monotypic dense saltcedar (Bosque del Apache NWR dense study site) and used as a baseline. The following conclusions were achieved:

- The measured ET of mowed saltcedar at Caballo mowed saltcedar site for 2006 was 941mm/yr (3.09 ft/yr) for 322 days, 1015 mm/yr (3.33 ft/yr)for 365 days in 2007 with an average of 997 mm (3.27 ft) for 2006 and 2007;
- Annual ET of 644 mm/yr (2.11 ft/yr) and 623 mm/yr (2.04 ft/yr) was measured at the Monticello herbicide treated saltcedar site in 2006 and 2007, with an average of 633 mm (2.08 ft) for both years;
- Evapotranspiration at plowed (cleared) Bosque del Apache NWR of 902 mm/yr (2.96 ft/yr) was measured in 2006 for 365 days, 777 mm/yr (2.55 ft/yr) in 2007 for 326 days with an average of 907 mm (2.98 ft) for both years;
- Annual ET of 1283 mm/yr (4.21 ft/yr) and 1358 mm/yr (4.46ft/yr) was measured at Bosque del Apache NWR dense monotypic saltcedar site in 2006 and 2007 and an average of 1321 mm (4.33 ft);
- The ET decreased from 5 mm/day to an average of 3.8 mm/day (24%) for 19 consecutive days during the first mowing and from 5.3 mm/day to an average of 4.8 mm/day (15%) for 22 consecutive days during the second mowing in 2007, at the Caballo site. Precipitation of 31.75 mm (1.25 in) was also recorded during the second mowing which affected the reduction of ET;
- Mowing, twice a year, showed a reduction in ET of about 25% (dense saltcedar = 1358 mm/yr and mowed = 1015.33 mm/yr) when ET of a dense monotypic saltcedar stand was compared to mowed saltcedar stand. When precipitation was deducted from ET measurements at both sites, ET reduction of 36% (dense saltcedar = 1174.1 mm/yr and mowed = 751.93 mm/yr) was observed in 2007. Mean ET reduction during the two years of measurements was 24.5%; dense saltcedar = 1320.64 mm/yr and mowed = 997.11 mm/yr for both 2006 and 2007. When mean precipitation (annual precipitation at Bosque del Apache NWR = 191.75 mm and at Caballo mowed saltcedar site = 297.3 mm is deducted from the ET, the reduction in ET was about 38%;
- Herbicide treated site showed an average reduction in ET of about 52 % (average dense saltcedar ET = 1321 mm/yr and average treated saltcedar ET = 633 mm/yr) when compared to dense monotypic saltcedar stand at Bosque del Apache NWR for 2006 and 2007. An ET reduction of 66.4% was achieved when mean precipitation (annual precipitation at herbicide treated site = 253.75 mm) is deducted from ET at both sites during 2006 and 2007 measurements;

- Plowed study site showed a reduction in ET of 30% when compared to dense monotypic saltcedar stand at Bosque del Apache NWR (dense saltcedar ET = 1283 mm/yr and plowed ET = 902 mm/yr). This was based on 365 days of measurements in 2006. Mean ET reduction of 31.3% was observed during 2006 and 2007 measurements. A reduction of 36.6% was achieved when mean precipitation was deducted from measured ET values;

- Salinity measured at Caballo mowed saltcedar site was very high (EC ranged from 0.87 to 84.7 mmho/cm). The soil sodium-adsorption ratio (SAR) was higher than 13 which makes this area unsuitable for growing most agricultural crops;

- Salinity measured at Monticello treated saltcedar site was low (EC ranged from 0.83 to 3.91 mmho/cm). The soil sodium-adsorption ratio (SAR) was lower than 13 (measured SAR < 3) which makes this area suitable for growing most agricultural crops.