2003

# The Pecos River Ecosystem Project
# Progress Report

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## Background of Situation

Saltcedar (*Tamarix* spp.) is an introduced phreatophyte in western North America. The plant was estimated to occupy well over 600,000 ha of riparian acres in 1965 (Robinson 1965). Saltcedar is a vigorous invader of riparian, rangeland, and moist pastures. Saltcedar was introduced into the United States as an ornamental in the early 1800's. In the early 1900's, government agencies and private landowners began planting saltcedar for stream bank erosion control along such rivers as the Pecos River in New Mexico. The plant has spread down the Pecos River into Texas and is now known to occur along the river south of Interstate 10. More recently the plant has become a noxious plant not only along rivers and their tributaries, but also along irrigation ditch banks, low-lying areas that receive extra runoff accumulation, and areas with high water tables. In addition, many CRP acres in central Texas are being invaded with saltcedar.

Saltcedar is a prolific seeder over a long period of time (April through October). Early seedling recruitment is very slow but once established, seedlings grow faster than native plants (Tomanek and Ziegler 1960). Once mature the plant becomes well established with deep roots that occupy the capillary zone above the water table with some roots in the zone of saturation (Schopmeyer 1974). The plant can quickly dominate an area, out-competing native plants for sunlight, moisture, and nutrients. Mature plants can withstand prolonged drought or periods of inundation. The plant also brings salts to the surface through the plant and excreting it through the leaves dropping onto the soil surface below the canopy. Only extremely xeric or halophytic species of plants can tolerate the understory environment of saltcedar. As a result, the plant commonly forms a near monoculture where it grows.

Probably more important than any other fact about saltcedar is its hydrological implications. An invasion of a flood plain or river bank by saltcedar usually leads to depletion of stream/river flow, lowered water table, an increase in the area inundated by floods, and an increase in sediment production (Blackburn *et al.* 1982). The plant has an extremely high rate of evapotranspiration assists the plant to tolerate saline conditions. Numerous techniques have been used to estimate evapotranspiration rates of saltcedar including Bowen ration, eddy covariance, micro-meteorological data, evapotranspirometer, non-weighing lysimiter, tanks, sap flow, stem-heat-balance, and groundwater monitoring wells. Estimated evapotranspirational water use by saltcedar varied from 1.2 to 10.2 ft. per year. Major factors affecting volume of water transpired by saltcedar include leaf area, plant density and size, depth to water table, and soil type. Two specific studies reported that saltcedar transpired 0.3 cm to 1.0 cm of water per day and from 1.2 m to 3.1 m (3.9 to 10.2 ft.) of water per year (Davenport *et. al.,* 1982), and 2.1 cubic meters/square meter (Carmen and Brotherson 1982).

Monotypic stands of saltcedar have a negative impact on wildlife and livestock. The plant provides little browse and no seed food source for native wildlife species. The wildlife habitat value of saltcedar is limited to screening cover for mammals, nesting sites for some birds, and a pollen source for bees. In most instances, the wildlife habitat value of a saltcedar monoculture is much less than that of its native counterpart that it has replaced (Cohan *et. al.* 1978; Anderson and Ohmart 1977).

**Justification of Situation**

The management of saltcedar infestations has, more than once, resulted in the return of surface water to an area. Two examples documented include the Eagle Borax Spring in Death Valley National Monument (Neil 1983) and Spring Lake in New Mexico (Duncan 1997). At Spring Lake in New Mexico, saltcedar was treated with Arsenal™ herbicide. Within 34 months after application, the water table had risen to the soil surface from a depth of greater than 6.0 m below the soil surface. This occurred even though the area had experienced a mild drought.

Fires burn easily through dead or green saltcedar and will almost always top kill the plants. However, due to its ability to re-sprout from the base, seldom does fire kill the plant as the root crown area is usually well protected from the fire. Mechanical control practices have shown only slightly greater success when compared to fire. Mowing or shredding have shown similar results to burning, while root plowing or bull dozing have provided some mortality. However, the soil surface is greatly disturbed causing high erosion potential, the plants have a high re-sprouting capability, and the associated costs are prohibitive in most instances. Because of these reasons, use of the root plow or other heavy equipment as a control method for saltcedar has become less frequent (Hollingsworth 1973).

The response of saltcedar to chemical control has historically been variable, with little satisfactory control except under specific conditions or repetitive applications. The most satisfactory control was provided by cut stump or basal bark treatments. These treatments tend to be very time consuming and not practical for larger acreage. Additionally, many of the herbicides historically used for saltcedar control are no longer approved or currently unavailable. Research has been conducted recently (1987 to present) with Arsenal™ (Imazapyr) herbicide. Results indicate Arsenal™ applied alone or in combination with Glyphosate controlled saltcedar to levels of 90% or greater within one year after application when applied in August or September (Duncan and McDaniel 1998). Their recommendations include 0.5 + 0.5 lbs. a.i./acre of Arsenal™ and Glyphosate, respectively, applied with a fixed wing aircraft.

Saltcedar occupies a near continuous buffer along both banks of the Pecos River from Red Bluff Dam southward for the entire area (approx. 180 river miles) of the Red Bluff Irrigation District. The width of the saltcedar band varied from 25 to 500 feet with an average of 150 feet on each river bank. Within this stretch of river, saltcedar occupies about 30 to 40 acres per river mile. Additionally, the Pecos River in Texas is a meandering stream with a ratio of river miles to air miles of about 3 to 1. Another primary concern of the project was to apply the herbicide with minimal contact of off-target vegetation. This situation created a real challenge for aerial application of herbicides.

**Project History and Accomplishments**

The Pecos River Ecosystem Project was proposed by the Red Bluff Water and Power Control District in 1997, to address saltcedar issues along the Pecos River. The initial objectives of the project were to increase efficiency of water delivery in the river to irrigation districts within the Red Bluff District and improve the quality of the water by decreasing the salinity. After four years of herbicide application on the saltcedar, the project has emerged as the first step to what could be important to the overall statewide plan for water conservation along Texas rivers by managing saltcedar infestations. Success of the Pecos River Ecosystem Project can be attributed mainly to its cooperative effort and organization. Numerous agencies, organizations, and companies were involved in the organizational efforts early in the project development, some of which are listed below.

- Upper Pecos Soil and Water Conservation District
- Texas Cooperative Extension
- Texas Department of Agriculture
- USDA Natural Resources Conservation Service
- Red Bluff Water and Power Control District
- Irrigation Districts in Loving, Reeves, Ward and Pecos Counties
- US Environmental Protection Agency
- Pecos River Compact
- International Boundary and Water Commission
- BASF
- Local landowners

The first step undertaken by the group was to develop a section 24(C) special use label to use Arsenal™ herbicide on saltcedar within rangeland and aquatic areas in Texas. The label was prepared by the Pesticide Division of the Texas Department of Agriculture and approved for use in 1999. The project was setup with two major phases, saltcedar treatment phase and debris removal phase. Also of major concern to the project group was the revegetation of the river banks with native plants to complete the ecosystem restoration. Once the label and funding were secured, the project was ready to begin the first phase of herbicide treatments. The Upper Pecos Soil and Water Conservation District Board of Directors were selected to administer the project.

Phase one of the project began in October 1999. During the initial meetings to begin planning the process of saltcedar removal, several major concerns emerged. First, the treatment method selected should provide a high rate of saltcedar mortality while minimizing the detrimental effects on existing native vegetation. Second, this should be accomplished in the most economical way possible. And finally, soil loss from stream banks should be minimized as much as possible. Another daunting task was to obtain permission from private landowners to treat saltcedar along the river. A "spray easement" was developed and used as a contract between the Project and private landowners, allowing access for treatment and follow-up management for a 10 year period. To date, over 800 easements have been signed by private landowners, with a rejection rate of less than 1%. Bids were solicited from aerial applicators in late summer 1999 with the project ultimately being awarded to North Star Helicopters from Jasper, Texas. With funding, landowner permission, and applicator contract in hand by August 1999, initial treatments began in September.

Applications of 4 pints a.i./acre of Arsenal™ were made with helicopter applying the herbicide with large droplets and high total spray volume. The helicopter had the advantage of being able to fly at slower air speeds compared to fixed-wing aircraft, which made the sharp turns of the river much easier to navigate. The helicopter application also provided for much higher precision of application by utilizing specialized nozzle and boom technology. The herbicide was applied in a total spray volume of 15 gallons per acre with a 1500µ droplet. Less than 0.5% of the droplets were "driftable" fines (<200µ). The boom was also sectioned into 3 – 15 ft. sections for an overall width of 45 ft. Combinations of the boom could be turned on to allow for a 15, 30 or 45 ft. swath width. This further reduced the amount of herbicide that came in contact with off-target vegetation. Another advantage of the helicopter over fixed-wing aircraft was its ability to land on loader trucks that were positioned near the river and eliminated the need of ferrying to and from a landing strip.

Helicopters were also equipped with GPS navigational equipment to aid in application. The use of on-board GPS allowed for near elimination of skips between spray swaths and allowed the pilot to easily return to the point where they finished spraying the previous batch load. The system was also tied into the sprayers flow control system so that rate of flow through the boom was varied to precisely match ground speed, eliminating the need to maintain a constant ground speed. After completion of treatments, GPS log files were downloaded to a computer to produce maps of the treated area and make calculations about the area treated.

Percent mortality estimates were made during the summer of 2002 at five sites along the river (Fig. 1). Multiple transects were conducted at each site to determine percent mortality of saltcedar by counting live and dead plants along transects on both sides of the river. A minimum of four transects were read at each site. Results indicate an average of 85-90% mortality of saltcedar from previous year applications. An extensive monitoring program was initiated prior to the beginning of the project in 1999. The specific objectives of the monitoring project are to determine the effects of saltcedar removal on water quality and quantity in the Pecos River and estimates of water salvage from control of saltcedar are being estimated. A separate 2003 Pecos River Monitoring Report highlights findings from these monitoring efforts.

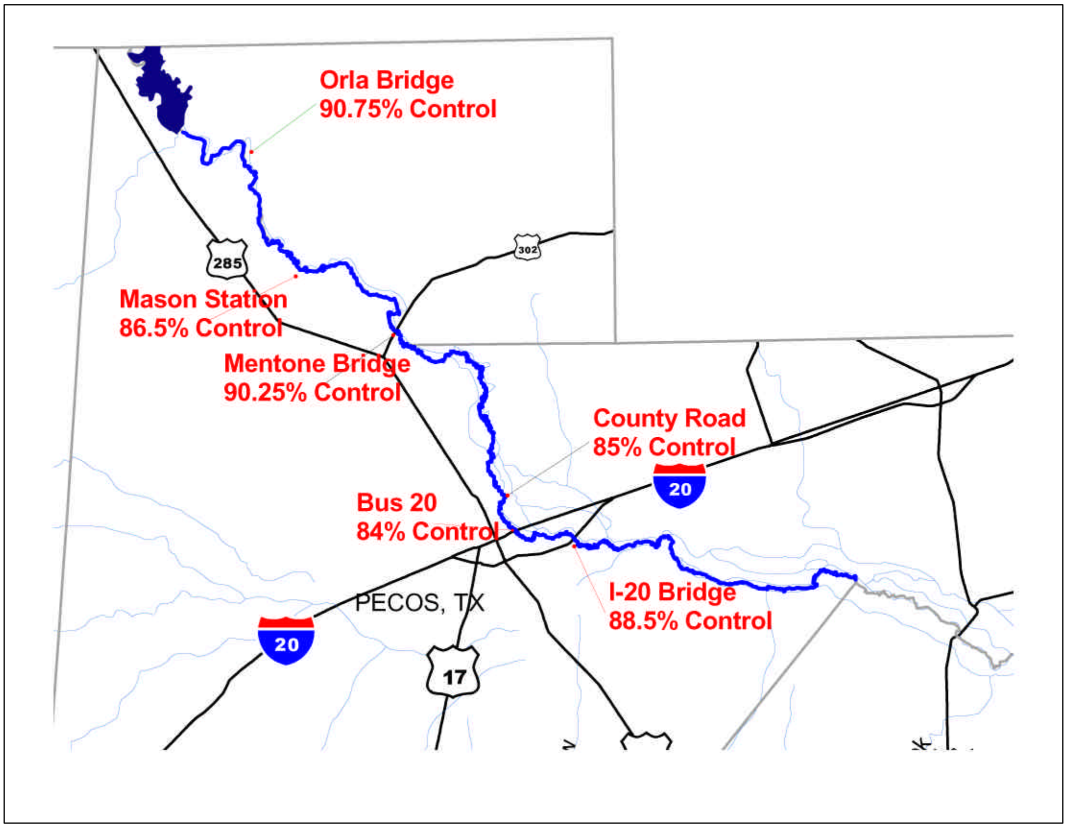


**Figure 1.** Percent mortality estimates on saltcedar trees along several site locations on the Pecos River, Texas.

The project was privately funded in 1999 and 2000 by Red Bluff Water and Power Control District and irrigation districts along the Pecos River. Approximately 66 river miles (Table 1.) or about 1344 acres of saltcedar were treated with an actual spray cost of $253,555.

During the 2001 legislative session, $1 million was allocated to the Pecos River Ecosystem Project by the State of Texas. Eight percent of these funds were used for project administration and monitoring with the remaining 92% used for saltcedar treatments in 2001 and 2002. Third year (2001) applications treated approximately 57 river miles or 1440 acres of saltcedar at a cost of $263,000. From 1999 through 2001, 2774 acres of saltcedar were treated at a total cost of $515,635.

Fourth year applications were completed in September 2002. Approximately 3567 acres were treated including segments of the river between Red Bluff and Grandfalls, TX that were not sprayed during the previous years, from the New Mexico/Texas state line to Red Bluff Lake (including areas around the lake) and 5 miles of Salt Creek from the convergence with the Pecos to the bridge over highway 285. About $660,000 was spent during the 2002 spray season.

Applications in 2003 were made through the USDA NRCS Environmental Quality Incentives Program. This is a private landowner based program for cost share of environmental practices. The program provided 75% of the saltcedar treatment costs to the landowner. The Texas State Soil and Water Conservation Board provided the remaining 25% of the cost through the Texas

Brush Control Program. During 2003, approximately 3730 additional acres of saltcedar were treated within the Pecos Basin Watershed in Culberson, Reeves, Ward, Crane, Pecos, Crockett, Terrell, and Val Verde Counties. Of this acreage treated, approximately 76 miles of Pecos River or 2,667 acres were treated. The remaining acres were treated along tributaries and springs within the basin. Treatment cost during 2003 was $210/acre for a total of $783,300 spent (unofficial estimate of EQIP contracts).

To summarize, from 1999 through 2003, 199 river miles of the Pecos River and various tributaries and springs within the basin have been treated for saltcedar control in Texas (10, 241 acres). Projected acreages and river miles treated are summarized in Table 1. Approximately $1,959,855 has been spent to treat 10,070 acres and 199 Pecos River miles have been treated. Average percent mortality of saltcedar from aerial applications is estimated between 85 and 90. Debris removal and follow-up management continues to be a priority to complete the project. The project directors are currently trying to secure funding to begin this second phase of the project.

Additional information on the project can be obtained from the Internet at the following web site:

http://farwest.tamu.edu/rangemgt/prep.html

*Research and monitoring efforts on the Pecos River Ecosystem Project were funded by a grant from the Texas Department of Agriculture and by the Rio Grande Basin Initiative administered by the Texas Water Resources Institute of the Texas A&M University System Agriculture Program with funds provided through a grant from Cooperative State Research, Education, and Extension Service, U.S. Department of Agriculture, under Agreement No. 2001-45049-01149.*

Texas Water
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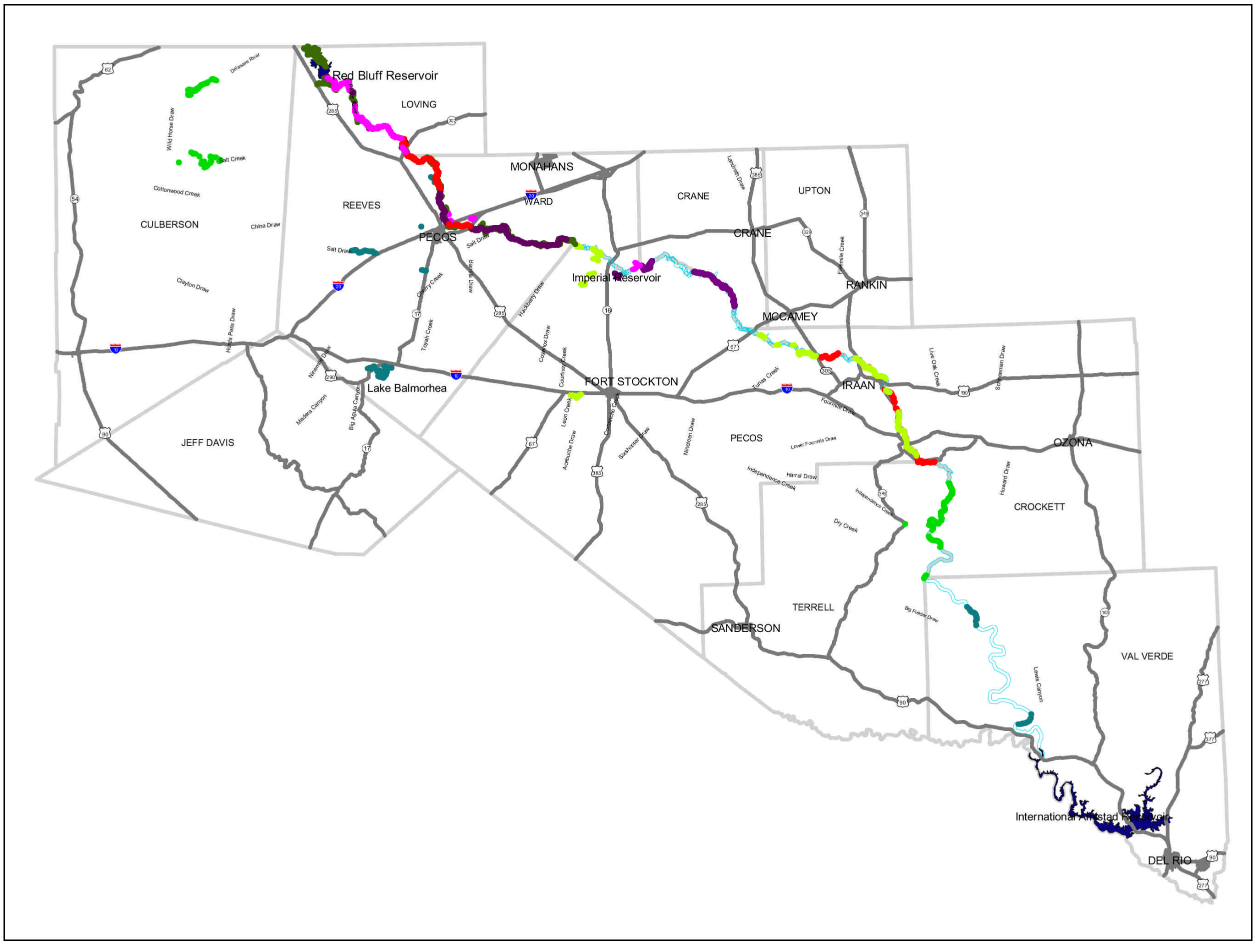
**Table 1.** Saltcedar acreage and river miles treated along the Pecos River by year and river segment as measured with spray logs files.

| Area Treated | Year Treated | Acres Treated | Total Acres | River Miles | Acres/Mile |
|---|---|---|---|---|---|
| **Red Bluff Lake** | 2001 | 22 | | | |
| | 2002 | 1137 | | | |
| | **Total** | | **1159** | | |
| **Delaware River** | 2003 | 158 | | | |
| | **Total** | | **158** | | |
| **Salt Creek** | 2002 | 151 | | | |
| | 2003 | 122 | | | |
| | **Total** | | **273** | | |
| **Salt Draw** | 2003 | 67 | | | |
| | **Total** | | **67** | | |
| **Leon Creek** | 2003 | 157 | | | |
| | **Total** | | **157** | | |
| **Toyah Creek** | 2003 | 410 | | | |
| | **Total** | | **410** | | |
| **Misc. off river** | 2003 | 149 | | | |
| | **Total** | | **149** | | |
| **Red Bluff to Mentone** | 1999 | 658 | | | |
| | 2000 | 47 | | | |
| | 2001 | 240 | | | |
| | 2002 | 1031 | | | |
| | **Total** | | **1976** | **40** | **49** |
| **Mentone to Barstow** | 2000 | 527 | | | |
| | 2002 | 432 | | | |
| | **Total** | | **959** | **26** | **37** |
| **Barstow to I-20** | 2000 | 102 | | | |
| | 2001 | 301 | | | |
| | 2002 | 224 | | | |
| | **Total** | | **627** | **20** | **31** |
| **I-20 to Grandfalls** | 2001 | 876 | | | |
| | 2002 | 592 | | | |
| | **Total** | | **1468** | **37** | **40** |
| **Grandfalls to Girvin** | 2003 | 936 | | | |
| | **Total** | | **936** | **22** | **43** |
| **Girvin to Iraan** | 2003 | 641 | | | |
| | **Total** | | **641** | **15** | **43** |
| **Iraan to I-10** | 2003 | 319 | | | |
| | **Total** | | **319** | **16** | **20** |
| **I-10 to Val Verde Co.** | 2003 | 645 | | | |
| | **Total** | | **645** | **18** | **36** |
| **Val Verde Co. to Hwy 90 Bridge** | 2003 | 126 | | | |
| | **Total** | | **126** | **5** | **25** |
| **Pecos River by Year** | 1999 | 658 | | | |
| | 2000 | 676 | | | |
| | 2001 | 1417 | | | |
| | 2002 | 2279 | | | |
| | 2003 | 2667 | | | **Average** |
| | **Total** | **7697** | | **199** | **39** |
| **Pecos Basin by Year** | 1999 | 658 | | | |
| | 2000 | 676 | | | |
| | 2001 | 1439 | | | |
| | 2002 | 3567 | | | |
| | 2003 | 3730 | | | |
| | **Total** | **10070** | **10070** | | |




Map showing general area of saltcedar treatments along the Pecos River in Texas from 1999-2003.

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