Veguita Bridge Longstem Transplant Study

Project No. NMPMC-T-0701-RI

The USDA Natural Resources Conservation Service Los Lunas Plant Materials Center (LLPMC) staff planted 60 indigobush (*Amorpha fruticosa*), 367 New Mexico olive (*Forestiera pubescens*), 60 false willow (*Baccharis salicina),* and 74 wolfberry (*Lycium torreyi*) transplants on three separate 5-acre sites near the Veguita Bridge in Veguita, New Mexico. All plantings were completed in January of 2007. The sites, owned by the Middle Rio Grande Conservancy, are located on the northeast, northwest, and southwest sides of the Veguita Bridge over the Rio

Figure 1. South edge of southwest Veguita Bridge site showing "wall" of uncleared saltcedar and plants with tubes.

Grande adjacent to the community of Veguita (T4N, R2E, S29 and S30, lat 34.33ºN, long −106.46ºW). In addition to increasing the aesthetics of the Rio Grande bosque, the expected benefits of the project include improving wildlife habitat and recreational opportunities and increasing the plant diversity and microflora; thereby creating a much healthier ecosystem than the existing saltcedar monoculture (Fig. 1). Additionally, this project provided the LLPMC an opportunity to test both new plant materials and longstem planting methods. Based on the expected benefits in water conservation, the project received funding from Senator Bingaman's program for the control of non-native phreatophytes and Rio Grande bosque watershed restoration.

Methods

Site preparation

Three to four months before planting, saltcedar (*Tamarix sp*., dominant species), Russian olive (*Elaeagnus angustifolia*), and Siberian elm (*Ulmus pumila*) (all three on the New Mexico "Class C" noxious weed list, National Plant Board 2007) were removed by extraction method using an excavator with articulate thumb. The removed plants were chipped, and these chips were applied for a mulch cover ranging from 2- to 6-inches in depth. Resprouts of all woody noxious species were spot-treated once in the fall by foliar spraying with the herbicide Arsenal (isopropylamine

salt of imazapyr) before the January 2007 plantings. Additionally, in June 2007 LLPMC staff sprayed (using a four percent solution mix of 2,4-D and glyphosate) perennial pepperweed (*Lepidium latifolium*, classified in New Mexico as a "Class A" noxious weed).

Planting methods

All four species of the 2- to 3-year-old nursery longstem stock transplants were grown at the LLPMC in Stewie and Sons, Inc. one-gallon tree pots (4" X 4" X 14") to a stem height of up to 6 feet (i.e., total plant height = 8.5 feet). As directed, the transplants were planted to the depth of capillary water, which at the time of planting varied from 4- to 5-feet, while ground water varied from 6- to 7-feet deep. This technique of deeply burying the root crown in contact with the capillary fringe enables establishment of understory transplants without supplementary irrigation (LLPMC 2007). The soil appeared to be sandy. All transplants were planted with a 9-inch by 8-foot augur attached to a front-end loader on a 65-hp farm tractor. The transplants were placed in the 8-foot holes and back-filled with hand shovels. A 20-inch section of schedule 20 PVC thin-wall pipe perforated along the bottom one-third of the pipe was inserted into the holes. The pipe was used as a flag to locate plants, to distinguish plantings from volunteer plants, and to provide irrigation at root crown depth in the event watering was needed. Following an evaluation of the plants for drought stress, LLPMC personnel returned in late August to hand irrigate, delivering approximately 2.5 gallons of water to each plant.

Evaluation

At the time of irrigation and four days post-irrigation, each plant was evaluated by species by LLPMC staff member for survival (live/dead above-ground growth) and every fifth plant was evaluated for the following: length of new growth, height, vigor (color), herbivory, amount of top die-off, and overall health. Most of the plants were measured on the first day; the only water they had received since planting was via sub-irrigation or surface runoff (precipitation). To facilitate survey efforts and eliminate double-counting, transplant tubes were spray-painted using a gold metallic paint. Geospatial coordinates were recorded for all plants exhibiting above-ground die-off and projected on USGS digital orthographic quarter quadrants (SW Veguita) using ESRI ArcGIS 9.1 (ESRI 2005). Data was entered into Microsoft Excel® and analyzed using Statistix 8.1 software (Statistix 2006). The Linear Models statistic was used to run a Factorial ANOVA for all dependent variables with species as a main effect without interaction, blocking on location.

Figure 2. Vigorous wolfberry plantings with one season's growth.

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Results

Of the 561 transplants, 534 plants were located. Based on the survival rate for those plants that were located, total survival for the four species reached 96.3 percent (Table 1). Wolfberry had the highest survival rate (98.4 percent, Fig. 2), followed by New Mexico olive (98.0 percent, Fig. 3), false willow (96.1 percent), and indigobush (88.1 percent).

Table 1. Results of summary statistics and ANOVA for Veguita Bridge longstem transplant study.

	Amorpha fruticosa	*Baccharis salicina*	*Forestiera pubescens*	*Lycium torreyi*	Unknown
Percent survival [a] (n = 514) Total survival = 96.3	88.1 (n = 52)	96.1 (n = 49)	98.0 (n = 351)	98.4 (n = 62)	0.006
Percent of all plants (n = 534)	11.1 (n = 59)	9.6 (n = 51)	67.4 (n = 358)	11.9 (n = 63)	0.006 (n = 3)
Average height (inches)	47.5 (n = 16)	46.7 (n = 15)	43.7 (n = 59)	23.4 (n = 9)	tube, no plant
New growth (inches)	13.8 (n = 15)	19.1 (n = 15)	10.5 (n = 59)	8.0 (n = 9)	tube, no plant
Vigor (1−3, 3 highest) [b]	2.12 (n = 17)	2.67 (n = 15)	2.02 (n = 60)	2.33 (n = 9)	tube, no plant
Herbivory (0−3, 3 highest) [c]	0.50 (n = 14)	0.00 (n = 15)	0.52 (n = 60)	0.11 (n = 9)	tube, no plant
Die-off (0−3, 3 highest)	0.75 (n = 16)	0.53 (n = 15)	0.52 (n = 60)	0.33	

a $P = 0.008$
b $P = 0.004$
c $P = 0.011$

Geospatial analysis revealed that dead-top transplants appeared to have a patchy distribution, perhaps relating to drought conditions. The majority of dead-top plants in the southwest site occurred either in open areas close to the river or farthest inland. Those found in clusters near the river may have died due to sandy soil texture over clay that limited their access to water.

Figure 3. New Mexico olive transplant.

The majority of species were of average to above average vigor (86.1 percent, n = 101), experienced no woody die-off (60.0 percent) and no herbivory (65.3 percent). Species effect was statistically significant for survival ($P = 0.008$, lower survival for *Amorpha*), vigor ($P = 0.004$, higher vigor for *Baccharis*), and herbivory ($P = 0.011$, *Baccharis* and *Lycium* with no or lowest herbivory).

Discussion

The species that were planted for this study are riparian phreatophytes that require irrigation until their root systems can tap into groundwater and establish healthy root systems and robust above-ground growth. For example, New Mexico olive (which is also adapted to non-riparian habitats) is

routinely found in Ponderosa pine (*Pinus ponderosa*) forests that receive from 16- to 18-inches of annual rainfall. Annual precipitation for the study region is 9.2 inches per year (Western Regional Climate Center 2007).

Precipitation was 12.1 percent above average from the time of planting to the end of August 2007 and 2.5 percent below average for the year preceding this study. Currently the region is experiencing a period of climate extremes; July 2007 precipitation was 37.6 percent below average, while August precipitation exceeded the average by 33.9 percent. The majority of August rainfall (86 percent) occurred on just one day at the end of the month. Lower survival rate for *Amorpha fruticosa*, a species adapted for moist situations, may reflect drought stress as a result of a lowered water table and reduced flow in the Rio Grande.

The high survival rate and vigorous growth indicated by results from the Veguita Bridge study are supported by similar, positive results from the previous four years at other restoration sites where LLPMC has planted longstems (LLPMC 2005) and in Australia (Chalmers et al. 2007). Longstem planting methodology provides a successful means to establish plantings in arid sites with shallow water tables and obviates the need for supplemental watering.

References

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