RECLAMATION

Managing Water in the West

An Assessment of Potential Southwestern Willow Flycatcher Habitat

Los Lunas and San Marcial, New Mexico

U.S. Department of the Interior
Bureau of Reclamation
Fisheries and Wildlife Resources
Denver, Colorado

February 2009

Mission Statements

The mission of the Department of the Interior is to protect and provide access to our Nation's natural and cultural heritage and honor our trust responsibilities to Indian Tribes and our commitments to island communities.

The mission of the Bureau of Reclamation is to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public.

Assessment of Potential Southwestern Willow Flycatcher Habitat

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prepared for

Albuquerque Area Office
555 Broadway NE, Suite 100
Albuquerque, NM 87102

by

Technical Service Center
Fisheries and Wildlife Resources Group
Dave Moore, Wildlife Biologist

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Introduction

The Bureau of Reclamation (Reclamation) has been conducting studies of the endangered Southwestern Willow Flycatcher (*Empidonax traillii extimus* - SWFL) within several reaches of the Middle Rio Grande since 1995. Currently, breeding SWFLs are concentrated in suitable habitat within the conservation pool of Elephant Butte Reservoir and in a few isolated areas upstream including the Pueblo of Isleta, La Joya State Wildlife Area (SWA), Sevilleta National Wildlife Refuge (NWR), and the reach between Bosque del Apache NWR and San Marcial. During the past eight years, the SWFL population in the pool of Elephant Butte Reservoir has increased dramatically by dispersing into new, primarily native riparian habitat.

To facilitate recovery of this endangered subspecies in the Middle Rio Grande, it is necessary to understand habitat relationships and features selected by breeding SWFLs. The SWFL Recovery Plan (USFWS 2002) states that SWFL breeding habitat, although variable in terms of plant species composition, patch size and shape, and canopy structure, usually consists of a mosaic of dense vegetation, particularly in the first 3 to 4 meters above ground, and small openings, open water or shorter vegetation. Usually, surface water or saturated soil is present in proximity to breeding sites. However, dense is a very subjective term and few studies have quantified the habitat at SWFL breeding sites. These data are important for restoration efforts targeted for SWFL breeding habitat.

Between 2004 and 2006, Reclamation gathered and analyzed vegetation data from 112 SWFL nest sites within the Middle Rio Grande. Results of this study are presented in *Vegetation Quantification of Southwestern Willow Flycatcher Nest Sites* (Moore 2007). Subsequently, in an effort to assess the suitability of developing habitat for breeding SWFLs and test our ability to visually identify suitable SWFL breeding habitat, Reclamation gathered similar vegetation data at sites that appeared suitable for breeding SWFLs but were currently unoccupied (hereafter called assessment sites) and compared these data to data presented in Moore (2007). These comparisons are presented in this report.

Methods

Study Area

A total of 498 SWFL nests were monitored by Reclamation between 2004 and 2006 in the Middle Rio Grande. 112 of these were selected for the original vegetation quantification study (Moore 2007). Table 1 and Figure 1 detail the number of nests monitored and selected for the original study by river reach during the 2004 to 2006 study period. An attempt was made to select study nests proportionally to represent the habitat selection and reaches occupied by breeding SWFLs.

Table 1. Nests monitored and quantified by river reach between 2004 and 2006.

Reach	Nests Monitored (% of total)	Quantification Nests (% of total)
Sevilleta/La Joya	49 (9.8)	12 (10.7)
Bosque del Apache	3 (0.6)	2 (1.8)
Tiffany	16 (3.2)	8 (7.1)
San Marcial	428 (85.9)	90 (80.4)
Total	498	112

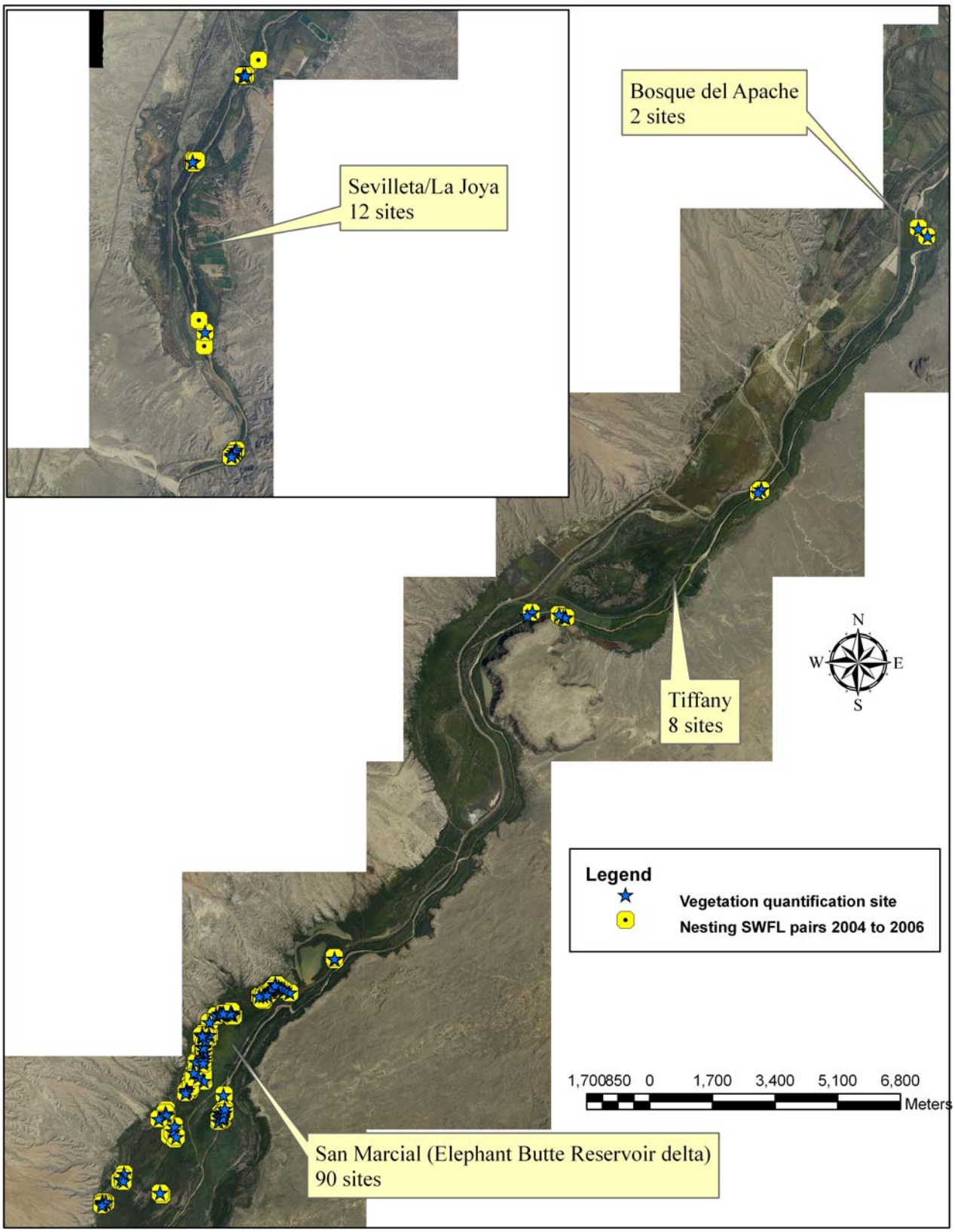

Figure 1. Location of SWFL nest sites sampled for vegetation quantification study between 2004 and 2006.

A total of 11 assessment sites (Figure 2) were selected by biologists familiar with the habitat requirements of breeding SWFLs. Eight sites were sampled in the Elephant Butte Reservoir delta. Habitat within these areas consists of mid-aged stands of Goodding's willow (*Salix gooddingii*) with occasional saltcedar (*Tamarix* sp.), coyote willow (*Salix exigua*), and Rio Grande cottonwood (*Populus deltoides*). All of these sites periodically contain standing water or saturated soils. The remaining three sampling sites were near the Los Lunas Restoration Site on the west side of the Rio Grande approximately 5 km south of Los Lunas. Habitat at these sites is a mixture of mid-aged coyote willow, saltcedar, Russian olive (*Eleagnus angustifolia*), and Rio Grande cottonwood. These sites are drier than sites in the Elephant Butte Reservoir delta and rarely receive overbank flooding.

Study Design

To determine vegetation quantification methodology, we consulted with an interagency work group in August 2003 consisting of biologists from Reclamation, U.S. Fish and Wildlife Service, New Mexico Natural Heritage Program, and University of New Mexico (UNM). Methods were adapted from BBIRD protocol (Martin et al. 1997), similar studies conducted by the New Mexico Natural Heritage Program along the Rio Grande (DeRagon et al 1995), Ahlers and White (1997), Stoleson and Finch (1999), and University of New Mexico (Peter Stacey, pers. comm.). During the late summer and early fall of 2003, we conducted a pilot study to test the methodology. As a result, we refined certain methods which were incorporated into subsequent data collection.

Vegetation and habitat data were collected at nest and assessment sites in the Middle Rio Grande from late August to early October following the SWFL breeding seasons of 2004 through 2007. At selected nest and assessment locations, an 11.35-meter radius plot (0.04 hectare BBIRD-type plot) was centered below the SWFL nest (or suitable nest substrate at assessment sites) and an identical plot was located at a random distance and direction between 50 and 100 meters (m) from the nest plot (Figure 3). All trees within the plot were tallied by species and DBH class and densities, species composition, and percentage of dead trees were computed. Tree stems had a diameter at breast height (DBH) of greater than 5 centimeters (cm) and were divided into three DBH classes: Class I consists of trees greater than 5 cm to 10 cm DBH, Class II consists of trees greater than 10 cm to 20 cm DBH, and Class III consists of trees greater than 20 cm. Shrubs were measured in four 1 x 4 m subplots located at random distances less than 7.35 m from the plot center along each of four radii in cardinal directions. Shrub stems were defined as having a DBH between 0.5 cm and 5 cm. All shrub stems within each subplot were counted by species and densities, species composition, and percentage of dead were computed. In cases with exceptional stem densities, shrub stems where measured in four 1 x 2 m subplots. Nest-centered data were recorded at nest sites within the 11.35 m radius center plot including: nest substrate species, height, and DBH, distance to substrate edge, distance to patch edge, distance to riparian edge, hydrology, distance to water, distance to road, ground cover, and canopy height.

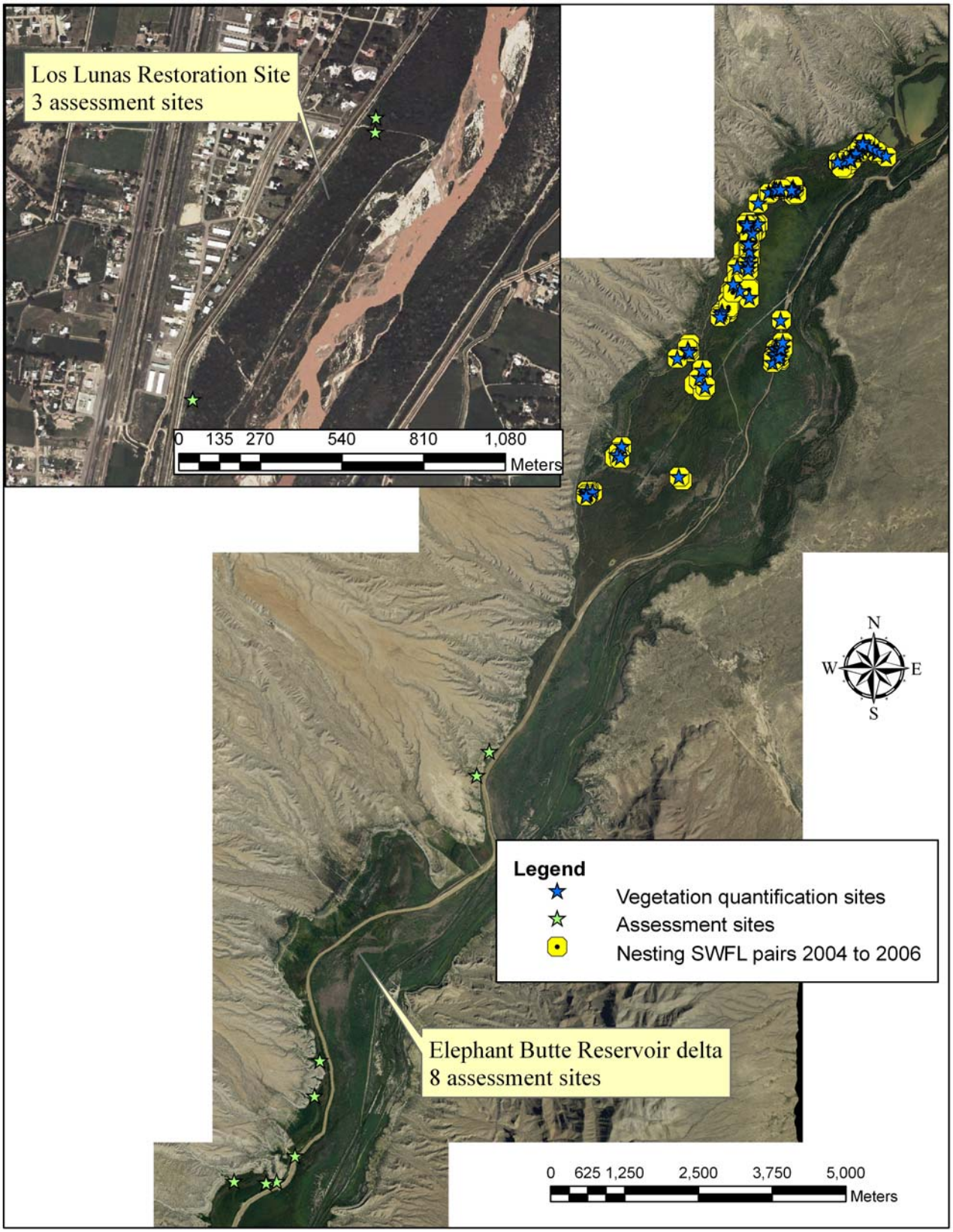

Figure 2. Location of assessment sites in Elephant Butte Reservoir delta and Los Lunas Restoration Site.

To gain insight into canopy cover and plant densities by canopy layer, three additional plots, each with a 5 m radius, were established adjacent to each center plot (Figure 3). From the center point of each smaller plot, point-centered quarter measurements were taken for plants in three canopy classes (shrub, mid-canopy, and upper canopy). Canopy layers were classified beginning with the lowest. Thus, some sites had all three layers (Figure 4) but most only had a shrub and mid-canopy layer (Figure 5). From these data, stem densities were calculated for the respective canopy layers. Canopy cover visual estimates were made within each of three canopy layers (0 to 3 m, 3 to 6 m, and >6 m) within the 5 m radius plots. Estimates were made using a Daubenmire ranking of 0 to 6 where 0 equals 0 percent cover, 1 equals 1 to 10 percent, 2 equals 11 to 25 percent, 3 equals 26 to 50 percent, 4 equals 51 to 75 percent, 5 equals 76 to 90 percent, and 6 equals greater than 90 percent cover.

For data analysis, habitat parameters were pooled for each plot type (nest and random) and statistically analyzed to determine significant differences ($\alpha = 0.05$). T-tests were used to compare sample means if data were normally distributed. Mann-Whitney tests were used for data with non-normal distributions. Due to the fact that the SWFL population in the delta of Elephant Butte Reservoir is the largest population within our study area and appears to occupy the best habitat, these data were first considered separately. Then, in order to gain insight into the full range of habitat that SWFLs occupy in the Middle Rio Grande, all data were considered together. See Moore (2007) for results of the 2004 to 2006 study.

In order to compare assessment sites to SWFL nest sites, data from each assessment location (Los Lunas Restoration Site and Elephant Butte Reservoir delta) were pooled separately and compared to mean values from the 112 nest sites quantified in the original nest vegetation quantification study. If mean values were within 0.5 standard deviations of means calculated in the original study, these parameters were considered suitable for nesting SWFLs.

Results

When comparing data collected at assessment sites, mean values within 0.5 standard deviations of mean values collected at nest sites were considered suitable for breeding SWFLs. Of the 31 variables analyzed in this study, 17 were similar to nest site values at Elephant Butte sites and only ten were similar at Los Lunas sites (Tables 2 and 3). Shrub and tree species composition was relatively similar in the three samples; native willows (Goodding's and coyote combined) are dominant with a minimum species composition of 67 percent. However, very few Goodding's willows were recorded in both the shrub and tree size classes at Los Lunas. Shrub stem density at Elephant Butte sites was almost identical to values collected at nest sites. Conversely, tree stem densities at both Elephant Butte and Los Lunas sites were outside the "suitable" range. Although tree size class composition was very similar for all three samples, only the percentage of Class 1 trees at Elephant Butte and Class 3 trees at Los Lunas were within the "suitable" range.

When considering the three canopy layers, several variables within the shrub and mid-canopy layers were within the "suitable" range. No assessment sites in either Elephant Butte or Los Lunas had a measurable upper canopy layer (only 11 of the nest sites did). Perhaps the most important variable to SWFL nesting habitat, vegetative cover at different height intervals was similar to nest sites in the

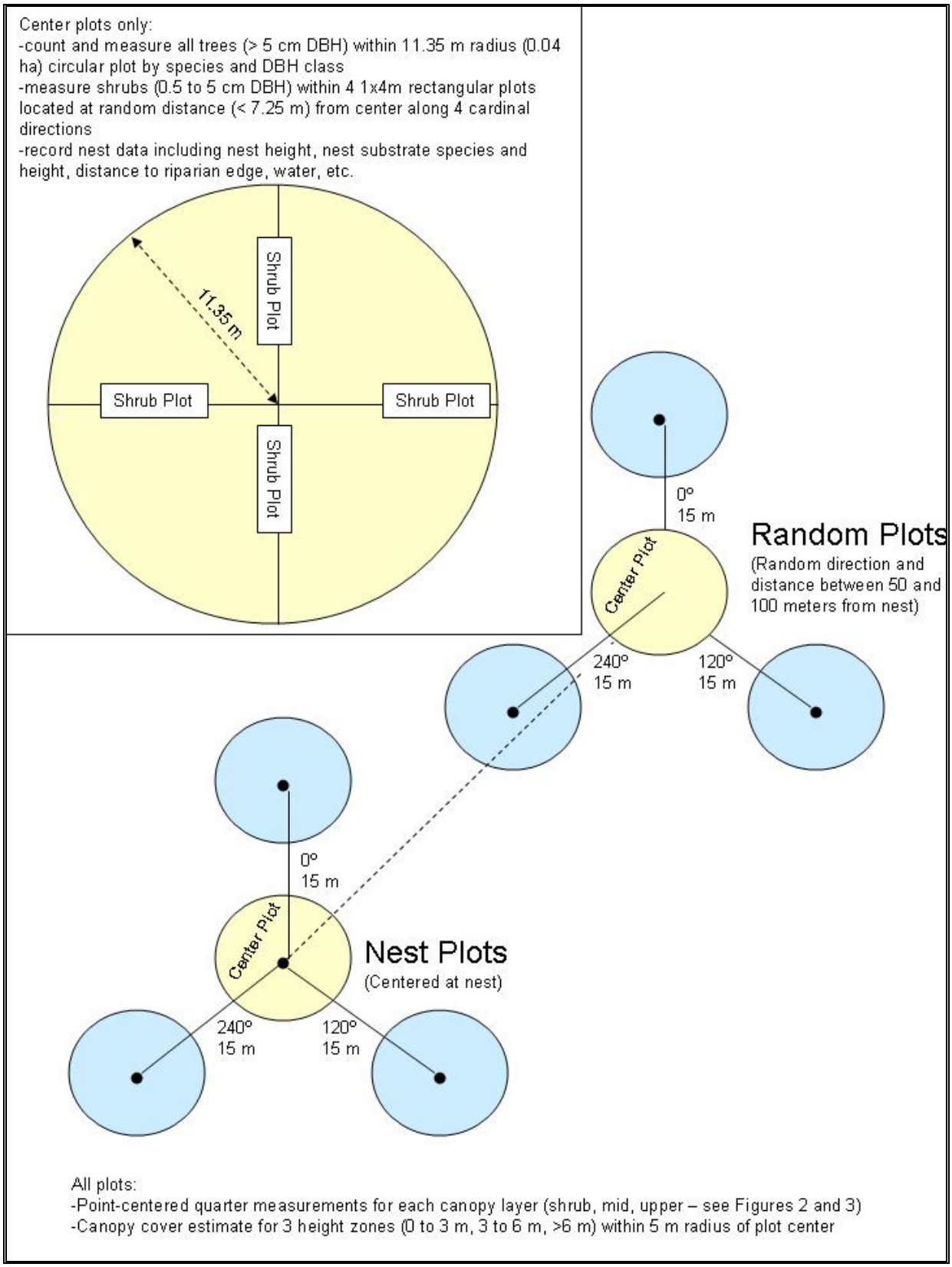

Figure 3. SWFL habitat vegetation quantification study plot layout.

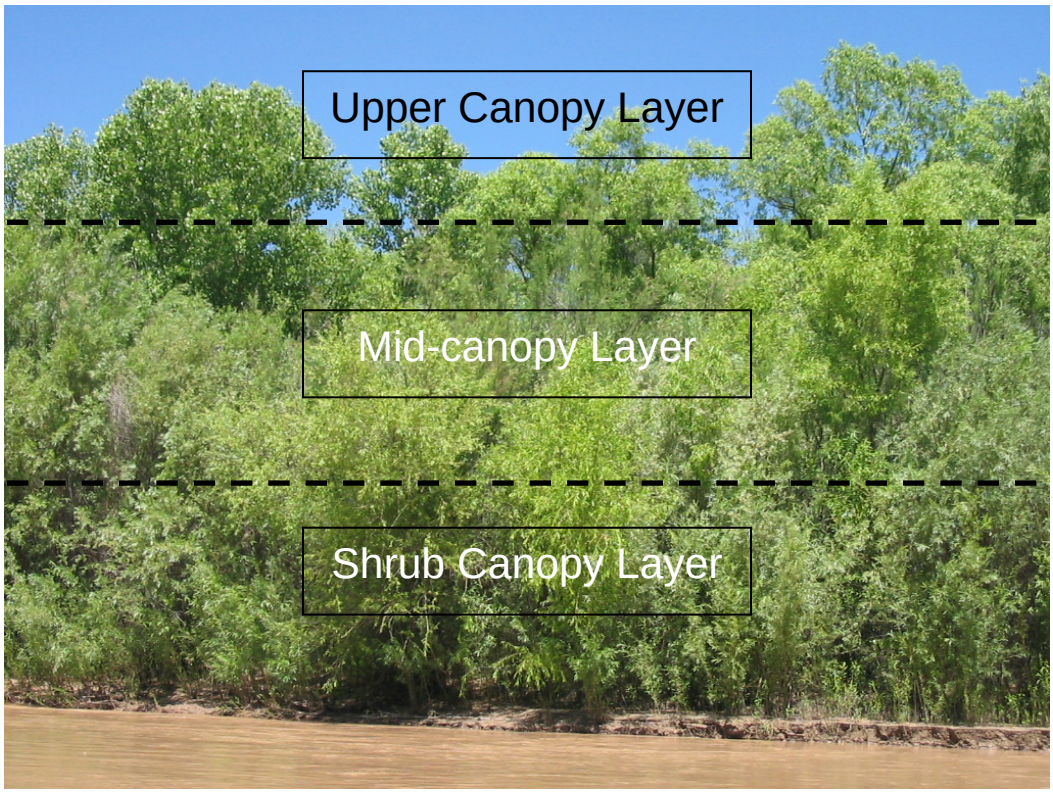

Figure 4. Riparian habitat showing three different canopy layers.

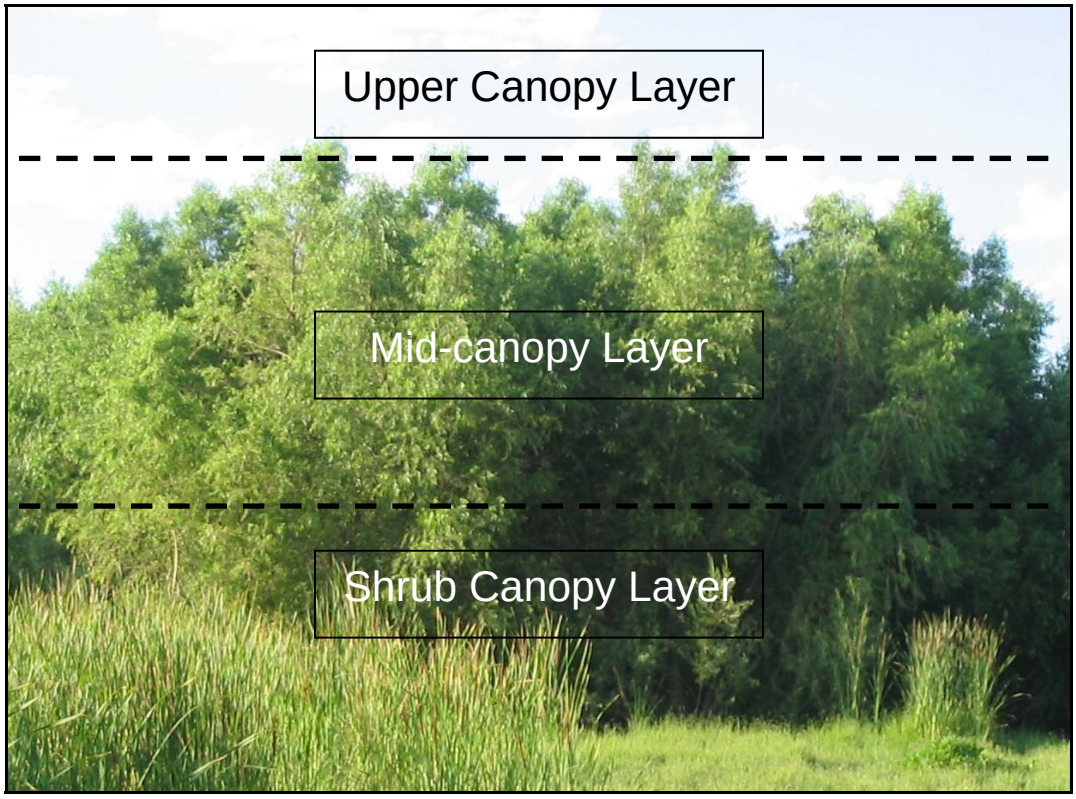

Figure 5. Typical SWFL habitat showing lack of upper canopy layer.

Table 2. Summary of center plot shrub and tree stem count data gathered at SWFL nest sites (2004 to 2006) and assessment sites (2007). Values in parentheses behind nest means are "suitable" habitat ranges (+/- 0.5 sd). **Boldface values for Elephant Butte and Los Lunas sites are within "suitable" range.**

Vegetation parameter	Nest site mean (n = 112)	Assessment Sites: Elephant Butte mean (n = 8)	Assessment Sites: Los Lunas mean (n = 3)
Shrub Stem Density #/m^2	3.64 (2.44 to 4.84)	**3.73**	5.35
Shrub Stem Species Composition %			
Salix gooddingii	36.82 (17.52 to 56.12)	**53.83**	1.72
Salix exigua	31.11 (13.81 to 48.41)	**22.53**	79.39
Both *Salix* species	67.93 (49.23 to 86.63)	**76.36**	**81.12**
Populus deltoides	1.26 (0 to 3.56)	**2.36**	**3.17**
Tamarix sp.	23.15 (6.65 to 39.65)	0.67	2.30
Eleagnus angustifolia	6.05 (0 to 15.6)	**0.00**	**13.41**
Dead Shrubs %	37.00 (26.35 to 47.65)	**44.94**	50.80
Tree Stem Density #/ha	2,829 (2,164 to 3,494)	2,162	1,417
Tree Stem Species Composition %			
Salix gooddingii	71.50 (52.35 to 90.65)	96.17	19.30
Salix exigua	5.09 (0 to 11.49)	**0.61**	**0.00**
Both *Salix* species	76.59 (57.54 to 95.64))	96.78	19.30
Populus deltoides	3.36 (0 to 8.21)	**3.22**	61.15
Tamarix sp.	11.93 (0 to 25.33)	**0.00**	**6.14**
Eleagnus angustifolia	8.12 (0 to 20.22)	**0.00**	**13.41**
Dead Trees %	3.96 (0.71 to 7.21)	15.27	16.41
Tree DBH Size Class Composition %			
Class 1	70.06 (61.91 to 78.21)	**76.83**	79.48
Class 2	29.02 (21.07 to 36.97)	21.00	20.52
Class 3	0.92 (0 to 1.97)	2.17	**0.00**

Table 3. Summary of point-centered quarter and canopy cover data from nest sites (2004 to 2006) and assessment sites (2007). Values in parentheses behind nest means are "suitable" habitat ranges (+/- 0.5 sd). **Boldface values for Elephant Butte and Los Lunas sites are within "suitable" range**.

Vegetation parameter	Nest site mean value (n = 112)	Assessment Sites: Elephant Butte mean value (n = 8)	Assessment Sites: Los Lunas mean value (n = 3)
Shrub Canopy Layer			
Mean Plant Density #/ha	7,645 (3,776 to 11,515)	3,191	**8,277**
Mean Plant Height	2.68 (2.28 to 3.08)	**2.38**	**2.45**
Mean Plant Crown Width	0.99 (0.82 to 1.17)	0.76	0.56
Mid-Canopy Layer			
Mean Plant Density #/ha	3,109 (1,941 to 4,277)	1,910	921
Mean Plant Height	8.05 (7.27 to 8.84)	**7.85**	9.35
Mean Plant Crown Width	2.88 (2.36 to 3.40)	**2.62**	**2.55**
Upper Canopy Layer	(n = 11)		
Mean Plant Density #/ha	850 (501 to 1199)	N/A	N/A
Mean Plant Height	11.99 (11.10 to 12.88)	N/A	N/A
Mean Plant Crown Width	6.07 (4.57 to 7.58)	N/A	N/A
Mean Cover Value*			
0 – 3 m	28.70 (19.23 to 38.17)	**37.06**	54.25
3 – 6 m	33.40 (23.77 to 43.03)	**41.47**	46.25
>6 m	20.09 (11.49 to 28.70)	37.77	31.75

* Values based on mid-point of Daubenmire ranking of 0 to 6: 0 = 0%; 1 = 5%(1-10%); 2 =18%(11-25%); 3 = 38%(26-50%); 4 = 63% (51-75%); 5 = 83%(76-90%); 6 =95%(>90%)

zero to three meter and three to six meter intervals at Elephant Butte assessment sites. All vegetative cover values were outside the "suitable" range at Los Lunas.

Discussion

The SWFL Recovery Plan (USFWS 2002) states that SWFL breeding habitat typically consists of dense vegetation in the first three to four meters above ground interspersed with small openings, open water or shorter/sparser vegetation. However, specific stem densities and vegetative cover values are not provided and may vary throughout the subspecies' range. Reclamation's SWFL breeding habitat study (Moore 2007) aimed to quantify vegetation parameters required by breeding SWFLs in the Middle Rio Grande. Cover values within three height intervals and stem densities of various plant size classes and canopy classes were calculated. We also determined, via statistical analyses, which variables are more important to nesting SWFLs (i.e. tree stem density, canopy cover at upper height intervals) and which are less important (i.e. species composition). Resource managers, when conducting restoration aimed at creating SWFL breeding habitat, can use these data in a variety of ways to guide restoration efforts and should establish goals and a monitoring protocol prior to initiation.

For our assessment of developing habitat, we gathered vegetation data at 11 sites that appear visually suitable for breeding SWFLs and compared them to data from the original vegetation study and shown in the previous sections of this report. Data from both assessment sites had similarities to data collected at nest sites.

Elephant Butte assessment sites

These sites, being influenced by the same formative factors as the occupied habitat upstream in the reservoir delta, highly resemble nest sites. Habitat in these sites established as the reservoir receded and is a few years younger than the occupied habitat upstream. Shrub stem density is slightly higher (although within the "suitable" range) and tree stem density is 24 percent lower than at nest sites. It is likely that, as the habitat matures, the density of plants in the "tree" category (> 5 cm DBH) will increase and shrub density will decrease via self-thinning. Other variables related to plant density and cover at lower canopy levels, including the percentage of Class 1 trees and canopy cover values at the 0 to 3 and 3 to 6 meter height intervals, were similar to nest sites. Lastly, although not the most important factor to SWFL breeding habitat, species composition in both the shrub and tree categories is similar to nest sites. Thus, it can be assumed that within a year or two this habitat will be suitable to breeding SWFLs and may be occupied in the near future and, in fact, habitat within close proximity to several assessment sites became occupied by resident SWFLs in 2008 (Figure 6).

Los Lunas assessment sites

These sites are adjacent to a large (approximately 42 acres) restoration site designed to provide habitat for the endangered Rio Grande Silvery Minnow (*Hybognathus amarus* - RGSM) and SWFL. A large area adjacent to the river was contoured and high flow channels were constructed to provide backwater refugia for RGSM and grow habitat for SWFLs. The western side of the site is separated from the restoration portion of the site by a rootwad berm that was designed to allow flooding at 2500 cfs river flow. Habitat in this area consists of a mix of cottonwood, coyote willow, Russian olive and saltcedar. The assessment sites are in this area. Stem densities in these sites are characteristic of younger age-class habitat. Plant stem densities in both the shrub size class and

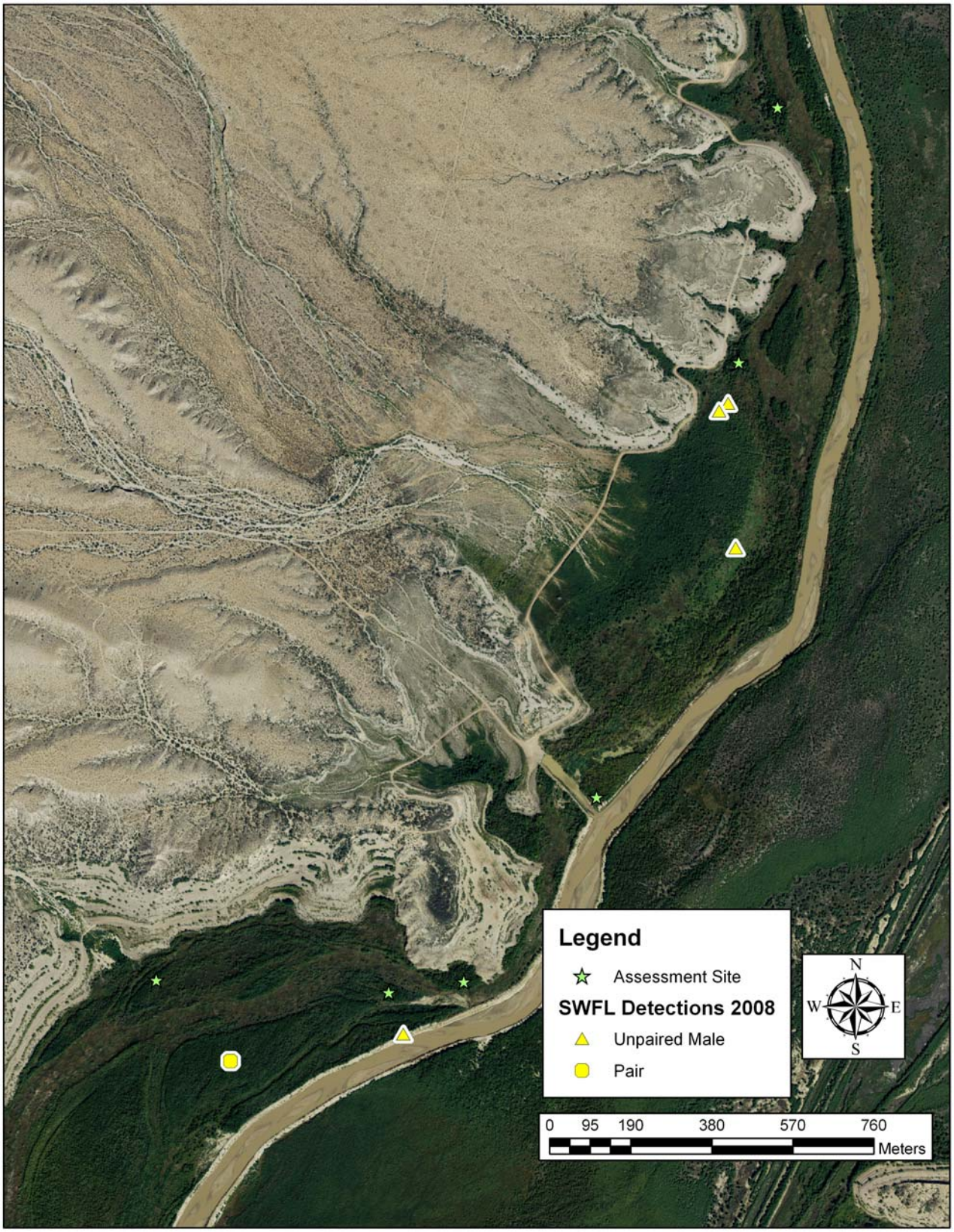

Figure 6. Southern Elephant Butte assessment sites and occupation of adjacent habitat by resident SWFLs in 2008.

shrub canopy layer are higher than those documented in nest sites. Tree stem densities and mid-canopy plant densities are lower. Plant species composition is also different from that observed in nest sites, primarily due to the lack of a significant Goodding's willow component and the increased abundance of Russian olive. Lastly, cover values at the lower two height intervals are higher than at nest sites. All these factors indicate younger age-class vegetation that, in a few growing seasons and with some self-thinning of the understory, will more closely approximate occupied SWFL breeding habitat. However, habitat at these sites is currently unsuitable for breeding SWFLs.

Conclusion

The vegetation quantification study of 2007 provided valuable data regarding the habitat requirements of breeding SWFLs in the Middle Rio Grande. These data will be a valuable tool for resource managers in the construction and maintenance of SWFL habitat in restoration sites. This report provides an example of how data from unoccupied habitat may be compared to nest site data to assess its suitability for breeding SWFLs. And, although other variables, including proximity to source populations, patch size, the overall habitat mosaic, hydrology, and migratory corridors, factor into the colonization of newly developed habitat, the knowledge that a particular habitat patch provides at least the vegetative structure suitable for breeding SWFLs will allow resource managers to focus on these areas for restoration, maintenance, and SWFL surveys.

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