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Distribution and Breeding Activities of the Least Bell's Vireo and Southwestern Willow Flycatcher at the San Luis Rey River, San Diego County, California

2005 Annual Report

Prepared for:

State of California
Department of Transportation
District 11
San Diego, California

U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY
WESTERN ECOLOGICAL RESEARCH CENTER

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Cover: Least Bell's vireo nestlings (left) and southwestern willow flycatcher nestling (right), photographs by Josephine Falcone

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EXECUTIVE SUMMARY

Surveys and monitoring for least Bell's vireos and southwestern willow flycatchers were conducted on the San Luis Rey River, San Diego County. Vireo surveys were conducted from Interstate 15, west approximately four kilometers to Gird Road. The southwestern willow flycatcher study area was located between College Road and a point approximately 2.5 kilometers upstream on the San Luis Rey River.

Forty-seven male least Bell's vireos were observed within the study area, one of which was determined to be a transient, as it was detected on 4 April, but was not observed throughout the remainder of the breeding season. Ninety-one percent of resident male vireos were confirmed as paired. Data indicate a possible least Bell's vireo carrying capacity at the vireo site ranging between the low to mid-forty territories. Over the past seven years the vireo population has fluctuated between a low of 31 territories in 1999 to a high of 46 territories in 2004 and 2005, with the population in four of the last seven years having 39 or more territories.

Nesting activity at 99 nests within 34 vireo territories was monitored. Sixty-eight percent of all vireo nests were parasitized. Nest predation and brown-headed cowbird nest parasitism accounted for 35 and 37 percent of failures, respectively. However, biologists "rescued" vireo nests by removing cowbird eggs shortly after they were laid, allowing some to fledge young. It is therefore probable that the impacts of cowbird nest parasitism are under represented in this dataset. Only 25 percent of vireo nests monitored fledged young and pairs fledged only 1.6 young per pair. In total, 52 vireo young fledged from 24 nests during the 2005 breeding season.

Three least Bell's vireos banded prior to the 2005 breeding season were resighted within the study area. Two had fledged from natal sites 14 and 2.5 km downstream on the San Luis Rey River. The third vireo was originally banded in 2000 on the Sweetwater River, approximately 70 km to the south. A fourth vireo was caught and color banded.

Fourteen different plant species were used by least Bell's vireos as nest substrates, with 73 percent of nests built in either *Salix lasiolepis*, *S. exigua,* or *Baccharis salicifoli*. A nest's host plant species had no apparent affect on a nest's fate as the majority of successful and unsuccessful nests were built in the same species, in roughly the same proportions.

Two southwestern willow flycatcher pairs were documented on the San Luis Rey River within the flycatcher study area during the 2005 breeding season. Each pair nested once, but neither fledged young. One flycatcher nest was constructed in *Tamarix* spp. and was parasitized by brown-head cowbird(s). Two cowbird eggs were removed, but the nest was later lost to predation. The second pair built a nest in *Salix exigua.* It is unknown whether this nest was depredated in the egg stage or abandoned prior to egg laying, as it failed during the time eggs should have been laid. Both male flycatchers had been color banded prior to 2005 and each had bred within the study area in 2004. One female flycatcher was caught and color banded. A third transient willow flycatcher of unknown subspecies was observed in the upper San Luis Rey study area.

INTRODUCTION

This report summarizes the results of least Bell's vireo (*Vireo bellii pusillus*, hereafter "vireo") and southwestern willow flycatcher (*Empidonax traillii extimus*, hereafter "flycatcher") monitoring conducted in 2005 along the San Luis Rey River in San Diego County, California. The primary objectives of this study were to: 1) document the abundance and distribution of least Bell's vireos and southwestern willow flycatchers, and 2) monitor nesting activity of the species within the study areas.

The least Bell's vireo is a small, migratory, songbird that breeds in southern California and northwestern Baja California, Mexico from April through July. Historically abundant within lowland riparian ecosystems, vireo populations began declining in the late 1900's as a result of habitat loss and alteration associated with urbanization and conversion of land adjacent to rivers to agriculture, and by 1986 numbered just 300 territorial males statewide (Franzreb 1989, USWFS 1998, RHJV 2004). Additional factors influencing the decline have been the expansion in range of the brown-headed cowbird (*Molothrus ater*), a brood parasite, to include the Pacific coast (USFWS 1986; Franzreb 1989; Brown 1993; Kus 1998, 1999). In response to the dramatic reduction in numbers of the vireo in California, the California Fish and Game Commission listed the species as endangered in 1980, with the U.S. Fish and Wildlife Service (USFWS) following suit in 1986. Since listing, the vireo population in southern California has rebounded, largely in response to cowbird control, and habitat restoration and preservation. As of 2004, the statewide vireo population was estimated to be approximately 2500 territories (USGS, unpublished data).

The southwestern willow flycatcher is one of four subspecies of willow flycatcher in the United States, with a breeding range including southern California, Arizona, New Mexico, extreme southern portions of Nevada, Colorado and Utah, and western Texas (Hubbard 1987, Unitt 1987). Similar to the vireo, the southwestern willow flycatcher has declined in recent decades in response to widespread habitat loss throughout its range and, possibly, cowbird parasitism (Wheelock 1912; Willett 1912, 1933; Grinnell and Miller 1944; Remson 1978; Garrett and Dunn 1981; Unitt 1984, 1987; Gaines 1988; Schlorff 1990; Whitfield and Sogge 1999). By 1993, the species was believed to number approximately 70 pairs in California (USFWS 1993) in small disjunct populations. The southwestern willow flycatcher was listed as endangered by the State of California in 1992 and by the USFWS in 1995.

Willow flycatchers in southern California co-occur within riparian systems with the least Bell's vireo. However, unlike the vireo, which has increased eight-fold in response to management alleviating threats (USGS, unpublished data), willow flycatcher numbers remain low. Currently, the majority of southwestern willow flycatchers in California are concentrated in three sites: the South Fork of the Kern River in Kern County (Whitfield 2002), the Upper San Luis Rey River, including a portion of the Cleveland National Forest in San Diego County (Varanus Biological Services 2001), and Marine Corps Base Camp Pendleton in San Diego County (Kus and Kenwood 2006). Outside of these sites, southwestern willow flycatchers occur as small, isolated populations of one to half a dozen pairs (Kus et al. 2003). Data on the distribution and demography of the flycatcher, as well as identification of factors limiting the species, are critical information needs during the current stage of recovery planning.

STUDY AREAS AND METHODS

Study Area and Surveys

Surveys and monitoring of least Bell's vireos were conducted on the San Luis Rey River, San Diego County, from Interstate 15, west approximately four kilometers to Gird Road (Figure 1). Typically, the entire site was surveyed over a number of days, as surveys were often paired with nest monitoring to maximize the probability of detecting vireos. This methodology ensured the site was surveyed in its entirety every three to four weeks between 1 April and 31 July. Biologists followed standard survey techniques described in the least Bell's vireo Working Group and USFWS's least Bell's vireo survey guidelines (USFWS 2001). Protocol willow flycatcher surveys were not conducted within the vireo study area, but field investigators were attentive to detecting flycatchers while in the habitat.

The southwestern willow flycatcher study area was located between College Road and a point approximately 2.5 kilometers upstream on the San Luis Rey River (Figure 1). A standard protocol survey (Sogge *et al*. 1997) of the entire site was conducted on 27 May to locate male flycatchers actively defending territories. Areas containing flycatchers in previous years that were vacant during the initial survey were periodically checked for occupancy throughout the breeding season. Surveys were conducted by moving slowly through the riparian habitat while searching and listening for willow flycatchers. Observers walked along the edge(s) of the riparian corridor on the upland and/or river side where habitat was narrow enough to detect a bird on the opposite edge. In wider stands, observers traversed the habitat in a way that permitted detection of all birds throughout its extent.

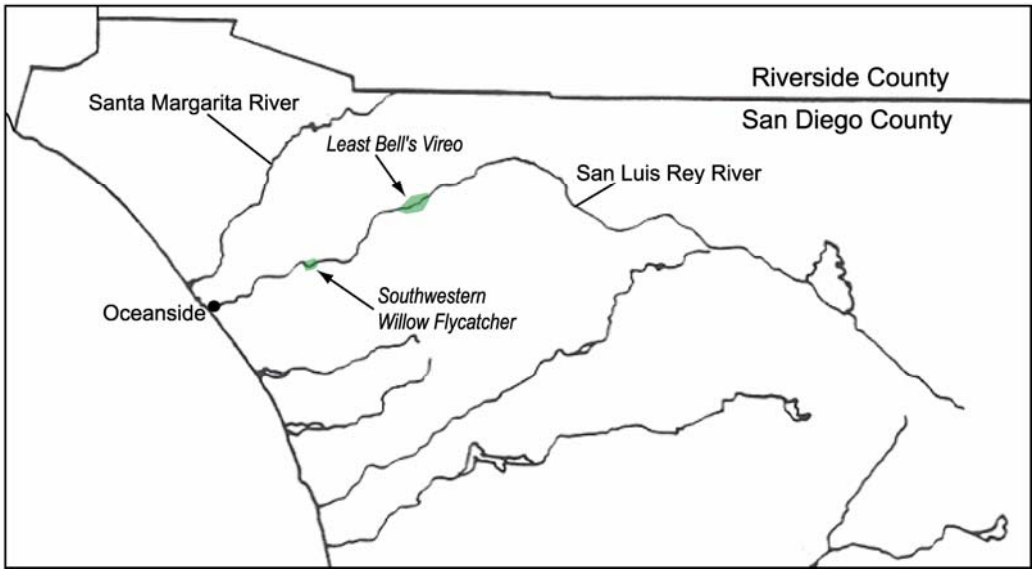

Figure 1. Location of least Bell's vireo and southwestern willow flycatcher study sites in San Diego County.

Surveys were conducted between dawn and early afternoon, depending on wind and weather conditions. For each bird encountered (whether vireo or flycatcher), investigators recorded age (adult or juvenile), sex, breeding status (paired, unpaired, or undetermined), and

whether the bird was banded. Birds were considered transients if they were detected in a area for less than three weeks. Bird locations were mapped on 1":12,000" aerial photographs as well as 1":24,000" USGS topographic maps, using a Garmin 12 Global Positioning System (GPS) unit with 1-15 m positioning accuracy to determine geographic coordinates (WSG84).

Nest Monitoring

Thirty-four vireo territories and all flycatcher territories (2) were monitored to document breeding activity during the 2005 season. Pairs were observed for evidence of nesting, and their nests were located. Nests were visited as infrequently as possible to minimize the chances of leading predators or brown-headed cowbirds to nest sites; typically, there were four to six visits per nest. The first visit was timed to determine the number of eggs laid, the next few visits to determine hatching and age of young, the next to band nestlings, and the last to confirm fledging. Brown-headed cowbird eggs and nestlings were removed from host nests as they were found. Characteristics of nests, including height, host species, and host height were recorded following abandonment or fledging of nests.

Banding

Least Bell's vireo nestlings were banded at 5-8 days of age with a single anodized dark blue-colored aluminum numbered federal band on the right leg. Returning adult vireos previously banded with a single federal numbered band were target netted to learn their identity and banded with a unique combination of colored plastic and anodized metal bands.

Nestling southwestern willow flycatchers were banded at 7-10 days of age with an aluminum federal numbered band on the right leg. Unbanded adult flycatchers and returning flycatchers with a single federal band were target netted and banded with a unique combination of colored aluminum bands. Flycatchers were banded with a maximum of one band on each leg.

RESULTS

Least Bell's Vireo

Population Size and Distribution

Forty-seven male least Bell's vireos were observed within the study area, 91 percent of which were confirmed as paired (Figure 2; Table 1). The only single male vireo was first observed at the site on 4 June after all other vireos had found mates. Through subsequent monitoring it was determined that this bird did not pair during the 2005 season. One transient male vireo was detected on 4 April 2005, but was not observed throughout the remainder of the breeding season.

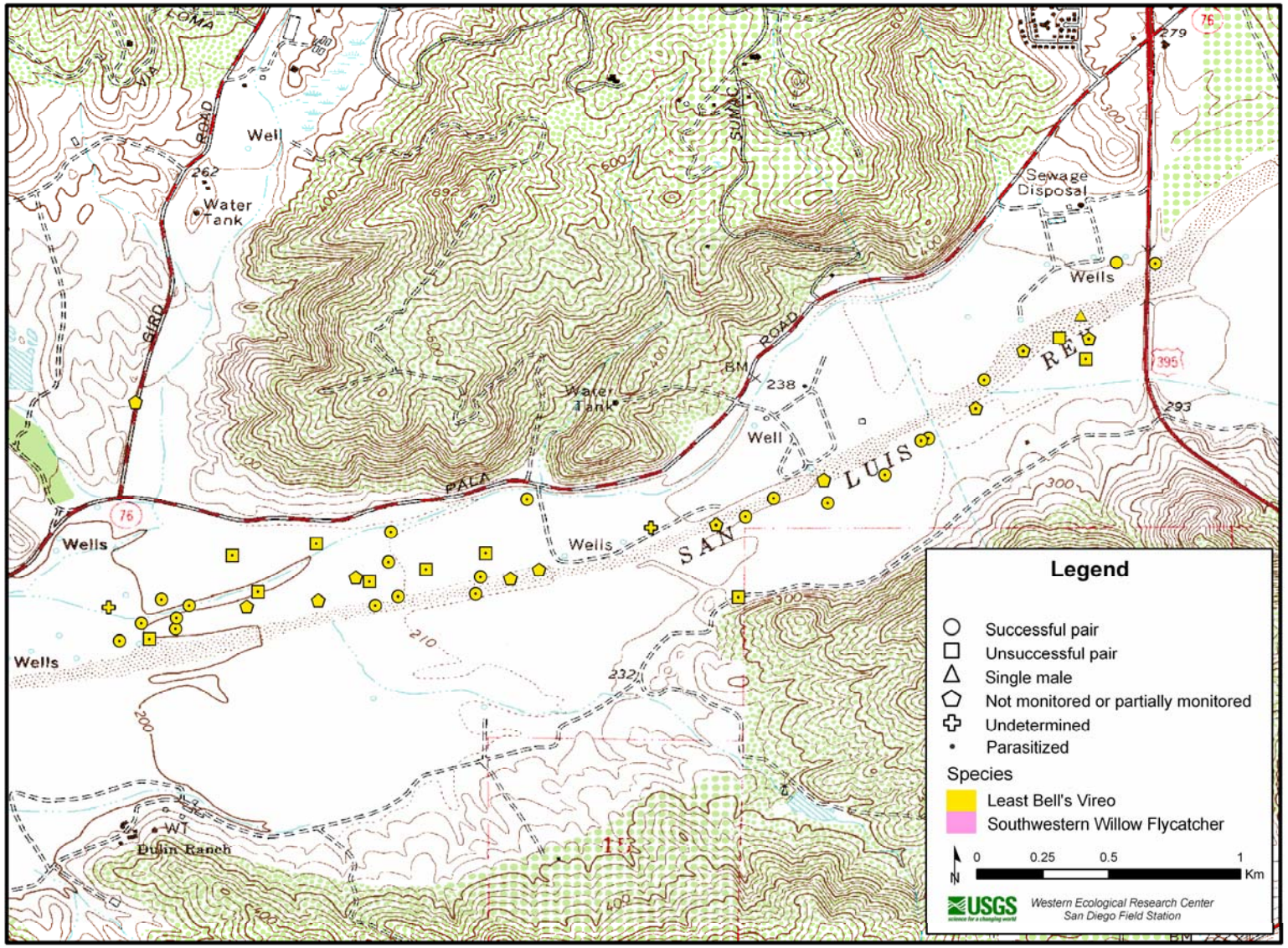

Figure 2. Least Bell's vireo locations and breeding status along the upper San Luis Rey River, 2005.

Table 1. Status and nesting activities of least Bell's vireos at the San Luis Rey River, 2005.

Territory	Status	Nest	Nest fate[a]	# Young fledged	Nest Parasitized?	# BHCO eggs removed[b]	Comments
AIR	Pair	1	SUC	3	Y	1	
AVO	Pair	-	-	-	-	-	Not monitored.
BIG	Pair	1	UND	0	Y	2	
		2	UND	0	N	-	
		3	PRE	0	N	-	
		4	PAR	0	Y	0	
BTL	Pair	1	UND	0	N	-	
		2	INC	0	N	-	Eggs not confirmed in nest.
		3	UND	0	Y	3	Nest never completed.
		4	PAR	0	Y	0	Abandoned after partial egg predation.
		5	INC	0	-	-	Nest never completed.
		6	UND	0	Y	3	Possible BHCO predation of egg(s).
BTN	Pair	-	-	-	-	-	Not monitored.
BUF	Pair	-	-	-	-	-	Not monitored.
CAS	Pair	1	PAR	0	Y	0	
		2	SUC	2	N	-	
CAT	Pair	1	UND	0	N	-	Possibly abandoned or depredated.
		2	OTH	0	Y	0	
		3	PRE	0	N	-	
		4	SUC	2	N	-	
CHA	Pair	1	PAR	0	Y	0	
		2	PAR	0	Y	0	
DEW	Unknown	-	-	-	-	-	Not monitored.
DSH	Pair	1	PAR	0	Y	-	Not monitored. Adults seen feeding 1 BHCO young.
DOZ	Pair	1	PRE	0	N	-	
		2	SUC	3	Y	1	
FEA	Pair	1	SUC	3	Y	2	
		2	SUC	2	Y	1	
FEF	Pair	-	-	-	-	-	Not monitored.
GAT	Pair	1	PAR	0	Y	0	
		2	SUC	4	N	-	
GME	Pair	1	PRE	0	Y	1	
		2	SUC	2	Y	1	
HDZ	Pair	1	PRE	0	N	-	
		2	SUC	1	Y	1	
KHN	Pair	1	UND	0	Y	1	Abandoned after partial egg predation.
		2	SUC	3	N	-	
LSH	Single	-	-	-	-	-	Arrived in late June.
LGL	Pair	1	SUC	1	Y	2	

Table 1 (*continued*). Status and nesting activities of least Bell's vireos at the San Luis Rey River, 2005.

Territory	Status	Nest	Nest fate[a]	# Young fledged	Nest Parasitized?	# BHCO eggs removed[b]	Comments
LLT	Pair	1	PRE	0	N	-	
		2	PRE	0	Y	1	
		3	PRE	0	N	-	
		4	PAR	0	Y	0	
		5	PRE	0	Y	1	
LC1	Pair	-	-	-	-	-	Not monitored.
LKF	Pair	1	PAR	0	Y	0	
		2	PAR	0	Y	0	
		3	PAR	0	Y	0	
LKN	Pair	1	PRE	0	N	-	
		2	PRE	0	N	-	
		3	SUC	3	N	-	
MRY	Pair	1	PAR	0	Y	-	Not monitored. Adults seen feeding 1 BHCO young.
MOC	Transient	-	-	-	-	-	Detected once in early April.
NKO	Pair	1	PRE	0	Y	3	
		2	SUC	2	Y	1	
		3	PAR	0	Y	1	
NWB	Pair	1	SUC	3	N	-	
		2	UND	0	Y	2	Abandoned after partial egg predation.
		3	SUC	2	-	-	Not monitored. Adults seen feeding 1 BHCO young.
PAC	Pair	1	PRE	0	N	-	
		2	PAR	0	Y	1	
		3	PAR	0	Y	1	
		4	PRE	0	Y	1	
PCK	Pair	1	PAR	0	Y	0	
		2	PAR	0	Y	0	
		3	SUC	1	Y	2	
PTC	Pair	-	-	-	-	-	Not monitored.
PTG	Pair	1	PAR	0	Y	0	
		2	PRE	0	Y	1	
		3	SUC	2	Y	2	
PGH	Pair	1	PRE	0	N	-	
		2	PRE	0	Y	1	
		3	SUC	1	Y	3	
PNT	Pair	1	PAR	0	Y	1	
		2	SUC	3	Y	1	
PMT	Pair	1	PAR	0	Y	1	
		2	PRE	0	N	-	

Table 1 (*continued*). Status and nesting activities of least Bell's vireos at the San Luis Rey River, 2005.

Territory	Status	Nest	Nest fate[a]	# Young fledged	Nest Parasitized?	# BHCO eggs removed[b]	Comments
QTH	Pair	1	PRE	0	N	-	
		2	PRE	0	Y	1	
		3	UND	0	N	-	Possible BHCO predation of egg(s).
		4	SUC	1	N	-	
QNC	Pair	1	PRE	0	Y	1	
RTL	Pair	1	PAR	0	Y	-	
		2	SUC	4	Y	1	
		3	PAR	0	Y	1	
RVO	Pair	1	INC	0	-	-	Nest never completed.
		2	UND	0	Y	1	Possibly abandoned after predation.
		3	PRE	0	Y	1	
		4	UND	0	Y	1	
		5	SUC	2	Y	2	
SSH	Unknown	-	-	-	-	-	Not monitored.
SWT	Pair	1	UND	0	N	-	
TCO	Pair	1	OTH	0	-	-	Substrate failure.
		2	OTH	0	N	-	Three eggs found punctured under nest, probable cowbird predation.
		3	SUC	1	Y	1	
		4	PRE	0	Y	1	
		5	UND	0	Y	0	
TIR	Pair	-	-	-	-	-	Not monitored.
TSH	Pair	1	SUC	1	N	-	Possible BHCO predation of nestling(s).
		2	UND	0	Y	1	Abandoned with eggs.
		3	PRE	0	Y	1	
		4	OTH	0	Y	1	Possible ant predation of nestling(s).
WAT	Pair	1	UND	0	-	-	Eggs not confirmed in nest.
		2	PAR	0	Y	0	
		3	PRE	0	Y	3	Possible BHCO predation of nestling(s).
		4	UND	0	-	-	Eggs not confirmed in nest.
		5	PAR	0	Y	3	
		6	UND	0	Y	0	Possible BHCO predation of egg(s).
WG2	Pair	1	PAR	0	Y	0	
		2	PAR	0	Y	0	
		3	SUC	2	Y	2	

Table 1 (*continued*). Status and nesting activities of least Bell's vireos at the San Luis Rey River, 2005.

Territory	Status	Nest	Nest fate[a]	# Young fledged	Nest Parasitized?	# BHCO eggs removed[b]	Comments
WG3	Pair	1	PAR	0	Y	2	
		2	UND	0	N	-	Possible BHCO predation of egg(s).
		3	UND	0	Y	2	Abandoned with eggs.
		4	PRE	0	Y	1	

[a] Nest fate: INC = nest never completed; OTH = reason for nest failure known, such as substrate failure; PAR = failure/abandonment caused by brown-headed cowbird parasitism event; PRE = nest failure caused by predation event; SUC = fledged at least one least Bell's vireo young; UND = reason for nest failure/abandonment unknown.
[b] Brown-headed cowbird (BHCO) eggs were removed from active nests in attempt to "rescue" nest.

Least Bell's vireo numbers in 2005 were similar to those in 2003 and 2004 (Figure 3). In 2003 the study site contained 40 male vireos. This number increased by six territories in 2004. In 2005 the number of male vireos detected remained unchanged at 46, possibly indicating that the number of vireo territories in this section of river can support may range from the low to mid-forties.

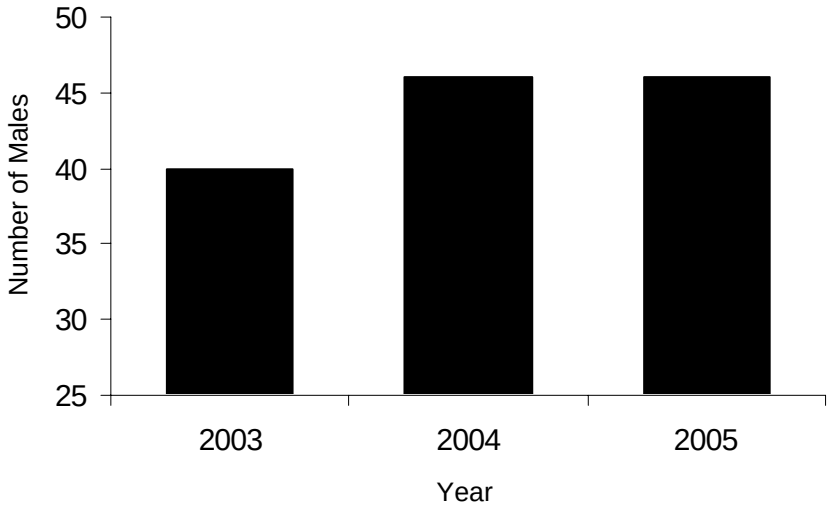

Figure 3. Number of singing male least Bell's vireos detected between Interstate 15 and Gird Road along the San Luis Rey River, 2005.

Banded Birds

Three least Bell's vireos banded prior to the 2005 breeding season were resighted within the study area (Table 2). Each bird was originally banded as a nestling and dispersed into the study area. Two vireos fledged from natal sites in other locations on the San Luis Rey River, while the third dispersed between drainages. The female within the PNT territory was banded in 2004 approximately 14 km downstream on the San Luis Rey River, while the male in the CAT territory was banded in 2003 approximately 2.5 km downstream. The CHA territory male was originally banded in 2000 on the Sweetwater River, approximately 70 km south of the San Luis

Rey River. None of the 146 nestling banded between 2000 and 2004 within the area encompassing the study site and an adjacent section of river 800 meters to the west, were documented in 2005.

Table 2. Banded adult least Bell's vireos at the San Luis Rey River, 2005.

		Band combination[a]			
Territory	**Sex**	**Left leg**	**Right leg**	**Age[b]**	**Comments**
PNT	M	-	BKBK / Mdb	AHY	Banded as an adult, 2005.
PNT	F	BWST / Mdb	-	1 yr	Banded as a nestling at the San Luis Rey River - COL3 territory.
CAT	M	DBWH / Mdb	-	2 yrs	Banded as a nestling at the San Luis Rey River - GAT territory.
CHA	M	LGLG	DBWH / Msi	5 yrs	Banded as a nestling at the Sweetwater River.

[a] Band colors: Mdb = dark blue numbered federal band; Msi = silver numbered federal band; BKBK = plastic black; BWST = plastic blue-white stripe; DBWH = plastic dark blue-white split; LGLG = plastic light green.
[b] Age: AHY = after hatch year.

Nest Monitoring

Nesting activity was monitored in a total of 34 least Bell's vireo territories. Of these, 32 were "fully" monitored, meaning that all nests within the territory were found and documented during the breeding season (Table 3). Pairs within the remaining two territories were documented nesting; however, only a subset of nests were found and monitored. A total of 99 nests were monitored during the breeding season, 97 of which came from fully monitored territories. Within fully monitored territories, pairs averaged 2.9 nesting attempts over the course of the 2005 breeding season, including one pair that nested six times without fledging young.

Table 3. Number of least Bell's vireo territories and nests monitored, San Luis Rey River, 2005.

	Total number
Territories fully monitored	32
Nests in fully monitored territories	97
Completed nests per pair (fully monitored territories only)	2.9
Total # of nests monitored	99

Twenty-five percent (25/99) of all vireo nests monitored fledged at least one young. Nest predation and brown-headed cowbird nest parasitism were believed to be the primary sources of nest failure, accounting for 35 and 37 percent of failures, respectively (Table 4). Overall, 26 and 27 percent of completed vireo nests were lost to predation and cowbird nest parasitism, respectively. It is probable that the impacts of cowbird nest parasitism are under-represented in this dataset as cowbird eggs were removed by biologists monitoring nests shortly after they were laid. The actual level of parasitism of vireo nests was 68 percent (68/99). This includes 16 nests (16 percent, 16/99) that were "rescued" from parasitism and subsequently fledged young. Had this intervention not occurred it is likely that vireo nest success would have been less than ten percent (9/99), as vireo nestlings are unable to fledge in the presence of cowbird young. On two instances adult least Bell's vireos were documented feeding newly fledged cowbird young.

Table 4. Cause of failure of least Bell's vireo nests, San Luis Rey River, 2005.

Cause of failure	Number[a]
Predation	26 (35)
Parasitism	27 (37)
Other/Unknown	21 (28)
Total completed nests	99

[a] Numbers in parentheses are the percent of failure.

The affects of cowbirds on vireo nest success may extend beyond nest parasitism as six least Bell's vireo nests showed signs of having been depredated by cowbirds. In four instances vireo eggs were punctured and/or ejected from the nests, but the contents were not consumed. In the remaining two instances, nestlings were ejected from active nests. Some nestlings had lacerations and/or puncture marks on their heads. One nestling that remained in its nest and survived an attack eventually fledged.

Nest fate influenced the likelihood that pairs would re-nest. While 96 percent (27/28) of pairs whose initial nests failed attempted second nests, only 27 percent (6/22) of pairs renested after they had successfully fledged at least one young. During the course of the 2005 breeding season, 31 percent (10/32) of pairs failed to fledge young. Two pairs fledged young from two separate nesting attempts.

Productivity

Despite having high average clutch and brood sizes, seasonal productivity of least Bell's vireos nesting on the San Luis Rey River in 2005 was low (Table 5). Vireos possessed low estimates in two measures of hatching and fledging success, in the number of fledglings produced per egg and per nest, in the average number of young fledged per pair, and in the number of pairs fledging at least one young. This discrepancy can be partly explained by the high incidence of nest parasitism. Typically, average clutch and brood sizes are calculated from a sample of nests that were not parasitized and were determined to have a complete vireo clutch or brood, respectively. However, female cowbirds typically remove a host egg when parasitizing nests, effectively reducing the number of vireo eggs in a clutch and subsequently lowering the number of young in a brood. When this is taken into account the effective average vireo clutch and brood sizes at this site reduce to 3.0 eggs/nest and 2.6 nestlings/nest. In total, 52 vireo young fledged from 24 nests during the 2005 breeding season.

Table 5. Reproductive success and productivity of nesting least Bell's vireos on the San Luis Rey River, 2005.

Parameter	Number
Nests with eggs	84
Eggs laid	256
Average clutch size[a]	3.7 ± 0.5 (std)
Nests with hatchlings	36
Hatchlings	92
Average brood size[b]	3.3 ± 0.5 (std)
Hatching success:	
Eggs[c]	36%
Nests[d]	43%
Nests with fledglings	24
Fledglings[e]	52
Fledgling success:	
Hatchlings[f]	57%
Nests[g]	67%
Fledglings per egg	0.2
Fledglings per nest	0.6
Average number of young fledged per pair[h]	1.6 ± 1.4 (std)
Pairs fledgling ≥ one young[h]	22 (69%)

[a] Based on 13 non-parasitized nests with a full clutch.
[b] Based on 6 non-parasitized nests known to have a full brood.
[c] Percent of all eggs that hatched.
[d] Percent of all nests with eggs in which at least one egg hatched.
[e] Excludes one nest that was not found, but fledgling(s) were detected.
[f] Percent of all nestlings that fledged.
[g] Percent of all nests with nestlings in which at least one young fledged.
[h] Based on 32 pairs whose territories were monitored fully.

Nest Characteristics

Successful and unsuccessful nests did not differ statistically in the height of the host plant, the distance the nest was placed from the edge of the host, or from the edge of the vegetation clump (Table 6). However, the difference in nest height between successful and unsuccessful nests was marginally significant, with successful nests built slightly lower than unsuccessful nests.

Table 6. Least Bell's vireo nest characteristics and results of two-sample unequal variance t-tests of successful vs. unsuccessful nesting attempts at the San Luis Rey River, 2005.

	Nest Fate				
Nest Characteristic	**Successful**	**Unsuccessful**	**df**	**t**	***P***
Average Nest Height (m)	0.9	1.1	89	-1.71	0.08
Average Host Height (m)	3.4	3.5	46	-0.19	0.85
Average Distance to Edge of Host (m)	0.4	0.3	30	0.80	0.43
Average Distance to Edge of Vegetation Clump (m)	1.2	0.9	29	1.07	0.29

Fourteen different plant species were used by least Bell's vireos as nest substrates during the 2005 breeding season, with 73 percent of nests built in either *S. lasiolepis*, *S. exigua,* or *B. salicifolia* (Table 7). Host plant species had no apparent affect on nest fate as the majority of successful and unsuccessful nests were built in the same species, in roughly the same proportions. However, even though the number of nests placed in *Anacardiaceae* spp., *Artemisia douglasiana*, *Cirsium* spp., *C. maculatum*, *Quercus* spp., *Sambucus mexicana*, and *Tamarix* spp. were small, none successfully fledged young. In general, vireo pairs choose

Table 7. Host plant species used by least Bell's vireos at the San Luis Rey River, 2005.

Host Species[a]	**Successful**[b]	**Unsuccessful**[b]	**Total**[b]
Salix lasiolepis	7 (0.29)	18 (0.25)	25 (0.26)
S. exigua	7 (0.29)	17 (0.23)	24 (0.25)
S. goodingii	1 (0.04)	8 (0.11)	9 (0.09)
Baccharis salicifolia	6 (0.25)	15 (0.21)	21 (0.22)
Populus fremontii	1 (0.04)	3 (0.04)	4 (0.04)
Toxicodendron spp.	1 (0.04)	2 (0.03)	3 (0.03)
Conium maculatum	0 (0.00)	3 (0.04)	3 (0.03)
Sambucus mexicana	0 (0.00)	2 (0.03)	2 (0.02)
Anacardiaceae spp.	0 (0.00)	1 (0.01)	1 (0.01)
Artemisia douglasiana	0 (0.00)	1 (0.01)	1 (0.01)
Brassica nigra	1 (0.04)	0 (0.00)	1 (0.01)
Cirsium spp.	0 (0.00)	1 (0.01)	1 (0.01)
Quercus spp.	0 (0.00)	1 (0.01)	1 (0.01)
Tamarix spp.	0 (0.00)	1 (0.01)	1 (0.01)

[a] Host species for one nest not known. One nest in *S. lasiolepis* was used twice.

[b] Numbers in parentheses are proportions of total nests.

different locations to place subsequent nesting attempts; however, one vireo pair was documented reusing a previously successful nest placed in *S. lasiolepis*. This second nesting attempt was abandoned after the vireo egg it contained was ejected from the nest and two brown-headed cowbird eggs were laid.

Southwestern Willow Flycatchers

Population Size and Distribution

Two southwestern willow flycatcher pairs were documented on the San Luis Rey River within the lower study area during the 2005 breeding season (Figure 4). The linear distance between the two territories was approximately 0.5 km. A third transient willow flycatcher of unknown subspecies was observed on May 20 in the upper San Luis Rey study area adjacent to Highway 395, but was not detected throughout the remainder of the breeding season.

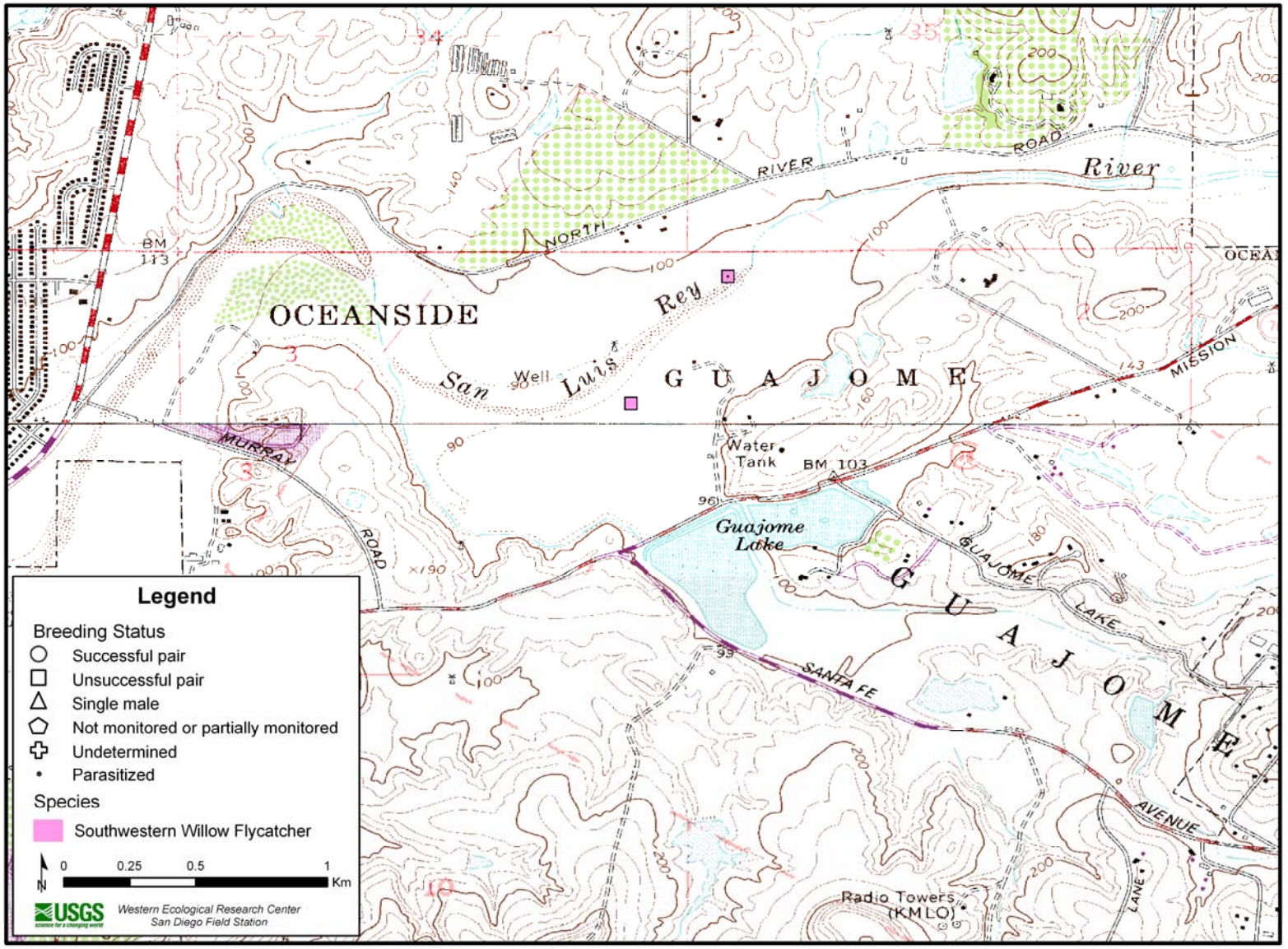

Figure 4. Southwestern willow flycatcher locations and breeding status along the upper San Luis Rey River, 2005.

Banded Birds

Two banded southwestern willow flycatchers that previously bred within the study area returned in 2005 (Table 8). The male occupying the GUS territory was originally banded on the Santa Margarita River in 2000, approximately 8.5 km away. In 2004, it was documented nesting in the same area it occupied on the San Luis Rey River during the 2005 breeding season. Between 2001 and 2004 its location was unknown. In 2004, the male occupying the GRP territory was banded as an adult in its current location with a Mdg:puye color band combination. When recaptured in 2005, its puye band was found to be faded and was replaced with a dgwh band.

Table 8. Banded adult southwestern willow flycatchers at the San Luis Rey River, 2005.

		Band Combination[a]			
Territory	**Sex**	**Left Leg**	**Right Leg**	**Age[b]**	**Comments**
GUS	M	Mdg	WHWH	≥ 6 yrs	Banded as an adult on the Santa Margarita River, 2000.
GUS	F	Msi	dbdb	AHY	Banded as an adult, 2005.
GRP	M	Mdg	dgwh	≥ 2 yrs	Banded as an adult in same location, 2004.

[a] Band colors: Mdg = dark green numbered federal band; Msi = silver numbered federal band; WHWH = plastic white; dbdb = metal dark blue; dgwh = metal dark green-white split; puye = metal purple-yellow split.
[b] Age: AHY = after hatch year.

Nesting

Both pairs of southwestern willow flycatchers nested once during the 2005 breeding season; neither pair fledged young. The nest built by the pair occupying the GUS territory was built in *Tamarix* spp. (Table 9). When found, the nest contained one willow flycatcher and two brown-headed cowbird eggs, which the female was incubating. The two cowbird eggs were

Table 9. Southwestern willow flycatcher nest characteristics and placement at the San Luis Rey River, 2005.

	Territory	
Parameter	**GRP**	**GUS**
Nest Height (m)	2.5	2.4
Host Species	*Salix exigua*	*Tamarix* spp.
Host Height (m)	3.9	3.7
Distance (m) to:		
Edge of Host Plant	0.1	0.05
Vegetation Clump	10	1.5
Riparian Habitat	60	40
Water (Early Season)[a]	0	0
Water (Late Season)[b]	18	20

[a] Early season, 15 May to 15 June, corresponding with flycatcher arrival and territory selection.
[b] Late Season, 15 July to 15 August, corresponding with the end of flycatcher nesting.

removed, and the female continued to incubate the remaining flycatcher egg. The willow flycatcher egg was subsequently lost to predation, after which time the female was no longer detected in the territory. The pair occupying the GRP territory built a nest in *S. exigua*. It is unknown whether this nest was depredated in the egg stage or abandoned prior to egg laying, as it failed during the time eggs should have been laid and no eggs were observed in the nest. After the nest failed, the male continued to defend the territory, but the female was not detected during the remainder of the breeding season.

DISCUSSION

Population estimates indicate a possible least Bell's vireo carrying capacity at the upper study site on the San Luis Rey River to range between the low to mid-forty territories. Over the past seven years the vireo population has fluctuated between a low of 31 territories in 1999 to a high of 46 territories in 2004 and 2005, with the population in four of the last seven years supporting 39 or more territories (USGS, unpublished data).

Although the population at this site appears relatively stable, 2005 nest monitoring data indicate the population may not be self-sustaining. Using estimates for adult (0.47) and juvenile (high = 0.29, low = 0.05) survivorship contained in the Draft Recovery Plan for the least Bell's vireo (USWFS 1998), the total number of adults in the 2005 population (91, 46 males and 45 females), and the number of young fledged per adult in 2005 (0.8 young/adult), the following basic equation to estimate population change (Meffe et al. 1997) predicts the population to decline between 30 to 49 percent in 2006 based on productivity alone:

$$n_{T+1} = n_T(P_A + bP_J) \quad (1)$$

where n_T is the current population size, P_A and P_J are the probabilities of an adult and juvenile vireo surviving to the next breeding season, respectively, b is the average number of offspring produced per adult, and n_{T+1} is the population size at the beginning of the next breeding season. If 2005 productivity estimates are representative, it is probable that the population of vireos on this section of river is supported by immigration from other population(s). One of the closest and largest potential source populations is that contained on Marine Corps Base Camp Pendleton, approximately 13 km distant. In 2005, USGS initiated an intensive banding and nest monitoring study on Base in hopes of better understanding vireo demography in southern California (Rourke and Kus 2006). It is only through continued banding, nest monitoring, and surveys for Bell's vireos within this region that we will be able to fully understand the roll the San Luis Rey River plays in vireo persistence in San Diego County.

It is apparent that brown-headed cowbird nest parasitism, in the absence of immigration, presents a problem to vireo persistence within the San Luis Rey study site. Nest abandonment by vireos, as result of parasitism, and the potential removal of vireo egg(s) by female cowbirds when parasitizing nests are the most probable causes of low vireo productivity. Parasitism of least Bell's vireo nests in 2005 was very high, with 68 percent of all nests parasitized. More nests were lost to parasitism than to nest predation, typically the most common cause of nest failure. This resulted in only 25 percent of nests fledgling young, an estimate that would have

been much lower if some parasitized nests had not been "rescued" through cowbird egg(s) removal by nest monitors. Without cowbird egg removal, it is likely that only nine percent of all vireo nests would have successfully fledged young.

The impacts of brown-head cowbird parasitism are apparent when these results are compared to data from vireos nesting within a similar habitat on Camp Pendleton, a site intensively trapped for cowbirds. In 2005, no nest parasitism was documented on Camp Pendleton (n = 98 nests). Vireos nesting on Base had similar average clutch and brood sizes as did non-parasitized nests at the San Luis Rey site, but pairs fledged more young per pair (2.5 to 2.8 young/pair vs. 1.6 young/pair) while initiating fewer nesting attempts (1.9 vs. 2.9 attempt/pair; Rourke and Kus 2006). As is typical, predation was the primary cause of nest failure on Camp Pendleton, accounting for 77 to 87 percent of failed nests.

Southwestern willow flycatchers continue to persist in the lower San Luis Rey study site. Over the past seven years, the population of flycatchers has fluctuated between one and six territories. In 1999 a single pair of flycatchers was documented nesting within the study area. That number climbed to six territories by 2003, and included one male that was polygynous with two females. In 2004, the population declined to three pairs, and in 2005 lost another pair to itscurrent number of two pairs.

Because of the small population size of southwestern willow flycatchers in southern California, the cause of the decline of this species in the study area is difficult to determine. However, because flycatchers typically demonstrate high site fidelity (USFWS 2002), two possible factors may explain its absence: 1) the death of individual flycatchers that previously nested within the study area, preventing their return, and 2) the dispersal of birds to sites containing more suitable habitat. The second factor is worth addressing further as it is can be considered within a management context. The possible emigration of willow flycatchers from the study site is not unreasonable as habitat adjacent to the river was extensively altered and/or removed by heavy winter rains and spring flooding in 2005. Young trees with vertical structure preferred by flycatchers were uprooted and/or "laid over" forming dense thickets no longer suitable for nesting willow flycatchers. It is possible that some flycatchers that would have nested within the study area dispersed to other more suitable habitats within the San Luis Rey River or to nearby drainages. Since flycatchers prefer habitat composed of young willows the scouring of vegetation may have temporarily displaced willow flycatchers, but could foster the creation of suitable habitat if the appropriate plant species are allowed to establish within the study site. However, this may not occur within the system without direct management as numerous invasive exotic species, such as Giant Reed (*A. donax*) and Castor Bean (*Ricinus communis*) are prevalent within the site.

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